Chemsex and the city: an investigation into recreational drug use, poly drug use, chemsex, and sexual behaviours among HIV negative men who have sex with men.

Jane Sewell

Institute for Global Health
UCL Centre for Population Research in Sexual Health and HIV
University College London

Thesis presented for the degree of
DOCTOR OF PHILOSOPHY

January 2020
Declaration

I, Jane Sewell, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.
Acknowledgements

Firstly, thank you to every single person who took part in the AURAH and AURAH2 studies, I am always amazed by how generous people are with their commitment to research and this PhD has been no exception, I am so grateful for your valuable time. Thank you also to the clinic staff and research teams who spent a huge amount of time and effort on recruitment, data collection and study admin whilst facilitating the studies at busy clinics, you’re all awesome.

I realise how fortunate I am to have had a brilliant supervisory team who propelled me through this process; Dr Andrew Speakman – your attention to detail and ability to check and re-check website/questionnaire functionality with good humour made the early stages of this PhD actually enjoyable when they could have been quite stressful. Equally Dr Vale Cambiano, your patience with my statistics and ability to check and re-check my code made the later stages of this PhD much more bearable and even enjoyable! Professor Andrew Phillips and Dr Fiona Lampe, thank you for your guidance and comments throughout which have been invaluable.

My deepest thanks to Professor Alison Rodger – your calm and constant encouragement has extended well beyond the role of PhD supervisor and has supported and inspired me over the last five years. I know this would not have been possible without you.

Thank you to my family and friends for the coffees, cakes, biscuits, suppers, overnight stays, weekends away, and regular injections of fun in to my PhD journey which has made it less of a mountain and more of a series of large molehills with some kind of culinary or social treat after each one. I am especially grateful to my Mum and Sir for your constant support, encouragement, interest and endless(!) childcare.

To Pete, Wilf and Albie, for keeping it all in perspective and always making me laugh. Roll on the next adventure!
Abstract

Recreational drug use and the emerging phenomenon of chemsex (the use of mephedrone, crystal methamphetamine and γ-hydroxybutyrate/γ-butyrolactone (GHB/GBL) to enable, enhance and prolong sexual interactions), are of significant concern in men who have sex with men (MSM), particularly in the context of HIV and STI transmission. Prevalence data from the UK and Europe are lacking and no studies have examined changes in chemsex over time within a cohort of MSM.

In this thesis I use data from two studies that recruited HIV negative MSM from sexual health clinics in England: the cross-sectional AURAH study (Attitudes to and Understanding Risk of Acquisition of HIV), 2013-2014, (n=1484), and the prospective cohort study, AURAH2 study (Attitudes to and Understanding Risk of Acquisition of HIV over Time) (n=1167), which collected online questionnaire data from 2015 to 2018. I investigate the prevalence of recreational drug use including chemsex, and associations with sexual behaviours, and examine whether prevalence of chemsex and sexual behaviour changed over time.

Over half (54.7% AURAH, 60.4% AURAH2) of HIV negative MSM attending sexual health clinics self-reported recreational drug use, and whilst the proportion engaged in chemsex was less (21.8% AURAH, 32.3% AURAH2), it is significant in terms of vulnerability to HIV and STI infections. Prevalence of chemsex significantly declined during online follow-up of AURAH2 participants (n=622) from 31.8% (198/622) at first online questionnaire, to 11.1% (8/72; p < 0.001) at the 9th. Most measures of sexual behaviour also declined over the follow-up period.

MSM engaged in recreational drug use, and in particular chemsex, are at significant risk of both STI and HIV infection, as well as other harms, and should be a focus for targeted prevention interventions such as regular HIV and STI testing and treatment, PrEP initiation and chemsex support, which is potentially only necessary for select, and relatively short periods of time.
Impact Statement

In 2014, Public Health England identified a triad of health inequalities in gay, bisexual and other men who have sex with men (MSM), who constitute an estimated 5.5% of the UK male population (1). The three distinct, but interrelated areas were; sexual health and HIV, mental health, and the use of alcohol, drugs and tobacco (1). Addressing these inequalities is integral to improving the health and wellbeing of MSM in general, as well as being a key part of improving public health in England. Within the last decade the emerging practice of chemsex among MSM has focused considerable clinical, academic and media attention on the overlap of drug use and sexual health and HIV, due to the potential for HIV and STI transmission, as well as other related harms connected to broader drug use, including mental and physical health. Therefore, understanding the scale of recreational drug use and specifically chemsex, particularly among HIV negative MSM, for whom HIV prevention strategies would be highly beneficial, as well as potentially cost-effective for the NHS, could inform public health prevention strategies and identify optimal allocation of resources.

Within academia, two published results chapters from this thesis provided unique prevalence estimates of recreational drug use and chemsex among HIV negative MSM attending sexual health clinics in the UK and demonstrated the strong associations with measure of sexual behaviour that potentiate HIV and STI transmission (2, 3). The third published results chapter provided the first examination of changes in chemsex over time among a cohort of MSM from the UK, Europe and internationally. It indicated that chemsex declined over time (in the study), as did a number of measures of sexual behaviour(4). These findings highlight the vital role that sexual health clinics can play in the identification and support of HIV negative MSM and demonstrate that the integration of drug and psychological services with sexual health, particularly in large, urban settings, offer an opportunity with which to engage MSM on drug use as well as sexual health.

At a policy level, the results of my thesis are considered by the PANTHEON programme grant ‘Engagement, Dissemination and Translation’ working group which is chaired by Professor Kevin Fenton. This policy group which includes members from the community sector, uses the programme grant research results, including the AURAH2 study, to disseminate results and inform recommendations to improve health and wellbeing of HIV negative gay men.

At a clinical level, several sexual health clinics have observed an apparent increase in the number of MSM reporting chemsex in the last five years (2, 5-7) and my thesis results substantiate these findings, highlighting a clear need for service development, and potential areas for funding requirements. The novel evidence from this thesis which showed that
chemsex in fact declined over time among a cohort of MSM, further emphasises the importance of heightened engagement with MSM during relatively short periods of increased sexual risk behaviour so that HIV prevention strategies, such as PrEP, can have long-term benefits at both individual and public health level.
Contents

Declaration .................................................................................................................. 2
Acknowledgements ..................................................................................................... 3
Abstract ....................................................................................................................... 4
Impact Statement ........................................................................................................ 5
List of Abbreviations ................................................................................................... 17
Chapter 1: Introduction ............................................................................................... 18
  1.1 Overview ............................................................................................................ 18
  1.2 Thesis aims and objectives ................................................................................ 18
  1.2.1 Aim ............................................................................................................... 18
  1.2.2 Objectives ..................................................................................................... 19
  1.2.3 Chapter objectives ......................................................................................... 20
  1.3 Defining the thesis study population ................................................................. 22
Chapter 2: Literature review ...................................................................................... 24
  2.1 Introduction ....................................................................................................... 24
  2.2 Literature review methodology ......................................................................... 24
  2.3 Background ....................................................................................................... 25
    2.3.1 Early research into recreational drug use and sexual behaviour among MSM (1982-1996) ........................................................................................................... 25
    2.3.2 Sexual behaviour, HIV risk reduction strategies and recreational drug use in the cART era 1996-2019) ........................................................................................................... 27
    2.3.3 The emergence of research into recreational drug use in the UK ............... 34
    2.3.4 Sexualised drug use within the UK ............................................................. 36
    2.3.5 Chemsex ...................................................................................................... 37
    2.3.6 Individual drugs, types of recreational drug use and associations with sexual risk behaviour and STI and HIV infection ................................................................. 41
    2.3.7 Other physical and psychological harms associated with recreational drug use ................................................................................................................................. 44
    2.3.8 Possible reasons for recreational drug use among MSM ............................ 45
    2.3.9 Methodological issues in recreational drug use and sexual behaviour research ................................................................................................................................. 45
  2.4 Recreational drug use in the UK 2000-2014: Prevalence, definitions and gaps in the evidence base ......................................................................................... 46
    2.4.1 Results of the literature search .................................................................... 46
    2.4.2 Review of the literature .............................................................................. 51
    2.4.3 Prevalence estimate of recreational drug use and chemsex in the UK at the time this PhD commenced in Oct 2014 ........................................................................ 54
    2.4.4 Identified gaps in the evidence base (up to October 2014) ....................... 57
Chapter 3: Methods: Attitudes to and Understanding Risk of Acquisition of HIV (AURAH) study

3.1 Introduction ........................................................................................................ 61
3.2 Aims and Objectives .......................................................................................... 61
3.3 Study team and funding ..................................................................................... 62
3.4 Rationale for the study ...................................................................................... 63
3.5 Study design ....................................................................................................... 63
3.6 Study setting and study population .................................................................... 63
   3.6.1 Inclusion criteria ......................................................................................... 65
3.7 Recruitment ........................................................................................................ 65
3.8 Consent ................................................................................................................ 69
   3.8.1 Confidentiality ............................................................................................. 70
3.9 Sample size ......................................................................................................... 70
3.10 Data collection ................................................................................................... 71
   3.10.1 Study questionnaire .................................................................................. 71
   3.10.2 Questionnaire and study language .......................................................... 72
   3.10.3 Questionnaire content ............................................................................. 72
   3.10.4 Clinic data .................................................................................................. 73
3.11 Ethical considerations ....................................................................................... 74
   3.11.1 Ethical review ............................................................................................ 75
   3.11.2 Confidentiality .......................................................................................... 75
   3.11.3 Data security ............................................................................................. 75
   3.11.4 Study amendments .................................................................................. 76
3.12 Study management and my role as study coordinator ..................................... 77
   3.12.1 Site initiation visits .................................................................................. 78
   3.12.2 Management of recruitment phase ........................................................ 78

Chapter 4: Methods: Attitudes to and Understanding Risk of Acquisition of HIV over time (AURAH2) study .................................................................................. 80

4.1 Introduction ....................................................................................................... 80
4.2 Aims and objectives .......................................................................................... 80
4.3 Study team and funding ................................................................................... 81
4.4 Rationale for the study .................................................................................... 81
4.5 Study design ..................................................................................................... 82
4.6 Study setting and methodology ....................................................................... 82
   4.6.1 Inclusion criteria ....................................................................................... 82
4.7 Recruitment ....................................................................................................... 82
4.7.1 Study transition from AURAH to AURAH2 study ........................................ 85
4.8 Consent ........................................................................................................... 86
4.9 Sample size .................................................................................................... 87
4.10 Data collection ............................................................................................... 88
4.10.1 Baseline data collection ........................................................................... 88
4.10.2 Online follow-up data collection .............................................................. 88
4.10.3 Questionnaire development .................................................................... 89
4.10.4 Website development .............................................................................. 92
4.10.5 Pilot study .................................................................................................. 99
4.10.6 Website amendments .............................................................................. 100
4.11 Ethical considerations .................................................................................. 101
4.11.1 Study amendments ................................................................................ 102
4.11.2 Ethical review .......................................................................................... 102
4.11.3 Patient information sheets ........................................................................ 102
4.11.4 Confidentiality ......................................................................................... 103
4.11.5 Data security ............................................................................................ 103
4.11.6 Data transfer to coordinating centre ......................................................... 104
4.11.7 Data storage .............................................................................................. 105
4.11.8 Data linkage .............................................................................................. 105
4.12 Study management and my role as study coordinator ................................. 105
4.12.1 Set up procedures .................................................................................... 106
4.12.2 Management of recruitment phase ........................................................... 106
4.12.3 Data breach (not AURAH2 related) at a clinical site ............................... 106
4.12.4 Completion of online follow-up ................................................................. 107

Chapter 5: Data Management: The AURAH and AURAH2 study .................. 108
5.1 Introduction ..................................................................................................... 108
5.2 Data management .......................................................................................... 108
5.2.1 Digitisation of the Paper questionnaires .................................................. 108
5.2.2 Data storage for the AURAH and AURAH2 baseline data ....................... 110
5.2.3 Data storage for the AURAH2 study online follow-up data ....................... 110
5.3 Data cleaning ................................................................................................ 111
5.3.1 The AURAH study data cleaning ............................................................... 111
5.3.2 The AURAH study: definitions and key variables ...................................... 112
5.3.3 The AURAH2 study: baseline data cleaning .............................................. 125
5.4 Appending the AURAH and AURAH2 datasets ........................................... 132
5.5 The AURAH2 study: online data ................................................................. 132
5.5.1 The AURAH2 study: online data management and cleaning .................... 132
Chapter 6: Results: Recreational drug use, poly drug use and chemsex drug use, among
MSM in the AURAH study ................................................................. 139
6.1 Introduction ................................................................................. 139
6.2 Methods ....................................................................................... 140
  6.2.1 Recreational drug use .............................................................. 140
  6.2.2 Sexual behaviour measures ...................................................... 140
  6.2.3 Statistical Analysis .................................................................. 142
6.3 Results ......................................................................................... 142
  6.3.1 Overall Response rates for the AURAH study ........................... 142
  6.3.2 Characteristics of MSM in the AURAH study ............................ 145
  6.3.3 Prevalence of sexual behaviour measures ................................. 146
  6.3.4 Prevalence of recreational drug use .......................................... 148
  6.3.5 Correlates of poly drug use and chemsex drug use .................... 151
  6.3.6 Recreational drug use and sexual behaviour measures ............... 155
6.4 Key points ..................................................................................... 160
  6.4.1 Strengths and limitations .......................................................... 160
  6.4.2 Conclusion and Recommendations .......................................... 161
Chapter 7: Results: A comparison of recreational drug use, poly drug use and chemsex drug
use, and sexual behaviours among MSM at baseline from the AURAH2 study (2014/15) with
MSM from the AURAH study (2013/14) ................................................ 162
7.1 Introduction .................................................................................. 162
7.2 Methods ....................................................................................... 163
  7.2.1 Recreational drug use .............................................................. 163
  7.2.2 Sexual behaviour measures ...................................................... 163
  7.2.3 Statistical Analysis .................................................................. 164
7.3 Results .......................................................................................... 165
  7.3.1 Baseline questionnaire response rates for the AURAH2 study .... 165
  7.3.2 Sociodemographic and lifestyle characteristics of MSM that completed a
  baseline questionnaire for the AURAH2 study compared to MSM in the AURAH study ...
  ........................................................................................................... 165
  7.3.3 Prevalence of sexual behaviours, PEP, PrEP and HIV testing among MSM in
  the AURAH study and at baseline in the AURAH2 study ...................... 167
9.2.2 Relationship status .......................................................... 206
9.2.3 Sexual behaviour measures .............................................. 207
9.2.4 Statistical analysis .......................................................... 207
9.3 Results ............................................................................ 208
  9.3.1 Starting chemsex ............................................................ 208
  9.3.2 Stopping chemsex ........................................................... 210
  9.3.3 Initiating chemsex (including starting for the first time) ....... 214
9.4 Key points ........................................................................ 217
  9.4.1 Strengths and Limitations ............................................... 218
  9.4.2 Conclusions and recommendations ................................ 218
Chapter 10: Discussion of thesis findings and final conclusions ............. 220
  10.1 My role in this thesis .......................................................... 220
  10.2 Publications and other outputs arising from the thesis ............ 221
  10.3 Summary of thesis findings ............................................... 221
  10.4 Prevalence of recreational drug use, poly drug use and chemsex, and associations with measures of sexual behaviour, in the AURAH and AURAH2 studies .......... 223
    10.4.1 Prevalence of recreational drug use among MSM ............. 223
    10.4.2 Prevalence of poly drug use among MSM ....................... 229
    10.4.3 Prevalence of chemsex among MSM ............................... 232
    10.4.4 Associations of recreational drug use, poly drug use and chemsex with sexual behaviour, and other related physical and mental health harms .................. 237
  10.5 Longitudinal data on chemsex among MSM and predictors of starting or stopping chemsex ........................................................................................................... 239
    10.5.1 Changes in chemsex over time among MSM .................... 239
    10.5.2 Predictors of starting or stopping chemsex ................. 242
  10.6 ....................................................................................... Study limitations
    10.6.1 AURAH study limitations .............................................. 243
    10.6.2 AURAH2 study limitations ............................................ 245
  10.7 Recommendations for future work ...................................... 246
10.8 Conclusion ....................................................................... 248
Appendix I. AURAH study Patient Information Sheet and Consent form .......... 249
Appendix II. AURAH study questionnaire (male) .............................. 254
Appendix III. AURAH study Protocol ........................................... 277
Appendix IV. AURAH2 online Patient Information Sheet and Consent .......... 294
Appendix V. AURAH2 in-clinic Patient Information Sheet and Consent form...... 299
Appendix VI. AURAH2 study four month online HIV negative questionnaire .... 305
Appendix VII. AURAH2 study annual online HIV negative questionnaire .... 308
Appendix VIII. Newly diagnosed online first HIV positive questionnaire ....... 316
Appendix IX. AURAH2 study four month online HIV-diagnosed questionnaire ................................................................. 319
Appendix X. AURAH2 study annual online HIV-diagnosed questionnaire ............................................................ 322
Appendix XI. AURAH2 study website homepage ............................................................................................................ 329
Appendix XII. AURAH2 study Protocol ...................................................................................................................... 330
Appendix XIII. The AURAH study methods paper “A Cross-Sectional Study on Attitudes to and Understanding of Risk of Acquisition of HIV: Design, Methods and Participant Characteristics” ........................................ 347
Appendix XIV. The AURAH2 study methods paper “Attitudes to and Understanding of Risk of Acquisition of HIV Over Time: Design and Methods for an Internet-based Prospective Cohort Study Among UK Men Who Have Sex With Men (the AURAH2 Study).” .......... 363
Appendix XV. The AURAH study results paper “Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics.” .......................................................................................... 375
Appendix XVI. A comparison of the AURAH study and the AURAH2 study results paper “Changes in recreational drug use, drug use associated with chemsex, and HIV-related behaviours, among HIV-negative men who have sex with men in London and Brighton, 2013–2016” ........................................................................................................... 387
Appendix XVII. The AURAH2 study longitudinal results paper “Changes in chemsex and sexual behaviour over time, among a cohort of MSM in London and Brighton: Findings from the AURAH2 study,” ............................................................................................................ 396
Appendix XVIII. Poster presentation from the 2nd European Chemsex Forum, Berlin 2018. ................................................ 405
Appendix XIX. Results from Literature review October 2014–October 2019 .............................................................. 406
Appendix XX. AURAH study acknowledgements ...................................................................................................... 417
Appendix XXI. AURAH2 study acknowledgements .................................................................................................... 419
References .................................................................................................................................................................... 420

Table of Tables

Table 1 Chemsex drugs and effects – Drug profiles (EMCDDA 2018)(140) ................................................................. 38
Table 2 Summary of available literature on recreational drug use among MSM in the UK up until October 2014 ........................................................................................................................................ 48
Table 3 AURAH study sites: recruitment targets ........................................................................................................... 66
Table 4 AURAH2 website and online questionnaire development November 2014 – March 2015 ........................................................................................................................................ 96
Table 5 Key sociodemographic, mental health and lifestyle variables and their construction for the AURAH study dataset ........................................................................................................................................ 116
Table 6 Recreational drug use variables for the AURAH study dataset ................................................................. 119
Table 7 Sexual behaviour variables for the AURAH study dataset .............................................................................. 122
Table 8 Additional variables created for AURAH2 analysis .................................................................................... 127
Table 9 Solving inconsistencies in sexual behaviour questions for the paper-based AURAH2 questionnaire (see Appendix II) ................................................................................................. 130
Table 10 Additional online variables constructed for the AURAH2 study (see Appendix VI and VII) ................................. 134
Table 11 AURAH study recruitment; sites, recruitment targets and results .............................................................. 144
Table 12 Characteristics of MSM in the AURAH study (n=1484) ................................................................. 145
Table 13 Prevalence of sexual behaviours among MSM in the AURAH study (n=1484) ................................ 147
Table 14 Prevalence of STIs among MSM in the AURAH study in the past year ............................................ 147
Table 15 Unadjusted and adjusted associations of socio-demographic and lifestyle factors with measures of recreational drug use and chemsex drug use in the past 3 months (n=1484) 153
Table 16 Unadjusted and adjusted associations of poly drug use with eight measures of sexual behaviour among MSM in the AURAH study (n=1484) .................................................................................. 156
Table 17 Sociodemographic and lifestyle factors of MSM participants in the AURAH cross sectional study (2013/14) and at baseline in the AURAH2 study (2014/15) ................................................................. 166
Table 18 Prevalence of 10 sexual behaviour measures among MSM in the AURAH study (2013/14) (n=991) and AURAH2 baseline data (2015/16) (n=1031) and association of these measures with the study. ................................................................................................................................. 169
Table 19 Prevalence of STIs among MSM at entry into the AURAH2 study in the past year ................................. 172
Table 20 Associations of poly drug use and chemsex drug use with ten measures of sexual behaviour among MSM in the AURAH2 study who reported anal sex within the past three months at baseline (n=949) ......................................................................................................................... 176
Table 21. Differences in sociodemographic and lifestyle factors, prevalence of chemsex drug use and individual chemsex drugs at baseline, among MSM that completed only the baseline questionnaire and those that completed at least one follow-up questionnaire, in the AURAH2 study. ................................................................................................................................. 186
Table 22 Measures of sexual behaviour among MSM that answered at least one online follow-up questionnaire in the AURAH2 study (n=622) ................................................................................................................................. 188
Table 23 Unadjusted associations of sociodemographic and lifestyle characteristics, PEP, PrEP, HIV status, calendar year and time in the study, with chemsex during follow-up in the AURAH2 study. ................................................................................................................................. 189
Table 24 Associations of time since first online questionnaire with chemsex, and individual chemsex drugs, during follow-up in the AURAH2 study. Analysis used pooled data from all available follow-up questionnaires (n=3277) ................................................................................................................................. 191
Table 25 Association of chemsex with 'lost to follow-up' or missing an online follow-up questionnaire, over time in the AURAH2 study* ................................................................................................................................. 199
Table 26 Associations of chemsex and individual chemsex drugs with lost to follow-up, over time* ........................................................................................................................................................................ 200
Table 27 Unadjusted risk ratios of sociodemographic, health and lifestyle characteristics with starting chemsex for the first time among MSM in the AURAH2 study. ................................................................................................................................. 209
Table 28 Unadjusted risk ratios of sexual behaviour measures with starting chemsex for the first time among MSM in the AURAH2 study. ................................................................................................................................. 210
Table 29 Unadjusted risk ratios of stopping chemsex with sociodemographic, health and lifestyle characteristics among MSM in the AURAH2 study

Table 30 Unadjusted risk ratios of stopping chemsex with measure of sexual behaviour among MSM in the AURAH2 study

Table 31 Unadjusted risk ratios of initiating chemsex with sociodemographic characteristics, health and lifestyle characteristics among MSM in the AURAH2 study

Table 32 Unadjusted risk ratios of initiating chemsex with measures of sexual behaviour among MSM in the AURAH2 study

Table of Figures

Figure 1 Prevalence of recreational drug use and individual drug use in the UK 2000-2014

Figure 2 Trends in number of new presentations to treatment (for drug addiction) citing club drug use

Figure 3 AURAH study clinic sites

Figure 4 Flowchart of AURAH clinic recruitment and questionnaire collection procedures

Figure 5 Timeline of AURAH study protocol amendments

Figure 6 Questionnaire sequence and timeline for recruitment route 1

Figure 7 Questionnaire sequence and timeline for recruitment route 2

Figure 8 AURAH2 study flowchart

Figure 9 Example of drop-down list

Figure 10 Example of radio buttons as answers

Figure 11 Tool tip example to explain ‘chemsex’

Figure 12 Graphic to describe assignment of online ‘visits’ for the AURAH2 dataset

Figure 13 Number of STIs reported by MSM in the AURAH study (past year) (n=1484)

Figure 14 Prevalence of poly drug use, chemsex drug use and individual recreational drug use in the past three months among MSM in the AURAH study (n=1484)

Figure 15 Associations of poly drug use with eight measures of sexual behaviour among MSM in the AURAH study

Figure 16 Associations of chemsex drug use with eight measures of sexual behaviour among MSM in the AURAH study

Figure 17 A comparison of the 10 measures of sexual behaviour between MSM in the AURAH (2013/14) and at baseline in the AURAH2 study (2015/16)

Figure 18 Number of STIs reported by MSM at baseline in the AURAH2 study (n=1031) past year

Figure 19 Prevalence of poly drug use, chemsex drug use and individual drug use among MSM in the AURAH (2013/14) and AURAH2 (2015/16) studies

15
Figure 20 Prevalence of chemsex, and individual chemsex drugs over time in the study, among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277)* ................................................................. 192
Figure 21 Within-person changes in frequency of chemsex over time in the study among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277 questionnaires) .................................................................................................................. 194
Figure 22 Prevalence of sexual behaviours¹ over time among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277 questionnaires) *.. 196
Figure 23 Proportion of MSM reporting chemsex and individual chemsex drugs, who completed a questionnaire in the last six months of online follow-up (n=400*) of the AURAH2 study. ............................................................................................................................... 198
Figure 24 Number of observations among MSM in the starting chemsex (for the first time) analysis (n=38), and proportion (%) in which chemsex is started during follow-up in the AURAH2 study. ........................................................................................................................................ 208
Figure 25 Proportion of observations among MSM included in the stopping chemsex (at least once) analysis (n=175), and proportion that stopped chemsex at each online follow-up questionnaire during follow-up in the AURAH2 study. .......................................................................................................................... 211
Figure 26 Proportion of observations among MSM included in the initiating chemsex analysis (n=367), and proportion that started chemsex at each online follow-up questionnaire during follow-up in the AURAH2 study. ........................................................................................................................................ 215
Figure 27 Prevalence of recreational drug use, poly drug use, sexualised drug use and chemsex among MSM in the UK 2017-2019 ........................................................................................................................................... 226
List of Abbreviations

ACMD    Advisory Council for the Misuse of Drugs
ART     Anti-Retroviral Therapy
AURAH   Attitudes to and Understanding Risk of Acquisition of HIV
AURAH2  Attitudes to and Understanding Risk of Acquisition of HIV
CAGE    Cut-annoyed-guilty- eye Questionnaire
cART    Combination Anti-Retroviral Treatment
CCS     Coping and Change Study
CI      Confidence Interval
CLAI    Condomless Anal Intercourse
CLS     Condomless Sex
CREME   Clinical Research, Epidemiology, Modelling and Evaluation
CSEW    Crime Survey for England and Wales
EMCDDA  European Monitoring Centre for Drugs and Drug Addiction
EMIS    European Men who have sex with men’s Internet Survey
FLUX    Following Lives Undergoing Change Study
GAD-7   General Anxiety Disorder scale-7
GHB/GBL Gamma Hydroxybutyrate/ Gamma Butyrolactone
GMSS    Gay Men’s Sex Survey
HARS    National HIV and AIDS reporting system
HIV     Human Immunodeficiency Virus
LGBTQ+  Lesbian Gay Bisexual Trans Queer +
LGV     Lymphogranuloma Venereum
MACS    Multicentre AIDS Cohort Study
MSM     Men who have Sex with Men
NATSAL  National Survey of Sexual Attitudes and Lifestyles
NDTMS   National Drug Treatment Monitoring Survey
NIHR    National Institute for Health Research
ONS     Office for National Statistics
PEP     Post Exposure Prophylaxis
PHQ-9   Patient Health Questionnaire-9
PIS     Patient Information Sheet
PLWHIV  People living with HIV
PR      Prevalence Ratio
PrEP    Pre-Exposure Prophylaxis
RR      Risk Ratio
STI     Sexually Transmitted Infection
TasP    Treatment as Prevention
UCL     University College London
UTT     Universal Test and Treat
WHO     World Health Organisation
Chapter 1: Introduction

1.1 Overview

This thesis explores the complex relationship between types of recreational drug use and sexual risk behaviours, among HIV negative or undiagnosed (herein referred to as HIV negative) men who have sex with men (MSM), attending sexual health clinics in the UK. Particular patterns of drug use that are studied include poly drug use (use of multiple, different drugs) and the emerging phenomenon of chemsex (drug use to enhance or facilitate sex). The thesis describes the conception, management and implementation of two studies; the 2013/14 cross-sectional study ‘Attitudes to and Understanding Risk of Acquisition of HIV,’ (AURAH) and the 2015 to 2018 prospective cohort study ‘Attitudes to and Understanding Risk of Acquisition of HIV over time’ (AURAH2). Both studies included large MSM samples and were designed to capture information on a multitude of characteristics and behaviours, including poly drug use and chemsex, which are potentially associated with sexual risk behaviours and could increase the risk of acquiring HIV. The data provided by the AURAH and AURAH2 studies provides unique prevalence estimates for the types of recreational drug use (poly drug use and chemsex drug use) explored in this thesis, assesses which demographic, socioeconomic and mental well-being factors are linked to drug use, and specifically investigates any associations of drug use with sexual behaviour. The thesis goes on assess trends in recreational drug use, both in terms of changes over calendar time and changes within individuals. This is done firstly by comparing cross-sectional prevalence data on recreational drug use, in two consecutive periods of time from the AURAH study in 2013/14 to baseline data from the AURAH2 study in 2015/16. Next, within-person changes over time in chemsex and sexual behaviour over a three-year time period from 2015 to 2018 are investigated. Finally, predictors of starting (for the first time), stopping or initiating chemsex within the aforementioned three-year time period are examined. I then discuss my role in this thesis in the final chapter, before contextualising my results with the most current evidence and making recommendations for future work.

In this introductory chapter, I describe the aims and objectives of the thesis, outline the chapter contents and define the thesis population.

1.2 Thesis aims and objectives

1.2.1 Aim

The overall aim of this PhD is to investigate the prevalence of recreational drug use, including poly drug use and chemsex, and associations with sexual risk behaviours, among HIV negative MSM, attending sexual health clinics, in the UK within the last five years, and to examine whether prevalence of chemsex and sexual behaviour changed over time (in the
study). This will provide contemporary data to inform and support health care professionals and clinical services in the provision of integrated sexual health care and drug services. It will also support the development of recommendations for risk reduction and HIV prevention strategies among MSM, and provide further evidence to inform policy makers and commissioners on the extent to which recreational drug use impacts upon the health and well-being of a population that face significant mental and physical health inequalities compared to the heterosexual population (8), and who are particularly vulnerable to HIV infection.

1.2.2 Objectives

Using data from the cross-sectional AURAH study (2013/14) and data from the prospective cohort AURAH2 study (2014 -2018), to investigate among HIV negative MSM attending sexual health clinics in the UK:

1. Prevalence of recreational drug use, poly drug use and chemsex (AURAH study)
2. Prevalence of sexual risk behaviours, including HIV/STI transmission risk (AURAH study)
3. Associations of poly drug use and chemsex with demographic, socioeconomic and health related factors (AURAH study)
4. Associations of poly drug use and chemsex with sexual risk behaviours (AURAH study)
5. Changes in prevalence of recreational drug use, poly drug use and chemsex, over calendar time (AURAH study and baseline data from the AURAH2 study)
6. Changes in sexual risk behaviours, including HIV/STI transmission risk behaviours over calendar time (AURAH study and baseline data from the AURAH2 study)
7. Within-person changes in chemsex and frequency of chemsex over time (since entering the study) (AURAH2 study)
8. Within-person changes in sexual risk behaviours, including HIV/STI transmission risk behaviours, in the context of chemsex over time (since entering the study) (AURAH2 study)
9. Factors such as relationship status and sexual risk behaviours, associated with starting (for the first time), stopping or initiating chemsex (AURAH2 study)

The chapters that address each objective are outlined in the next section.
1.2.3 Chapter objectives

This section outlines the content of each chapter and which chapters the objectives are addressed in.

Chapter 1: In this chapter I outline the aims and objectives of the thesis and a summary of the content of each subsequent chapter.

Chapter 2: This chapter is divided into two main sections. In the first, I provide background evidence (1980-2000) on recreational drug use among MSM from when it was first described in light of the HIV/AIDS epidemic in the early 1980’s, predominantly in studies from the USA. I discuss how this evidence impacted on research in the UK and led to increased research into patterns and prevalence of drug use at the start of the millennium. I go on to describe how sexualised drug use, and specifically the emergence of chemsex, have been facilitated by the rise of geo-spatial networking apps. I examine how the relationship between sexual risk behaviours and types of recreational drug use, specifically poly drug use and chemsex, as well as risk of drug related harms, has necessitated putting recreational drug use and chemsex at the forefront of UK public health policy for MSM in recent years.

In the second section of the chapter, I review the literature specifically on recreational drug use and chemsex among MSM in the UK, from January 2000 up until the time this PhD commenced in October 2014. I provide prevalence estimates for poly drug use and chemsex drug use for this time and identify any gaps in the evidence base. Finally, I provide current definitions of poly drug use and chemsex that are investigated in this thesis.

Chapter 3: In this chapter I outline the design, methodology and implementation of the cross-sectional AURAH study which I developed for the collection of data in 2013/14 that are analysed in this thesis. This includes the development of the study protocol and questionnaire that I designed, the set-up of the study at the twenty participating clinical sites, and the ethical considerations and substantial amendments that I coordinated and implemented over the duration of the study.

Chapter 4: This chapter describes the design, methodology and implementation of the prospective cohort study, AURAH2, which collected baseline data from Nov 2014 to December 2016, and online follow up data until March 2018. Similarly to Chapter 3, I describe the study design and the methods I used to develop the materials for the study, including the study protocol and online questionnaires for longitudinal data collection. I describe the set-up of the study at the three participating clinical sites and the ethical considerations and amendments that I implemented during the course of the study across the clinical sites.
Chapter 5: In this chapter I describe the data management procedures for both the AURAH and AURAH2 studies from the point of data collection in-clinic, through to the storage of paper and digital data at the research site. I then provide an overview of the data cleaning I undertook for both studies, and describe how I derived variables for analysis, some of which were common to both studies, and others which were specific to the AURAH2 study and are defined in this chapter.

Chapter 6: Using data from the cross-sectional AURAH study, I firstly detail the statistical analysis that I planned. I then describe the characteristics of the study cohort, present the study response rates and then present the prevalence of the two types of recreational drug use of interest, poly drug use and chemsex drug use, as self-reported by participants. I then explore associations between the two types of drug use with socioeconomic variables and health related factors as well as sexual risk behaviours. I conclude by recommending key points for health care service delivery.

This results chapter specifically addresses Objectives 1, 2, 3 and 4 (Section 1.2.2).

Chapter 7: Using data from the AURAH and AURAH2 study, this chapter assesses trends over calendar time, by comparing the prevalence of poly drug use and chemsex drug use, between the two studies using the cross-sectional data from the AURAH study (2013/14) and the baseline data from the AURAH2 study (2015/16). Initially I detail the statistical analysis plan before I describe the overall study response rate of the AURAH2 study and describe the characteristics of the cohort, before exploring changes in prevalence of the two types of recreational drug use and individual drugs. I then examine associations of the drug use variables (poly drug use and chemsex) with measures of sexual risk behaviour, using the AURAH2 data. I use these findings to make recommendations for funding, policy makers and commissioners.

This results chapter specifically meets Objectives 5 and 6 (Section 1.2.2).

Chapter 8: Using data from the online phase of the AURAH2 study, in this chapter I investigate the changes in chemsex over time in the study, among the AURAH2 cohort. Initially, I detail the statistical analysis plan before I describe the characteristics of MSM that participated in follow-up in the AURAH2 study. I then present changes in prevalence of chemsex and individual chemsex drugs from online study initiation to end of online follow-up. I next describe within-person reported changes in frequency of chemsex. Finally, I examine measures of sexual risk behaviour over the same time period before I detail recommendations for HIV prevention based on the results.
This chapter address Objectives 7 and 8 (Section 1.2.2).

Chapter 9: In this chapter I use data from the baseline and online phase of the AURAH2 study to investigate predictors of starting (for the first time), stopping, and initiating (including both starting for the first time and re-starting) chemsex. I outline the statistical analysis that I planned before providing a description of MSM who reported starting, stopping and initiating chemsex (within the online follow-up period of the study). Next, I explore associations of starting, stopping and initiating chemsex with demographic and socioeconomic characteristics, relationship status and measures of sexual behaviour, before making recommendations for health care and drug service providers.

The results from this chapter specifically meet Objective 9 (Section 1.2.2).

Chapter 10: In this chapter I start by detailing my role in this thesis and presenting the thesis outputs. Next, I contextualise my findings using updated UK literature on recreational drug use and chemsex among MSM in the UK, from October 2014 to October 2019. I contextualise these findings with contemporary international evidence. Finally, I describe the strengths and limitations of the work and make recommendations for clinical services and commissioners.

The findings for each results chapter (Chapters 6 to 9) are discussed within the context of the available evidence at the time that the results were published, and key points are made at the end of each.

1.3 Defining the thesis study population

The term ‘men who have sex with men’ was introduced in 1992 in an attempt to question assumptions on homosexuality and heterosexuality and capture a range of male-male sexual behaviours (9). It avoids the characterisation of men that engage in male-male sexual behaviour, but do not identify by sexual orientation such as homosexual, gay, heterosexual or bisexual, or identify with a particular community such as the gay community (10). Despite the fact that the vast proportion of men that contributed data to this thesis self-identified as gay, I have used the term MSM throughout, as in academic literature it is used to indicate a broader category that includes gay and non-gay identified men, heterosexually identified men who have sex with men, bisexual men, men with any orientation and other subgroups who may face difficulty in disclosing their sexual behaviours in comparison to gay identified men, particularly in countries where same-sex behaviours may be a criminal offence (not the UK) and highly stigmatised (10). Although widespread use of the term MSM has received criticism for its potential to obscure the interplay of gender identity and sexual orientation (11), the term is now standard in HIV research and policy and is used throughout this thesis;
however, as with any term, it also has limitations and I acknowledge that it may not necessarily be a term with which the gay community identify.
Chapter 2: Literature review

2.1 Introduction

This chapter starts by presenting the background evidence on recreational drug use among MSM from when it was first explored in the context of sexual risk behaviour and the HIV epidemic in the early 1980’s. I then describe how patterns of sexual behaviour among MSM evolved in the context of developments in HIV treatment and HIV prevention milestones. I go on to describe the evolution of sexualised drug use and chemsex which, combined, make up a small but significant proportion of recreational drug taking by MSM in the UK in the present day. I demonstrate how evidence on recreational drug use from the USA around the millennium stimulated a research focus in the UK which has since examined types and trends of drug use such as poly drug use and chemsex, as well as individual drugs, and their associations with sexual risk behaviour including STI and HIV transmission. I also summarise the literature on other harms, both physical and psychological, associated with recreational drug use, and examine some of the issues faced by MSM that have been attributed to higher rates of drug use by the population. To conclude the first part of this chapter I discuss some of the methodological issues that previous research has encountered in collecting and interpreting data on recreational drug use and sexual behaviour.

The second part of this chapter aims to review the literature on recreational drug use and specifically chemsex, and sexual behaviours among MSM in the UK, from January 2000 to the time this PhD commenced in October 2014. In doing so, I describe the prevalence estimates of recreational drug use and types of drug use among MSM that this PhD focusses on, poly drug use and chemsex (Section 2.4.3, pg.54), and I identify gaps in the evidence concerning recreational drug use in the UK (Section 2.4.4, pg.57). Next I contextualise the UK evidence using available international evidence from the same time period (Section 2.4.5, pg.58) which I identified either through references from papers included in the literature review or through specifically searching Pubmed and Google, for national prevalence data on recreational drug use and sexual behaviour among MSM from the USA, Australia (from where the majority of evidence was drawn from before 2014) and Europe.

2.2 Literature review methodology

For my literature review (Section 2.4, pg. 46) I limited the search dates to include papers published from 1st January 2000 to 1st October 2014, which detailed prevalence estimates of recreational drug use and chemsex and contained UK data. The review was conducted using Pubmed and included a combination of terms in a title search for; ‘recreational drug use’ or ‘substance use’ or ‘drug use’ or ‘drug taking’ or ‘sexualised drug use’ or ‘chemsex', or
‘methamphetamine’ or ‘mephedrone’ or ‘GHB’ or ‘GBL’, or ‘gamma hydroxybutyrate’ or gamma butyrolactone and, ‘men who have sex with men’, or ‘gay men’. I conducted a full title screen to remove irrelevant or duplicate publications and then undertook an abstract review. Publications were included if they contained any prevalence data on recreational drug use and/or the use of any chemsex drugs (mephedrone, γ-hydroxybutyrate/γ-butyrolactone (GHB/GBL), crystal methamphetamine) I also used citations of relevant papers and the fortnightly bulletins on research in sexual health provided by the Sexual Health Research Network (http://www.sexualhealthnetwork.org.uk/), which I joined at the start of my PhD. In addition I searched the SIGMA research group’s website (a research group specialising in the social, behavioural and policy aspects of HIV and sexual health, part of the Faculty of Public Health and Policy at the London School of Hygiene & Tropical Medicine), looking at the website sections on ‘Drugs and Alcohol’ and ‘Chemsex’ and ‘Gay Men’s sex survey’ (www.sigmaresearch.org.uk) for any reports or publications that may not have been published on Pubmed. I limited the search to high-income countries because social, structural and biomedical drivers of the HIV epidemic in low- and middle-income countries and subsequent HIV prevention strategies may be very different (5). As this thesis uses data from the UK, classified by the World Bank as a high-income country (6), the literature used in this thesis is from other high-income regions, namely North America, Western Europe, Australia and New Zealand. The results of my literature review are described in Section 2.4.1 pg.46.

2.3 Background

2.3.1 Early research into recreational drug use and sexual behaviour among MSM (1982-1996)

Historically, the gay community has been associated with higher levels of recreational drug taking than the general population (12). Despite this, the majority of research on drug use among MSM in the UK has only been conducted within the last two decades. Outside of the UK, one of the first studies to investigate and report an association of substance use and sexual risk behaviour was published in 1986 from the USA in the context of the emerging HIV/AIDS crisis (13). The virus thought to cause AIDS was finally isolated by Luc Montagnier and Françoise Barré-Sinoussi in 1983 (14, 15), and proved to cause AIDS by Robert Gallo (16). The virus caused severe immune deficiency which had first been described among a group of gay men in the USA, leading to the syndrome being called gay-related immune deficiency (GRID) (17). Whilst little was known about the transmission and lifecycle of HIV, the notion of a ‘risk group’ that held individuals responsible for their health behaviours caused huge stigma and discrimination in what was an already stigmatised community (18), and gave people who did not identify as part of a ‘risk group’ a false reassurance of safety.
In the early 1980’s and into the 90’s, initial focus for HIV prevention was on behaviour change (20), and condom use was at the forefront of campaigns (21), as highlighted by several systematic reviews that explored HIV prevention research from the start of the epidemic (22, 23). As primary HIV prevention campaigns focused on potentially modifiable risk taking behaviours, substance use (including alcohol) was scrutinised as it was thought to interfere with decision making and judgment, which increased the probability that risky sexual behaviours such as condomless sex (CLS), would occur (24, 25). As such, research into substance use, its relationship with sexual behaviour and the extent of the issue among MSM was examined to determine whether a causal relationship existed between alcohol or drug use and high risk sexual behaviour for HIV transmission (26, 27).

In 1986, the AIDS Behavioural Research Project, a prospective cohort study from the USA used cross sectional data from a group of MSM (n=655) in San Francisco between May 1984 to May 1985, to investigate associations between drug and alcohol use during sexual activity and sexual behaviour linked to risk of transmission of HIV/AIDS (27). It showed that use of particular drugs during sex (which were listed as alcohol, amyl or butyl (volatile) nitrites “poppers”, marijuana/hashish or “other drugs”), the number of drugs used during sexual activity, and the frequency of combining drugs and sex, were all positively associated with sexual activity associated with increased risk of HIV transmission, such as condomless anal intercourse (CLAI) (27). Possible reasons for the significant association between substance use and increased sexual risk behaviour included the following: (i) substance use has a dis-inhibitory effect which enables high risk sexual activities; (ii) substance use has an aphrodisiacal effect that causes such an intensity of libido through a physiological mechanism that control of sexual behaviour is lost; and (iii) individuals have different personality needs, which in some manifests in the use of substances in order to participate in higher risk sexual behaviour that may transmit HIV (27). This study from the USA was one of the first studies to document a positive association between substance use and sexual risk behaviour in the 1980’s. However, to better understand the scale of substance use within the MSM population, prevalence estimates were needed. Early prevalence estimates suggested that up to a third of MSM were problematic drinkers and nearly a fifth manifested problems associated with drug use (28-30). However in parallel with current day research (31), such estimates were contentious and hard to generalise due to the small number of studies that had been conducted and the limited representativeness of the often opportunistically-drawn samples of MSM which such studies were based on (28, 30). In 1988, Stall and Wiley, again using data from the USA (32), questioned previous research, that had shown very high prevalence rates of drug and alcohol use in the MSM community. They argued that the use of convenience study samples (or opportunistically-drawn
samples) may or may not accurately represent the community from which they are drawn and that using bar patrons could potentially overestimate the scale of substance use among MSM (32). Stall and Wiley used data from the prospective cohort study, ‘the San Francisco Men’s Health Study’ which recruited a large scale random household sample of homosexual and heterosexual men living within an urban district of San Francisco, California (n=1034), to show that, whilst rates of alcohol use were higher among MSM compared to their heterosexual counterparts (19% and 11% respectively for frequent/heavy drinking), they were not as high as had been previously estimated (32). However the difference was more notable for substance use than alcohol; MSM were five times more likely to use MDA (a stimulant closely related to ecstasy), three times more likely to use barbiturates, and twice as likely to use amphetamines (other than MDA) than heterosexual men (32). Despite limitations including generalisability (the study was only conducted within a single, middle-class, urban district of San Francisco) and potential biases that are common in face-to-face interviews, including social desirability and self-presentation bias (discussed in Section 2.3.9, pg.45), several key themes emerged from Stall and Whiley’s research that are reflected in trends in drug use among MSM in the current era. Firstly, that MSM who use drugs are likely to be poly drug users (33), using different drugs either in combination or sequentially. Secondly, that there are certain kinds of drugs that are particularly popular among MSM (34) (in the 1988 paper these were named as amyl nitrites (poppers) and amphetamines). Thirdly that few MSM seem to be characterised by the excessive use of one drug at any given time in a way that might suggest abuse or dependence (although abuse/dependence were not defined in the paper). However, research on problems and predictors of problematic substance use (whereby substance use is measurably impacting in a negative manner on an individual’s physical or mental health) was lacking (32).

2.3.2 Sexual behaviour, HIV risk reduction strategies and recreational drug use in the cART era 1996-2019)

The era of combination anti-retroviral treatment (cART) started at the 11th International AIDS Conference in Vancouver in July 1996, where data on the substantial benefit of indinavir-based highly active cART were reported (35, 36). This concept of three drug therapy was quickly incorporated into clinical practice and rapidly showed impressive benefit with a 60% to 80% decline in rates of AIDS, death, and hospitalization in countries with access to cART (37). Whilst cART significantly improved morbidity and mortality rates among those who were diagnosed with HIV and had access to it, behavioural interventions and the investigation of factors that effected behaviour were still at the forefront of prevention efforts to reduce transmission of HIV in the decade following 1996 (21). Between 2006 and 2012, epidemiological research continued to focus on substance use and the relationship with
sexual behaviour. Four reviews, all from the USA (38-41), found a strong positive association between substance use and sexual risk behaviour. However, it was increasingly recognised that, although previous approaches had provided essential indicators on sexual risk behaviour among substance using MSM, they remained limited in scope to explain the dynamics of the relationship, due mostly to the design of the studies reviewed. The vast majority of studies in the reviews were cross-sectional, which by nature of design meant that temporality was impossible to determine: substance use could cause high risk sexual behaviour, or high risk sexual behaviour could cause drug use, or some third factor (such as having a “risk-taking personality” or another unquantified characteristic) could cause both substance use and high-risk sex (42).

In some of the first UK research (in 1994) to look at the relationship between drug taking and sexual risk among MSM, there was a call for re-shaping of future research paradigms to improve methodological designs so that they were more able to provide evidence on causality (43), as well as to explore individual expectations related to drug taking, risk behaviour and social relationships. Such evidence could provide both a social epidemiology and a sociology of risk behaviour (43). This call for a change in research direction was echoed in a later paper from the USA, published in 2000, which suggested that research must extend beyond the quantification of substance use to the social and medical problems that MSM experience in connection with substance use, as well investigate how cultural and social shifts shape individual behaviour, to better design more effective community-level interventions (44). This call is reflected in Public Health England’s current action plan to improve the physical and mental health of MSM by addressing core issues that impact upon health, issues at the intersection of mental health, alcohol and recreational drug use (45).

Details of recent studies that have been able to address the issue of temporality between substance use and sexual behaviour, and qualitative studies that have explored individual behaviours and reasons attributed to substance use, are explored later in this chapter in Section 2.3.8, pg.45.

2.3.2.1 Sexual behaviour and HIV risk reduction strategies

The introduction of cART transformed HIV from a terminal illness to a chronic manageable condition with similar shifts in community perceptions among MSM on HIV (46). Similar to research into substance use and sexual behaviour, most of the research on HIV transmission risk reduction strategies originated from the USA, with some from Australia. This research described innovative risk reduction practices that were adopted by MSM in this period (1996 - c2000) to facilitate sexual behaviour (and CLS in particular) whilst taking HIV status into account. These risk reduction practices included: sero-sorting (individuals...
only have condomless sex (CLS) with partners of the same perceived HIV status as themselves) (47), strategic positioning (allocation of sexual positioning during anal sex dependent on HIV status, i.e. HIV-diagnosed partner is receptive not insertive, due to the known increased acquisition risk from receptive compared with insertive anal intercourse) (48), negotiated safety, whereby partners practicing CLS come to an agreement to use condoms with other sexual partners (49) and, in the last two decades, the use of viral load to negotiate condom use (for example if someone has an undetectable viral load then condoms are not used) (50).

Risk reduction practices were also explored among MSM in the UK in the late 90’s and early 2000’s (51-54) and similar practices to data from the USA and Australia were evident. A large (n=6064) annual survey of gay men (both HIV-diagnosed and HIV negative) using London gyms between 1998 to 2005 and 2008, demonstrated that overall there had been a steady increase in CLS over calendar time. However the overall increase concealed important differences between non-concordant CLS (i.e. CLS with a partner of unknown or discordant HIV status) and concordant CLS(52). The London gyms study found that the percentage of MSM reporting non-concordant CLS significantly increased between 1998 and 2001, significantly decreased between 2001 and 2005 and then levelled off between 2005 and 2008, and whilst the percentage of HIV negative men who reported concordant CLS increased between 1998 and 2008; less than half established seroconcordance by testing together (52). Subsequent scrutiny of the same data, showed that the increase in CLS actually plateaued and remained high from 2002 (55), and that there was evidence to suggest that risk reduction strategies such as negotiated safety were being widely adopted (51). However risk reduction strategies themselves are not able to provide complete protection against HIV transmission and were not adopted in a manner (i.e. a couple taking an HIV test together to establish concordance) to provide effective prevention of HIV transmission (51). Data gathered in 2010-2012 by the National Survey of Sexual Attitudes and Lifestyles (NATSAL), a large (n=6293 men) representative survey of sexual behaviour from the UK general population conducted every decade since the early 90's, described no change in prevalence of condomless sex or HIV risk perception in MSM over the first decade of the millennium, although the sample of MSM in the study was small (2.6% n=190), meaning estimates should be interpreted with caution (56).

A 2013 study that modelled HIV trends in the UK from the beginning of the epidemic (1980–2010) demonstrated that the incidence of HIV among MSM in the United Kingdom had increased (estimated mean incidence 0.30/100 person-years 1990–1997, 0.45/100 person-years 1998–2010), despite only modest increases in CLS and high ART coverage (57). An increasing incidence in the number of new diagnoses was also reflected in data from across
North America, Western Europe and Australia (58). The ongoing increase in the number of new HIV diagnoses among MSM in the study period could not be fully explained by changes in HIV testing alone (58), suggesting some ongoing increase in condomless sex among MSM must have occurred (59). Thus, behavioural strategies and practices such as recreational drug use, which had been shown to be associated with sexual behaviour, were still of significant importance in terms of HIV prevention, alongside emerging biomedical interventions (discussed further in Section 2.3.2.2). Whilst evidence on risk reduction strategies demonstrated that MSM were adopting sexual behaviours to limit HIV transmission whilst engaging in CLS, research into the extent of, and impact that substance use might have on the “grass roots” risk reduction strategies (sero-sorting, strategic positioning, negotiated safety and use of viral load) was, and remains, relatively limited. A 2015 report into crystal methamphetamine use in a sexual setting demonstrated that, particularly when injected, the effects of crystal methamphetamine (detailed in Section 2.3.6, pg.41) are likely to impact risk reduction precautions and intentions to practice safer sex such as the use of condoms (60). A cross-sectional, online study that used event-level analysis conducted in 2011/12 among 321 MSM also concluded that the association between crystal methamphetamine and sexual risk behaviour may be mediated by loss of control (61). Furthermore, some substances are specifically used to facilitate the types of sex that the individual desires (62, 63), i.e. poppers (amyl nitrites) which relax smooth muscles and facilitate penis-anus penetration, are associated with receptive anal intercourse (64), whilst erectile disfunction drugs such as Viagra® may be associated with the insertive role (65).

2.3.2.2 Treatment as Prevention (TasP) and Pre-Exposure Prophylaxis (PrEP)

The last two decades have proved pivotal for advances in HIV in terms of understanding HIV transmission and developing biomedical prevention strategies. This section describes the key studies that dramatically changed HIV prevention interventions and the influence these may have had on sexual behaviour among MSM, before the following section discusses the impact that recreational drug use might have on such strategies.

In 2000, using data from community cohort studies in the Rakai area of Uganda, Quinn et al demonstrated the strong association between higher HIV viral load and increased risk of HIV transmission among heterosexuals, and concluded that viral load is the chief predictor of the risk of heterosexual transmission of HIV and that HIV transmission was rare among persons with a viral load of less than 1500 copies of HIV-1 RNA per millilitre (66). Following this, in 2008, the Swiss Federal Commission for AIDS related Issues released a statement, based on an expert opinion of risk of HIV transmission with suppressive cART. This stated that the
risk of HIV transmission from an HIV-diagnosed individual once the virus was stably suppressed for at least six months with cART (and there were no other reported STIs), was negligible (67). The pivotal evidence for the concept of ‘Treatment as Prevention’ (also known as Universal Test and Treat (UTT)), came from an international randomised controlled trial (n=1763) in 2011 conducted by the HIV Prevention Trials Network study 052 (HPTN 052). In HPTN 052, HIV-diagnosed individuals in serodifferent couples were randomised to either early initiation of cART or initiation of cART delayed until CD4 counts fell below in-country guideline thresholds. The final study results reported in 2016 demonstrated that early initiation of cART reduce sexual transmission of HIV by 96% (68).

However, the reported effect of cART on transmission was in conjunction with high levels of self-reported condom use and was not necessarily generalisable to MSM, as the sample of MSM in the study was very small (<2%, 37 couples). The fact that cART reduces transmission risk to effectively zero in the absence of condom use in individuals with VL below 200 was demonstrated first in heterosexuals in 2016 through the PARTNER Study (69) and more recently among MSM in the PARTNER2 study (69, 70) and the Opposites Attract study (Australia) (71). The combined weight of evidence has had huge implications for HIV prevention strategies, the most far-reaching being the “U=U” campaign, Undetectable=Untransmittable, which has been endorsed by over 900 organisations in nearly 100 countries, including the Centers for Disease Control in the USA, UNAIDS, the World Health Organisation and the British HIV Association (72).

Similar in terms of impact for HIV prevention efforts as ‘TasP’, but aimed at the HIV negative population, is the role of pre-exposure prophylaxis (PrEP), anti-retroviral drug(s) taken by HIV negative individuals prior to sexual exposure either daily (73) or “on demand” (74) (i.e. around the time of potential sexual risk). The iPREX study, conducted in 2010, was an international randomised placebo-controlled trial of MSM and transgender women (who have sex with men) (n=2499) which provided an anti-retroviral medication (used for treating HIV) in the form of emtricitabine and tenofovir disoproxil fumarate (FTC-TDF) or placebo, plus a comprehensive HIV prevention package including condoms, HIV and STI testing and counselling (75). PrEP was shown to reduce the risk of HIV acquisition by 44% in the iPREX study (75). Following on from this, two randomised controlled trials in MSM (and very small numbers of transgender women), the IPERGAY study in France (which used on demand PrEP) and the PROUD study (which used daily PrEP) in the UK, simultaneously presented results in 2016, both demonstrating that the use of PrEP prevented the transmission of HIV to HIV negative individuals by 86% (76, 77). Despite the significant implications for HIV prevention of these studies, PrEP, was only made available in 2017 in England for 13,000 participants enrolled on the IMPACT trial, which has since been increased to 26,000 (78).
PrEP was made freely available in Scotland and Wales in 2018. As a result of the slow and limited access to PrEP in England, websites that were developed by community activists (79, 80) sprung up in 2016, to offer access to generic PrEP by ordering it online.

Using 2016 data, Public Health England reported an 18% reduction in new HIV diagnoses, with a 21% decrease among gay and bisexual men. This was the first decline in diagnoses among this group since the beginning of the epidemic (81). The decline was initially focused in five London clinics which delivered high levels of HIV testing, rapid initiation of cART upon HIV diagnosis, and where PrEP purchased online was supported (82). The decline in HIV incidence has continued and continues to be attributed to a combination of prevention efforts including condom provision, PrEP, prompt cART after diagnosis and expanded HIV testing (83).

The significant changes in HIV prevention in the post cART era led to some debate on whether new prevention tools such as TasP and PrEP would impact upon sexual behaviour among MSM. A study from two decades ago, conducted in 1999 in Australia, showed that HIV-negative MSM had a higher likelihood of engaging in CLS in sero-different relationships (i.e. with an HIV-diagnosed partner) where their partner reported an undetectable viral load (50), even before the concept of TasP was recognised. In terms of risk behaviours and PrEP, a recent systematic review from the USA (2018) was inconclusive as to whether PrEP led to increased sexual risk behaviours (84), and another recent systematic review reported that well coordinated and integrated PrEP and STI programmes could offer an opportunity to bring down the incidence of STI infections (85). Quantitative data from the UK PROUD study, which recruited MSM at high risk of HIV acquisition, reported a very high rate of high risk sexual behaviour (24% of participants had CLS with more than ten partners in the past three months) (n=136/544) (76). Qualitative data from the study suggested that, in general, PrEP users (selected on the basis of risk) were already having frequent CLS and that PrEP added to inconsistent use of other existing risk management strategies such as irregular condom use, sero-sorting and strategic positioning (86).

The term ‘treatment optimism’ has been used to broadly describe beliefs that HIV is a less serious health threat due to the availability of cART, and that there is a reduced susceptibility to HIV transmission due to the suppressive effect of cART on the viral load of HIV-diagnosed sexual partners (87). Longitudinal studies from the USA and the Netherlands (published between 2000 to 2005) reported conflicting views on whether sexual behaviour among MSM increased in light of HIV treatment optimism, although these studies were conducted before the results of HPTN 052, PARTNER and PARTNER2 studies (88-91). However research
from the UK suggested that HIV optimism alone was not sufficient to explain changes in increases in sexual behaviour (namely CLS) at population level in the early 2000’s (92-94).

2.3.2.3 Impact of recreational drug use on adherence and interactions with cART, and HIV prevention interventions

In light of the major steps forward in HIV prevention, research to establish whether recreational drug use impacts upon access to and adherence to HIV treatment (for HIV-diagnosed MSM) became increasingly important, as did understanding the negative consequences that drug use could have in relation to interactions with cART. In the early 2000’s, a small qualitative study (n=23) (95) used semi-structured interviews to discuss the effects of methamphetamine use on medication adherence among gay and bisexual methamphetamine-abusing men enrolled in an outpatient drug treatment research project. It described two types of non-adherence to cART that were linked to methamphetamine use, planned and unplanned. Planned non-adherence was a strategy employed for coping with demanding HIV medication schedules or linked to sexual behaviours whilst using methamphetamine or through fear of interaction between methamphetamine and HIV medication (95). Unplanned non-adherence was related to food and sleep disturbances linked to methamphetamine use (95). Despite the small sample size, the study provided a valuable insight in to the importance of tailoring specific HIV medication adherence plans for specific populations. A larger (n=150), longitudinal study, also from the USA, followed medication adherence among HIV-diagnosed individuals over six-month periods between 2001 and 2005 (96). It demonstrated that drug users (predominantly stimulant users, cocaine and/or methamphetamine) were over four times more likely to have suboptimal adherence to cART (defined as fewer than 90% doses taken) compared to those who showed no recent drug use (96). Although the study did not disaggregate by sexuality so may not be specifically generalisable to MSM, its strength lay in its assessment of drug use through multiple methods that went beyond self-report (which can be unreliable among active drug users (97)) to urine toxicology and structured interviews (96). An extensive review from the USA, published in 2006, summarised available evidence on individual club drug use and HIV infection. It highlighted a lack of research on club drugs (drugs taken in the social or clubbing environment, defined in this study as MDMA, methamphetamine, ketamine, GHB, and inhaled nitrites “poppers”) and HIV infection, and demonstrated that the combination of some club drugs (specifically MDMA, GHB, ketamine, and methamphetamine) and cART can produce serious drug-drug interactions, with some resulting in fatality (98) due to their partial clearance through the cytochrome P-450 system, which is the same for a variety of retroviral medications (99).
Multiple studies in the first decade of the millennium demonstrated that recreational drug use was associated with a greater risk of adherence failure and virological failure (95, 96, 98, 100-102), with available cART at the time. Newer regimens of cART are more forgiving in terms of missed doses (particularly regimens including protease inhibitors, and the integrase inhibitor, Dolutegravir) and levels of adherence needed to achieve and maintain HIV viral suppression may be lower today than they previously were (103). However the risk of interactions with cART (particularly regimens including boosting agents such as the protease inhibitors) are most likely to be involved in harmful interactions with recreational drugs (104). Therefore, careful consideration needs to be paid to cART regimens for those using recreational drugs with an emphasis on adherence support as well as standard mental health and well-being and physical health screening.

In terms of the impact of substance use on HIV prevention strategies, there is limited research. One recent (2018) study, from a sub-group of MSM (n=330) in iPREX, the placebo controlled randomised controlled trial of PrEP, demonstrated that PrEP adherence, indicated a fivefold greater odds of sub-optimal PrEP adherence in substance users, compared to non-users (105). In contrast another recent (2019) study from the USA demonstrated that, among a small group (n=104) of substance using MSM (in this case club drugs used included ketamine, MDMA/ecstasy, GHB/GBL, cocaine, or methamphetamine), MSM club drug users (n=51), on average were no more likely to miss a PrEP dose if it was taken as a daily regimen than non-club drug users (n=53) (106). However the use of club drugs at event-level (i.e. specifically with CLS) was significantly associated with missing a PrEP dose either on the same days as reported club drug use or the day after (106).

2.3.3 The emergence of research into recreational drug use in the UK

As is clear from the earlier sections of this chapter, research in to recreational drug use and sexual behaviour among MSM before the millennium was from the USA. However, the early 2000’s saw an increase in the number of UK studies investigating recreational drug use among MSM, for several reasons. Firstly, evidence from the USA (in 2001) and Australia (in 2003 and 2004) showed that crystal methamphetamine was becoming an increasing public health concern among MSM and that there were significant associations between the growing popularity of crystal methamphetamine (and other recreational drugs) and a possible sexual culture shift towards more high risk behaviours (107-109). Secondly, the lack of data on recreational drug use, its prevalence and associations with sexual behaviour among MSM in the UK, was sharply contrasted with the wealth of data particularly from the USA (110). There was concern that a shift from traditional club drugs such as ecstasy and cocaine, towards a more potent, cheap, and longer lasting drug, with a documented
association with high risk sexual behaviour and HIV transmission risk (111-113), could be occurring in the UK unmonitored. Thirdly, the emerging use of the internet and potential for meeting sexual partners and engaging in high risk sexual behaviour among MSM in the early 2000’s (114) was becoming an integral platform for the subsequent planning of sexual encounters involving specific drugs which would evolve in to the phenomenon now known as chemsex (see Section 2.3.5, pg.37).

As research from the USA (109, 111, 115-117) and Melbourne, Australia (118) demonstrated that the use of crystal methamphetamine was increasing among MSM in the late 90’s and early 2000’s, a UK study was set up to investigate whether this pattern or use was similar in the UK. The study recruited MSM from London gyms, HIV testing clinics and HIV treatment centres (all in London) in 2003-2005 (n=2246) and showed that use of one or more drugs (from a list of five: methamphetamine, cocaine, ecstasy, ketamine and amphetamine) in the previous year ranged from 36.2% among HIV untested men in gyms to 72.4% among HIV-diagnosed men in gyms (119). The same study estimated that approximately 1 in 10 MSM in London had used crystal methamphetamine in the previous year, but most used it infrequently, once or twice in a 12-month period. In contrast to trends in the USA and Australia, there was no evidence to suggest that the use of crystal methamphetamine had risen between 2003 and 2005 in London (119). Aside from crystal methamphetamine use, some of the earliest UK data to provide prevalence estimates of recreational drug use among MSM in the UK was from the 1999 Gay Men’s Sex Survey (GMSS) (n=9322), where participants were recruited from PRIDE events across England as well as through HIV health promoters working with MSM outside of large urban centres (120). GMSS showed that nearly half (48.4%) of the men surveyed had used poppers in the past year and that over a quarter (28.7%) had used a Class A drug in the past year (the highest of three classes under the Misuse of Drugs Act 1971, includes crack cocaine, cocaine, ecstasy (MDMA), heroin, LSD, magic mushrooms, methadone, methamphetamine (crystal meth)(121)). Subsequently, GMSS expanded on this research both geographically (to England and Wales) and in the number of drugs surveyed (to a list of 11: alkyl nitrates, cannabis, ecstasy, cocaine, ketamine, amphetamine, GHB, LSD, crack, heroin, any drugs), and it further compared findings from 1999 to data collected in 2005 to examine possible trends in illicit drug use (34). The study showed that: the majority (59.9%) of MSM surveyed in 2005 had used one or more drugs in the last year (similar prevalence in 1999, 59.7%), that London had the highest reported rate of drug use (67.5%) but prevalence was also high outside of London (57.4%) and that there had been significant changes in the drugs used over the 6 year period. Whilst amphetamine and LSD use had become much less common,
ketamine use had increased by over three-fold, and the use of cocaine, GHB and ecstasy had also increased significantly (34).

The public health concern in the USA around crystal methamphetamine use, including addiction (discussed further in Section 2.3.6, pg.41), highlighted the need for better surveillance of recreational drug use in the UK, despite evidence indicating that there was not an increase of use among MSM in the UK (110). The reasons for this were, firstly, an emerging theme from research into recreational drug use among MSM described increasing rates of poly drug use, particularly of newer, synthetic drugs, the use of which could be becoming normalised in specific sexual and social environments (108, 109, 122). Secondly, whilst the nature of the relationship of substance use with sexual risk behaviour and STI transmission remained unclear since it had first been explored in the 1980’s and 90’s, more up to date research had demonstrated a strong correlation between substance use and sexual risk behaviour after controlling for potential confounders. New evidence demonstrated that certain drugs such as crystal methamphetamine, ecstasy, GHB/GBL, cocaine, and ketamine taken before or during sex, were independently associated with CLS with casual partners of unknown HIV status, although this research was largely conducted in HIV-diagnosed MSM (41, 111, 113, 123, 124). Finally, research from the USA showed that it was sexual health services where MSM with problematic drug use were most likely to present in large numbers (124), and that sexual health services could be ideally placed to offer early interventions including behaviour change support, health promotion and harm minimisation strategies. However, evidence on the impact of recreational drug use among MSM on sexual health services was not reported in the UK until almost a decade later in 2013 when it was first described in a toolkit written for sexual health staff (7). The 2013 toolkit written for sexual health and HIV service staff at 56 Dean Street clinic, London, reported that 110 MSM who had presented for HIV post-exposure prophylaxis (PEP) or sexual health screening within one month, had disclosed and requested support with sexualised drug use, highlighting the need for established substance use services within an acceptable setting for MSM (125). For this reason, a full-time drugs worker who had bridged the gap between substance use services and sexual health, trained the clinic health care providers in supporting sexualised drug use, within the sexual health setting.

2.3.4 Sexualised drug use within the UK

Whilst stimulants, such as ecstasy and cocaine, in combination with volatile nitrites (poppers), a muscle relaxant, had been shown to facilitate MSM sexual encounters over the decades spanning the millennium (126), a report from Antidote, the UKs only LGBT drug and alcohol service that was established in London in 2002, described how in 2013, sexualised
use of drugs such as crystal methamphetamine, mephedrone and GHB/GBL, were fast replacing the more common drugs used in the early 2000’s, such as ecstasy and cocaine, which were used in a social, rather than sexual setting (7). The report also noted that in 2012, referrals from sexual health clinics to Antidote had increased from 8% of Antidote presentations (n not reported) in 2005, to 63% in 2012, (7). Further anecdotal evidence described the rise in sexualised drug use on the London gay scene and the severe impact this was having on sexual health services (127). Results from the ASTRA study (Antiretrovirals, Sexual Transmission risk and Attitudes study) in 2014 (detailed in Section 2.4.2, pg.53) also highlighted the changing culture of recreational drug use among (HIV-diagnosed) MSM in the UK, the potential scale of the issue among MSM, and the need for services to respond by collaborating with substance use services (128). This cross-sectional study of over 2000 HIV-diagnosed MSM, recruited from HIV out-patient clinics demonstrated that over half (51%) had taken recreational drugs within the last three months, about a quarter had used at least three drugs (defined as poly drug use) within that time period, and that recreational drug use and poly drug use were associated with being sexually active, and more strongly associated with all measures of CLS (128). Findings from several studies had shown HIV-diagnosed MSM were more likely to use almost all types of recreational drugs compared with MSM who were HIV-negative or undiagnosed (126, 129, 130). However concurrent research around the same time as the ASTRA study demonstrated that sexualised drug use was not confined to the HIV-diagnosed population, as demonstrated by an increase in MSM reporting sexualised drug use whilst attending sexual health clinics for PEP (clinic data from Brighton from over 250 MSM from two four-month periods in 2013/2014 and 2015). This study (detailed in the literature review in Chapter 10, Section 10.4.3, pg.232) showed an increase in drug use leading to a PEP episode had increased significantly from 2013/14 18% (n=9/51) to 41% 41/101 in the 2015 period) (131, 132). Furthermore an emerging pattern of specific types of drugs (mephedrone, crystal methamphetamine and GHB/GBL) used to facilitate and prolong sexual activity were being reported by MSM attending sexual health clinics (133-135), often in conjunction with lengthy episodes of CLS with multiple partners, now characterised as chemsex.

2.3.5 Chemsex

Chemsex, in the UK, is primarily defined as the use of three specific drugs (mephedrone, crystal methamphetamine and, or, GHB/GBL), either used individually or concurrently to enable, enhance and prolong sexual interactions (133). The choice of the three drugs is in part due to market availability and in part structural drivers such as local norms and cultures around drug use (136). However other drugs, such as ketamine and alkyl nitrites (such as poppers) are also used within the context of chemsex, and there is variance of individual
chemsex drugs in different countries (136). Different substances outside of the three chemsex specific drugs, may be used within a chemsex setting such as Viagra (to enhance or extend sexual functioning or overcome erectile dysfunction which often accompanies methamphetamine use (137, 138)). However this drug is often considered a “casual addition” as it does not provide the pleasure, disinhibition and length of sexual episodes that drive and define chemsex (139). Table 1 describes the three individual chemsex drugs, how they are taken, their effects and side effects.

Table 1 Chemsex drugs and effects – Drug profiles (EMCDDA 2018)(140)

<table>
<thead>
<tr>
<th>Name of Drug (also known as)</th>
<th>Delivery</th>
<th>Pharmacology</th>
<th>Effects</th>
<th>Side-effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal methamphetamine (chalk, T, crank, crystal, ice, meth, shabu, Tina, tweak)</td>
<td>Swallowed, snorted, rectal insertion, smoked, injected</td>
<td>Central Nervous System (CNS) stimulant increases the activity of the noradrenaline and dopamine neurotransmitter systems.</td>
<td>Increased confidence, disinhibition, sociability, libido and energy. Effects usually start within 30 minutes and last for many hours</td>
<td>Loss of appetite, insomnia, agitation, confusion, paranoia, impulsivity, aggression, psychosis, dehydration, hypertension, tachycardia, rapid breathing, elevated body temperature, teeth clenching, dilated pupils.</td>
</tr>
<tr>
<td>Mephedrone (meph, drone, meow meow, subcoca-1, Bubbles)</td>
<td>Snorted, swallowed, rectal insertion, injected</td>
<td>CNS stimulant (cathinone class)</td>
<td>Increased confidence, disinhibition, sociability, libido and energy. Effects usually start within 15-45 minutes, lasts 2-3 hours</td>
<td>CNS symptoms like above</td>
</tr>
<tr>
<td>GHB/GBL (G, Liquid G, X or E, gamma, lakk, Juice)</td>
<td>Swallowed, rectal insertion,</td>
<td>CNS depressant</td>
<td>Disinhibition, sociability, libido, relaxation, increased confidence Effects usually start within 15-20</td>
<td>Drowsiness, seizures, nausea, vomiting, incontinence, amnesia,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High doses can lead to</td>
</tr>
</tbody>
</table>
minutes, lasts 2-3 hours
withdrawal syndrome, unconsciousness, bradycardia, respiratory depression and death
Interaction with alcohol can lead to death

The publication of “The Chemsex study” in 2014 (133) (further described in the literature review, Section 2.4.2, pg.53) provided the first literature to comprehensively describe chemsex in the UK. The phenomenon of chemsex attracted intensive media attention (141, 142), as well as academic (134, 143-147) and clinical notice. The Chemsex study used mixed methods to describe and contextualise chemsex. It involved two analyses, the first was a secondary analysis of quantitative data from the 2010 European Men who have sex with Men Internet Survey, an online survey conducted across 38 countries in Europe in 2010 (n=174,209), using the data from MSM in London (specifically the boroughs of Lambeth, Southwark and Lewisham(LSL)) (n=1142, 22% of the London sample and 8% of the England sample). The second analysis was a qualitative study of thirty face to face interviews among London-based MSM that had used any of the three chemsex drugs within the last twelve months, and a series of focus groups with the gay community and clinical service providers (133). Before 2014, chemsex had predominantly been described in the USA and Australia, but referred to as ‘party’n’play’ in the USA, where, aligned with increasing reports of crystal methamphetamine use, ‘party’n’play’ simultaneously emerged as a public health concern in the first decade of the millennium (148-150) when the use of the internet for drug seeking and sex became a public health concern due to the considerable potential to transmit HIV as well as other related harms (151) (discussed in Section 2.3.7, pg.44). The results of The Chemsex study highlighted that whilst chemsex was only engaged in by a minority of MSM (10% of MSM in LSL had used GHB/GBL and 10% had used mephedrone, <5% had used crystal methamphetamine, all in the last 4 weeks), the complex array of issues to men’s health, including HIV/STI transmission, psycho-social issues, mental health and well-being, and physical harms related to individual drugs used in chemsex, were of significant concern (133). The report noted that there were few services in place for MSM in sexual health services that were competent to address the psychosocial aspects of health and harms arising from chemsex, and that there was a lack of harm reduction information relating to chemsex in gay sexual contexts (133).
Since 2014, there has been considerably more research into chemsex as its emergence was recognised by Public Health England to pose significant hazards both to the individual involved and public health (152). Detailed evidence on prevalence of chemsex within the UK from the period of Oct 2014 to Oct 2019 is discussed and presented in Chapter 10. However, of note, both pre 2014 and in the present day, there is no national surveillance data that captures the prevalence of chemsex within the population (31). There also continues to be ambiguity around the definition of chemsex, particularly concerning which drugs are included, which survey instrument or recall period(s) is best placed to capture chemsex, and whether the reported use of chemsex associated drugs can be used as a proxy for chemsex itself, given that some of the drugs are often used in a social setting as well as a sexual one (153-155).

An activist and community expert on chemsex, David Stuart, Chemsex lead at 56 Dean Street clinic, London, argued that to define chemsex by the use of the three most common drugs associated with it and the consequential actions within a sexual setting would be to misunderstand the phenomenon (139). Stuart (2019) posited that it is some of the distinctive characteristics around gay sex and culture which impact upon the enjoyment of sex that defines the chemsex phenomenon (139). Cultural factors such as societal attitudes towards homosexuality, the trauma and stigma around the AIDS epidemic, the technological revolution that arrived with the advent of smartphones and “hook-up” apps and a subsequent rejection culture derived from these avenues, may all be uniquely part of the historical and cultural experiences in gay sex that define chemsex (139). This view is reflected in another paper that attempts to bring together the sociological and psychological threads of chemsex as a phenomena rather than a defined activity (156). Despite ongoing ambiguity and difficulty in defining chemsex, its emergence was undoubtedly facilitated by the rapid rise and popularity of the internet and the arrival of geo-spatial networking apps that enable users to rapidly organise meet-ups with sexual partners and access chemsex drugs all on their smartphones.

2.3.5.1 The internet, geo-spatial networking apps and the evolution of chemsex

Cross-sectional studies from the USA in 1999 (n=175 internet chat rooms observed) and 2000 (n=856) demonstrated an association between seeking sex on the internet and high risk sexual behaviour (157, 158). The first research in to this topic from the UK (London) in 2001 also showed that seeking sex on the internet was associated with high-risk sexual behaviour and recent STI diagnosis among HIV-diagnosed and HIV negative MSM (n=743) (114). The study noted that access to the internet had risen dramatically in the few years preceding the study period (Jan-Feb 2000). The body of evidence demonstrating the
associations between high risk sexual behaviour and seeking sex on the internet grew in the early 2000’s (157, 159-161). Although an extensive review and meta-analysis evidenced the growing trend in seeking sex on the internet and the strong associations with higher risk sexual behaviour (157, 162, 163), other cross-sectional studies demonstrated that seeking sex on the internet facilitated sero-sorting, which, although less of a risk for HIV transmission (if both partners HIV status were accurately known, or HIV treatment status known), did not reduce the potential for transmission of other STIs (160, 161). Whilst use of and access to the internet has significantly increased since the millennium (164), it was not until the last decade that the relationship between seeking sex on the internet and substance use has been shown to directly facilitate chemsex. This can occur specifically through the use of geo-spatial networking apps, which have made drug use and drug procurement more visible and accessible than ever before (5, 132, 133). A retrospective case note review of MSM attending sexual health clinics in London in 2014/15 (n=818) showed that MSM reporting chemsex were over seven times more likely to have reported using a ‘bareback’ (CLS) sexual networking app than those who did not report chemsex (5). Further qualitative work involving thirty in-depth interviews with MSM who reported chemsex in the previous year (2013/14), investigated social norms related to chemsex and found that mobile geospatial networking apps were perceived as an established and acceptable virtual space to arrange chemsex, negating the need for physical settings such as bars and clubs to meet men and buy drugs (144).

2.3.5.2 Chemsex setting

The 2014 Chemsex study further highlighted the nature of venues that are used by MSM for chemsex (133). Whilst a variety of settings was mentioned, including private homes, bars, clubs, hotel rooms and sex on premise venues (saunas, bathhouses, event venues), most chemsex sessions happened in private homes, in saunas or other sex-on-premises venues, and the use of methamphetamine was most common in private settings (133).

2.3.6 Individual drugs, types of recreational drug use and associations with sexual risk behaviour and STI and HIV infection

As described in previous sections of the chapter, there is extensive research showing a significant association between sexual risk behaviour and certain types of drug use. In terms of individual drugs, as described sequentially in this section based on the amount of available evidence, the majority of research has investigated crystal methamphetamine (107-109, 119, 165-168), in part because of increasing use that was documented in the USA around the millennium, and in part because of the highly addictive and destructive nature of the drug (169) and its associations with high risk sexual behaviour (165). The research has
shown significant associations with CLS, higher number of sexual partners, and multi-partner encounters, all of which are risk factors for HIV and STI transmission (119, 170-174), but only a few studies have established a temporal pathway between crystal methamphetamine use and high risk sexual behaviour (40, 113, 175). A review in 2013 cautioned the use of language by researchers in attributing crystal methamphetamine as a direct cause of high risk sexual behaviour as it can be counterproductive if misinterpreted by the media, and potentially have the unintended adverse effect of creating an excuse for engaging in unsafe sex (165).

Research from the early 1990’s, using data from two large community studies of MSM, the Chicago Multicentre AIDS Cohort Study (MACS) and the Coping and Change study (CCS), placed ‘Poppers’ (volatile nitrites, amyl nitrites) as one of the drugs most consistently and strongly associated with behaviours linked to HIV seroconversion among a cohort of MSM who participated in both studies (n=1005) (176). Overall, the average rate of seroconversion was almost four times higher among MSM reporting popper use in the prior six months (1.27/100 person-years of observation among initially seronegative men not using poppers, and 4.55/100 person-years of observation for seronegative men reporting popper use) (176). Also using MACS data, a study published in 2007, which investigated outcomes for HIV negative MSM enrolled at certain time points since the start of the study (n=4003), showed that the relative hazard of HIV seroconversion associated with popper use was 2.10 (95% CI: 1.63 to 2.70), and that the use of poppers had an independent effect on the number of condomless receptive anal sex partners (177). Further research from the MACS cohort as well as several cross-sectional studies (all from the USA), have also demonstrated that poppers are associated with sexual risk behaviours (111, 176, 178).

Another individual drug which has received substantial attention due to its increasing popularity and potential associations with high risk sexual behaviour due to its known disinhibitory effect, is GHB/GBL. It is cheap to purchase, readily accessible, and easy to take (a liquid or spray that is ingested) with libido enhancing and disinhibiting effects (179). GHB/GBL gained popularity as a club drug before becoming predominantly linked to chemsex in the last decade (133). A recent (2017) online prospective cohort study (Following Lives Undergoing Change (FLUX)) of over 3000 MSM in Australia has shown that GHB use in the previous six months was strongly associated with multi-partner encounters and CLS (180). In addition, 14% of MSM (n=3190) had reported overdosing which was more common among men who reported using GHB monthly, highlighting the other physical harms associated with this drug outside of its associations with high risk sexual behaviour (discussed further in Section 2.3.7, pg.44) (180).
Despite being a relatively new drug (first emerged on to the UK drug scene circa 2009), mephedrone gained popularity quickly in the UK where it was initially classed as a 'legal high' (before being criminalised and classed as a Class B substance in 2010 after advice from The Advisory Council for the Misuse of Drugs (ACMD)(181)). Before, and in fact after it was criminalised, mephedrone could be accessed easily and cheaply through the internet (182). Whilst its stimulant effect include sociability, sexual arousal, feelings of empathy and sensory intensification (183), there is limited research into its specific relationship with high risk sexual behaviour, except in the context of the two other chemsex drugs: crystal methamphetamine and GHB/GBL. Research published in 2019 that used data from over 16,000 UK based respondents in the 2010 European MSM Internet Survey reported that whilst crystal methamphetamine and GHB/GBL were both significantly associated with a gonorrhoea diagnosis, mephedrone was not (184).

With regards to other individual drugs, an extensive review of the association between club drugs (defined as methamphetamine, MDMA, GHB, ketamine, flunitrazepam (Rohypnol®), LSD, Viagra® and volatile nitrites (poppers)) and sexual behaviour conducted in 2006, identified methamphetamine and poppers as the most studied drugs and concluded that current evidence would suggest that while a causative relationship is likely to exist between methamphetamine and high risk sexual behaviour, further evidence is needed to conclude the same for poppers (41), and other drugs. Whilst several cross-sectional studies have assessed other drugs such as cannabis and its relationship with sexual behaviour (185, 186), I have not focused on cannabis in the context of this PhD as it is not typically included in research relating to sexualised drug use among MSM.

In terms of types of recreational drug use, research as far back as the 1980’s identified poly drug use as a specific form of drug use that was common among drug using MSM (32)(162-165). Definitions of poly drug use have varied (187). Some researchers have defined poly drug use as actively combining two or more substances simultaneously (188), whilst others have classified it as using more than one drug within the same event, although not necessarily at the same time. For example, the use of mephedrone whilst already under the influence of GHB/GBL, or the use of one drug to expediate the effect of another (189). Other studies have defined poly drug use as concurrent, defined as taking one or more drugs within a set time period (190). However the implications of poly drug use are attributable to all the definitions (191), and typically within a UK context poly drug use is defined as concurrent. As noted by Stall & Whiley in their 1988 paper (32) and in multiple other sources investigating sexual risk behaviour and recreational drug use, poly drug use has been found to have significant associations with high risk sexual behaviour including HIV transmission (2, 3, 128, 129, 192).
The emerging phenomenon of chemsex was described in Section 2.3.5, pg.37, and, since it was first described in the UK literature in 2014 (133), extensive research has investigated the associations between chemsex and sexual risk behaviour (104, 132, 139, 141, 166) (described in Chapter 10). Substantial evidence has now highlighted the potential risks associated with chemsex, in particular high risk sexual behaviour and potential for STIs and HIV transmission due to prolonged sexual episodes often with multiple partners (2, 3, 147, 153, 184, 193).

2.3.7 Other physical and psychological harms associated with recreational drug use

Added to the potential physical and psychological harms that an STI or HIV infection may have on an individual there are other harms related to recreational drug use that are important to consider. Perhaps the most obvious is the potential for drug addiction and physical dependence, which has been documented in the cases of certain drugs such as crystal methamphetamine (194, 195) and GHB/GBL (196) and can cause serious issues if withdrawal is not managed, including, in the case of GHB/GBL, psychosis, agitation, hallucinations, tachycardia, hypertension and death (197, 198). Whilst other recreational drugs, such as mephedrone, have been linked to overdoses and death (183, 199), none to the same extent as GHB/GBL which has led to the large numbers of hospital admissions attributed to its use (200), and use of which has resulted in a number of overdoses and deaths (179, 201). In 2013, a study from a large inner city (London) Emergency Department reported a significant increase in the number of patient presentations relating to GHB/GBL (from 158 to 270) from 2006 to 2010 (202). Furthermore, in 2016, a study that used data from six out of seven Coroner’s jurisdictions in London of over 6000 cases that underwent toxicological analysis showed an increase of 119% (n=29 in 2015) in GHB-associated deaths from 2014 to 2015 and concluded this was likely to be linked to the increased use of GHB for chemsex (203). GHB/GBL has a narrow therapeutic index (the ratio that compares the blood concentration at which a drug becomes toxic and the concentration at which the drug is effective). The larger the therapeutic index, the safer the drug is, thus the ‘safe’ dose of GHB/GBL is small, usually a maximum of 1.6ml, and is regularly re-administered, often 1-2 hourly, which leaves a large margin for error and potential for overdose (204) potentially resulting in unconsciousness (colloquially known as a ‘G-sleep’) and possible death. Furthermore intensification of the toxic effects of GHB/GBL have been reported when it is consumed with alcohol (205).

In addition to the physical harms that certain drugs can cause, the relationship between mental health and recreational drug use has been examined. A UK meta-analysis of studies in 2014 demonstrated that recreational drug use was independently associated with
depressive symptoms among MSM (206) and this has been found in other UK studies (207, 208). The relationship between recreational drug use, sexual behaviour and mental health was further brought in to focus in 2015, when Public Health England described a syndemic of inequalities that affect MSM consisting of mental health and wellbeing, alcohol, drugs and tobacco, and sexual health and HIV, in their action plan to improve the health and wellbeing of MSM (45).

2.3.8 Possible reasons for recreational drug use among MSM

Multiple reasons have been considered to provide an understanding of specific patterns of drug use and higher prevalence of drug use among MSM and the wider Lesbian Gay Bisexual Transgender Queer + (LGBTQ+) population. A literature review by Green and Feinstein in 2012 supports a minority stress model, wherein a link exists between higher rates of substance use and specific stressors felt by MSM such as discrimination and internalised homo-negativity (209). In this review it is suggested that social stressors that are stigma-related, combined with the additional stress of discrimination towards sexual minorities, could increase the rates of substance use within this population (209). The ‘gay scene’ (including clubs, bars, pubs and saunas) can represent a culturally endorsed ‘time-out’ from stresses which are commonly described by the gay community (and other sexual minority men). However, as described in Section 2.3.5.2, pg.41, the gay scene is changing, with more social and sexual encounters being facilitated by the proliferation of hook-up apps on smart phones where access to drugs is also rapid and potentially becoming normalised (144, 210) and drug use often plays a key role in escaping self-awareness of social and sexual norms. For many men, the ‘scene’ is an important social nexus (211) where gay sexuality is endorsed and celebrated (212).

A 2012 review from the USA described the impact of living with HIV as a stressor which was linked to elevated rates of recreational drug use among MSM due to the potential for anxiety and depression which themselves are associated with higher rates of substance use (209). Extensive evidence has demonstrated that HIV-diagnosed MSM are more likely to use drugs than those not diagnosed with HIV, which could be due to those using drugs being more likely to acquire HIV (119, 133, 166). However, the evidence specifically on recreational drug use among HIV negative MSM is limited, particularly within the UK context.

2.3.9 Methodological issues in recreational drug use and sexual behaviour research

In 1993, Leigh and Stall outlined a number of methodological limitations that hampered the ability to draw coherent conclusions in much of the research on substance use and sexual behaviour (26). Specific issues related to measurement of substance use and risk (inconsistencies in the manner in which both are measured), bias (common sources of bias
for both substance use and high-risk sex such as social desirability and self-presentation biases, or method bias due to self-report, discussed further in chapter 10), and sampling frames (relying on convenience sampling (although often still used) which has implications for representativeness, as well as the possibility that a substance use/high-risk sex link may be different in different populations). These issues are mirrored in the conclusions of a recent literature review of sexualised drug use in the UK (31), which also highlighted sampling methodologies and a lack of standard definition and use of recency of drug use as major limitations that constrain current evidence (31). Importantly, Leigh and Stall’s research identified three measurement approaches for substance use and sexual behaviour; (i) global - substance use and sexual behaviour are measured during a specified broad period of time (e.g., past three months)—the drug use and sexual behaviours do not necessarily occur together; however, they take place during the same recall period (I have used this measure in the paper based questionnaires of the AURAH and AURAH2 studies, results Chapter 5 and 6); (ii) situational - substance use and sexual behaviour occurring together within a specified time period (e.g., past three months) but given a broad recall period, this assessment may measure any number of events where sex and substance use occurred together, and; (iii) event-level - specific substances used and sexual behaviours surrounding a specific sexual encounter (e.g. most recent sexual encounter) (26). Some recent research, including the online questionnaires that I have used to collect data in the AURAH2 study (results Chapters 8 and 9) have adopted the use of event-level assessment, which has eliminated some (i.e. measurement of substance use and sexual behaviour), but not all (sample representativeness and bias will be discussed in Chapter 10) of the earlier methodological problems (213). Issues that remain include definitions around both “high risk sex” and a universal standardised definition for substance use (31, 213, 214) and there continues to be ongoing methodological and definition issues concerning substance use and sexual risk behaviour, particularly the inference of causation from cross-sectional analyses. This is highlighted in a recent review of the literature on sexualised drug use in the UK (31) and another review from the USA on event-level associations between specific drugs and sexual risk behaviour in MSM (40).

2.4 Recreational drug use in the UK 2000-2014: Prevalence, definitions and gaps in the evidence base

2.4.1 Results of the literature search

Results of the scoping literature search that I conducted for this chapter (described in Section 2.2, pg.24) and which specifically looked for studies from the UK up to the start of my PhD in 2014, identified 173 papers. From these, 25 were excluded as they were duplicates, and 140 were excluded as they did not present data on the UK. Full texts were
then assessed (n=8), two were excluded as they contained no prevalence data of recreational drug use and one was excluded as it reported data already included in one of the other studies. Eligible publications identified in the literature search (n=5) were then included alongside any found through reviewing citations (n=2, two journal articles), and five reports that were identified through the SIGMA research group website that were not published on Pubmed, into a final data synthesis of 12 eligible publications, see Table 2.
Table 2 Summary of available literature on recreational drug use among MSM in the UK up until October 2014

<table>
<thead>
<tr>
<th>Author Year (ref)</th>
<th>Population and methods</th>
<th>HIV status</th>
<th>Location</th>
<th>Recall Period</th>
<th>Prevalence of drug use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolding et al 2006 (119)</td>
<td>Self-complete questionnaires given to MSM attending 4 sites (i) gay men using central London gyms; ii) HIV-positive men attending an out-patient treatment clinic; and (iii) gay men seeking an HIV test (n=2246) between 2003 and 2005</td>
<td>Both</td>
<td>London</td>
<td>Last year</td>
<td>Crystal methamphetamine/any drug use (i) 20.7% / 55.6% (ii) 12.6% / 53.6% (iii) 8.3% / 50.8% No evidence of increasing use between 2003 and 2005</td>
</tr>
<tr>
<td>Gay Men's Sex Survey 2005 (215)</td>
<td>Self-completed questionnaires given to MSM through community health agencies and available online in 2005 (n=16426)</td>
<td>Both</td>
<td>UK</td>
<td>Last year</td>
<td>Alkyl nitrates 39.4% Cannabis 27.3% Ecstasy 18.5% Erectile dysfunction drugs 17.4% Cocaine 16.8% Ketamine 9.1% Amphetamine 7.2%</td>
</tr>
<tr>
<td>Gay Men's Sex Survey 2006 (216)</td>
<td>Self-completed questionnaires given to MSM through community health agencies and available online in 2006 (n=12155)</td>
<td>Both</td>
<td>UK</td>
<td>Last year</td>
<td>Poppers 51.9% Poppers - rAI* 33.3% Poppers - rUAI** 17.6%</td>
</tr>
<tr>
<td>Gay Men's Sex Survey* 2007 (217)</td>
<td>Self-completed questionnaires given to MSM through community health workers and available online in 2007 (n=6155)</td>
<td>Both</td>
<td>England</td>
<td>Last year</td>
<td>Alkyl nitrates 42.0% Cannabis 27.7% Cocaine 21.2 Ecstasy 20.7% Ketamine 12.2% Amphetamine 9.5%</td>
</tr>
<tr>
<td>Gay Men's Sex Survey 2008 (218)</td>
<td>Self-completed questionnaires given to MSM through community health workers and available online in 2008(n=7461)</td>
<td>Both</td>
<td>UK &amp; Ireland</td>
<td>Last year</td>
<td>Poppers 48.1% Poppers - rAI* 30.2% Poppers – rUAI** 16.2%</td>
</tr>
<tr>
<td>Hickson et al 2010 (34)</td>
<td>Self-completed questionnaires given to MSM through</td>
<td>Both</td>
<td>England &amp; Wales</td>
<td>Last year</td>
<td>1997 v 2005 Alkyl nitrates 47.6% v 43.7%</td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Bonnell et al* 2010 (172)</td>
<td>Community-based agencies in 1999 and 2005 (GMSS data from 1999 and 2005.) (n=6393)</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
</tr>
<tr>
<td>Borg et al 2013 (219)</td>
<td>Self-completed questionnaires given to MSM through community-based organisations in 2007 (GMSS data 2007) (n=6155)</td>
<td>Both</td>
<td>UK</td>
<td>Last year</td>
<td>Crystal methamphetamine 7.8% London 4.8% Wales 3.5% middle/Eastern England</td>
</tr>
<tr>
<td>Li et al 2014 (129)</td>
<td>MSM interviewed after Shigella diagnosis in 2009-11 (n=12)</td>
<td>Both</td>
<td>England &amp; Wales</td>
<td>Use during sex</td>
<td>Poppers -36.3% Stimulants-22.2%</td>
</tr>
<tr>
<td>Hunter et al 2014 (220)</td>
<td>Self-completed questionnaires given to male attendees of two sexual health clinics in 2011 (n=254 MSM, 475 non-MSM)</td>
<td>Both</td>
<td>London</td>
<td>Last month</td>
<td>Cannabis 10.2% Cocaine 4.3% MDMA 5.5% Mephedrone 3.1% Poppers 18.4% GHB/GBL 5.5% Erectile dysfunction drugs 11.8%</td>
</tr>
<tr>
<td>Daskalopoulou et al 2014 (221)</td>
<td>Self-completed questionnaires given to MSM at 8 HIV outpatient clinics in 2011-2012 (n=2248)</td>
<td>HIV+</td>
<td>UK</td>
<td>Last 3 months</td>
<td>51% (n=1138) in total Nitrites 27% Cannabis 21% Erectile dysfunction drugs 21% Cocaine 20% Ketamine 13% MDMA 12% GHB/GBL 10% Mephedrone 7% Poly drug use (3+ drugs) 47%</td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Bourne et al 2014 (133)</td>
<td>(i) Survey data from European Men who have sex with men Internet Survey 2010 (n=1142) (ii) Qualitative interviews with MSM living in South London in 2013 (n=30)</td>
<td>Both</td>
<td>(i) National (ii) London and Lambeth, Southwark and Lewisham (LSL)</td>
<td>Multiple time frames including last week, month, 6 months, year</td>
<td>(i) Last 6 months: Poppers 13.0% Mephedrone 12.8% Cocaine 11.5% Ecstasy 11.1% Ketamine 9.4% Crystal methamphetamine 5.5% GHB/GBL 5.3% injecting drugs (other than steroids) (last year) London-2.7% LSL-3.5% (ii) all of the men in the qualitative arm of the study (n=30)</td>
</tr>
</tbody>
</table>

Abbreviations: MSM- men who have sex with men *rAI – receptive anal intercourse **rUAI – receptive unprotected anal intercourse *denotes same data
2.4.2 Review of the literature

The oldest study within the time frame of the literature review (Jan 2000-Oct 2014) by Bolding et al in 2006 (119) was a large study which used a series of cross-sectional surveys to sample groups of both HIV-diagnosed and HIV negative MSM in London from an array of settings (HIV treatment clinics for HIV-diagnosed MSM, sexual health clinics for HIV negative MSM and MSM using London gyms) (outlined in Section 2.3.3, pg.35). It was one of the first to document prevalence of drug use by MSM in the UK. Whilst it found that approximately 1 in 10 gay men in the last year in London had used crystal methamphetamine (slightly higher among HIV-diagnosed (12.6%) than in HIV negative (8.3%)), it had several strengths and limitations. Strengths included the large sample size and diverse sample settings including both recreational (gyms, hence the name ‘the London gyms survey’) and clinical settings. However, the study was limited to London and therefore not generalisable to MSM across the UK, or representative of HIV negative MSM in London not engaged with sexual health clinics and not attending London gyms. As with any self-reported data, not limited to this study, it is important to consider the different types of bias that can occur, such as recall bias (where participants might not recall events accurately) or response bias (where participants offer a biased response for a variety of reasons including misunderstanding the question) or social desirability bias- wanting to ‘look good’ in the survey even if it is anonymous (222).

The four Gay Men’s Sex Surveys included in this review (2005-2008) offered insight into prevalence of different individual recreational drugs used by MSM (215-218). The large sample sizes of MSM for each community-based survey could offer a better general picture of recreational drug taking by MSM at population level than the London gyms survey, although the surveys had varying response rates, particularly for their booklets (response rate of 18.1% of booklets returned in 2005 to 9.3% of booklets returned in 2008). The use of community data and online data are limited by the potential for participants to complete multiple surveys using different entry details as well as the same recall and response bias that are applicable to any self-reported questionnaires. However, the regular and consistent methods employed for each survey mean that trends in the data can be drawn and, in the absence of any national surveillance systems for recreational drug use among MSM, these were the largest surveys that had been conducted in the UK at the time. Although overall prevalence of any recreational drug use was not provided by any of the GMSSs, and GMSS 2006 and 2008 only reported on use of poppers (51.9% in 2006 and 48.1% in 2008), the surveys demonstrate the changing popularity of drugs; whilst poppers remains consistently the highest reported drug used across all four surveys, GHB/GBL use (in past year) almost doubled from 3.6% in 2005 (215) to 7% in 2007 (126).
Although the paper by Hickson et al (2010) uses the 2005 data from the Gay Men’s Sex Survey (which has been described above), I have included it in this review as it analyses the data to compare novel patterns and trends that are not explored in GMSS 2005, using data from 1999 also. Therefore, whilst the same limitations that apply to survey data apply to this, the comparison shows that the use of individual drugs such as ecstasy, cocaine, ketamine and GHB had significantly increased from 1999 to 2005 and that reported use of a recreational drug (other than cannabis and alkyl nitrites) was significantly associated with younger age, living in London, higher education, reporting more sexual partners and reporting having tested HIV positive(34). Similarly, the study by Bonnell et al (2010) also drew on data from the Gay Men’s Sex survey (2007) (described above), and I have included this for the same reason as I included the paper by Hickson. It provides more in-depth analysis of a particular drug and new information that is useful to provide a prevalence estimate, specifically of methamphetamine use both in and outside of London which was estimated to be 7.8% in London (so a decrease since the London Gyms survey), 4.8% in Wales and 3.5% in Mid and Eastern England (172).

The study by Borg et al (2013) which was part of an ongoing investigation of an outbreak of Shigellosis among MSM in London in the UK (219) reported on twelve interviews with MSM who had been diagnosed with Shigella between 2009 and 2011. Despite a very small sample size (n=12), so limited generalisability and not representative of the wider MSM population, it was the first study to report on the use of mephedrone, ketamine, crystal methamphetamine, and GBL during sexual encounters (chemsex).

The study by Hunter et al (2014) was conducted in two London sexual health clinics in 2011 and was the first to compare prevalence of recreational drug use among MSM and heterosexual in the UK (n=254 MSM, 475 non-MSM). It used two different recall methods, ‘ever used’, and, ‘used in last month’, which are useful for comparison of recency of drug use. As per the other studies and reports included, it included both HIV-diagnosed and HIV negative individuals and did not collect information on HIV status to disaggregate differences of drug use between the two populations. The study demonstrated that lifetime and last month use of mephedrone, ketamine, volatile nitrites, Viagra, GHB/GBL were all significantly higher in the MSM group compared to the non-MSM group (220) Similarly to the other studies and reports in the review, the study could be affected by similar biases, and limited generalisability due to the locations of the sexual health clinics only being in London, plus no representation of MSM that are not engaged with sexual health services (220).

The study by Li et al (2014) was conducted across multiple gay commercial venues in Glasgow and Edinburgh, Scotland in 2011 (129). It collected data from over 1000 MSM and
was the first study to investigate drug and alcohol use in the context of CLS among MSM in Scotland. Detailed sociodemographic and behavioural factors were investigated, however the reporting categories for drug and alcohol use were quite broad, ‘always’ or ‘sometimes’ or ‘never’ in the past 12 months were used. The study demonstrated that, in the past 12 months, one-third of the MSM sampled used poppers, one-fifth used a stimulant or other recreational/illicit drug, and one in seven used Viagra. However as a venue-based study, the prevalence estimate could be inflated, as it has been suggested that samples recruited from bars might contain higher proportions who regularly combine drug use and sex, and engage in risky sexual behaviours in general (26).

The ASTRA study (outlined in Section 2.3.4, pg.37) looked specifically at recreational drug use and sexual behaviour among HIV-diagnosed MSM. It collected data from over 2000 MSM in eight sexual health clinics across the UK in 2011/12 and provided some of the most comprehensive data on drug use and sexual behaviour at the time. Results from the ASTRA study, reported by Daskalopolou et al described the commonest drugs used by HIV-diagnosed MSM, and also provided a prevalence estimate of poly drug use of 47% (3+drugs in past three months)(221). Despite only drawing on a sample of HIV-diagnosed MSM under care, the large sample size, high response rate (64%) and locations of clinics (both in and out of London) provided a useful insight in to the picture of recreational drug use among HIV-diagnosed MSM at the time this PhD commenced (221).

The Chemsex study (described in Section 2.3.5, pg.37) used quantitative and qualitative methods to investigate chemsex among MSM in London, specifically the boroughs of Lambeth, Southwark and Lewisham (133). It provided prevalence data (n=1142) on use of individual drugs across multiple time frames; past 24 hours, past week, past four weeks, past six months, past year, past one to five years, more than five years, never, and produced recency curves for when (using time frames listed) and where (i.e. private sex parties, saunas, sex clubs) specific chemsex drugs (listed as mephedrone, GHB/GBL, crystal methamphetamine, and ketamine) were used. Its strengths lay in the mixed methods undertaken to provide the first descriptive analysis of chemsex in the UK. However the quantitative data did not provide a prevalence estimate of chemsex, but rather the prevalence estimates of drugs associated with chemsex (as well as other drugs) across different time frames (10% of MSM in Lambeth Southwark and Lewisham had used GHB/GBL and 10% had used mephedrone, <5% had used crystal methamphetamine, all in the last 4 weeks). The study was conducted in specific boroughs of London, known for their large populations of gay men and large commercial gay scene, making it hard to generalise the results to outside of London, or even outside of the three specific boroughs.
Nevertheless the study provided comprehensive information on chemsex and was the first to extensively explore sexualised drug use among MSM in England (133).

2.4.3 Prevalence estimate of recreational drug use and chemsex in the UK at the time this PhD commenced in Oct 2014

It can therefore be established based on the literature that, in October 2014, at the start of this PhD, reported use of recreational drugs among MSM in the UK was relatively high, although the majority of studies reported prevalence of individual drug use rather than providing an overall prevalence estimate of any drug use (34, 119, 133, 172, 215-220) or types of drug use such as poly drug use or chemsex. Both the ASTRA study (2011/12) and the London Gyms study (2003-2005), reported similar overall prevalence of any recreational drug use among MSM (ASTRA - 51% of HIV-diagnosed MSM had used any recreational drug within the past three months (221), London gyms - 55.6% of MSM attending London gyms, 53.6% of HIV-diagnosed MSM and 50.8% of HIV negative MSM attending sexual health clinics, had had used recreational drugs in the past year (119)). The prevalence was significantly higher among MSM than in male heterosexuals in general in the few studies that compared the two populations (220, 223), despite earlier evidence being limited by a lack of studies that either considered both groups using the same methodology or population studies that neglected to collect data about sexual identity (143). Using the ‘ever used’ recreational drug data that was provided by Hunter et al’s cross-sectional studies in two London sexual health clinics in 2014 (n=729), compared to their heterosexual counterparts MSM were significantly more likely to have ever used cocaine (48.6 vs 31.6%), MDMA (40.8% vs 28.9%), mephedrone (23.9% vs 8.0%), ketamine (33.7% vs 13.9%), poppers (71.4% vs 25.1%), Viagra (43.5% vs 17.7%), amphetamine (29.8% vs 18.4%), GHB (22.7% vs 5.7%) or GBL (16.1% vs 2.7%) and methamphetamine (16.9% vs 2.9%) (220). Figure 1 shows the prevalence estimates of recreational drug use and types of recreational drug use from the studies and reports included in the literature review (excluding Borg et al (219) which did not specifically aim to investigate recreational drug use).
Figure 1 Prevalence of recreational drug use and individual drug use in the UK 2000-2014

Key: Author, year of publication (ref), population and setting. Year of study.

Recall period: 1 year:

Recall period: 3 months:

Recall period: 1 month:
- Hunter et al, 2014 (214) MSM using sexual health

Footnote: Borg et al 2013 not included as the study did not aim to investigate recreational drug use or chemsex
As can be seen from Figure 1, the prevalence estimates for individual drugs vary greatly and are hard to compare due to the different recall periods and study designs. Whilst the ASTRA study reported in 2014 that a quarter of HIV-diagnosed MSM reported poly drug use (defined as the use of three or more drugs within the last 3 months), there were no studies from the UK that reported a prevalence estimate of different types of drug use such as poly drug use or chemsex among HIV negative or undiagnosed MSM before 2014.

2.4.3.1 National prevalence data on recreational drug use among MSM in the UK (up to 2014)

By searching UK national databases and searching for data from Antidote, there are a few additional sources of prevalence data that were either not published on Pubmed or not specific to MSM and thus not included in the results of the literature search, but which help to contextualise UK data in 2014.

In the last national survey that disaggregated data by sexual orientation, the Crime Survey for England and Wales (CSEW) (released in Dec 2014 and thus not included in this chapter) identified that the likelihood of gay and bisexual men reporting illicit substance use was three times higher (33%) than their heterosexual counterparts (11%) (224). Subsequent surveys have not presented data by sexual orientation, and the relatively small number of LGBT respondents in the 2014 survey (around 3%) means that findings should be interpreted with caution. The survey further demonstrated that reported use of all stimulants was approximately five times higher among gay and bisexual men than among heterosexual men, with methamphetamine use around 15 times higher (224). Another study from 2011, not specifically among MSM but among attendees of two dance clubs in south London (n=308) supported the 2014 CSEW findings and demonstrated that the use of some specific substances was concentrated among gay and bisexual men, in particular GHB/GBL and methamphetamine(225). In 2014, other than the CSEW, the only national survey to have collected data on drug use was data from an unlinked anonymous monitoring survey of people who inject drugs (226), the National Drug Treatment Monitoring System (NDTMS). The survey did not disaggregate participants by sexuality so a specific prevalence estimate among MSM could not be determined. However it demonstrated that use of some club drugs had declined (which was similar to findings from the study that compared data from GMSS 1999 and 2005 (34)), and reported a decline in use of club drugs such as ecstasy and an increase in drugs such as mephedrone and ketamine (226), as can be seen in Figure 2.
Figure 2 Trends in number of new presentations to treatment (for drug addiction) citing club drug use

Source: Public Health England: Adult substance misuse statistics from the National Drug Treatment Monitoring system 2013/14 (NDTMS)

A 2014 report by Antidote (n=720) (not specifically among MSM), the UKs only LGBT drug and alcohol service that was established in London in 2002, reported that of 758 clients who attended the service in 2013/14 60.8% of clients attended clinic for issues relating to mephedrone use which had not been an issue at all in a 2004/05 survey (n=174), 44.1% for GHB/GBL (compared to 1.7% in 2004/05) and 5.8% for ketamine use (compared to 13.2% in 2004/05) (227). Other data from Antidote in 2013 suggested a sharp rise in presentations relating to chemsex drugs; in 2005 it was reported that crystal methamphetamine, mephedrone and GHB/GBL were responsible for only 3% of all presentations (the majority of the others related to alcohol, cocaine and marijuana), whilst in 2012, the three chemsex drugs were responsible for over 85% of presentations and referrals from sexual health clinics had increased from 8% to 63% over the same time frame (7). However, sample sizes were not provided in this report and therefore results should be interpreted with caution.

2.4.4 Identified gaps in the evidence base (up to October 2014)

The number of UK studies to investigate recreational drug use among MSM between 2000 and October 2014 that were highlighted by the search in Pubmed and the other sources listed in Section 2.2, pg.24, was small (n=12). As can be seen from Figure 1 there was considerable variation in the prevalence estimates of individual drugs and of any recreational drug use among MSM. This may be due to a number of reasons, the most apparent being the different recall periods of the studies (last month, last three months, last 1 year), the wide range of years (ranging from 2002 to 2013) that the studies were conducted (which could
potentially have led to changes in popularity of different recreational drugs leading to
different prevalence estimates), and the different sampling frames of MSM in the studies
(gym based, HIV clinics, HIV testing centres and the community). Whilst the ASTRA study
(221) provided a comprehensive overview of recreational drug use, including individual drug
use as well as poly drug use and the associations of drug use and sexual behaviour, this
was in HIV-diagnosed MSM. The majority of studies from the review, with the exception of
the London Gyms study (119), did not disaggregate by HIV status and there were no studies
that solely investigated recreational drug use among HIV negative or undiagnosed MSM, for
whom targeted HIV prevention policies including support on recreational drug use would be
of benefit. Furthermore, as The Chemsex study (133) highlighted, there was an emerging
phenomena among MSM reporting sexualised drug use in 2013, however the quantitative
data used in the study was from a survey in 2010 which did not specifically ask about
chemsex but rather attributed the use of either of the three chemsex drugs as a proxy for
chemsex. There was a clear need for a focus on recreational drug use among HIV negative
or undiagnosed MSM and for further research into chemsex, both prevalence and patterns,
as well as associations with sexual behaviour.

2.4.5 Recreational drug use among MSM - an international context in 2014

To contextualise the UK data, some evidence from the USA, Australia and Europe can be
drawn upon which were sourced by searching national databases of the respective countries
or regions. Data from the USA’s National HIV Behavioural Surveillance System (NHBS),
which conducts behavioural surveillance among a representative group of people (n=9640
MSM) at high risk for HIV infection (including MSM, injecting drug users and high risk
heterosexuals) on a rotating 12 month cycle, provides information on substance use among
HIV negative, undiagnosed (positive but unaware) and HIV-diagnosed participants (228). In
2014, the prevalence of non-injecting drug use during the 12 months before the interview for
HIV negative MSM was 56% (n=3812), with 19% reporting use of marijuana, 12% reporting
use of cocaine and 8% reporting use of ecstasy. The results were similar for non-injecting
drug use, although the prevalence was slightly higher at 61% for HIV-diagnosed MSM
(n=868) (compare to 56% in HIV negative MSM) and the pattern was the same with regards
to the use of individual drugs (marijuana most common, followed by cocaine, then ecstasy
with similar prevalence) (228).

In Australia, data from the Private Lives 2 survey: the second national survey of the health
and wellbeing for LGBT Australians, was published in 2012 based on online survey data
from over 3000 respondents. Similar to the USA prevalence, nearly half (45%) reported
using one or more of fifteen drugs in the past twelve months, with 22% using two drugs and
12% using three. Gay men were more likely than all other sexuality groups to use methamphetamine, cocaine, ecstasy, GHB/GBL and ketamine (overall estimate for gay men not provided) (229).

Within the European context, an annual report published by the European Monitoring Centre for Drugs and Drug Addiction, the European drug report in 2014 did not disaggregate data by sexuality (neither did previous reports). However, new injection trends were noted among MSM in some large European cities including the injection of mephedrone (230). In 2010 the European Men’s Internet Survey collected data from over 180,000 MSM across 35 European and European neighbouring countries (231). The overall sample reported using an average of 1.5 recreational drugs in the preceding 12 months, although this was higher in the UK (2.03) and the Netherlands (2.19). Almost a fifth (19%) of the sample reported using poppers within the preceding four weeks, with the highest percentages in the Netherlands (34%) and the UK (29%) (232). Similarly, whilst only 6% of the overall sample reported using drugs typically used at sex parties in the preceding four weeks (named as ecstasy, amphetamines, crystal methamphetamine, mephedrone, GHB/GBL, ketamine or cocaine), the proportions exceeded 10% in the Netherlands (17%), the UK (13%) and Spain (12%) (232). A further analysis of the results of EMIS specifically relating to illicit drug use was published in 2016 and will be discussed further in Chapter 10 (136).

2.4.6 Defining recreational drug use for this thesis

Despite considerable amounts of research being conducted on recreational drug use, its complexity has meant that clarifying type and extent of substance use remains contentious due to differing definitions and recall periods (31). I have used the term ‘substance use’ predominantly in the early parts of this chapter to reflect the terminology that was used in the early 1980’s and 90’s. However, ‘substance use’ is interchangeable with ‘recreational drug use’ which is the term I have used in the later parts of this chapter and in my results chapters as this is the term currently used in the majority of literature.

Distinctions have been made between ‘problematic’ use, sometimes called ‘abuse’, and ‘non-problematic’ use, referred to as ‘use’ of recreational drugs. The implication of ‘problematic’ drug use is that the lifestyle choice to take recreational drugs has begun to negatively encroach on physical or mental health or social or employment circumstances in a measurable manner (233). In this thesis, although I recognise that there are different health implications for ‘problematic’ and ‘non-problematic’ recreational drug use, I use the term ‘recreational drug use’ to include both. I have done this because whilst I recognise the potential for ‘non-problematic’ use to turn in to ‘problematic use’ and vice versa, both carry
implications for health education and promotion which the findings of this thesis are aimed at enriching.

2.4.6.1 Injecting drug use

Injecting-drug use has its own significant implications for HIV and other blood borne virus transmission pathways (234), and is typically separated in studies assessing the association of sexual risk behaviour and substance use (40). As such, the prevalence of injecting drug use in the context of sexualised drug use (sometimes termed as ‘slamming’) is presented in Chapters 6, 7 and 8, separately from the main analysis on recreational drug use, poly drug use and chemsex.

2.4.6.2 Alcohol

Substantial amounts of literature on recreational drug use has included alcohol, which is often disaggregated from other substance use in research (235). Despite extensive evidence on alcohol and its unique relationship with sexual behaviour among MSM, this thesis does not investigate alcohol or the intersection between alcohol and recreational drug use with sexual behaviour, because I wanted to specifically investigate the relationship between illicit recreational drug use and the seemingly increasing popularity of chemsex.

2.4.6.3 Definitions

As discussed in earlier in the chapter, poly drug use can have a variety of definitions. For the purpose of this PhD I use the concurrent definition whereby poly drug use is defined as the use of three or more drugs within a recall period of three months.

I have used two definitions for chemsex. The first, used in Chapters 6 and 7, defines chemsex as the use of one or more of mephedrone, methamphetamine or GHB/GBL in the past three months, and is specifically termed chemsex associated drug use. In Chapters 8 and 9 chemsex is defined as the use of one or more of mephedrone, methamphetamine or GHB/GBL specifically before or during sex, in the past three months. The reason for the two definitions is based on the different questions that were used for data collection, one in paper form and the other online. The design of both paper and online questionnaires will be detailed further in Chapters 3 and 4.
Chapter 3: Methods: Attitudes to and Understanding Risk of Acquisition of HIV (AURAH) study

3.1 Introduction

In 2013/2014, I set up and coordinated the cross-sectional 'Attitudes to and Understanding Risk of Acquisition of HIV (AURAH)' study, overseen by my supervisors (the core group of researchers from UCL, see Section 3.3, pg.62). In this chapter I describe the overall aims and objectives of the AURAH study, the design and setting of the study, the development of the study materials, the practical implementation of the study procedures at the participating clinical sites, the handling and storage of the data and the ethical considerations that were necessary for the study to gain approval from the Research Ethics Committee before it commenced recruitment. To conclude the chapter, I detail the study management including my role as the study coordinator. The coordination of the study was broadly divided into two areas; (i) the pre-ethics design phase which included the development of the study protocol, questionnaires, patient information sheets and consent forms, the ethics application and approval from the London-Hampstead Research Ethics Committee and subsequent approval from the twenty participating NHS sites, and (ii) the post-ethics implementation of the study which included data collection, transfer and storage at the research institute and analysis.

The AURAH study collected a large amount of information from HIV negative or undiagnosed adults attending sexual health clinics across the UK, to investigate factors associated with risk of HIV acquisition and sexual behaviour, from which I specifically focused on recreational drug use among MSM for this PhD. I set the study-up in the year before I enrolled in my PhD (Oct 2014), however, the data management, analyses and methods paper that was subsequently published on the AURAH study, were all completed post PhD-enrolment and thus a complete overview of the study procedures and implementation are described in this chapter.

3.2 Aims and Objectives

The primary aim of the AURAH study was to assess patterns of sexual behaviour, and attitudes to sexual risk, among HIV negative or undiagnosed adults at risk of HIV-infection, attending sexual health clinics, and, to investigate associations between demographic, socioeconomic, mental health and lifestyle factors, including alcohol consumption and recreational drug use, with HIV sexual transmission risk.

The detailed objectives of the AURAH study were to assess among the study participants;

1. Prevalence of condomless vaginal or anal sex in the previous three months according to demographic groups (sexuality; ethnicity).
2. Among those who have had condomless sex, the distribution of number of sexual partners; type of partners, knowledge of HIV status of partners, number of times had condomless sex; type of condomless sex; reasons for not using condom

3. Among those having condomless sex with partners of positive or unknown HIV sero-status, the prevalence of risk reduction measures such as sero-positioning

4. The prevalence of psychological and physical symptoms (i.e. depression, anxiety) and lifestyle factors (i.e. drug and alcohol use) and whether demographic/social factors, psychological and physical symptoms, quality of life and lifestyle factors are associated with condomless sex

5. Beliefs regarding the effect of suppressive ART in HIV positive individuals, on HIV transmission risk (transmission risk beliefs) and the association of such beliefs with sexual behaviour

6. History of HIV testing and attitudes to HIV and anti-retroviral therapy, including awareness of and any history of taking post exposure prophylaxis (PEP) and pre-exposure prophylaxis (PrEP)

7. Attitudes towards testing for HIV in different settings (i.e. sexual health clinic, GP surgery, community-based testing), type of testing (i.e. self-sampling, self-testing) and preferred sample type for HIV self-testing (i.e. saliva based or finger prick sample of blood)

In addition the study was planned to allow comparison of HIV negative individuals at risk of HIV infection to HIV positive individuals recruited to an earlier study (the ‘Antiretrovirals, Sexual Transmission Risk and Attitudes’ (ASTRA study) – see Section 3.4, pg.63), with respect to sexual behaviour and attitudes, beliefs about HIV transmission risk, physical and psychological symptoms, quality of life, lifestyle and health and wellbeing.

### 3.3 Study team and funding

The AURAH study was funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research funding scheme (PGfAR RP-PG-0608-10142). It was overseen by a core group of researchers; Professor Alison Rodger (Chief Investigator), Professor Andrew Phillips, Dr Fiona Lampe, and Dr Andrew Speakman, Data Manager, from UCL Centre for Clinical Research, Epidemiology, Modelling and Evaluation, Institute of Global Health. My role as study coordinator is discussed later in the chapter in Section 3.12, pg.77.
3.4 **Rationale for the study**

The AURAH study aimed to provide substantive information on those considered to be at risk of being infected with HIV in the UK, although restricted to those who were engaged with sexual health services. The data from the AURAH study was collected to provide important insights into the relationships between sociodemographic factors, physical and psychological symptoms, lifestyle factors, health-related quality of life and sexual behaviour in this population. The results aimed to improve understanding of behaviours that are associated with elevated risk of HIV acquisition among the two most ‘at risk’ populations for HIV in the UK, black Africans and MSM, and for developing improved, targeted national prevention efforts.

The research questions that the AURAH study aimed to address were developed in the context of a previous study by the same core researchers that took place in 2011, the ASTRA study (detailed in Chapter 2, Section 2.3.4, pg.37). The ASTRA study had been designed to assess the patterns of condom use in people living with HIV (PLWH), factors associated with condomless sex and the impact of ART use on condomless sex (236). Its study design was cross-sectional, and the study took place in eight HIV out-patient clinics across the UK in 2011 and 2012. The results from the ASTRA study have offered substantial insights into issues such as drug use, disclosure of HIV status and sexual behaviour of PLWH in the UK (128, 237). These results and the reported high rates of depression (238, 239), anxiety (239), drug and alcohol use in MSM compared with heterosexual men (34, 220, 232, 240, 241) highlighted the need for more research around these issues in the HIV negative and undiagnosed MSM population.

3.5 **Study design**

The AURAH study was designed to collect data on HIV negative or undiagnosed men and women at risk of acquiring HIV. Its design was cross-sectional and data were collected using self-completed paper questionnaires.

3.6 **Study setting and study population**

Twenty UK sexual health services across England were invited and agreed to participate in the study. The sites were chosen based on geographical location, demographics of patients and previous collaboration with UCL and are listed below,

- Sydenham Center, Barking, Havering and Redbridge University Hospitals NHS Trust, London
- Barts Sexual Health Center, Barts Health NHS Trust, London
The twenty sites that participated in the AURAH study were comprised of thirteen sites in London and seven from across the rest of England see Figure 3;
3.6.1 Inclusion criteria

The study inclusion criteria were; HIV negative (or undiagnosed) subjects aged 18 years or over, attending for routine STI or HIV testing in sexual health clinics.

Participants who were unable to complete questionnaire in English due to language difficulties, or, were already diagnosed as HIV positive, were excluded from participation.

3.7 Recruitment

Each site was set an individual recruitment target that was based on the number of participants that the Principal Investigator at each site agreed would be realistic to achieve, given the time frame for recruitment which was initially set at 1 year, the size of their clinic cohort, and the sample size required for the study (see Section 3.9, pg.70). The recruitment targets for each clinic are outlined in Table 3.
Table 3 AURAH study sites: recruitment targets

<table>
<thead>
<tr>
<th>Study Site</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking (London)</td>
<td>60</td>
</tr>
<tr>
<td>Barts (London)</td>
<td>100</td>
</tr>
<tr>
<td>Birmingham</td>
<td>100</td>
</tr>
<tr>
<td>Brighton</td>
<td>240</td>
</tr>
<tr>
<td>Bristol</td>
<td>100</td>
</tr>
<tr>
<td>Calderdale &amp; Huddersfield</td>
<td>60</td>
</tr>
<tr>
<td>Coventry</td>
<td>180</td>
</tr>
<tr>
<td>56 Dean Street (London)</td>
<td>250</td>
</tr>
<tr>
<td>Homerton (London)</td>
<td>120</td>
</tr>
<tr>
<td>John Hunter (London)</td>
<td>150</td>
</tr>
<tr>
<td>Kings (London)</td>
<td>200</td>
</tr>
<tr>
<td>Leicester</td>
<td>100</td>
</tr>
<tr>
<td>Mortimer Market (London)</td>
<td>300</td>
</tr>
<tr>
<td>Newham (London)</td>
<td>100</td>
</tr>
<tr>
<td>Reading</td>
<td>60</td>
</tr>
<tr>
<td>Royal Free (London)</td>
<td>60</td>
</tr>
<tr>
<td>St Georges (London)</td>
<td>100</td>
</tr>
<tr>
<td>The London (London)</td>
<td>100</td>
</tr>
<tr>
<td>West London (London)</td>
<td>100</td>
</tr>
<tr>
<td>Whipps Cross (London)</td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2580</strong></td>
</tr>
</tbody>
</table>

During the initial few months of recruitment (June 2013 to October 2013), all consecutive patients attending the participating sexual health clinics were approached by research staff to take part in the study and there was no restriction on the inclusion in terms of ethnicity or sexuality.

After five months of unrestricted recruitment, in November 2013, the Data Manager and I, Dr Andrew Speakman after agreement with the study core group, implemented targeted recruitment across the sites to ensure that the recruitment goals for the two main groups of interest were reached. The inclusion criteria were narrowed to include only those self-identifying as of black African ethnicity or men who self-defined as gay, bisexual or MSM. Other inclusion criteria remained the same.
Once individual clinic recruitment targets had been achieved each site was closed to recruitment. The final sites were closed in September 2014. However, an application for a non-substantial amendment (see Section 3.11.4, pg.76) was granted in September 2014 which allowed a recruitment extension in the three sites (56 Dean street clinic, Mortimer market clinic and Claude Nicol sexual health clinic) that had recruited the largest number of MSM to the study. These three sites continued recruitment of MSM from September 2014 until the end of February 2015. The aim of this recruitment extension was to maintain recruitment momentum in the three clinics that had been selected to participate in the planned AURAH2 study, (described in Chapter 4) so that once ethics approval had been gained for the AURAH2 study, it could continue recruiting in the three sites without a break. A flowchart of AURAH clinic recruitment is presented in Figure 4.
Figure 4 Flowchart of AURAH clinic recruitment and questionnaire collection procedures
3.8 Consent

Research assistants and research nurses at each study site were trained on the study information, Participant Information Sheet (PIS) and consent form, by myself during the site initiation meeting (described in Section 3.12.1, pg.78). All subjects who were invited to participate were given a PIS and consent form (see Appendix I) about the study by the clinic researchers who had completed ‘Good Clinical Practice’ training within the past two years. The informed consent process in the clinic environment was planned specifically to maintain patient confidentiality and site researchers were required to provide study information and obtain consent in a designated area in the clinic for this purpose. Participants were given approximately 15 minutes to read the consent form before the decision on taking part was requested by the clinic researcher. Those who agreed to complete the questionnaire were asked to sign the consent form attached to the PIS (see Appendix I). The form included an optional section for participants to provide their contact details if they were interested in taking part in future research by UCL which was then recorded in the study log at the clinical site. Participants were informed that consent to be contacted was optional but that those who provided contact details would be entered into a monthly draw offering a prize of £100 of shopping vouchers. Those who agreed to be contacted were asked for their preferred contact details (email address and mobile number for SMS contact). The consent form noted that their contact details would only be used for these purposes and would be held securely at the study management centre as part of the study records but would be deleted after a period of two years.

During the consent process, the researchers at the clinic sites were asked to reiterate that the study was for HIV negative or undiagnosed individuals only. If a participant consented and completed the questionnaire and subsequently received a positive HIV test result during their clinic appointment, their questionnaire was included in the study as they were HIV-undiagnosed at the time of questionnaire completion and so the information they provided referred to a period when they were not aware of their HIV infection.

Participants were made aware during informed consent that participation included supplying information on the results of any HIV tests that took place in the clinic on the day they were enrolled in to the study (see Appendix I). In September 2014, after approval by the Research Ethics Committee of a substantial amendment (see Section 3.11.1, pg.75), I modified the ‘optional section’ on the consent form for provision of contact details, so that only participants who were willing to provide contact details were eligible to join the study. This was to build a group of potential participants to contact and invite to join the AURAH2 study once it was ready to recruit (in 2015, detailed in Chapter 4). I also amended the information
sheet to provide details of the AURAH2 study which would consist of a series of online follow-up questionnaires every four months for a three-year period. Participants who agreed to be contacted in the future were asked for their preferred contact details (email addresses and mobile number for SMS contact were the only options and email was highlighted as the preferred method of contact) and made aware during informed consent that their contact details would be transferred to the research group outside of the clinic setting using the electronic study log. If participants consented for future contact by the research group, the contact details were recorded in the study log by the clinic researcher and transferred securely (via NHS email) back to the data manager, Dr Speakman, using the electronic study log (see Section 3.8.1).

3.8.1 Confidentiality

The site researcher allocated a study number to each participant once they had consented to participate and signed the study consent form. The study number was hand-written by the site researcher on to the questionnaire so that the completed questionnaire was pseudo-anonymous. The researcher recorded the study number manually in the site log and then transcribed it on a fortnightly to monthly basis to a password protected spreadsheet that was sent (via NHS mail) to the data manager at the research institute, along with any further details the participant disclosed – for example, contact details (email address) should the participants wish to be contacted about future research. If participants chose to take the questionnaire off-site, the study number was hand-written on the questionnaire and they were provided with a stamped, addressed envelope to post the questionnaire back to the research group.

3.9 Sample size

The sample size calculations for the AURAH study were performed by Dr Fiona Lampe, from the AURAH study core group, UCL. The calculations were included in the Research Ethics Application and also informed the planning of recruitment targets at each clinical site (see Table 3, pg.6) (Section 3.7, pg.65).

The AURAH study aimed to recruit 2000 participants: 1000 MSM, and 1000 heterosexuals of whom 600 black African, to address three main objectives;

(i) Ascertain the proportion of individuals who report that they have had condomless sex in the past three months with a partner of unknown or positive status and that one of the reasons for this was “I knew there was a risk of acquiring HIV but I am not so concerned about having the disease that it made me want to have sex using a condom.” This will
be calculated as a proportion of all study participants and as a proportion of all participants reporting condomless sex.

(ii) Ascertain the proportion of individuals who report that they have had condomless sex in the past 3 months with a positive partner who give a reason as “I thought the risks of catching HIV were low because my partner was taking anti-retroviral therapy.”

(iii) Compare the prevalence of PHQ-9 depression between HIV diagnosed (from the ASTRA study) and HIV negative individuals (from the AURAH study), separately for HIV negative MSM, heterosexual men and women, black African men and women.

For objectives (i) and (ii), the planned sample size of 1000 MSM would allow estimation of a 5% prevalence with 95% confidence interval (CI) of +/- 1.35%, a 10% prevalence with 95% CI of +/- 1.35%, and a 20% prevalence with 95% CI of +/- 2.48%. For the planned sample size of approximately 600 black African men (or women), prevalences of 5%, 10% and 20% would be estimated with 95% CIs of: +/-2.45, +/- 3.40%, and +/- 4.53% respectively.

For objective (iii) given in ASTRA there were approximately 2250 MSM, 200 black African men and 450 black African women [37], and assuming a prevalence of depressive symptoms of 25% among each of these groups, the study would have 80% power (with 5% 2-sided significance level) and absolute difference in prevalence of 4.5% for MSM, 10.0% for black African men, and 8.5% for black African women.

3.10 Data collection

Participants were invited to complete a self-administered, paper-based questionnaire while waiting for a sexual health clinic appointment, or directly following an appointment. It was requested that participants complete the questionnaire on the same day of the appointment, in the clinic, however it was also possible to take the questionnaire out of the clinic and post it back to the study team with a stamped, addressed envelope provided by the clinic researcher. In order to maximise the study response rate, it was stressed that completion of the questionnaire in the clinic was the greatly preferred option.

3.10.1 Study questionnaire

I developed the questionnaires for the AURAH study in collaboration with the UCL core group and based them on the structure of the questionnaires that were used in the ASTRA study. Thus sociodemographic information was collected first, followed by questions on mental health and well-being, then general health and lifestyle, then sexual health and identity and finally sexual behaviour. I used this structure because research has shown that collecting information that starts general and moves to the particular, especially when asking
questions that require sensitive information, can optimise completion rate of questionnaires as participants have time to become comfortable with answering personal questions (242). The same recall timeframes for behavioural questions were applied (either previous three months or twelve months) as used in the ASTRA study, and standard assessment tools for measuring lifestyle and health and wellbeing factors (such as the PHQ-9 score for Depression, GAD-7 for Anxiety) were used to allow comparison on various behaviours between the HIV negative or undiagnosed population from the AURAH study and the HIV-diagnosed that participated in the ASTRA study.

Once completed, the questionnaires were placed in a sealed envelope and put in a box in the clinic. Participants who took the questionnaire out of the clinic, and had consented for future contact by the study team, were sent two email reminders (one week after the participants clinic visit, and the second a week after the first), by the site researcher using an NHS email account if the questionnaire had not been received by the study team within a month. Separate versions of the questionnaire (A5 booklet size) were designed for male (see Appendix II) and female participants.

3.10.2 Questionnaire and study language

The ASTRA study demonstrated that the demand and uptake of questionnaires in languages other than English/foreign languages in the clinics was minimal (236), therefore the questionnaires were not made available in any languages other than English in the AURAH study.

3.10.3 Questionnaire content

The questionnaire included the following sections to be completed by the participant:

- **Demographic and social factors:** including gender, age and year of birth, ethnicity, education, employment, housing, financial status, sexuality, relationship status (whether in long-term partnership and HIV-status of partner), country of birth, number of children
- **Health and well-being:**
  - Psychological and physical symptoms – collected using a modified version of Memorial Symptom Assessment Scale Short-Form (243, 244)
  - Depression – collected using the Patient Health Questionnaire (PHQ-9) (245)
  - Anxiety – collected using the General Anxiety Disorder scale (GAD-7) (246)
  - Health-related quality of life – collected using the EuroQoL-3L (247)
  - Social support – collected using a modified version of the Duke–UNC Functional Social Support Questionnaire (248)
Health and Relevant medical history: including any major medical conditions, recently diagnosed STIs, symptoms of STIs, diagnosed hepatitis B and C, treatment for depression, treatment for other mental health problems, whether circumcised if male

HIV-related information: HIV status (participants reporting HIV positive status on the questionnaire were excluded) and history of any HIV tests, beliefs about transmission risk in relation to ART and undetectable viral load, knowledge and any history of PEP and PREP; attitudes to HIV self-testing and clinic-based tests

Lifestyle factors: cigarette smoking status, usual alcohol intake, evidence of alcohol dependency (the CAGE questionnaire) (249), recent use of recreational drugs (list of eighteen individual drugs plus space for free text) and recent use of injecting drugs

Sexual lifestyle: men who identified as MSM were asked about disclosure of their sexuality to others and involvement in the gay social scene

Sexual activity: sexual activity during the previous three months was ascertained for all participants. For those participants who reported CLS in the past three months, there were questions on number of partners, type of partners (long-term or other), attitudes to the risk of HIV infection and knowledge of the HIV status of partners. There were additional questions on the number and type of partners if the participant reported condom-less sex with people known to be HIV-positive. All participants were also asked about: use of the internet to find sexual partners; different sex practices and group sex, attitudes to disclosure of HIV status to sexual partners and negotiation of condom use; their total number of new sexual partners in the past year and preferred information sources (if any) about safer sex

HIV testing preferences: participants were asked to rank different ways of testing for HIV. Ranking from least liked to most appealing on a scale of 1-4, the options were (i) in a sexual health clinic (ii) GP surgery (iii) self-sampling (iv) self-testing. They were also asked to indicate a preference for saliva or blood based self-testing options.

3.10.4 Clinic data
Participants were asked to self-report their HIV status in the questionnaire. The clinic researcher recorded the result of the HIV test (if the participant had completed one) that was performed on the day that the questionnaire was completed, in the study log. If a participant had not had a point of care HIV test result on the day of questionnaire completion, the researcher completed the HIV test result in the study log once the laboratory confirmed result was available. The researcher also noted in the study log if the participant did not receive either a point of care HIV test or a blood test result. Paper study logs (containing the
HIV test results and questionnaire study numbers) were transcribed in to a password protected digital study log that were exported to the Data Manager on a weekly or fortnightly basis using secure NHS mail.

3.11 Ethical considerations

During the design of the study, myself, the core group, and the Research & Development team at the Royal Free hospital who assisted in the Ethics application form, identified three areas in the study procedures that warranted focused ethical considerations due to the sensitive nature of the questionnaires and the information provided by the participants. These areas were potentially where patient confidentiality could be jeopardised should the study processes for data management and storage be sub-optimal. The solutions for the three areas are listed after each point (and the processes are further described in the Data Management chapter, Chapter 5);

(i) transfer of data between clinic site and research group at UCL Centre for Clinical Research, Epidemiology, Modelling and Evaluation, Royal Free hospital.

Myself and the data manager designed the transfer of questionnaires and site logs to be two separate processes so that study identification numbers on the questionnaire (returned via registered post or collection by myself or the data manager) were not returned using the same mechanism as the study log (returned via NHS email from site researcher to data manager) which contained the study ID and HIV test result.

(ii) storage of electronic data and questionnaires at research institute

I planned the storage of digital and paper-based study materials in accordance with UCL’s Information Governance Framework which consists of policies, procedures and guidance materials to support researchers in handling information, including sensitive personal data, legally, securely, efficiently and effectively. The storage of electronic data was on an encrypted memory stick that was held by the data manager. The storage of the paper-based study materials was in a locked cabinet within a locked office that was accessible to myself, the data manager and the Chief Investigator, Professor Alison Rodger.

(iii) management of data by researchers

Access to data was limited to specific members of the research group in encrypted form on password protected computers. Study logs were only transferred from named and verified NHS to NHS email account.
3.11.1 Ethical review

After collaboration with the Royal Free Research and Development office on the study documents, I submitted the research protocol (Appendix III) and all the study documents (PIS and consent form, questionnaires (Appendix I, II) online (using the Integrated Research Application System version 3.5) and in paper, to the local Research Ethics Committee in Hampstead, London. Approval by the designated research ethics committee, NRES committee London-Hampstead, ref: 13/LO/0246 was given in April 2013. Based on these documents, I subsequently sought and gained permission online (using the Integrated Research Application System version 3.5) for the study to be carried out at all participating National Health Service sites.

3.11.2 Confidentiality

Site researchers were asked to specifically emphasise and explain how confidentiality would be maintained for the participant should they chose to take part in the study. Furthermore, participants were informed in the PIS that their confidentiality throughout the study process would be maintained and that questionnaire responses would not be seen by clinic staff. An envelope was provided with each questionnaire so that participants were able to seal their completed questionnaires before returning it to the clinic researcher. Participants were requested by the site researcher not to write their name or clinic number on the questionnaire to maintain their anonymity and questionnaires were identified only by a unique study number (see Appendix I and II).

3.11.3 Data security

The site researcher was responsible for collecting the details of all clinic attendees who were approached for the study. These details, clinic number and date of approach for study, were written in to a study log in paper form, maintained securely, kept in an on-site locked cabinet accessible only to the site researcher and site Principal Investigator, and updated daily (on recruitment days) at each clinical site by the site researcher for the duration of the study. For those that consented and participated in the study, the study log contained study numbers, whether or not HIV and other STI tests had been done, and the result of any HIV test. For those who were invited but did not participate in the study only clinic identifiers and details of consent status (i.e. declined) were written in the study log. All study numbers of those who were invited to participate in the study were kept in the study log along with consent status so that consent rates could be monitored. Contact details of participants were only entered in to the log if participants consented to being contacted about future research. Large sites that recruited quickly tended to update and email the study log on a fortnightly basis to the Data Manager, Dr Speakman, whilst smaller sites would send the log on a monthly basis.
3.11.4 Study amendments

During the design and recruitment phase of the study, I made three substantial amendments to the study documents after discussion and agreement with the study core group. A substantial amendment is defined by the Health Research Authority as an amendment to the terms of the application, or to the protocol or any other supporting documentation, that is likely to affect to a significant degree:

- the safety or physical or mental integrity of the subjects of the study
- the scientific value of the study, the conduct or management of the study
- the quality or safety of any investigational medicinal product used in the trial

The first substantial amendment was made to the questionnaire and patient information sheet in June 2013, before recruitment commenced but after approval of the study protocol and documents had been granted by the Research Ethics Committee (April 2013). This amendment made final changes to the questionnaire and patient information sheet based on a review of the documents by the study core group at UCL. The second substantial amendment was made to the questionnaire in August 2013. This amendment involved including an insert to each questionnaire to capture information on HIV testing preferences in view of the need to expand HIV testing options, particularly for ‘at risk’ groups, highlighted by a Public Health England report (250). The questions on HIV testing had not originally been considered in the design of the questionnaire. The third substantial amendment was made in May 2014. This amendment restricted recruitment solely to MSM that consented for future contact in three of the sites, Brighton, 56 Dean street and the Mortimer market clinic, to assess the feasibility of the proposed prospective cohort study, AURAH2, and create a group of MSM willing to be contacted about the study when planned recruitment commenced in 2015.

A non-substantial amendment includes minor changes to the study documentation, inclusion of new sites and extension of recruitment periods beyond the period specified in the application form (251). I made four non-substantial amendments during the study recruitment phase in April 2014, July 2014, August 2014 and January 2015. All non-substantial amendments were for recruitment extensions to ensure that the recruitment targets for the study were met. A timeline of the AURAH study substantial amendments and non-substantial amendments can be seen in Figure 5.
3.12 Study management and my role as study coordinator

The study was managed by the core group at the research department, UCL Clinical Research, Epidemiology, Modelling and Evaluation (CREME), and coordinated by myself with support from the Data Manager, Dr Speakman. An advisory group was also established at the start of the study to provide guidance and support. The advisory group (Appendix III) consisted of representatives from University College London, HIV i-Base, the London School of Hygiene and Tropical Medicine and City University London.
3.12.1 Site initiation visits

I conducted all the site initiation visits across the 20 sites in June-August 2013. Each visit outlined the study objectives and discussed the practicalities of conducting the study within the clinic setting, with an emphasis on maintaining confidentiality and the areas of data management where confidentiality could be at risk. Each site initiation visit consisted of a presentation of the study, its aims, objectives and specific recruitment targets for that site. The audience usually consisted of the PI at the study site and the research team including the study researcher(s), and, in a few instances, the wider clinical team. I developed a general slide set of the study procedures for presentation which were tailored to match different site recruitment targets. At each visit I discussed with the team, potential issues around implementation, such as private areas in clinic for consent, where participants could leave completed questionnaires and the return of questionnaires and study logs to the coordinating centre. At each site visit I emphasised to the team that the main groups of interest were MSM and black Africans, as the key UK groups living with and at risk of HIV infection, and that recruitment rates would be monitored to ensure a representative sample from these two demographics were met with the potential for targeted recruitment to be implemented once the study had met its targets for recruitment of heterosexuals. I also discussed how the study researchers could contact myself and the study core group with any issues may arise during the implementation of the study, usually via email but for more urgent questions or issues via telephone.

3.12.2 Management of recruitment phase

As detailed in the Section 3.7, pg.65, the data manager, Dr Speakman, and I monitored the in-clinic response and recruitment rates for the study. We did this on a monthly basis and ensured that the study recruitment procedure was moved to targeted recruitment of MSM and black Africans once the recruitment targets for heterosexuals had been met (after five months of unrestricted recruitment) to ensure the required sample size of the two populations were met. Once I had gained ethical approval for the substantial amendment to move to targeted recruitment, I communicated this to the clinic researchers at each clinic site via NHS email. The majority of communication I had with individual clinic sites was via email, with the exception of some of the clinics in London from which I met the site researcher on a monthly basis to collect completed questionnaires. These clinics were 56 Dean street clinic, The Royal Free Marlborough clinic, and Mortimer market clinic. I maintained regular contact with the research staff from all participating sites throughout the recruitment phase of the study and myself and the Chief Investigator had teleconferences with the participating sites every three months for the duration of recruitment. Once the recruitment target was successfully achieved for each site I issued a site closure email, thanking the site for their
participation, advising the site researcher to return any excess study materials to the research institute and requesting that the study log would be stored in a locked cabinet within the clinic for the next two years before being archived in accordance with the site Trust policy.
Chapter 4: Methods: Attitudes to and Understanding Risk of Acquisition of HIV over time (AURAH2) study

4.1 Introduction

This chapter describes the design and methodology of the prospective cohort study ‘Attitudes to and Understanding risk of Acquisition of HIV over time (AURAH2)’ which, in collaboration with the same core group of researchers from UCL that oversaw the AURAH study, I designed whilst the AURAH study was still recruiting. AURAH2 recruited HIV negative or undiagnosed MSM from sexual health clinics in 2015/16 collecting baseline information using the same paper questionnaire as the AURAH study. It then followed-up participants online using four monthly questionnaires for a maximum of three years, until March 2018. In this chapter I describe the overall aims and objectives of the AURAH2 study, the rationale, study design and set-up of the study. Next, I detail the process I developed which allowed consenting participants from the AURAH study to join the online phase of the AURAH2 study and the consent process for those that joined the AURAH2 study directly. Then, I detail the data collection tools that I developed, including the design and development of the study website which was used for data collection during the online phase of the study, the ethical considerations and study management. Finally, I describe my role as study coordinator. The coordination of the study ran from the pre-ethics design phase including the development of the study protocol, patient information sheets and consent forms, questionnaires, website and online questionnaire development, and the ethics application and approval from the three participating NHS sites, to the post-ethics implementation of the study which included data collection, invitation emails to online participants, management of the online cohort, data transfer, storage and analysis.

4.2 Aims and objectives

The aim of the AURAH2 study was to estimate HIV incidence, to identify predictors of new HIV infections among originally HIV negative MSM at risk of acquiring HIV, and to assess changes over time in sexual behaviour, recreational drug use, and HIV testing practices within MSM.

The detailed objectives of the AURAH2 study were to investigate:

(i) the prevalence and correlates of specific sexual behaviours, including numbers of condomless sex partners, condomless sex with casual partners and partners of unknown HIV status, insertive/receptive condomless sex, and other specific higher-risk sexual activities such as group sex and chemsex
(ii) the number of condomless sex partners before, during, and after the estimated period of primary HIV-infection and time of HIV diagnosis in men who become infected during the study, as well as correlates of within-person changes in sexual behaviour

(iii) the frequency and type of HIV testing accessed over time (sexual health clinic, self-testing, general practitioner, surgery, hospital, other)

(iv) the extent to which baseline demographic, socioeconomic, and health and lifestyle factors (including recreational drug use and chemsex) are predictive of subsequent levels of condomless sex, incident HIV infection, and HIV-testing behaviours

(v) the association of attitudes to HIV transmission, disclosure, treatment, and prognosis, with high-risk sexual behaviours, HIV-testing behaviours, and subsequent HIV acquisition

(vi) the associations of participant characteristics, sexual behaviour, and attitudes with reported use of, and willingness to consider use of, post exposure prophylaxis (PEP) and pre-exposure prophylaxis (PrEP)

4.3 Study team and funding

The AURAH2 study was a component of the PANTHEON programme grant that was held by the same core group of researchers at UCL who were responsible for the ASTRA and AURAH study (see Chapter 3), at UCL's Institute for Global Health; Professor Alison Rodger (Chief Investigator), Professor Andrew Phillips, Dr Fiona Lampe and Dr Speakman. PANTHEON was a five-year programme grant funded by the National Institute for Health Research (NIHR). My role as study coordinator is discussed later in the chapter (see Section 4.12, pg.105).

4.4 Rational for the study

In 2014, the annual HIV report from Public Health England reported that HIV incidence was continuing to increase among MSM in the UK despite HIV prevention interventions (252). The AURAH2 study aimed to provide the first detailed longitudinal data on the incidence and predictors of new infections among HIV negative MSM at risk of HIV infection in the UK. It further aimed to provide some of the first data on emerging behaviours such as chemsex, that had raised concern around sexual health and wellbeing among MSM, as well as identify interest and uptake of PrEP and expanded HIV testing options for this group. The wide range of topics explored by the AURAH2 study would provide a variety of targeted health
promotion strategies that were specific to the MSM and be highly relevant to HIV prevention efforts. The data would also be used to parameterise a mathematical model to evaluate the effectiveness and cost-effectiveness of different prevention strategies in MSM both independently and in combination (57, 253, 254) and the results of the study would be placed to inform national policies aimed at reducing HIV incidence and increase HIV testing in the UK in this population.

4.5 Study design
The AURAH2 study was a prospective cohort study designed to collect longitudinal data on HIV negative or undiagnosed MSM at risk of HIV infection. It used a combination of (one) paper-based questionnaire and multiple (up to nine) online follow-up questionnaires.

4.6 Study setting and methodology
The AURAH2 study recruited MSM adults attending any of the three UK sexual health clinics that contributed the largest number of MSM to the AURAH study. Two of the clinics were situated in London and the third in Brighton;

- Mortimer Market Clinic (Central and North West London NHS Foundation Trust), London, (MMC)
- 56 Dean Street Clinic (Chelsea and Westminster hospital NHS Foundation Trust), London, (DS)
- Claude Nicol Clinic (Brighton and Sussex University hospital NHS Trust), Brighton, (CN)

4.6.1 Inclusion criteria
Inclusion criteria for the AURAH2 study was similar to the AURAH study; HIV negative (or undiagnosed) subjects aged 18 years or over, attending for routine STI or HIV testing in participating sexual health clinics. However, a further inclusion criterion was added to the AURAH2 study which stipulated that only those participants who consented to be followed up using online questionnaires over a three-year period were eligible to join the study. Only participants who were able to complete the questionnaires in English were eligible to join the study.

4.7 Recruitment
Two groups of participants were recruited to the AURAH2 study; (i) MSM participants from the AURAH study who had consented for future contact, and (ii) participants that were recruited directly in to the AURAH2 study at a routine clinic visit at one of the three sites.
Recruitment route 1: MSM (who consented to contact for future follow up from any of the three AURAH study sites that participated in the AURAH2 study) were emailed through the secure AURAH2 study website (see Section 4.10.4, pg.92), invited to register and join the AURAH2 study. Potential participants received an individual email containing information on the AURAH2 study and a link to a registration page on the AURAH2 study website. If the link was utilised, the participant was directed to an online registration form, nested within the AURAH2 study website (described in Section 4.10.4, pg.92).

Recruitment via route 1 took place from March – April 2015 and was managed by myself and the data manager, Dr Speakman. As per Ethics approval (see Section 4.11.2, pg.102), participants were contacted a maximum of three times with an invitation to join the AURAH2 study; twice via email (a week apart) and finally via text (a week after the second email) if they had provided a mobile number on the consent form, if not they were emailed for a third and final time. Participants who joined the AURAH2 study from AURAH were assigned the same study number in their online follow-up as their original AURAH study number so that online follow-up could be linked to responses in the original cross-sectional study. They also followed a specific timeline for questionnaire completion to ensure that a complete set of data (including the online annual questionnaire) was collected in the first year of the study (see Figure 6). Therefore, they were invited to complete an annual online questionnaire four months after their first online questionnaire.

Figure 6 Questionnaire sequence and timeline for recruitment route 1

Recruitment route 2: This group consisted of HIV negative or undiagnosed MSM who were prospectively recruited at a routine clinic visit through the three AURAH2 clinic sites from March 2015 to December 2016. Participant contact details, obtained during consent and exported to the data manager via the study log, were uploaded to the AURAH2 study website and database on a monthly basis. Participants were subsequently emailed and invited to join and complete their first online questionnaire within four months of completing a baseline questionnaire in-clinic. Participants recruited through recruitment route 2 followed a
specific questionnaire timeline to ensure that relevant information was collected on a yearly basis (see Figure 7), (i.e. their baseline questionnaire was followed by two online four monthly questionnaires, then the online annual questionnaire, during the online phase of the study).

Figure 7 Questionnaire sequence and timeline for recruitment route 2

A study flowchart was constructed to demonstrate how the separate recruitment routes joined the online phase of the study, see Figure 8.
4.7.1 Study transition from AURAH to AURAH2 study

In September 2014 the three sites that had been invited, and accepted, to participate in the AURAH2 study continued with AURAH study recruitment whilst the remaining 17 sites were closed. The three sites agreed to continue recruitment of MSM to the AURAH study who specifically consented to provide contact details with a view to joining the proposed prospective cohort study, AURAH2. This allowed MSM who attended the three clinics between September 2014 (when the other 17 AURAH study sites closed for recruitment) and March 2015 (the commencement of the AURAH2 study) to be contacted by the research group and invited to join the AURAH2 study in March 2015.
4.8 Consent

Due to the two different groups of participants that could consent to join the study, those from the AURAH study and those directly recruited to AURAH2, I had to ensure that the consent process and study details were clearly defined and identical for both groups. Therefore consent for the study was gained through two mechanisms, according to the recruitment route. For those participants who joined from the AURAH study (recruitment route 1), an individual was sent an email from the study website (detailed in Section 4.10.4, pg. 92) from which they could click on a secure link to register with the study website online. They were directed to an online AURAH2 Patient Information Sheet (PIS) and consent form
(see Appendix IV) which was automatically loaded on to the screen once they had clicked the AURAH2 link in the email. At the end of the online form participants were required to select (click) on the consent boxes to indicate their consent. They also had the option of leaving the study website without consenting and joining the study.

Participants who were recruited directly in to the AURAH2 study in the clinic setting completed a PIS and consent form (see Appendix V) within the clinic setting and did not need to complete a further one online. This ensured that participants from both recruitment routes had access to the same information regarding the AURAH2 study because although some of the aims and objectives of the AURAH and AURAH2 study were similar, participants were made aware of the significant differences between the two studies which were:

- participation in the AURAH2 study meant that participants were expected to complete brief online questionnaires about sexual behaviour and HIV testing on a regular (four monthly) basis over a maximum of a three-year period
- provision of email addresses and mobile phone numbers was necessary and participants needed to consent to receive reminders to complete the online questionnaires via email and/or text message (maximum of two reminders by email followed by one text message) following which no further contact attempts would be made
- provision of full name and date of birth was necessary as this information could be used to link with UK national clinical databases including the national HIV and AIDS reporting system (HARS) database hold by Public Health England (see clinical data)
- results of any HIV test results from the day they joined the AURAH2 study, or that were self-reported during the online phase of the study would be recorded and stored securely
- withdrawal from the online phase of the study was acceptable at any point via an email to myself, the study coordinator, and upon withdrawal any personal data would be deleted without affecting care at their sexual health clinic

4.9 Sample size

Sample size calculations were completed by statistician and AURAH2 core group member Dr Fiona Lampe and were used to plan recruitment targets and submitted to the Research Ethics Committee. The sample size calculation was based on objective (ii) of the AURAH2 study which was, “assess within-person changes in sexual behaviour after receiving an HIV diagnosis”. This outcome was more constrained by power than others because it relied on
comparisons within the group who were diagnosed with HIV during follow-up. Considering sexual behaviour classified as whether or not a man reported more than three condomless sex partners in the past three months, 85 new HIV diagnoses would be needed to detect, with 80% power and 5% significance level, the following changes: 17 (20%) of men newly diagnosed switching from >3 to ≤3 condomless sex partners pre to post-diagnosis, and 4 (5%) of men newly diagnosed switching from ≤3 to >3 condomless sex partners pre to post-diagnosis. A sample size of 1000 would provide adequate power for the objectives.

4.10 Data collection

4.10.1 Baseline data collection

Initial baseline information was collected from each participant using the AURAH paper-based questionnaire which collected information on demographics, ethnicity, psychological health and well-being, knowledge and understanding of HIV and antiretroviral treatment and HIV testing preferences (see Appendix II). Recruited participants completed the baseline questionnaire within the sexual health service clinic-setting and the questionnaires were posted back to the study team at UCL on a fortnightly basis. Similar to the AURAH study procedures, password protected digitised study logs were emailed back to the data manager at UCL on a fortnightly to monthly basis using NHS email accounts by the clinic researchers.

4.10.2 Online follow-up data collection

During informed consent, participants were made aware that after completion of the paper-based questionnaire in-clinic, all subsequent follow-up data would be collected via a series of online questionnaires accessed through the study website. Participants recruited directly in to the AURAH2 study (recruitment route 2) were contacted via an email which was sent through the study website (described in Section 4.10.4, pg.92) within four months after completion of the baseline paper questionnaire in clinic, participants. Participants from the AURAH study (recruitment route 1) were contacted in the same manner in March/April 2015.

I sent the first email to each participant using the study website which allowed for individual emails to be sent in batches, without revealing email addresses of other participants to the email recipient. The first email thanked participants for joining the AURAH2 study at a recent clinic appointment, informed them that an AURAH2 study questionnaire was due for completion and contained a link to the website’s registration page on which the participant was asked to confirm their email address and create a password for their AURAH2 account. This process ensured that the email address of the invited participant matched the one provided by the participant during consent in-clinic. If a participant provided a different email or text message, they were prompted to use the same one that they had provided when they
visited the clinic, if it still did not match, a message thanked them for their time and advised them to contact myself, the study coordinator, through the study website email address.

Once registration was complete the participant was automatically directed to the relevant questionnaire. Subsequent four monthly reminder emails or texts contained a link directly to the website log-in page and were sent automatically by the study website once the participant had registered. Each time a participant logged-in following the link to the study website provided in an email, they were automatically directed to their relevant questionnaire. If a participant had not logged in to the study website within a week of the first reminder email or text being sent, a second reminder email was sent, followed by a final text message a week later if there had still been no log-in. Participants that did not-log in to complete a questionnaire after the final reminder text message had been sent were not contacted further regarding that specific questionnaire, but were automatically contacted four months later for the next questionnaire unless they specifically opted out of the study by emailing ‘STOP’ to the study email address, info@aurah2.org, which I monitored on a daily basis.

Follow-up continued for three years until March 2018. Given the three year follow-up period, if a participant recruited in March 2015 completed every questionnaire that they were prompted to, they would complete a total of ten questionnaires over a three year period; one baseline paper-based in clinic, nine online follow up questionnaires via the AURAH2 website of which at least three were annual questionnaires and six were four monthly questionnaires (details of the difference between questionnaires are described in Section 4.10.3).

4.10.3 Questionnaire development

Paper-based questionnaire development
Extensive baseline data was collected through the self-completed paper questionnaire which was used for the AURAH study (255) and as baseline data for the AURAH2 study, as detailed in Chapter 3 (see Appendix II).

Online questionnaire development
The online questionnaires were developed directly from the paper-based AURAH questionnaire so that as far as possible, answers between the paper and online questionnaires were comparable. Due to the length of the study follow up period online, there was the potential for the HIV status of some individuals to change which would require the online questionnaires to adapt to a change in HIV status to ask relevant and appropriate questions. To ensure questionnaires were adaptable to a change in HIV status, the first online question of each questionnaire requested the date (month/year) and outcome of an
individual’s most recent HIV test. If an individual reported receiving an HIV positive result they were directed to a different questionnaire to gather information on HIV diagnosis and subsequent online questionnaires would gather similar information to the negative questionnaires but collect additional information on the individual’s HIV, treatment and progress (see questionnaires below). In total five different online questionnaires were developed to allow effective capture of information that was sensitive to a change in individual HIV status. The different types of questionnaire available online were:

- Four monthly questionnaire: for HIV negative or undiagnosed participants
- Annual questionnaire: for HIV negative or undiagnosed participants
- 1st HIV positive questionnaire: for participants that reported an HIV diagnosis since last online questionnaire
- Four monthly questionnaire: for HIV-diagnosed participants
- Annual questionnaire: for HIV-diagnosed participants

4.10.3.1 Four monthly questionnaires for HIV negative or undiagnosed participants

These brief five-minute questionnaires were the most common of the online questionnaires and participants were invited to complete them twice a year. The questionnaire related to the time period since the previous questionnaire had been completed. The questions related to five themes (all with a three month recall period) on: (i) recent HIV testing history, reasons for testing and recent test result, (ii) sexual behaviour, number of CLS partners, type of CLS (receptive, insertive, versatile), status of partners and whether on ART if partners were HIV-diagnosed, (iii) group sex (iv) sexual health, STI diagnosis, and, (v) chemsex, what drugs and how often. The sexual behaviour questions were roughly based on an HIV risk assessment used in a pre-test discussion in a clinical setting (256) with additional questions on drug use for the purpose of the study (see Appendix VI).

4.10.3.2 Annual questionnaires for HIV negative or undiagnosed participants

The annual online questionnaires included all the questions asked in the four monthly questionnaires but were more extensive. Unless stated otherwise, the annual questionnaires also used a three month recall period. Annual questionnaires included questions related to 13 themes. These were: (i) recent HIV testing (same as four monthly questionnaire), but additionally whether self-tested for HIV in previous year was used and whether in long-term relationship (ii) sexual behaviour (same as four monthly questionnaire), but additionally where participant is most likely to meet new partners with a list of places including cafes, saunas, cruising areas, online or other, (iii) group sex, (iv) sexual health, STI diagnosis (same questions as four monthly questionnaire), (v) PEP use in past year, how often and
whether taken following chemsex (vi) PrEP use in past year, where PrEP was obtained from, approximately how much of the time the participant was on PrEP for, (vii) recreational drug-use, what drugs had been used in past three months (viii) chemsex (same questions as four monthly questionnaires), (ix) injecting drug use in past three months and who injects – the participant or someone else (x) alcohol, using the CAGE questionnaire (249) (xi) physical symptoms using the using a modified version of Memorial Symptom Assessment Scale Short-Form) (243) (xii) mental health using the using the Patient Health Questionnaire for depression (PHQ-9) (245) and the General Anxiety Disorder scale for anxiety (GAD-7) (246), and finally (xiii) total number of CLS partners in previous year. This annual questionnaire was designed to take between 20-25 minutes to complete (see Appendix VII).

4.10.3.3 First questionnaire after HIV diagnosis
The newly HIV diagnosed questionnaire related to five core themes, the first and fifth theme were different to any of the other online questionnaires as they specifically related to an HIV diagnosis, however the others were similar to the other online questionnaires. The five themes were (i) engagement in care, whether a participant had been seen by a healthcare professional since their HIV diagnosis and whether they were now taking ART, (ii) sexual behaviour in the three months prior to their HIV diagnosis, how many CLS partners/new CLS partners, (iii) STI diagnoses in the three months prior to their HIV diagnosis, and which STIs, (iv) chemsex in the three months prior to their HIV diagnosis, which drugs, how often, and whether chemsex has increased or decreased since HIV diagnosis (see Appendix VIII).

4.10.3.4 Four monthly questionnaire for HIV-diagnosed participants
The four monthly HIV-diagnosed questionnaires were very similar to the four monthly questionnaires for HIV negative participants in terms of questions and duration. The only difference was that they also included questions on engagement in care, whether a participant had seen a healthcare professional since they were diagnosed, if they were on ART and when they started, and whether they knew what their viral load was (detectable or undetectable) (see Appendix IX).

4.10.3.5 Annual questionnaire for HIV-diagnosed participants
The annual questionnaire for HIV-diagnosed participants was also very similar to the annual questionnaire for HIV negative participants in content and duration. Similar to the four-monthly questionnaire for HIV-diagnosed participants it contained questions on engagement in care. In contrast to the annual questionnaire it did not contain questions on PEP or PrEP use and therefore took slightly less time to complete (see Appendix X) than the annual HIV negative questionnaire.
4.10.4 Website development

The online component of AURAH2 was designed to capture data on sexual behaviour and risk factors for HIV transmission on a regular four monthly basis, whilst broader information including psychological and physical symptoms, alcohol and drug use was captured on an annual basis. The time interval of four months between the online questionnaires was chosen as, after discussion with the AURAH2 core group, it was felt that answering online questionnaires on a four monthly basis would be a reasonable request for the participants without placing too much of a study burden on them which might impact upon retention. It was also important to keep the four monthly questionnaires relatively short to encourage completion of questionnaires and only request participants to complete the longer questionnaires on an annual basis.

The development of the study website and database started in October 2014. The basic requirements of the website were agreed by myself and the AURAH2 core group to inform the necessary design and function, and then an appropriate timeline was planned to coordinate the launch of the study website and the commencement of recruitment (recruitment route 2) in-clinic.

The website was required to; provide adequate data capture in the form of a database over a three year period, comply with UK legislation and UCL guidance (see Data Security 4.11.5), work according to the study protocol as approved by the Research Ethics Committee (see Ethics Approval 4.11.2) and provide value for money in set-up and maintenance over the three year data collection period via the website. Based on these requirements, an external organisation, AN Computing was sub-contracted to build and maintain the website and database that would capture all of the online study data for the duration of the study.

4.10.4.1 AN Computing

The collaboration with AN Computing was initiated primarily due to their prior experience of developing software for other NHS organisations, local health authorities and Public Health England. During an introductory meeting myself, the data manager, Dr Speakman, and the Chief Investigator, Professor Rodger, met with AN Computing, and they were able to demonstrate extensive prior experience of the governance and policies that would be important issues for our planned study. For the study to comply with NHS Trust and national data security requirements such as the Data Protection Act 1998 (257) it was important that we worked with an organisation that had knowledge and experience of the regulations relevant to data security and data management. During the introductory meeting with AN
Computing in November 2014, we outlined the scope of the AURAH2 study and timelines for the delivery of the AURAH2 website were set.

Following the introductory meeting, Dr Speakman and I held weekly teleconferences with the AN Computing project lead during the project inception phase, from November 2014 to December 2014 (see Table 4). During this period, the structure of the website was developed and the separate recruitment route journeys through the website pages and questionnaires were designed and implemented in the website. Graphic design input from a UCL website designer, David Pearce, was also incorporated for images, lay-out and AURAH2 logo development. The weekly teleconferences and feedback from Dr Speakman and myself were mainly focused on user functionality across the website, the correct order that participants would navigate their way from a link in an email through to the study website, development of a password linked to their email address and study ID, and commencement of a questionnaire.

From January to the end of February 2015 Dr Speakman and I undertook intensive questionnaire development and testing. During this phase the teleconferences with AN Computing were increased to twice a week to feedback on a regular basis on order of questions, phrasing of questions and sub-questions and which answers warranted a skip to the next relevant question (see Table 4). Once I had designed the questionnaires and they had been approved by the core group at UCL, they were sent to AN Computing to be constructed online. The entire design and testing phase of the website construction was hosted on a test website, which was hosted by AN Computing (now not in use) http://www.anc.utlnet.co.uk/AURAH2HIV/Menu/Pages/Home. The test website allowed myself and Dr Speakman to simulate scenarios that would be used to create the correct participant pathway once the website went live and recruitment commenced. A full outline of the development and testing phases for the website and questionnaires are outlined in Table 4.

Once AN Computing had made the questionnaires available on the test website, the next step was to apply and test the correct ‘logic’ in the answers. I requested that AN Computing applied conditional display to the questionnaires whereby participants are directed to the next relevant question depending on the answer that has been provided to the original question (which would save participants who, for example, might answer ‘No’ to whether they had had any CLS in the past three months, answering questions on the type of sex, their position, number of partners, HIV status of partners). The use of conditional display based on response to questions has been shown to be an important factor in online questionnaire completion rate (258). The answers provided by participants automatically
populated an excel database with each row of answers identifiable by the participants study number. Each time a questionnaire was saved or submitted by the participant a row with the participant study number and date of completion was generated in the spreadsheet. This output was termed a ‘line listing’ and Dr Speakman and I also tested this extensively for accuracy of response and correct data capture. Each of the five questionnaires had to be individually tested to ensure that the answers were correctly recorded in the spreadsheet. Once the questionnaire answers had been correctly captured the excel spreadsheet was available to download by the system administrators (myself and Dr Speakman).

The content of the questionnaires was based on the information sheets that had been approved by the Research Ethics Committee (Section 4.11.2, pg.102) and local clinic information was also provided. Following advice from UCL’s medical illustration unit and web developers at AN Computing, I designed the website homepage to give participants (and non-participants who might have discovered the study homepage during an online search), a comprehensive overview of the study (see Appendix XI). Website content was reviewed and commented on by the AURAH2 core group and further extended to a wider group that included patients, nurses, doctors and researchers, to improve readability and acceptability (detailed in Section 4.10.5, pg.99).

The final version of the website went live on the 3rd March 2015 and was hosted on a secure web server provided by AN Computing and can be found at the following address: www.aurah2.org

4.10.4.2 Website accessibility

The website was designed to be accessed across multiple systems to ensure accessibility and ease of use. It was accessible on PCs, MACs, tablets and smartphones. It was important that the website was appealing to its users to minimise attrition and increase the degree of engagement the users had with the study (259). It also needed to be a useful source of study information for participants to refer to and, for any member of the public who came across it online (259).

4.10.4.3 Website spatial map

The website was divided up into two areas; the public domain, accessible to anyone, and the participant’s domain, which was only accessible through invited registration and upon creation of a log-in and password on the website homepage. The public domain was designed to give information about the study to anyone that accessed it online. It consisted of a homepage, secondary pages and tertiary pages. The homepage contained specific study information and the details of participating sites and was also where
participants were able to log-in and access their available online questionnaire. Secondary pages were designed for further information about the study, such as FAQ’s, study related research, relevant information on HIV and location of HIV testing clinics which were all accessed by clicking on the relevant tabs at the top of the website homepage.

The participant domain was only accessible to participants that had logged in to complete a questionnaire. It consisted of a welcome page that detailed how many questionnaires the participant had completed, whether there was a questionnaire that was due for completion (with a link to the questionnaire) and details of when the participant had previously logged in. If the participant had a questionnaire due to complete they were automatically directed to it once they had logged in.
Table 4 AURAH2 website and online questionnaire development November 2014 – March 2015

<table>
<thead>
<tr>
<th>Months</th>
<th>Nov</th>
<th>Dec-14</th>
<th>Jan-15</th>
<th>Feb-15</th>
<th>Mar-15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>week commencing</td>
<td>25th</td>
<td>1st</td>
<td>8th</td>
<td>15th</td>
</tr>
<tr>
<td><strong>Inception</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AN Computing initial brief</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project scope report production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCL graphic designer - website layout &amp; images development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Development phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teleconferences</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Website public domain content development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Website: questionnaire testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered participant domain content development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Website: questionnaire output (excel) testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot study findings incorporated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Go-live phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AURAH2 website launch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AURAH2 recruitment route 1 commencement (online)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AURAH2 recruitment route 2 commencement (in-clinic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.10.4.4 Online questionnaire format

To maximise questionnaire completion and to ensure participants were able to easily navigate through the questionnaire online, it was important that the questionnaire answers were formatted to maximise accuracy and to keep the duration of the questionnaires to a minimum. Answer formats between the five online questionnaires were consistent (the same formatting was applied to the same question if it appeared in different questionnaires). Different functions were used for questions depending on the types of answers that were required. For example;

- Drop-down list boxes were used for dates e.g. date of last HIV test, see Figure 9. This was to minimise potential information error by only allowing the selection of a specified month and year.

Figure 9 Example of drop-down list

- Radio buttons were used as options for answers in questions that had one or more potential answers as an option. This allowed the user to select the answers that applied from a predefined set of options. This was used for questions such as STI diagnoses in the previous 3 months, for example see Figure 10.
Free-text boxes allowed text to be entered by the participants. Free-text boxes were used to gather feedback from the participant at the end of each questionnaire. Participants were asked to leave any comments or report any issues that they had whilst completing the questionnaire.

4.10.4.5 Additional functions for the online questionnaires

Due to the longer duration of the annual questionnaires which took up to 25 minutes to complete, a ‘save questionnaire’ function was included at the bottom of each page for the online questionnaires. This allowed a participant to return at a later date to complete the questionnaire. If a participant selected the save function but did not log-in again to complete and submit the questionnaire, two email reminders, a week apart, were automatically sent via the study website to remind the participant to log-in and complete their saved questionnaire. Once the participant logged-in to complete their saved questionnaire they were only able to access the questionnaire that they had saved, this prevented multiple submissions of the same data. This mechanism guaranteed that a participant could only complete one questionnaire per quarter and thus avoided multiple data entries.

Another function that was added to all the online questionnaires was the ‘tooltip’ function which explained any unfamiliar words or phrases that appeared in the online questionnaires in order to encourage questionnaire completion. I developed the ‘Toolips’ to be presented alongside certain questions to explain any phrases or words within the questionnaire that the
participant might need further explanation of. Tooltips were denoted by a white question mark in a blue circle next to words or phrases such that when the participant’s cursor hovered over the question mark, an explanation of the word or phrase appeared for as long as the cursor remained over the question mark. For example, see the tool tip circled in red in Table 11 which is used to explain the term ‘chemsex’ in the four monthly and annual online questionnaires.

**Figure 11 Tool tip example to explain ‘chemsex’**

4.10.5 **Pilot study**

To test the usability and accessibility of the website and questionnaires, I set up a pilot study that was completed over a two-week period prior to the website go-live date in March 2015. Fifteen volunteers from the MSM community, two members of the AN Computing development team and the AURAH2 core group were invited to join the AURAH2 pilot study via email on the 9 February 2015. The pilot study participants were asked to register, log-in and complete the questionnaires that were made available to them. A feedback template was attached to the email to ensure comments were structured and that all aspects of the website and questionnaires were considered. Feedback was requested within one week of the invitation email. Considerations raised by the pilot study included; availability of information on data security, clarification of terminology used in the questionnaire, and lay-
out of the website and email template used to contact the participant with. The majority of feedback was positive. Participants in the pilot study felt that both the length of the questionnaires and the content were acceptable, however three participants felt that the time between questionnaires should be shorter and that participants would be willing to answer questionnaires on a quarterly basis. After discussion with the AURAH2 core group, it was felt that the duration between questionnaires was appropriate at four months so we did not change this. Five participants noted grammatical errors and spelling mistakes. Eight participants required further information on data security and information on data security was added in to each email that was sent to invite and remind participants to complete an online questionnaire. The feedback from the pilot study which was incorporated in to the website programming and questionnaire functionality took a week to complete.

It was important to pilot the study among experts within the HIV field and in members of the MSM community, to identify any issues in questionnaire sensitivity and to provide feedback on the website and questionnaires acceptability. Piloting by the AN Computing development team provided further testing for the programming and functionality of the online questionnaires as well as accessibility testing on multiple user platforms, for example; PC’s, MAC’s, mobile devices, tablets and laptops, and across different internet servers such as; Internet Explorer, Google Chrome, Mozilla Firefox and Safari.

4.10.6 Website amendments

Once the study had commenced in March 2015, after five months of recruitment, I (upon feedback from the research nurses and assistants at the recruiting sites) thought it would help to encourage participants to register with the study website immediately after they had been recruited in-clinic. The research nurses and assistants had suggested that some participants who had completed the paper-based questionnaire were keen to register immediately with the online phase of the study using their smart phone or tablet whilst they had time in the clinic setting and I thought that reducing the time in between completing the baseline questionnaire in-clinic, and the email for study registration might optimise retention. Therefore, after a week of testing on the test website, a ‘Register’ tab was added to the menu on the homepage of the live website. This allowed participants to register online with the study using either a smartphone or tablet after they had completed their paper-based questionnaire in the clinic.

Following this, the AURAH2 core group provided an i-pad to the research nurse at 56 Dean Street Clinic to facilitate immediate registration with the study website, as the recruitment rate was higher at this location than the other two clinics. This allowed participants to familiarise themselves with the AURAH2 website whilst they were in the clinic setting and
had the opportunity to ask the research nurse any questions about the website and also register for the online questions. The Registration page was available on the public side of the website and there were nine boxes to complete to allow registration. The first box required the study ID which had to be obtained from the research nurse in clinic (this was to deter users who had not signed the informed consent in clinic from joining). Other registration details were name, date of birth, (create a) username and password (plus password confirmation) (set by the participant at registration) and contact details, email address and mobile number.

4.11 Ethical considerations

During the design of the study, my main ethical consideration was the maintenance of participant confidentiality, particularly given the online aspects of data collection. The specific potential issues and solutions that I considered are listed below.

(i) Online contact of recruited participants via email

Participants who provided an email address for contact were individually emailed via the secure study website. The website was programmed to only send individual emails so that accidental group emails containing other participant email addresses could not be sent.

(ii) Online participant registration

Online registration was only possible either through a link supplied in an individual email sent to a participant via the study website, or with a study ID supplied by the research nurse in the clinic. This was to ensure that only participants who’s email addresses had been verified as consented to take part were able to register for the study.

(iii) Online participant information

Access to the administration section of the website, where participant information was held, was limited to myself and Dr Speakman and the AURAH2 developers (two) at AN computing. The password for administration was changed on a regular basis and was a set number of characters and numbers to achieve good strength.

(iv) Online questionnaire data storage

The ‘line listings’ of completed questionnaires were only accessible through the administration section of the website and were downloaded to encrypted form and stored on the research group password protected PCs. The completed questionnaires were only
identifiable through a study number which was stored separately to the email addresses of the participants. The line listings were only identifiable using the study number without personal identifiable information.

4.11.1 Study amendments
There were no substantial amendments made to the design of the study during the study. Non-substantial amendments were made predominantly within the first few months (March to May 2015) of the online phase of the study and addressed minor changes to study timelines and materials. The non-substantial amendments and dates were implemented as follows;

(i) March 2015: confirmation of data linkage at the end of the study to national databases was finalised and timeline for online follow-up questionnaires was set at four months, this was reflected in the study protocol and patient information sheet

(ii) March 2015: a study flyer for promotion was approved for use and distributed to the three study sites

(iii) May 2015: the Principal Investigator at the Brighton site was changed to Dr Amanda Clarke

4.11.2 Ethical review
After collaboration with the Joint Research Office at UCL, I submitted the research protocol (see Appendix III) and all versions of the study documents (information sheet, consent form, questionnaires and versions of the online questionnaires) online using the Integrated Research Application System version 3.5.5, and in paper, to the local Research Ethics Committee in Hampstead, London. I attended the Ethical review meeting for the study in November 2014 and all the study documents were approved by the designated research ethics committee, NRES committee London-Hampstead, ref: 14/LO/1881. Based on these documents, I sought and received permission online (using the Integrated Research Application System version 3.5.5) for clinical research at the three participating National Health Service sites: Chelsea and Westminster NHS Foundation Trust, Central and North West London NHS Foundation Trust and the Royal Sussex County Hospital.

4.11.3 Patient information sheets
I developed the PIS and consent forms in both an online format (for AURAH study participants that registered and joined online) and on paper (for participants recruited in-clinic directly in to the AURAH2 study) (see Appendix IV & V).
4.11.4 Confidentiality

I applied the same considerations to confidentiality for participants in the AURAH2 study as the AURAH study to collect paper-based questionnaire data. Baseline questionnaires for the AURAH2 study only had a study number written on to them by the site researcher, with no identifying information. The study log was the only document that linked the study number with clinic number and/or names and was password protected in digitised form and only sent via NHS email, and in paper form was locked in a designated area in clinic by the researcher.

I considered further confidentiality issues for the online phase of the study as discussed in the section on Ethical considerations. At the research group, information was treated as completely confidential. The personal identifiable information (names, dates of birth, mobile numbers and email addresses) collected during the consent process were only used for the consented purposes through the password protected study website, and once participants had either registered for the study and generated a study ID, or not responded to three email or text message prompts (generated via the study website) to register, the personal identifiable details were erased from the system.

4.11.5 Data security

Due to the extensive online component of the study, data security was identified as one of the major potential barriers for recruitment to the AURAH2 study and poor data security procedures could have prevented approval by the Research Ethics Committee. As the study was recruiting participants from NHS sites it was essential that it complied with NHS guidance as well as the policies and information governance guidelines imposed by UCL. Therefore, led by the data manager, Dr Speakman, a data management plan was developed for AN Computing to comply with to ensure that data captured on the website designed by them was held securely and in accordance with NHS and UCL guidance.

4.11.5.1 Website and database data security

There were several essential requirements for the website that Dr Speakman and I identified. Firstly it needed to provide a secure setting for the study participants to complete their online questionnaires and, as the study recruited participants from NHS clinics, it was essential that the data collection, transfer and storage were assessed against and in accordance with the principles of the NHS Information Governance toolkit (260) and UCL’s School of Life and Medical Sciences Information Governance framework (261). The NHS Information Governance toolkit is a Department of Health policy that draws together the rules and guidance from the following key policies;
All bodies that process the confidential information of citizens who access adult health and social care services are required to measure their compliance against information governance assessment to ascertain whether information is handled correctly and protected from unauthorised access, loss, damage and destruction with an aim of raising information governance standards through year on year improvements (260).

The study was sponsored by UCL thus further assessment against UCL’s School of Life and Medical Science Information Governance framework was necessary to ensure that the handling of information, including sensitive personal data was legal, secure and efficient. The framework defines roles and responsibilities and provides assurance that appropriate safeguards are in place. As study coordinator, I was trained on the framework in July 2014 and received annual online training during the course of the study.

Compliance with both the NHS Information Governance toolkit and UCL’s School of Life and Medical Sciences Information Governance framework was key in the decision-making process for choosing the organisation subcontracted to build and host the AURAH2 website but was also key for myself and Dr Speakman to understand if we were to be able to ensure that both were adhered to throughout the study process.

4.11.6 Data transfer to coordinating centre

Selected information from the study log at each clinical centre was transferred via a password protected spreadsheet sent via NHS mail on a regular basis to the study management centre. Information for transfer included; study ID, date of recruitment, contact information (email address/ mobile phone number), and result of HIV test (if one was done.
on the day of recruitment). Clinic identifiers were also transferred to the study management centre via the study log to allow participant HIV status to be confirmed against Public Health England’s HIV surveillance database at the end of the online follow-up period.

4.11.7 Data storage

The AURAH2 baseline paper questionnaires were stored securely in the same way as detailed in Chapter 3 for the AURAH study questionnaires. The AURAH2 online questionnaire web pages were hosted on a secure web server and the study datasets were downloaded at weekly intervals from the study website and securely stored and held on encrypted PC and laptop drives by IT facilities at University College London. The contact details of participants who had consented for their details to be used for future information but who did not opt to join the AURAH2 study, were removed from the AURAH2 study contact list and erased from the study records one month after their final email reminder or text message had been sent. All AURAH2 participant contact details were erased from the study website six months after the completion of the study.

4.11.8 Data linkage

As outlined in the PIS and consent form of the AURAH2 study, the result of the participant’s HIV test was collected using the same method described for the AURAH study, and results were reported in the site clinic log which was exported to the study’s data manager on a fortnightly basis. At the end of the study, linkage to Public Health England’s datasets was planned using limited participant identifiers; surname Soundex, sex and date of birth.

Whilst the data linkage has not yet occurred as contracts are currently being exchanged between UCL and Public Health England, it is planned that data from the AURAH2 study including HIV status and STI diagnoses will be checked against corresponding records and data in the following national clinical databases; HIV and AIDS reporting system (HARS) for HIV diagnoses, Genitourinary medicine clinical activity dataset (GUMCAD) for STI diagnoses, and the Office for National Statistics (ONS) for mortality data. The linkage of the study data to these databases will allow confirmation on the self-reported HIV status of participants, the identification of any new diagnoses that have not been self-reported through the questionnaires, confirmation of STI diagnoses and any deaths during the three-year follow-up period.

4.12 Study management and my role as study coordinator

As described in Section 4.3, pg.81, the study was managed by the same core group of researchers at the research department, and coordinated by myself with data support from
the Data Manager. An advisory group was also established at the start of the study to provide guidance and support (Appendix XII).

4.12.1 Set up procedures
I conducted site visits in February 2015. As the three sites were continuing to recruit participants to the AURAH study that were interested in taking part in an online prospective cohort study, I developed a slide set, based on the AURAH Study site initiation visit presentation but with additional information on the online component of the study. Each site initiation visit outlined the study objectives and discussed the practicalities of conducting the study within the clinic setting. The three sites that had agreed to take part in the study were familiar with the AURAH study procedures and therefore the focus of the site initiation visit was around the online component of the AURAH2 study and website security. It was emphasised that only MSM who agreed to provide their contact details (email address or text message) during informed consent would be eligible to join the study and that the researcher recruiting to the study should ensure that participants were fully aware that the email address they provided would be used for study contact.

4.12.2 Management of recruitment phase
During the recruitment phase of the study, regular updates were sent by Dr Speakman, on a monthly basis to the research staff at the three clinic sites and information was provided on the recruitment targets and predicted completion dates for the clinics as well as the recruitment targets for the study. The registration and completion of online questionnaires were also reported in the updates. Once the study had completed recruitment, I issued a site closure email, which thanked the individual clinics for their participation in the study and explained that online follow-up would continue for a three year period, during which, any questions relating to the study, should be directed to the info@aurah2.org email address which was regularly monitored by myself during the study follow-up phase. Study logs and materials were required to be stored at the study site for a period of two years after the follow-up phase of the study was completed (2018) before being archived in accordance with the site Trust’s policy.

4.12.3 Data breach (not AURAH2 related) at a clinical site
A major issue occurred during the online phase of the study which I managed in close collaboration with Dr Speakman. A data breach, completely unrelated to the AURAH2 study, but at one of the clinical sites that the study was recruiting from, impacted severely on in-clinic recruitment rates in September 2015. A group email from 56 Dean street clinic was accidentally sent to 780 patients containing a newsletter for HIV positive patients without concealing the name and email addresses of the recipients. UK National media reported a
significant information governance breach involving sensitive information and, although the AURAH2 study was not recruiting HIV diagnosed participants, clinical staff and clinic managers requested that AURAH2 did not recruit participants from the sexual health clinic during the height of media attention (23). I suspended recruitment for two weeks and the research nurse at the site was given further training on the data security and data policies in place to protect AURAH2 participants in anticipation that existing and potential participants would likely enquire about information safeguarding measures. Recruitment resumed two weeks after the data breach however the research nurse reported a higher number of refusals to the study than usual in the month following the breach.

4.12.4 Completion of online follow-up

The online phase of the study completed in March 2018 and a final dataset was downloaded. I sent a final email to all online participants once we had completed the online phase of the study, thanking them for their participation, and sign-posting them to the study website for future findings and reports based on the results of the analysis. I continue to update the website with results and publications from the study as they occur.
Chapter 5: Data Management: The AURAH and AURAH2 study

5.1 Introduction

Chapter five describes management of the data that were collected for the AURAH and AURAH2 studies. Firstly, I describe the process by which the completed paper-based questionnaires that were received from the study sites were processed at the UCL study centre, digitised and imported into STATA 13.0 (Stata Corporation, College Station, Texas, USA) to create two study datasets (AURAH and AURAH2). I also detail the data storage for the paper-based questionnaires from both studies and the online storage of data for the AURAH2 study. Next, I detail the methods I used to deal with missing data and data inconsistencies for each dataset and I will provide the definitions and the construction of key variables. Then, I outline the process for combining the AURAH and AURAH2 baseline datasets to allow comparison analyses between the two studies (for the analysis used in results Chapter 7). Finally, I describe the preparation and management of the AURAH2 online longitudinal data.

5.2 Data management

5.2.1 Digitisation of the Paper questionnaires

As described in the previous two methods chapters, paper questionnaires were used to collect information in the cross-sectional AURAH study and at baseline in the prospective cohort AURAH2 study. The following paragraphs outline the data collection, storage and digitisation processes that were followed and the data governance procedures that were in place for the digitisation of the paper-based questionnaires collected from both studies.

5.2.1.1 The AURAH study

During the process to gain approval for the study from the Research Ethics Committee, described in Chapter 2, I registered the AURAH study with the UCL Data Protection Officer, in January 2013, before any data was collected. The application process meant that the procedures that I outline in this chapter, for the collection, storage, and digitisation of the data collected in the AURAH study were approved by the UCL Data Protection Officer, and subsequently the Research Ethics Committee: London Hampstead.

Over the course of the AURAH study recruitment period (detailed in Chapter 3), the paper questionnaires from the study sites were collected, either by myself or the Data Manager, Dr Speakman, on a fortnightly basis from the clinics within close proximity to the study coordinating centre at the Royal Free Hospital. Study sites that were not within collection distance of the Royal Free Hospital were reimbursed for posting the questionnaires to the study coordinating centre on a monthly basis via registered post which required a signature.
from Dr Speakman or myself. Once the questionnaires were received at the study coordinating centre, they were stored in a locked cabinet within a locked room that was only accessible by Dr Speakman or the Department Administrator who held the spare key. The questionnaires were briefly checked by Dr Speakman upon arrival at the study coordinating centre. This brief check ensured that any personal details, for example, an email address in a comment box provided by a participant, were erased before the questionnaires were further processed, to maintain participant confidentiality. The brief check also allowed myself and Dr Speakman to note and monitor key demographics that informed recruitment targets, such as self-reported sexuality and ethnicity, which allowed us to inform the AURAH study core group, and the sites, once specific recruitment targets had been met.

The AURAH study paper questionnaires were digitized by an external data processing contractor, Damco Ltd. Questionnaires were sent from the study coordinating centre by Dr Speakman in batches of 400 to Damco. A courier was used to collect one batch, while returning an old batch at the same time. The contractor was required to digitally scan each questionnaire, and the resulting images were used as the source for two manual data entry rounds. Data was entered by Damco between January 2014 and May 2015. Over this time period, 1929 male and 643 female questionnaires were sent to Damco in nine batches. The completed scans and datasets delivered by the contractor were checked for accuracy at the study management centre by the Data Manager, Dr Andrew Speakman who fully examined a 5% sample. The 5% sample of the AURAH male questionnaires (99 out of 1929) found 11 errors in total. This was an error rate of <0.1% (11 errors out 12672 items entered = .087%) or 0.11 errors per questionnaire (11/99).

5.2.2.2 The AURAH2 study

I registered the AURAH2 study with UCL’s Joint Research Office for Data Protection as part of the data governance procedures in September 2014, and prior to submission of the study to the Research Ethics Committee. The study documents including protocol, patient information sheets and manual of operations were reviewed and approved before any data was collected.

Whilst the AURAH2 study baseline paper questionnaires were sent and collected from the clinic sites using the same process as the AURAH study, the questionnaires were digitised in a different process to the AURAH study, to conform with the new data governance guidance and procedures that were put in place by UCL which were introduced in 2015. UCL introduced a ‘Data Safe Haven’ which was specifically designed for the storage of digitised data, and provided a technical solution for storing, handling and analysing identifiable data for UCL researchers. Furthermore, it was designed to conform with the NHS Digital's
Information Governance Toolkit for research that involved NHS participants. Additionally, the REDCap data collection service was provided by UCL for the collection of data. REDCap is a secure web application for building and managing online surveys and databases and therefore we used this for the AURAH2 study to digitise the paper questionnaire data collected, as opposed to sending the questionnaires off site to the external contractor, Damco. Thus, the AURAH2 study paper questionnaires were digitised in-house using REDCap electronic data capture tools and hosted on the secure Data Safe Haven service of University College London, and thus never left the coordinating centre at the Royal Free hospital. The REDCap data entry tools for the AURAH2 study were adapted and developed by Dr Andrew Speakman to capture the AURAH2 data accurately. Each questionnaire was digitally scanned then entered into the REDCap system by two different research assistants, overseen by Dr Speakman. The completed data entry files were checked for accuracy by Dr Speakman fully examining a 5% sample of questionnaires. A 5% sample from one of the data entry staff found an individual unchecked error rate of <1% (37 errors from a total of 5553 items entered = 0.67%). The data was not sampled again after the differences were reconciled as the unchecked error rate would have been reduced close to zero as the comparisons between the independent datasets resulted in a correction rate of 1.4%. Not all these data alterations were errors, some were, for example, minor spelling differences in text entries.

5.2.2 Data storage for the AURAH and AURAH2 baseline data
Once the AURAH and AURAH2 questionnaires had been scanned and digitised, and the dataset(s) were created, the scanned images of the questionnaires were stored at the study management centre in encrypted digital form. Both datasets were stored on the UCL Data Safe Haven secure managed service which includes regular backup and professional administration by UCL. The original paper questionnaires were stored securely in locked cabinets at the study centre. Dr Speakman compiled a dictionary of the variables and variable values in digital form on an Excel spreadsheet along with a summary of the data management process for each study. The AURAH study dataset was available for use in October 2014 and the AURAH2 study baseline dataset in May 2017. I was provided with the two datasets in May 2017 by Dr Speakman on an encrypted memory stick in line with data governance procedures.

5.2.3 Data storage for the AURAH2 study online follow-up data
Over the AURAH2 study follow-up period (three years from March 2015 to March 2018), the online data was regularly (monthly) downloaded from the host server, provided by AN Computing (as detailed in Chapter 4) by Dr Speakman, using the UCL Data Safe Haven for
storage. Regularly downloading the data meant that Dr Speakman and I were able to briefly scrutinise the data to provide the AURAH2 core team with online retention rates and new HIV diagnoses. Once the online component of the project ended in March 2018 the website was de-commissioned and all off-site data was deleted within a month, as per the contract set-up with UCL and the data partner, ANC Computing. The final, complete online dataset for the AURAH2 study was stored on the UCL Data Safe Haven and available for use in April 2018. I was provided with the AURAH2 online data set by Dr Speakman and stored it on the same encrypted memory stick as the AURAH and AURAH2 baseline data, with backup on the UCL Data Safe Haven.

5.3 Data cleaning

5.3.1 The AURAH study data cleaning

In 2014/15, the AURAH dataset was imported from excel in to STATA 13 and the majority of data checks and data cleaning such as dealing with missing data and data inconsistencies, were carried out by a (then) fellow PhD student, Ada Miltz. Dr Miltz’s PhD used the AURAH study data to focus on mental health, anxiety and depression as well as sexual health, sexual behaviour, PEP and PrEP use among MSM participants from the AURAH study.

As I also planned to use the AURAH study dataset for analysis, I met with Dr Miltz (statistician) regularly in 2015/2016 to plan the management of the data, specifically data relating to key sociodemographic characteristics, recreational drug use and sexual behaviour variables. During the data entry process, missing data was assigned a ‘.’ and was subsequently recoded in two ways by Dr Miltz. Firstly, missing data were assigned ‘.n’ if the data was missing because the question was not applicable to the participant (i.e. the answer was correctly left blank), and secondly missing data were assigned ‘.u’ if the data were missing but the question should have been answered.

Data entry inconsistencies were coded as ‘99’ during data entry, for example where a participant had ticked two boxes in a response when they should have only ticked one. Where ‘99’s’ were assigned, Dr Miltz and I examined the scanned questionnaire in an attempt to clarify and then re-code the ‘99’ to the relevant answer. In the majority of cases, ‘99’s’ were assigned when participants had selected two or more options to answers that only required one as we agreed that, in such cases, the option with the highest value should be selected as the value, for example, in the case of question A8, education level, if the participant had selected ‘A levels (or equivalent qualifications at age 18)’ and ‘University degree or above’ then ‘99’ was recoded to ‘University degree or above’.
In questions which asked a participant to self-report an experience or diagnosis in the past three months, followed by a list of options to choose from, for example, ‘In the past year (before today), have you been diagnosed with a sexually transmitted infection?’ (answer options ‘Yes’ or ‘No’) followed by ‘If Yes, please select from the following list’ with a list of eleven STI's, in cases where a participant had selected ‘No’ to the first question but then selected an STI from the list, they were recoded to ‘Yes’ in the first question. This method was also applied to the question on recreational drug use.

5.3.2 The AURAH study: definitions and key variables

Simultaneously to the data cleaning process, Dr Miltz and I created a list of shared variables and definitions that would be common to both PhDs, such as sociodemographic characteristics, measures of sexual behaviour, alcohol consumption, recreational drug use and mental health and well-being measures. We also agreed on definitions for variables on population (i.e. MSM), drug use and sexual behaviour which are described below. Once we had agreed on these variables, we met with the AURAH study core group to discuss, develop further and ultimately agree the following variables. For the purpose of this chapter and specifically the AURAH study, I will only describe the variables that are relevant to this PhD. However, developing the variables and agreeing definitions was a collaborative process by myself and Dr Miltz and thus I use the term ‘we’ to indicate this where relevant.

Men were classified as MSM for the purposes of the analysis if they met at least one of the following criteria:

(i) reported being gay or bisexual
(ii) reported anal sex with a man in the past three months
(iii) reported having disclosed to their family, friends or workmates as being gay, bisexual and/or attracted to men

5.3.2.1 Defining sociodemographic variables

I identified and divided into categories the specific sociodemographic characteristics that were collected in the questionnaire, see Table 5. For sociodemographic variables, missing data was included with ‘No’ in dichotomised categories when it was missing in ≤ 20 observations.

The sociodemographic characteristics defined were, age (<25, 25-29, 30-39, 40-45, 45+), born in the UK (yes/no), ethnicity (white, non-white), sexuality (gay, bisexual, other), money to cover basic needs (all of the time, most of the time, sometimes, never), university education (yes/no), employed (yes/no), housing status (home owner, renting,
unstable/other), ongoing relationship (yes, no), clinically significant depressive symptoms (yes, no) (described in next section), clinically significant anxiety symptoms (yes, no) (described in next section), high risk alcohol consumption (yes, no) described in next section). In each results chapter, missing data was dealt with consistently and I have described how missing data was dealt with for each study in separate Sections (Section 5.3.2.8 (AURAH), Section 5.3.3.4 (AURAH2 baseline), Section 5.5.6 (AURAH2 online)).

5.3.2.2 Definition of depression and anxiety

Depression and anxiety were included with sociodemographic characteristics in planned analyses because of the strong interplay between mental health, sexual behaviour and recreational drug use that has been described in MSM (1). Due to this interplay, we decided to define depression and anxiety measures and investigate their prevalence alongside sociodemographic characteristics. To ascertain depression, we used question B2 in ‘Section A: General information’ of the AURAH men’s questionnaire (see Appendix I) which used the nine questions from the validated Patient Health Questionnaire (PHQ-9) scale (245). The PHQ-9 scale requires the participant to choose from a range of options for nine statements with a recall period of two weeks. The nine statements are:

1) Little interest or pleasure in doing things
2) Feeling down, depressed, or hopeless
3) Trouble falling or staying asleep, or sleeping too much
4) Feeling tired or having little energy
5) Poor appetite or overeating
6) Feeling bad about yourself – or that you are a failure of have let yourself or your family down
7) Trouble concentrating on things such as reading the newspaper or watching television
8) Moving or speaking so slowly that other people have noticed
9) Thoughts that you would be better off dead, or of hurting yourself in some way

Participants were asked to report whether they have experienced any of the nine statements using the options, ‘Not at all’, ‘Several days’, ‘More than half of the days’, ‘Nearly every day’ for each statement. Each option has a value from 0 to 3 ascribed to it, of which the minimum, zero equals ‘Not at all’ and the maximum, three, equals ‘Nearly every day’. Scores were then totalled (maximum score is 27) with Depression Severity being classified as: 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe (245). For our analysis, we
used a score of ≥10 as the cut off, as moderate depression severity indicates further screening and potential treatment (245).

To measure anxiety we used the validated Generalised Anxiety Disorder Assessment (GAD-7) (246) which was also asked in question B2 of 'Section A: General information' in the AURAH men’s questionnaire (Appendix II). Similarly to the PHQ-9 score, the recall period for participants is two weeks and the answer options and scores are the same. The seven statements that participants are asked to report are:

1) Feeling nervous, anxious or on edge
2) Not being able to stop or control worrying
3) Worrying too much about different things
4) Becoming easily annoyed or irritable
5) Trouble relaxing
6) Being so restless that it is hard to sit still
7) Feeling afraid as if something awful might happen

Scores were totalled (maximum of 21) and Anxiety Severity was classified as 0-4 none, 5-9 mild, 10-14 moderate, 15 and above severe. When used as a screening tool a score of greater than 10 warrants further evaluation and was considered the cut off for symptoms of moderate anxiety (246). Therefore we included a GAD-7 score of ≥ 10 as our definition of anxiety.

5.3.2.3 Definition of alcohol consumption and higher risk drinking

We included alcohol consumption as a key variable due to the associations that it has with sexual behaviour and high-risk sexual behaviour and HIV infection (273-275). We created a variable of ‘higher risk drinking’ which was based on the first two questions of the WHO AUDIT-C questionnaire, both found in ‘Section D: Your Lifestyle’ of the AURAH men’s questionnaire (see Appendix II). The first question of the WHO AUDIT-C questionnaire is, ‘How often do you have a drink that contains alcohol?’ with the answer options of ‘Never’, ‘Monthly or less’, ‘2-4 times a month’, ‘2-3 times a week’, or ‘4 or more times a week’. Using the WHO audit score, the answer ‘Never’ was allocated 0 points, ‘Monthly or less’ was given 1 point and each subsequent option was given an additional point, thus ‘4 or more times a week scored 4 points. The next question of the WHO AUDIT-C score (‘How many units of alcohol* do you drink on a typical day when you are drinking?’ *one unit = HALF a pint of beer /cider or a SMALL glass of wine or a SINGLE measure of spirits with the answer options of ‘1 or 2’, ‘3 or 4’, ‘5 or 6’, ‘7-9’ or ‘10 or more’) is then used to create an alcohol score. The option ‘1 or 2’ equates to 0 points and subsequent answer options are given additional 1 point increments, thus the option of ‘10 or more’ would equal 4 points. The
combined alcohol score, calculating by summing the two scores from the two questions, indicates ‘higher risk drinking’ by a score of ≥ 6 (276), which we used as the measure of higher risk drinking for our analysis.

Table 5 shows the list of the sociodemographic, depression, anxiety and alcohol consumption variables that were created. Column 1 shows the section of the questionnaire that the variable was developed from and the questions that were used, column 2 shows the name of the created variable and its description, column 3 details the construction of the created variable and how any missing values were dealt with for each variable.
<table>
<thead>
<tr>
<th>Questionnaire section and Question number (see Appendix II)</th>
<th>Variable name – description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A: General information, Question A2</td>
<td>a2_age_calcwhole - “Age (years)”</td>
<td>If age was not declared in ‘a2_ageyears’ then it was calculated using ‘dateattended’ (the date of clinic attendance) minus ‘a2_birthyear_date’. Checked ‘a2_ageyears’ was consistent with ‘dataeattended’ minus ‘a2_birthyear_date’ – all consistent</td>
</tr>
<tr>
<td>Section A: General information, Question A3, A4</td>
<td>a4_bornuk_ethnicity – “Born in the UK and ethnicity”</td>
<td>Two variables were combined using the participants self-identified ethnic group choice ‘a3_ethnicgroup_cat’, from the question “Which ethnic group best describes you?”, and born in the UK, ‘a4_bornuk_correct’, from the question “Were you born in the UK?”.</td>
</tr>
<tr>
<td>Section G: Your sexual identity, Question G1</td>
<td>g1.sexuality – “Self-reported sexuality”</td>
<td>Variable constructed using question G1 “how would you describe your sexuality?”, question H2, “In the past 3 months have you had anal sex with a man?” and question G2 “What proportion of the following groups know that you are gay, bisexual and/or attracted to men?”. Checked – the answers of question H2 and G2 for those that reported “Straight/heterosexual” for question G1, none gave inconsistent answers to question H2 and G2</td>
</tr>
<tr>
<td>Section A: General information, Question A7</td>
<td>a7_moneycat_correct - - “Money to cover basic needs”</td>
<td>The 4 answer options for question A7, “Do you have enough money to cover your basic needs?” were categorised to 3, ‘Yes, all of the time’, ‘Yes, most of the time’, ‘Sometimes/never’.</td>
</tr>
<tr>
<td>Section A: General information, Question A8</td>
<td>a8_uniYN – “University educated” (dichotomised)</td>
<td>The 5 answer options (including ‘other’) for question A8, “What is your current level of education?” were categorised in to two, university education ‘yes’ or ‘no’. Missing combined with ‘no’.</td>
</tr>
<tr>
<td>Section A: General information, Question A5</td>
<td>a5_employedYN – “Employed” (dichotomised)</td>
<td>The 10 answer options (including ‘other’) for question A5, “What is your current work situation?” were categorised in to two, employed ‘yes’ or ‘no’. Missing combined with ‘no’.</td>
</tr>
<tr>
<td>Questionnaire section and Question number (see Appendix II)</td>
<td>Variable name – description</td>
<td>Construction</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Section A: General information, Question A6</td>
<td>a6_housecat - “Housing status” (current)</td>
<td>The 7 answer options (including ‘other’) for question A6, “What is your current housing situation?” were categorised in to three, ‘Homeowner’, ‘Renting’, ‘Unstable/other’.</td>
</tr>
<tr>
<td>Section A: General information, Question A9</td>
<td>a9_inrelationshipYN - “Ongoing relationship” (dichotomised)</td>
<td>The 3 answer options for question A9, “Are you currently in an ongoing relationship with a partner (wife or civil partner or girlfriend/boyfriend)? were categorised in to two, in a relationship yes or no. Missing combined with ‘no’.</td>
</tr>
<tr>
<td>Section B: Your health and wellbeing, Question B2</td>
<td>phq9score10 – “Clinically significant depressive symptoms (PHQ-9 score &gt;=10)” (dichotomised)</td>
<td>The 9 questions that provide a PHQ-9 score were totalled and then categorised in to two; those that scored 10 or more, or less than 10. Missing combined with ‘no’.</td>
</tr>
<tr>
<td>Section B: Your health and wellbeing, Question B2</td>
<td>gad7anx – “Clinically significant anxiety symptoms (GAD&amp; score&gt;=10)” (dichotomised)</td>
<td>The 7 questions that provide a GAD-7 anxiety score were totalled and then categorised in 2, those that scored 10 or more, or less than 10. Missing combined with ‘no’.</td>
</tr>
<tr>
<td>Section D: Your lifestyle, Question D2 and D3</td>
<td>heavydrinking - “Higher risk alcohol consumption”(dichotomised)</td>
<td>The score from the answers to the 2 questions that are used in the WHO AUDIT_C alcohol audit, ‘how often do you have a drink that contains alcohol?’ and ‘how many units of alcohol do you drink on a typical day when you are drinking?’, ‘yes’ those that totalled 6 or more, or ‘no’, less than 6. Missing combined with ‘no’</td>
</tr>
</tbody>
</table>
5.3.2.4 Ascertainment of recreational drug use

To ascertain recreational drug use, we used question D8 from the AURAH men’s questionnaire (Appendix II). In ‘Section D: Your lifestyle’ participants were asked to report whether they had used recreational drugs in the past three months (Question D8, see Appendix II) and, if so, to select which drug or drugs from the following list of 18 options:

- Acid / LSD / magic mushrooms
- Anabolic steroids
- Cannabis (marijuana, grass)
- Cocaine (coke)
- Crack
- Codeine
- Crystal meth (methamphetamine)
- Ecstasy (E)
- GHB (liquid ecstasy)
- Heroin
- Ketamine (K)
- Khat (chat)
- Mephedrone
- Morphine
- Opium
- Poppers (amyl nitrite)
- Speed (amphetamine)
- Viagra
- Other (whereby participants were asked to specify the drug)

If ‘Other’ drugs had been specified, the answers were examined and coded to the relevant categories where appropriate. In most cases, participants had specified one of the drug options under a different or street name. Once the data had been cleaned there were no cases where participants had answered ‘No’ or left the answer missing to the first question and then reported using some drugs.

5.3.2.5 Definitions of recreational drug use

As described in Chapter 2, to understand the different types of recreational drug use as well as specific, individual drug use, it was necessary to clarify the common combinations, methods and context of drug use that were relevant to MSM. Therefore, in 2015, I organised
a meeting with David Stuart, the Substance Use lead at the 56 Dean Street sexual health clinic and Dr Miltz. From this meeting we developed two different measures of recreational drug use, based on the different combinations and forms of drug use that were being reported by clinic attendees. Using the list of drugs from question D8 in the AURAH men’s questionnaire, we defined the most common drug combinations and methods of use that MSM who attended the sexual health service at 56 Dean Street reported, as follows:

(i) poly drug use, use of three or more recreational drugs in the past three months  
(ii) chemsex-drug use, use of one or more of mephedrone, crystal methamphetamine or GHB/GBL in the past three months

The two resulting variables for poly drug use and chemsex drug use are listed in Table 6.

Table 6 Recreational drug use variables for the AURAH study dataset

<table>
<thead>
<tr>
<th>Questionnaire Section and Question number (Appendix II)</th>
<th>Variable – description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section D: Your lifestyle, Question D8</td>
<td>polydrugYN – “Polydrug use Y/N” - use of 3 or more drugs in the last 3 months (dichotomised)</td>
<td>Variable created using the separate answers to D8, “In the past 3 months, have you used recreational drugs (e.g. poppers, cannabis, cocaine)?, if YES, which drugs have you used?” If 3 or more drugs selected, categorised as ‘Yes’. Missing (to the first question?) included in ‘no’</td>
</tr>
<tr>
<td>Section D: Your lifestyle, Question D8</td>
<td>chemdrugYN – “Chemsex drug use Y/N” - use of one or more of crystal meth, GHB/GBL or mephedrone</td>
<td>Variable created using separate answers to D8 – answers of ‘yes’ to crystal meth/ GHB/GBL or mephedrone categorised as ‘Yes’. Missing (to the first question) included in ‘no’</td>
</tr>
</tbody>
</table>

5.3.2.6 Definition of sexual behaviour measures

We defined sexual behaviour measures in conjunction with the AURAH study core group so that we could agree upon measures that would best indicate high risk sexual behaviour and, or potential HIV transmission risk. Initially, we agreed on eight self-reported sexual behaviour measures which were derived from the AURAH men’s questionnaire using questions from Section E: Your Sexual Health, Section F: HIV and Section H: Sexual lifestyle (Appendix II). Additional measures were also created for subsequent papers and are detailed later in the chapter.
For all sexual behaviour measures, sex was defined as anal sex with men, which was defined in the questionnaire as ‘anal sex means your penis in a partner’s anus (rectum or back passage), OR a partner’s penis in your anus (rectum or back passage)’ and, for bisexual or other sexualities, vaginal or anal sex with women. The first were four measures of condomless (anal or vaginal) sex (CLS) in the past three months were defined:

- any CLS
- CLS with two or more partners
- CLS with partners of an unknown or HIV-diagnosed status (men who reported only one CLS partner who was HIV positive and with whom they ‘thought the risks were low because their partner was taking ART’, were not counted as fulfilling this criterion)
- receptive CLS with partners of an unknown HIV status

And next two proxy markers of sexual behaviour were used as additional measures which used a recall period of the past year:

- self-reported bacterial STI diagnosis (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV))
- PEP use

Finally, two measures of partner numbers were investigated:

- report of eleven or more new sexual partners in the past year
- group sex in the past three months

Table 7 shows the list of sexual behaviour variables and how they were constructed. I subsequently expanded and developed further the above sexual behaviour measures during the analysis of the AURAH2 data (results reported in Chapter 7) and added the developed measures to the AURAH study dataset. These are described later in the chapter (see Section 5.3.3.1, pg.126).

5.3.2.7 Dealing with free text in the AURAH study questionnaire

Some questions in the AURAH study questionnaire provided an ‘other’ box with free text to expand on an answer or provide a different answer to the options provided. To code these answers, Dr Miltz examined the free-text and coded it appropriately. For example in Section E: your sexual health, question E2 (Appendix II) ‘In the past year (BEFORE TODAY), have you been diagnosed with a sexually transmitted infection?, with the option of ‘Yes’ or ‘No please go to question E3’, ‘If YES, have you had any of the following in the past YEAR?'
(please tick MORE THAN ONE BOX, if applicable)’ with a list of different STIs provided underneath and the option ‘Other (please specify)’ was at the end of the STI list with space to write. In cases where participants had written a colloquial name for an STI that was provided on the list or failed to identify an STI on the list and written it under ‘Other’, I re-coded them to the relevant STI on the list. In total there were ten questions that provided the participant with space to write free text.

5.3.2.8 Dealing with missing data in the AURAH study

In collaboration with Dr Miltz, I considered non-response to a question as an indication that a measure had not occurred. For example, a missing response for recreational drug use was considered to indicate that no drugs had been taken. This was because there appeared to be a pattern whereby only symptoms that had been experienced were ticked in the answers to questions. The proportion of missing values was ≤5% for all variables used in analyses, and, unless otherwise stated in an individual table or figure, missing was included with ‘no’ for all the analyses.
<table>
<thead>
<tr>
<th>Questionnaire Section and Question number (Appendix II)</th>
<th>Variable – description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section H: Sexual lifestyle, Question H2 (i)</td>
<td>anyCLS - “Condomless sex within past 3 months”</td>
<td>Variable created using answer to H2 ‘In the past 3 months have you had anal sex with a man?’, Answer option ‘Yes’ or ‘No’, If YES, did any of the anal sex in the last 3 months take place without a condom?’. Answer option ‘Yes’ or ‘No’. Categorised as ‘Yes’ for ‘anyCLS’ if answered ‘Yes’ to both questions.</td>
</tr>
<tr>
<td>Section H: Sexual lifestyle, Question H2 (i)</td>
<td>CLS2binary – “Condomless sex with two or more partners (past 3 months)”</td>
<td>Variable created using answer to H2 (i) ‘In the past 3 months, how many men did you have sex with, without a condom?’. The answer options (above box) were dichotomised in to &gt;/=&lt; ‘2-4’. Missing included in ‘no’.</td>
</tr>
<tr>
<td>Section H: Sexual lifestyle, Question H2 (v) (vi)</td>
<td>key1_unknownex – “Condomless sex with unknown or HIV+ partners (long-term partners on ART not included)(past 3 months)”</td>
<td>Variable created using combined answers from three sub-questions H2 (v) ‘in the past 3 months, when you had sex without a condom, did you know the HIV status of your partners?’. Answer options were ‘No, did not know the status of any of my partners’, ‘Yes, I knew the status of all of my partners’ or ‘Yes, I knew the status of some of my partners’. (vi) ‘in the past 3 months, did you have anal sex without a condom with a man you knew was HIV positive?’. Answer options were ‘Yes’, ‘No’. (vi.d) ‘If yes was this man or one of these men your long-term partner?’ ‘Yes’, ‘No’, ‘I don’t have a long-term partner.’ (vi.e) ‘If Yes does the following statement apply? I thought the risks of catching HIV were low because my partner was taking anti-retroviral treatment’. To create the variable, the option ‘No, I did not know the status of any of my partners’ was combined with ‘Yes’ to question (vi) and then those that answered, ‘Yes to question (vi.d) and (vi.e) were re-coded as No. Missing included in ‘no’.</td>
</tr>
<tr>
<td>Questionnaire Section and Question number (Appendix II)</td>
<td>Variable – description</td>
<td>Construction</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Section H: Sexual lifestyle, Question H2 (ii) and (v)</td>
<td><strong>RCLSU</strong> – “Receptive CLS with unknown HIV status partner(s) (past 3 months)”</td>
<td>Variable created using sub-questions H2 (ii), “In the past 3 months, when you had anal sex without a condom, which partner were you?” and question H2 (v), “In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)?”. Answer options to H2(ii) were ‘Always the insertive (top)partner’, ‘Always the receptive (bottom) partner’ or ‘Sometimes the insertive(top) and sometimes the receptive (bottom) partner’. Answer option to H2(v) were ‘No, I did not know the status of any of my partners’ or ‘Yes, I knew the status of some of my partners’. To create the variable, the option from H2(v) ‘Always the receptive (bottom) partner’ was combined with H2(ii) ‘Always the receptive (bottom) partner’. Missing included in ‘no’.</td>
</tr>
<tr>
<td>Section E: Your sexual health, Question E2</td>
<td><strong>e2_sti</strong> – “Self-reported bacterial STI diagnosis (past year)”</td>
<td>Variable created using answers to E2, In the past year (before today), have you been diagnosed with a sexually transmitted infection? Answer option: ‘Yes’ or ‘No’. If YES, have you had any of the following in the past year?”. Answer options included a full list of STIs. To create the variable, those that reported any of; Syphilis, Gonorrhoea, Chlamydia, or LGV were categorised as ‘Yes’. Missing (to the first question) included in ‘no’.</td>
</tr>
</tbody>
</table>
| Section F: HIV, Question F5 | **PEPpastyear** - use of PEP in the past year | Variable created by combining answers to F5, ‘Have you ever taken post exposure prophylaxis PEP?’, ‘If Yes, approximately how often did you take PEP in the last year?’. Answer options were ‘Never’, ‘Once’, 2-3 times’, ‘More than 3 times’. Variable created by coding those that reported ‘Never’ as ‘No’ and those that reported any use of PEP as ‘Yes’. Missing was treated as ‘missing’.

123
<table>
<thead>
<tr>
<th>Questionnaire Section and Question number (Appendix II)</th>
<th>Variable – description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section H: Sexual lifestyle, Question H3</td>
<td>h3_newcat11 – 11 or more new sexual partners in past year</td>
<td>Variable created using answer to H3 ‘In the past 3 months, how many NEW sexual partners have you had in the past year?’. Answer options were ‘One’, ‘2-4’, ‘5-10’, ‘11-49’, ‘50-99’ or ‘100 or more’. The answer options were dichotomised in to &lt;/&gt; 11. Missing included in ‘no’</td>
</tr>
<tr>
<td>Section H: Sexual lifestyle, Question H7</td>
<td>mh7_groupsexbinary - group sex in past 3 months</td>
<td>Variable created using answer to H7 ‘In the past 3 months, have you participated in group sex?’. Answer options were ‘Yes’ or ‘No’. Missing included in ‘no’</td>
</tr>
</tbody>
</table>
5.3.3  The AURAH2 study: baseline data cleaning

I imported the AURAH2 dataset, containing the data collected from the baseline paper questionnaires, from excel into STATA13.0 in May 2017. I then carried out the data cleaning process; data validation, dealing with missing data and data inconsistencies in STATA and STATA ‘do-files’ for data cleaning were saved. Data validation consisted of running checks on the answer options that contained numerical values, to check answers were within an appropriate range. There was only one question which required validation in this way, question A2 ‘How old are you’, allowed the participant to either write their year of birth or their age. Therefore the enforced range for year of birth was 1915 to 1998 and age range was from 18 to 100. The only inconsistency found was where a participant had written his year of birth in place of his age which was then corrected to provide his age. A further check was carried out on the ‘Age’ variable to check that the difference between the variable ‘visitdate’ (date that questionnaire was completed in clinic, completed by researcher on the front of each questionnaire) and ‘dateofbirth’ (provided by the participant in the main body of the questionnaire) corresponded to the same value as provided in the ‘Age’ variable.

Missing data had been recorded as ‘.’ in the AURAH2 questionnaire during the digitisation process, but, unlike in the AURAH study dataset, I did not recode missing data to ‘.n’ or ‘.u’ but left it as ‘.’. I took this decision based upon my decision not to treat ‘.n’ or ‘.u’ any differently in my planned analysis, as Dr Miltz and I found that the two sets of missing data were not treated any differently in the AURAH study analyses. Similarly, to the data entry queries in the AURAH study, the queries during the digitisation process (where the person entering the data from paper questionnaire to excel spreadsheet could not interpret the answer that the participant had provided, or the participant had ticked more than one box) had been recorded as ‘99’. As per the AURAH study data queries, the majority were from participants incorrectly selecting two options from a list of answers when only one was required (for any question there were less than ten ‘99’s recorded). Therefore, for consistency, I used the same process as we had used for the AURAH study data cleaning. This involved examining the scanned paper questionnaires and allocating a single answer using the highest level of attainment or agreement, depending on the question and answer options. A small proportion (<5%) of the data entry queries were a result of illegibility of the questionnaire or where participants had crossed out answers and either written over the top of an answer or re-selected an answer. In these cases the scanned form of the questionnaire was examined in an attempt to decipher the correct answer that the participant provided.
5.3.3.1 The AURAH2 study additional variables from baseline questionnaire

In the AURAH2 study dataset I recreated the variables (described in Tables 5, 6 and 7) that had been built in the AURAH study dataset, so that comparisons could be made between the two studies. In addition, I created two new variables for the AURAH2 study analyses and then retrospectively added them to the AURAH study dataset so that comparative analyses between the two studies could be performed across new measures. Table 8 shows the list of additional variables and how they were constructed.
Table 8 Additional variables created for AURAH2 analysis

<table>
<thead>
<tr>
<th>Questionnaire Section and Question number (Appendix II)</th>
<th>Variable – description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section F: HIV, Question F6</td>
<td><strong>PrEPpastyear</strong> - use of PrEP in the past year</td>
<td>Variable created by using the answers to F6, ‘Have you ever taken PREP?’, ‘If Yes, approximately how many days did you take PrEP in the last year?’ Answer options were ‘Between 1 and 4 days’, ‘Between 5 and 19 days’, ‘20-50 days’, ‘More than 50 days’. Variable created by coding those that reported any use of PrEP as ‘Yes’ and those that reported ‘ever taken PrEP’ in the previous question but not reported any use in the last year, as ‘No’. Missing was treated as ‘missing’.</td>
</tr>
<tr>
<td>Section F: HIV, Question F2, F3</td>
<td><strong>recentHIVtest</strong> - HIV test on day of questionnaire completion or within past 6 months</td>
<td>Variable created by combining the answer to F2 ‘Are you having an HIV test today?’ and F3. ‘Have you ever had an HIV test?’. Answer options were ‘Within the last 6 months’, ‘More than 6 months and up to 2 years ago’, ‘More than 2 years ago and up to 5 years ago’ and ‘More than 5 years ago’. Variable was created by dichotomising all answer options in to the first answer option, ‘Within the last 6 months’ Vs the rest. Missing included in ‘no’</td>
</tr>
</tbody>
</table>
5.3.3.2 Dealing with free text in the AURAH2 baseline paper-based questionnaire

Six of the questions in the AURAH2 study baseline paper provided the participant with the option of ‘Other’ and space to write free text. I dealt with each in the same way as I had in the AURAH study. For example, for the question on STIs, 14 participants wrote free text, of which I re-coded 4/14 to the relevant STI, the remaining ‘Other’ were either pubic lice (7/14 cases) which were not assigned to an STI from the list, or scabies (2/7 cases) which were not assigned either. One participant had written ‘HIV’ under ‘Other’, which upon examination of his scanned questionnaire could have been mistaken for ‘HPV’, therefore I checked for other answers that might relate to an HIV positive status; and, as the participant had answered ‘No’ to question F1 ‘Are you HIV positive’ and answered ‘Yes’ to being interested in PrEP to prevent HIV infection, the questionnaire was kept in the dataset and ‘Other’ was not re-coded to any STI.

5.3.3.3 The AURAH2 study: baseline data inconsistencies

The paper-based baseline questionnaire used fifteen skip questions, i.e. ‘In the past 3 months have you used recreational drugs (e.g. poppers, cannabis, cocaine)?’ with the options ‘Yes’ ‘No’→If No PLEASE GO TO QUESTION D9’. Using STATA, I cross tabulated each skip question with the corresponding sub-questions (i.e. If YES, which drugs have you used? Please tick more than one option if applicable) to check whether, in the cases where the participant had ticked ‘No’ for example, that the correct sub-question was left blank or vice versa with ‘Yes’ and reporting of which drug. If sub-questions had been answered, i.e. the participant had selected ‘No’ to using recreational drugs but then ticked one or more of the drugs listed, their answer to the previous question was recoded to ‘Yes’. The majority of the skip questions only had one sub-question, therefore the inconsistencies were easy to resolve in the manner I have described. In cases where skip question inconsistencies occurred in ‘Section H: Sexual Lifestyle’, where there were multiple sub-questions, I ensured that inconsistencies in the AURAH2 data set were dealt with in a similar manner to the previous analysis on the AURAH dataset by consulting with Dr Miltz. For these skip questions, I checked the related sub-questions for inconsistencies and found 41 (3.5%) participants had ticked sub-questions inappropriately with regards to their answer to the skip questions which I then recoded appropriately. Table 9 shows which sub-questions were recoded; column 1 refers to the first skip question, column 2 the second skip question and column 3 the five sub-questions that should only have been answered if the answer to the first and second skip questions were ‘Yes’. Column 4 shows which category participants were assigned to in a new variable that was created for inconsistencies and column 5 shows
the number of participants in each category. Column 6 shows whether the sub-questions were re-coded and, if they were, what they were re-coded as.

The final AURAH2 baseline dataset consisted of 1167 data entries. Once the AURAH2 baseline data inconsistencies had been dealt with and the variables created, the resulting dataset was used in two subsequent chapters, Chapter 6 and Chapter 7.

5.3.3.4 Dealing with missing data in the AURAH2 baseline data

For consistency I used the same method to deal with missing data in the AURAH2 baseline data as I used for the AURAH study, detailed in Section 5.3.2.8, pg.121. There was a similar prevalence of missing data in the AURAH2 baseline questionnaire data, ≤5% for all variables used in analyses, and, unless otherwise stated in an individual table or figure, missing was included with ‘no’ for all the analyses.
Table 9 Solving inconsistencies in sexual behaviour questions for the paper-based AURAH2 questionnaire (see Appendix II)

<table>
<thead>
<tr>
<th>Answer to H2 'In the past 3 months, have you had anal sex with a man?'</th>
<th>Answer to first sub-question (i), 'If Yes, did any of the anal sex within the last 3 months take place without a condom?'</th>
<th>Five further sub-questions, (ii) (iii) (iv) (v) (vi) starting with &quot;In the last 3 months&quot;²</th>
<th>Answer assigned to (new) variable: ‘CLS’, ‘Sex with condom’, ‘No sex’, ‘Unknown’, ‘Possible CLS’.</th>
<th>N</th>
<th>Sub-questions recoded?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>CLS</td>
<td>739</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>All missing</td>
<td>Sex with condom</td>
<td>287</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Answered at least one</td>
<td>Possible CLS</td>
<td>*30</td>
<td>Sub-questions recoded to missing</td>
</tr>
<tr>
<td>Yes</td>
<td>Missing</td>
<td>All missing</td>
<td>Sex with condom</td>
<td>*1</td>
<td>CLS recoded as No</td>
</tr>
<tr>
<td>Yes</td>
<td>Missing</td>
<td>Answered at least one</td>
<td>Possible CLS</td>
<td>*8</td>
<td>CLS recoded as Yes</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>Answered at least one</td>
<td>CLS</td>
<td>2</td>
<td>Any sex recoded to Yes</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>All missing</td>
<td>No sex</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Answered at least one</td>
<td>Possible CLS</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>Missing</td>
<td>All missing</td>
<td>No sex</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>Missing</td>
<td>Answered at least one</td>
<td>Possible sex</td>
<td>*2</td>
<td>CLS recoded to Yes &amp; Any sex recoded to Yes</td>
</tr>
</tbody>
</table>

² (ii) ‘In the past 3 months, how many men did you have anal sex with, without a condom?’
(iii) ‘In the past 3 months, when you had anal sex without a condom, were the reasons for not using a condom in the following list? (please tick all that apply)’
(iv) ‘In the last 3 months, when you had anal sex without a condom, did you consider the risks of HIV infection?’
(v) ‘In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)?’
(vi) ‘In the past 3 months, did you have anal sex without a condom with a man you knew was HIV positive?’

*indicates sub-questions that were recoded
<table>
<thead>
<tr>
<th>Answer to H2 'In the past 3 months, have you had anal sex with a man?'</th>
<th>Answer to first sub-question (i), 'If Yes, did any of the anal sex within the last 3 months take place without a condom?'</th>
<th>Five further sub-questions, (ii) (iii) (iv) (v) (vi) starting with &quot;In the last 3 months&quot;²</th>
<th>Answer assigned to (new) variable: ‘CLS’, ‘Sex with condom’, ‘No sex’, ‘Unknown’, ‘Possible CLS’.</th>
<th>N</th>
<th>Sub-questions recoded?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td>Missing</td>
<td>Missing</td>
<td>Unknown</td>
<td>13</td>
<td>No</td>
</tr>
</tbody>
</table>

(ii) ‘In the past 3 months, how many men did you have anal sex with, without a condom?’
(iii) ‘In the past 3 months, when you had anal sex without a condom, were the reasons for not using a condom in the following list? (please tick all that apply)’
(iv) ‘In the last 3 months, when you had anal sex without a condom, did you consider, the risks of HIV infection?’
(v) ‘In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)?’
(vi) ‘In the past 3 months, did you have anal sex without a condom with a man you knew was HIV positive?’

*indicates sub-questions that were recoded
5.4 Appending the AURAH and AURAH2 datasets

In order to carry out comparative analyses between the AURAH and AURAH2 data, I combined the two datasets. To do this, I undertook a number of steps in each dataset to ensure that the datasets could be compared. First of all, I checked to ensure that all the variables in each dataset were labelled and coded exactly the same so that in an appended dataset they would appear as one variable (a separate variable would identify which dataset the values corresponded to). So as to keep each original dataset intact, I created a second data set from each of the AURAH and AURAH2 original datasets. The second datasets consisted only of the variables that would be used for a comparison of recreational drug use between the two studies. These datasets were named ‘AURAH(forappend)’ and ‘AURAH2(forappend)’. I checked each variable to ensure that they were coded the same in each dataset, for example if the variable ‘recreational drug use’ was coded as ‘Yes=1’ ‘No=0’ in the AURAH(forappend) dataset but ‘Yes=1’ ‘No=2’ in the AURAH2(forappend) dataset, then the ‘No=2’ in the AURAH2(forappend) dataset was re-coded to ‘No=0’. In the original AURAH study dataset, ‘No’ was always coded as ‘0’, whereas in the original AURAH2 dataset ‘No’ had been coded as ‘2’. For my planned analysis it was necessary to re-code the ‘No’s in the AURAH2 dataset to ‘0’ and this was also done in the AURAH2(forappend) dataset. Finally, once the AURAH(forappend) and AURAH2(forappend) had been checked, re-labelled and re-coded, the two datasets were combined and a variable that identified the source dataset (AURAH or AURAH2) was automatically created in STATA. The resulting dataset consisted of 2022 data entries, of which 1031 were from the AURAH2 study and 991 were from MSM in the AURAH study who attended the same three clinics that participated in the AURAH2 study.

The final combined dataset comprising of MSM from the AURAH study dataset and baseline data from the AURAH2 study was analysed and reported in results Chapter 6.

5.5 The AURAH2 study: online data

5.5.1 The AURAH2 study: online data management and cleaning

The online questionnaires, used to collect follow-up data in AURAH2, enforced (by means of displaying or not displaying) particular answer options for the participant to choose from. Therefore, sub-questions were only displayed when the appropriate answer to the skip question had been selected which meant that none of the data inconsistencies that I have described in the paper questionnaire data were possible in the online data. However, I checked skip questions and sub-questions using the same methods as I had done for the AURAH2 baseline dataset, by cross tabulating the skip questions with the corresponding
sub-questions in STATA. This confirmed that no participants had incorrectly completed any sub-questions.

5.5.2 The AURAH2 study: additional variables from online questionnaire

In the online questionnaire there was a question that asked ‘have you used drugs before or during sex (chemsex) in the last three months?’, which provided the opportunity to examine chemsex at event-level (i.e. specific drug use being reported in the context of sex) as opposed to the baseline questionnaire which used the self-report of use of one of three chemsex associated drugs (crystal methamphetamine, mephedrone or GBH/GBL) as a proxy for chemsex. Therefore, the question on event-level chemsex, which was asked at every online questionnaire, was used as the variable for analysis in Chapters 8 and 9 (using the online follow-up dataset for analysis), as was the subsequent question on frequency of chemsex in past three months. Whilst all the sexual behaviour measures (with the exception of ‘receptive CLS with partners of unknown HIV status (due to small sample size)) that were detailed in the earlier sections of this chapter were also used in the analysis of the online data and constructed in the same way as described using the online data for Chapters 8 and 9, one additional variable pertaining to sexual behaviour was created; ‘any anal sex’. This was created as I wanted to examine the difference in prevalence between MSM reporting ‘any anal sex’ and ‘any CLS’ in the analysis, described in Table 10.
Table 10 Additional online variables constructed for the AURAH2 study (see Appendix VI and VII)

<table>
<thead>
<tr>
<th>Online questionnaire: four monthly/annual</th>
<th>Variable-description</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four monthly and annual</td>
<td><strong>Anyanalsex</strong> - any anal sex within past 3 months</td>
<td>Variable created using Q3A ‘Have you had anal sex with a man in the past 3 months?’ Answer options ‘Yes’ or ‘No’.</td>
</tr>
<tr>
<td>Four monthly and annual</td>
<td><strong>Chemsex_yesno</strong> - chemsex within the past 3 months</td>
<td>Variable created using Q7B ‘Have you used drugs before or during sex (chemsex) in the last 3 months? Answer options: ‘Yes’ or ‘No’.</td>
</tr>
<tr>
<td>Four monthly and annual</td>
<td><strong>Chemsex_freq</strong> - frequency of chemsex in past 3 months</td>
<td>Variable created using Q7Bii ‘Approximately how often did you have chemsex in the last 3 months?’ Answer options ‘Once’, ‘Monthly’, ‘Weekly’.</td>
</tr>
<tr>
<td>Annual</td>
<td><strong>Rtype</strong> - long-term relationship</td>
<td>Variable constructed using Q1D of annual relationship questionnaire, ‘Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)? Answer options ‘Yes’ or ‘No’. Baseline questionnaire answer was used for first online visit as it was not asked in the four monthly questionnaires. Annual questionnaire answer was used to forward-fill gaps in the four monthly questionnaires until and answer was provided at next annual questionnaire. Change in relationship status i.e. previously answering yes and then at next questionnaire answering no was coded as ‘change in relationship status’ so variable had 3 categories, ‘in long-term relationship’, ‘change in relationship status’ and ‘not in long-term relationship’.</td>
</tr>
<tr>
<td>Four monthly and annual</td>
<td><strong>Startchemsex</strong> – starting chemsex for the first time</td>
<td>Using the chemsex_yesno variable and the questionnaire identification variable (‘visit’-described in Section 5.5.1) a variable was created to identify those that started chemsex for the first time within the follow-up period.</td>
</tr>
<tr>
<td>Four monthly and annual</td>
<td><strong>Initiatechemsex</strong> – starting or resuming chemsex</td>
<td>Using the chemsex_yesno variable and the questionnaire identification variable (‘visit’-described in Section 5.5.1) a variable was created to identify those that started chemsex for the first time within the follow-up period or re-started after having interrupted.</td>
</tr>
<tr>
<td>Four monthly and annual</td>
<td><strong>Stopchemsex</strong> - stopping and not re-starting chemsex</td>
<td>Using the chemsex_yesno variable and the questionnaire identification variable (‘visit’-described later in the chapter) a variable was created to identify those that stopped chemsex and did not resume.</td>
</tr>
</tbody>
</table>
During July and August 2016 there was a temporary technical problem with the AURAH2 website and this affected the sending of reminder emails to participants. During this period multiple email reminders were sent out to participants that were due to complete their online questionnaires, regardless of whether they had recently answered and submitted them. The problem was corrected by the service provider (AN Computing) within two weeks of system maintenance and updates, however during this time, some participants submitted multiple questionnaires. In total, there were 29 cases where questionnaires were submitted on the same day as each other. I identified and deleted these in STATA. If both an annual and four monthly questionnaires were submitted on the same day, the annual was kept as it collected the four monthly data as well as extra information. If both questionnaires were the same (i.e. two four monthly questionnaires) the first submitted questionnaire was kept if both were fully completed. There were an additional 36 cases where questionnaires had been submitted within 30 days of each other. I identified and deleted these in STATA using the same methods as described for the questionnaires that were submitted on the same day as each other.

The final online dataset inconsistency was a participant who incorrectly reported a new HIV diagnosis. The participant subsequently emailed the ‘info@aurah2.org’ address and reported that he had clicked the wrong button whilst completing the questionnaire. This self-report was checked against information provided by the clinic to confirm that he had not had a positive HIV test result. Once this was confirmed, the first positive questionnaire that the participant had completed was identified in the dataset using STATA and deleted. The AURAH2 system was then reset for this participant so that he would receive online HIV negative questionnaires.

I received five separate datasets from the AURAH2 online Data Manager, Dr Andrew Speakman, on the 28th March 2018. The five datasets were in separate Excel spreadsheets:

i) ‘AURAH2OnlineDataValidationv14Month’
   - Contained data from HIV negative participants that have completed 4 monthly questionnaires

ii) ‘AURAH2OnlineDataValidationv112Month’
    - Contained data from HIV negative participants that have completed annual questionnaires

iii) ‘LinelistingEditedEndSep17sheetFirstpositive’
    - Contained data from newly diagnosed HIV positive participants

iv) ‘LinelistingEditedEndSep17sheetFourMonthsPositive’
• Contained data from HIV positive participants that have completed 4 monthly questionnaires
v) ‘LinelistingEditedEndSep17sheetTwelveMonthsPositive’
• Contained data from HIV positive participants that have completed annual questionnaires

5.5.4 Accounting for AURA H2 missed online questionnaires

Participants had the option of ignoring email invitations to complete online questionnaires but were then able to complete subsequent ones when the next quarterly email reminder was sent to them. To account for missed questionnaires over the three-year period of the online data collection, I created a variable called ‘visit’ which assigned each online follow-up questionnaire that had been submitted, a number that corresponded to where in the sequence of a possible one to nine online questionnaires. For example, the ‘perfect’ participant should have completed an online questionnaire every four months after their first online questionnaire for a period of up to three years, resulting in a maximum of nine online questionnaires completed (if they had started the online component of the study in the first month, however the majority only had the option of completing eight). I defined a ‘visit’ as a participant completing a questionnaire ‘as scheduled’, i.e. every four months. If every participant had completed their questionnaires as scheduled, questionnaires would have been completed on day 0 (first online questionnaire), day 122 (2nd visit), day 244 (3rd visit), day 366 (4th visit), day 488 (5th visit), day 610 (6th visit), day 732 (7th visit), day 854 (8th visit) and day 976 (9th visit).

However, to account for missed ‘visits’ and ‘visits’ that were not completed on the exact day as scheduled, I created a variable called ‘differfromfirstfup’ to count, for each participant, the difference between the number of days from the first follow-up to each consecutive ‘visit’.

Every participant who completed an online questionnaire was assigned a ‘visit 1’, then I assigned ‘visit 2’ if the variable ‘differfromfirstfup’ was less than 244 days and not assigned visit 1 (for visit 2), ‘visit 3’ was assigned if ‘differfromfirstfup’ was less than or equal to 366 days and greater than 122 days, and not assigned ‘visit 1’ or ‘visit 2’, up to visit 9. Figure 12 shows a visual representation of how the visits were assigned.
5.5.5 **Use of baseline data in the AURAH2 study**

Sociodemographic characteristics were only collected in the baseline questionnaire. However, as there were two sets of participants that could join the AURAH2 online study, those from the AURAH study and those from the AURAH2 study, the time between the baseline questionnaire and the first online questionnaire had a lot of variation. The median time between baseline to first online follow-up visit was 110 days for all participants (AURAH and AURAH2), 78 days among AURAH2 participants only, and 367.5 days among AURAH participants. Due to the large difference in the medians time indicated, it would be inaccurate to use some of the data from the baseline questionnaire, particularly for the AURAH study participants, and particularly for example in data relating to sexual behaviour or drug use, where behaviours or relationships, and knowledge and beliefs may have changed over the considerable time period that had lapsed between baseline questionnaire and first online follow-up questionnaire. Therefore, I only used the online data-set for analysis in Chapters 8 and 9, and only included relevant variables from the AURAH2 baseline questionnaire that were not subject to change over time (for example, ethnicity, university education).

5.5.6 **Dealing with missing data in the AURAH2 online data**

In online questionnaires that had been commenced in the AURAH2 study, there was very little missing data. There was no missing data for any of the questions on chemsex and <1% of data was missing for any of the other online questions. Therefore, unless otherwise stated in an individual table or figure, missing was included with ‘no’ for all the analyses.

5.6 **The AURAH2 study: merging the online datasets**

To bring together the five online datasets I used the variable ‘studyid’ as the unique identifier which was assigned to each participant at the point of recruitment to the study. The
participants 'studyid' was linked to their email address to which the reminder email invitations were sent and contained the link to the online questionnaire (email addresses were not part of the dataset, only studyid). Thus each data entry had a studyid variable with the subsequent answers submitted. I merged the HIV negative four monthly and annual online datasets and the HIV positive four monthly, annual and first positive. Once I had combined the datasets in STATA and identified and deleted the described data inconsistencies, my final dataset consisted of, 622 participants, of which 136 participants were from the AURAH study and 486 participants were from the AURAH2 study. These 622 participants contributed a total of 3277 online data entries which consisted of 2,283 (69.7%) four monthly HIV negative questionnaires, 918 (28.0%) annual HIV negative questionnaires, 37 (1.1%) four monthly HIV positive questionnaires, 24 (0.7%) annual HIV positive questionnaires and 15 (0.5%) First HIV positive questionnaires.
Chapter 6: Results: Recreational drug use, poly drug use and chemsex drug use, among MSM in the AURAH study

6.1 Introduction

This chapter uses data from the AURAH study to investigate and provide prevalence estimates of individual recreational drug use, poly drug use and chemsex drug use among HIV negative MSM attending the 20 sexual health clinics that participated in the study in 2013/2014. As this is the first results chapter to present data from the AURAH study, I describe the study response rate from the twenty participating clinics, which is not MSM specific. Next, sociodemographic characteristics of MSM included in the analysis are detailed and the prevalence of eight sexual behaviour measures are presented before prevalence of each individual recreational drug, plus poly drug use and chemsex drug use are described. Finally, the associations of poly drug use and chemsex drug use with sociodemographic characteristics are examined and the associations of poly drug use and chemsex drug use with eight sexual behaviour measures are investigated. The chapter concludes by highlighting key points from the results.

The paucity of data on recreational drug use and chemsex among MSM, and in particular data relating specifically to HIV negative or undiagnosed MSM, was described in Chapter 2, Section 2.4.4, pg.57, and provides the rationale for the analyses in this chapter. The Chemsex study, published in 2014 and detailed in Chapter 2, was the first study in the UK to explore drug use in sexual settings among MSM (133). It highlighted a significant public health concern for MSM engaged in chemsex in part because of the associations with high risk sexual behaviour, and in part because of the (unknown but suspected) rise of chemsex within the MSM community, which led to increased clinical and academic attention in the UK (134, 147), as well as significant media attention around 2014. As chemsex was a newly described behaviour in UK literature in 2014, there was limited evidence or prevalence estimates that could elucidate the scale of the issue among MSM (277). However anecdotal evidence from sexual health clinics suggested an increasing number of MSM were seeking support from services relating to chemsex drug use (7). Potential associations of recreational drug use with sexual risk behaviour and HIV infection had been documented internationally (41, 98, 130, 150, 278, 279), but there was a notable lack of data from the UK with which to inform and develop targeted sexual health and HIV prevention policies, and which the results from this chapter aimed to address.
6.2 Methods

6.2.1 Recreational drug use

This chapter uses responses from question D8 in the AURAH study male questionnaire (Appendix I) to ascertain the two types of recreational drug use that are investigated in this chapter, poly drug use and chemsex drug use, as well as use of individual drugs. Question D8 asked participants, ‘In the past 3 months, have you used recreational drugs (e.g. poppers, cannabis, cocaine)?’ with the answer options of ‘Yes’ or ‘No’ and, if ‘Yes’, to select which drug or drugs from the following list: acid/LSD/magic mushrooms, anabolic steroids, cannabis (marijuana, grass), cocaine (coke), crack, codeine, crystal meth (methamphetamine), ecstasy (E), GHB/GBL (liquid ecstasy), heroin, ketamine (K), khat (chat), mephedrone, morphine, opium, poppers (amyl nitrate), speed (amphetamine), Viagra, Other. If a participant selected ‘Other’ there was space for free text and a request to specify the name(s) of the drug(s).

From the answers provided by the participants, two measures of recreational drug use were defined: (i) poly drug use, use of three or more recreational drugs in the past three months, and (ii) chemsex drug use, use of one or more of mephedrone, crystal meth or GHB/GBL in the past three months.

6.2.2 Sexual behaviour measures

To ascertain measures of sexual behaviour, the questions from H2 in the AURAH study male questionnaire (Appendix I) were used to develop eight measures of sexual behaviour which are used in the analysis for this chapter. The first two sexual behaviour measures related to CLS and were derived from the question ‘In the past 3 months, how many men did you have anal sex with, without a condom?’ with the following answer options, ‘one’, ‘2 to 4’, ‘5 to 10’, ‘more than 10’. The third sexual behaviour measure also related to CLS but was derived from a different question, ‘In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)’ with the options of, ‘No, I did not know the HIV status of any of my partners’ or ‘Yes, I knew the HIV status of all my partner(s)’ or ‘Yes, I knew the HIV status of some of my partner(s)’. The response from a subsequent question was also used for this measure to exclude those who had had CLS with a long-term HIV-diagnosed partner who was on ART; if a participant had selected the answer option of ‘one’ to ‘how many HIV positive men did you have anal sex with, without a condom, in the past 3 months’ and then replied ‘Yes’ to the question ‘was this man or one of these men your long-term partner?’ and ‘yes’ to ‘I thought the risks of catching HIV were low because my partner was taking anti-retroviral therapy’, then they were not included in CLS with partners of unknown or HIV positive status. The fourth sexual behaviour measure also
related to CLS and was derived from the two questions, ‘In the past 3 months, when you had anal sex without a condom, which partner were you?’ with the answer options of ‘Always the insertive/top partner (your penis was inside your partner)’ or ‘Always the receptive/bottom partner (your partner’s penis was inside you)’ or ‘Sometimes the insertive/top partner and sometimes the receptive/bottom partner’ and the question , ‘In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)?’ with the answer options, ‘No, I did not know the HIV status of any of my partner(s)’, ‘Yes, I knew the HIV status of all my partner(s)’ and ‘Yes, I knew the HIV status of some of my partner(s)’.

(i) Any CLS (past three months)
(ii) CLS with two or more partners (past three months)
(iii) CLS with partners of an unknown or HIV positive status (men who reported no CLS with partners of unknown HIV status, and only one HIV positive CLS partner who was a long-term partner and with whom they ‘thought the risks of catching HIV were low because their partner was taking ART’, were not included) (past three months)
(iv) receptive CLS with an HIV unknown status partner (past three months)

Two additional measures were investigated. The first used the question from E2 ‘In the past year (BEFORE today), have you been diagnosed with a sexually transmitted infection (STI)?’ with the answer options of ‘Yes’ or ‘No’ followed by a list of eleven STIs. If the participant answered yes, they were asked to select which STI(s) from the following list; syphilis, gonorrhoea, chlamydia, LGV, new (acute) Hepatitis B, new (acute) Hepatitis C, genital herpes (new or recurrent), genital warts (new or recurrent), trichomonas, NSU (non-specific urethritis), or NGU (non-gonococcal urethritis) or other with space to write free text. The next used the question from F5 ‘Have you ever taken post exposure prophylaxis PEP?’ with the options of ‘Yes’ or ‘No’ and ‘if YES, approximately how often did you take PEP in the last year?’ with the options of ‘Never’, ‘Once’, ‘2 to 3 times’, ‘More than 3 times’.

(v) self-reported diagnosis with a bacterial STI in the past year (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma venereum, LGV)
(vi) post-exposure prophylaxis (PEP) use in the past year.

Finally, two measures of partner numbers were also investigated, the first used the question H3 ‘In the past 12 months, have you had any NEW sexual partners?’ with the options of ‘Yes’ or ‘No’, ‘if YES, how many NEW sexual partners have you had in the past 12 months?’ with the options of ‘One’, ‘2-4’, ‘5 to 10’, ‘11 to 49’, ‘50 to 99’, ‘100 or more’. The second used
the response to the question H7, ‘In the past 3 months, have you participated in group sex?’ with the options of ‘Yes’ or ‘No’.

(vii) report of eleven or more new sexual partners in the past year
(viii) group sex in the past three months.

6.2.3 Statistical Analysis

The first analysis describes the sociodemographic, health and lifestyle characteristics of MSM in the AURAH study. To ascertain this, I used the number that reported the specific characteristic over the total number of MSM included in the analysis. I used this same method to determine the prevalence of use of individual recreational drugs, and the two types of recreational drug use, poly and chemsex drug use. To examine the associations of specific sociodemographic factors, health and lifestyle factors, relationship status and study region, with the two types of recreational drug use, I conducted univariable analysis using Pearson Chi-squared tests and Chi-squared tests for trend, and multivariable analysis using modified Poisson regression with robust error variances to produce partially adjusted prevalence ratios (PR) (280). In adjusted models, each factor was considered in a separate model and adjusted for age (continuous variable), ethnicity (white, non-white), university education (yes, no/missing), sexual identity (gay, bisexual, other), ongoing relationship (yes, no/missing) and study region (London, south, midlands & the north), all decided a priori. The associations between the two types of drug use and the sexual behaviour measures were assessed (i) unadjusted (ii) adjusted for age group, ethnicity, education, sexual identity, relationship status and study region, and (iii) adjusted for the previous factors plus depressive symptoms and alcohol use. The adjustments were made based on discussion with the AURAH study core group, with whom it was agreed that the sociodemographic factors (with the exception of relationship status) were likely to have been fixed before drug use started, and relationship status was included as it was thought that this might have an impact on drug use (explored further in Chapter 9). Additional adjustments for alcohol and depressive symptoms were made due to the evidence of their associations with measures of sexual behaviour (208, 281-283).

6.3 Results

6.3.1 Overall Response rates for the AURAH study

Over the 15-month study period a total of 4393 eligible patients were approached and asked to participate in this study. Of those approached, 3340 (76%) gave consent to take part in the study. The number of completed questionnaires finally collected was 2630 and thus the response rate was 60% (2630/4393) of eligible patients approached and 79% (2630/3340) of
those who gave consent. Of the 2630 respondents, 1432 (54%) agreed to provide their contact details for participation in future research. Eighteen of the 20 participating clinics provided estimates of the number of out-patients seen in all clinical sessions over the same period and the numbers of these in the key groups of interest (MSM and black Africans). More than 288,090 patients were found to have attended these 20 clinics at some point during the respective recruitment period and the length of recruitment period ensured a diverse sample of clinic attendees which included those who regularly visit and those who were first time or less frequent attendees. Of the 288,090 clinic attendees during the recruitment period in the AURAH sites, and based on the demographic of clinic attendees, it was estimated that approximately 7.6% were black African and 13.6% were MSM, which demonstrates that there were adequate numbers of the target populations attending the study clinics. Table 11 illustrates the recruitment target and results from the twenty participating clinics.
Table 11 AURAH study recruitment; sites, recruitment targets and results

<table>
<thead>
<tr>
<th>Clinic site, city</th>
<th>Date recruitment began</th>
<th>Recruitment target</th>
<th>Individual patients attending during recruitment period</th>
<th>Eligible patients approached</th>
<th>Patients consenting (as % of approached = consent rate)</th>
<th>Patients responding = completed questionnaires received (as % of approached = response rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking, London</td>
<td>16/10/2013</td>
<td>60</td>
<td>3475</td>
<td>64</td>
<td>59 (92%)</td>
<td>34 (53%)</td>
</tr>
<tr>
<td>Barts, London</td>
<td>13/01/2014</td>
<td>20</td>
<td>-*</td>
<td>16</td>
<td>13 (81%)</td>
<td>11 (69%)</td>
</tr>
<tr>
<td>Birmingham</td>
<td>19/09/2013</td>
<td>80</td>
<td>-*</td>
<td>53</td>
<td>49 (92%)</td>
<td>33 (62%)</td>
</tr>
<tr>
<td>Brighton</td>
<td>27/06/2013</td>
<td>240</td>
<td>13918A</td>
<td>243</td>
<td>240 (99%)</td>
<td>227 (93%)</td>
</tr>
<tr>
<td>Bristol</td>
<td>02/08/2013</td>
<td>100</td>
<td>1021</td>
<td>59</td>
<td>58 (98%)</td>
<td>55 (93%)</td>
</tr>
<tr>
<td>Calderdale &amp; H’field</td>
<td>25/06/2013</td>
<td>60</td>
<td>13662</td>
<td>92</td>
<td>82 (89%)</td>
<td>73 (79%)</td>
</tr>
<tr>
<td>Coventry</td>
<td>29/10/2013</td>
<td>180</td>
<td>11218**</td>
<td>269**</td>
<td>256 (95%)</td>
<td>246 (91%)</td>
</tr>
<tr>
<td>Dean Street, London</td>
<td>30/07/2013</td>
<td>250</td>
<td>51882A</td>
<td>1384</td>
<td>895 (65%)</td>
<td>604 (44%)</td>
</tr>
<tr>
<td>Homerton, London</td>
<td>14/11/2013</td>
<td>120</td>
<td>25312</td>
<td>159</td>
<td>149 (94%)</td>
<td>123 (77%)</td>
</tr>
<tr>
<td>John Hunter, London</td>
<td>11/07/2013</td>
<td>150</td>
<td>20236A</td>
<td>235</td>
<td>131 (56%)</td>
<td>84 (36%)</td>
</tr>
<tr>
<td>Kings, London</td>
<td>15/07/2013</td>
<td>200</td>
<td>15500</td>
<td>305</td>
<td>204 (67%)</td>
<td>168 (55%)</td>
</tr>
<tr>
<td>Leicester</td>
<td>08/10/2013</td>
<td>100</td>
<td>5173</td>
<td>69</td>
<td>66 (96%)</td>
<td>48 (70%)</td>
</tr>
<tr>
<td>Mortimer Market, London</td>
<td>06/11/2013</td>
<td>300</td>
<td>13652A</td>
<td>382</td>
<td>370 (97%)</td>
<td>313 (82%)</td>
</tr>
<tr>
<td>Newham, London</td>
<td>14/11/2013</td>
<td>100</td>
<td>9203</td>
<td>168</td>
<td>119 (71%)</td>
<td>113 (67%)</td>
</tr>
<tr>
<td>Reading</td>
<td>24/07/2013</td>
<td>60</td>
<td>14807</td>
<td>82</td>
<td>75 (91%)</td>
<td>75 (91%)</td>
</tr>
<tr>
<td>Royal Free, London</td>
<td>02/07/2013</td>
<td>60</td>
<td>33216</td>
<td>137</td>
<td>126 (92%)</td>
<td>101 (74%)</td>
</tr>
<tr>
<td>St George’s, London</td>
<td>29/10/2013</td>
<td>180</td>
<td>17041</td>
<td>110</td>
<td>90 (82%)</td>
<td>81 (74%)</td>
</tr>
<tr>
<td>The London</td>
<td>10/12/2013</td>
<td>80</td>
<td>13747</td>
<td>40</td>
<td>35 (88%)</td>
<td>33 (83%)</td>
</tr>
<tr>
<td>WLCSH, London</td>
<td>08/08/2013</td>
<td>100</td>
<td>19094A</td>
<td>462</td>
<td>270 (58%)</td>
<td>164 (35%)</td>
</tr>
<tr>
<td>Whipps Cross, London</td>
<td>20/11/2013</td>
<td>100</td>
<td>5933</td>
<td>64</td>
<td>53 (83%)</td>
<td>44 (69%)</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td>2540</td>
<td>288090</td>
<td>4393</td>
<td>3340 (76%)</td>
<td>2630 (60%)</td>
</tr>
</tbody>
</table>

* Clinic unable to supply data on total clinic attendance ** Clinic was unable to supply data about those declining to participate therefore value derived from 95% consent rate estimated by the clinic
A Covers the first year of the recruitment period only B Covers the first 14 months of the recruitment period only C Covers the first 6 months of the recruitment period only
6.3.2 Characteristics of MSM in the AURAH study

Between June 2013 and September 2014, the AURAH study recruited 1954 male participants from 20 sexual health clinics across England. Of the 1954 male participants, 1484 (75.9%) were MSM (as defined in Chapter 1) and were included in this analysis, of which two identified as transgender men (who had sex with men).

Table 12 shows the participant characteristics as self-reported in the questionnaire. In terms of sociodemographic characteristics, the majority of MSM reported white ethnicity (n=1196, 80.5%), 1313 (88.8%) self-identified as gay, 141 (9.5%) as bisexual and 25 (1.7%) as other. The median age was 31.5 years (Interquartile range: 26, 40) with nearly a third of MSM being in their 30's (30-39 age bracket n=470 (31.7%)). Overall, 1112 (74.9%) participants attended a clinic in London, 276 (18.6%) attended a clinic in the South of England (outside of London) and 96 (6.5%) attended a clinic in the Midlands/the North of England (see Chapter 3 for precise clinic locations). The majority of MSM reported having enough money to cover basic needs (n=1062, 71.6%) whilst a minority (n=107, 7.2%) reported ‘sometimes/never’ having enough money to cover basic needs. A large proportion of MSM in the study either rented or owned their own home (n=1253, 84.5%). Two thirds of MSM were educated to university degree level (n=990, 66.7%) and there was a high rate of employment (n=1182, 79.6%). Just under half (n=640, 43.1%) reported being in an ongoing relationship. Over 10% (n=171) of MSM in the study reported higher risk drinking (based on the first two questions of the WHO AUDIT-C questionnaire in which a score >6 indicates higher risk drinking (276)). More than 10% of MSM reported symptoms of clinically significant anxiety (n=158, 10.6%) or depression (n=185, 12.4%).

Table 12 Characteristics of MSM in the AURAH study (n=1484)

<table>
<thead>
<tr>
<th>Category</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>254 (17.1%)</td>
</tr>
<tr>
<td>25-29</td>
<td>372 (25.1%)</td>
</tr>
<tr>
<td>30-39</td>
<td>470 (31.7%)</td>
</tr>
<tr>
<td>40-45</td>
<td>170 (11.4%)</td>
</tr>
<tr>
<td>45+</td>
<td>198 (13.4%)</td>
</tr>
<tr>
<td>missing</td>
<td>20 (1.3%)</td>
</tr>
<tr>
<td>Born in the UK and white ethnicity</td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>759 (51.1%)</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>97 (6.5%)</td>
</tr>
<tr>
<td>No, white</td>
<td>437 (29.4%)</td>
</tr>
<tr>
<td>No, non-white</td>
<td>172 (11.6%)</td>
</tr>
<tr>
<td>missing</td>
<td>19 (1.4%)</td>
</tr>
<tr>
<td>Self reported sexuality</td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>1304 (87.9%)</td>
</tr>
<tr>
<td>Bisexual/other</td>
<td>173 (11.6%)</td>
</tr>
<tr>
<td>missing</td>
<td>7 (0.4%)</td>
</tr>
<tr>
<td>Money to cover basic needs</td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>1062 (71.6%)</td>
</tr>
<tr>
<td>Most of the time</td>
<td>311 (20.9%)</td>
</tr>
<tr>
<td>Sometimes/never</td>
<td>107 (7.2%)</td>
</tr>
</tbody>
</table>
|                                | Count (Percentage)  
|--------------------------------|--------------------
| University education           | Yes: 990 (66.7%)   
|                                | No/missing: 494 (33.3%)  
| Employed                       | Yes: 302 (20.4%)   
|                                | No/missing: 302 (20.4%)  
| Housing status                 | Home owner: 421 (28.4%)  
|                                | Renting: 832 (56.1%)  
|                                | Unstable/other: 210 (14.1%)  
|                                | missing: 21 (1.4%)  
| Ongoing relationship           | Yes: 640 (43.1%)   
|                                | No/missing: 844 (56.9%)  
| Clinically significant depressive symptoms (PHQ-9 score >=10) (N=1031) | Yes: 185 (12.4%)   
|                                | No/missing: 1299 (87.6%)  
| Clinically significant anxiety symptoms (GAD& score>=10) (N=1031) | Yes: 158 (10.6%)   
|                                | No/missing: 1326 (89.4%)  

*Renting includes from a private landlord and council or housing association.  
**Unstable includes temporary accommodation (hostel, shelter, bed and breakfast, squat), staying with partner/friend(s)/family and homeless.  
***Higher risk drinking is based on the first two questions of the WHO AUDIT questionnaire, higher risk drinking is indicated by a score of ≥ 6 (278)

6.3.3 Prevalence of sexual behaviour measures

6.3.3.1 CLS and partner numbers

I investigated the prevalence of eight sexual behaviour measures among the total number of MSM in the AURAH study population, see Table 13. Looking first at CLS and other measures of CLS and partner numbers, of the 1484 MSM, over half reported having CLS within the past three months (n=853; 57.5%). Nearly a third, 29.0% (n=430) reported CLS with ≥ 2 partners in the past three months, and over a third, 33.4% (n=495) reported CLS with unknown/HIV positive status partners (excluding men who reported on e HIV positive long-term partner with whom they reported CLS with as they thought the risks were low because their partner was on ART). A minority, 12.6% (n=187) reported receptive CLS with unknown HIV status partners in the past three months. Over a third (n=506, 34.1%) reported eleven or more new sexual partners in the past year and over a third, 35.5% (n=527), reported group sex in the past year.

6.3.3.2 PEP and self-reported STIs (past year)

Table 13 shows the prevalence of the eight measures of sexual behaviour that were investigated. Nearly a third of MSM self-reported a bacterial STI diagnosis in the past year and only a minority, nearly 15% of MSM, reported PEP use in the past year (n=212), see Table 13.
Table 13 Prevalence of sexual behaviours among MSM in the AURAH study (n=1484)

<table>
<thead>
<tr>
<th>Sexual behaviour measure</th>
<th>All MSM n (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any CLS (past 3 months)</td>
<td>853 (57.5%) (54.9%, 60.0%)</td>
</tr>
<tr>
<td>CLS with two or more partners (past 3 months)</td>
<td>430 (29.0%) (26.7%, 31.3%)</td>
</tr>
<tr>
<td>CLS with unknown/HIV positive status partner(s)* (past 3 months)</td>
<td>495 (33.4%) (29.6%, 34.4%)</td>
</tr>
<tr>
<td>Receptive CLS with unknown HIV status partner(s) (past 3 months)</td>
<td>187 (12.6%) (11.0%, 14.4%)</td>
</tr>
<tr>
<td>Self-reported bacterial STI diagnosis (past year) **</td>
<td>441 (29.7%) (27.4%, 32.1%)</td>
</tr>
<tr>
<td>Eleven or more new sexual partners (past year)</td>
<td>506 (34.1%) (31.7%, 36.6%)</td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td>212 (14.3%) (12.5%, 16.2%)</td>
</tr>
<tr>
<td>Group sex (past 3 month)</td>
<td>527 (35.5%) (33.1%, 38.0%)</td>
</tr>
</tbody>
</table>

*excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART. **bacterial STI includes LGV, gonorrhoea, chlamydia, syphilis. CLS condomless sex, STI sexually transmitted infection, PEP post exposure prophylaxis.

In total 563 (37.9%) of MSM in the AURAH study reported an STI in the past year, of which 441 (29.7%) were bacterial STIs. Among all MSM, the most common STI reported was gonorrhoea (21.7%, n=323) followed by chlamydia (14.0%) and genital warts (5.9%). The least common STIs were the blood borne viruses, new Hepatitis B infection (0.1% n=2) and new Hepatitis C infection, (0.1% n=2). Table 14 shows the complete list of STIs in order of the most common, that were reported in the study.

Table 14 Prevalence of STIs among MSM in the AURAH study in the past year

<table>
<thead>
<tr>
<th>Sexually Transmitted Infection(s)</th>
<th>All MSM (n=1484)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence n (%) (95%CI)</td>
<td></td>
</tr>
<tr>
<td>Self-reported STI (past year)</td>
<td>563 (37.9%) (35.5%, 40.4%)</td>
</tr>
<tr>
<td>Self-reported bacterial STI^ (past year)</td>
<td>441 (29.7%) (27.4%, 32.1%)</td>
</tr>
<tr>
<td>Gonorrhoea</td>
<td>323 (21.7% (19.7%, 23.9%)</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>208 (14.0%) (12.3%, 15.8%)</td>
</tr>
<tr>
<td>Genital warts (new or recurrent)</td>
<td>87 (5.9%) (4.7%, 7.1%)</td>
</tr>
<tr>
<td>NSU/NGU</td>
<td>86 (5.8%) (4.7%, 7.1%)</td>
</tr>
<tr>
<td>Syphilis</td>
<td>58 (3.9%) (3.0%, 5.1%)</td>
</tr>
<tr>
<td>Herpes (new or recurrent)</td>
<td>39 (2.6%) (1.9%, 3.6%)</td>
</tr>
<tr>
<td>LGV</td>
<td>6 (0.04%) (0.02%, 0.09%)</td>
</tr>
<tr>
<td>Hepatitis B (new)</td>
<td>2 (0.1%) (0.03%, 0.5%)</td>
</tr>
<tr>
<td>Hepatitis C (new)</td>
<td>2 (0.1%) (0.03%, 0.5%)</td>
</tr>
</tbody>
</table>
The majority of MSM (63.1%) did not report an STI an in the past year. However, of those that did, 23.8% reported one STI and 9.5% reported two. Only a small minority of MSM reported three STIs in the past year (2.6%), and this diminished for four (0.7%) and five STIs in the past year (0.4%), see Figure 13.

**Figure 13 Number of STIs reported by MSM in the AURAH study (past year) (n=1484)**

<table>
<thead>
<tr>
<th>Sexually Transmitted Infection(s)</th>
<th>All MSM (n=1484)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichomonas</td>
<td>0</td>
</tr>
</tbody>
</table>

STI sexually transmitted infection, NSU non-specific urethritis, NGU non gonococcal urethritis, LGV lymphogranuloma venereum, *bacterial STI* - Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV)

**6.3.4 Prevalence of recreational drug use**

Of the 1484 MSM included in the analysis, 812 (54.7%) reported use of one or more recreational drug(s) in the past three months. In terms of number of drugs used in the past three months, 512 (34.5%) reported use of two or more drugs and 350 (23.6%) MSM reported use of three or more drugs (defined as poly drug use), and 193 (13.0%) reported use of five or more drugs in the past three months. There were 324 (21.8%) MSM who reported use of at least one of either mephedrone, GHB/GBL or crystal methamphetamine (defined as chemsex drug use). Only 34 (2.3%) men reported injecting recreational drugs in the past three months.

In terms of location, the largest proportion of MSM that self-reported recreational drug use within the last three months was from sexual health clinics in the South (Brighton, Bristol and Reading), where the prevalence was 59.8%, whilst across the 13 clinics in London the
prevalence was 55.2%, and in clinics from the Midlands and the North (Birmingham, Coventry, Leicester, Calderdale and Huddersfield) the prevalence was 34.4%.

The most commonly reported drug used was nitrites (poppers) (32.9%). This was followed by cannabis (21.0%), cocaine (19.4%), mephedrone (19.1%), erectile dysfunction drugs (17.1%), MDMA (ecstasy) (13.0%), GHB/GBL (12.0%), ketamine (8.4%) and methamphetamine (6.4%). The other drugs had a prevalence of use of <5% each, see Figure 14.
Figure 14 Prevalence of poly drug use, chemsex drug use and individual recreational drug use in the past three months among MSM in the AURAH study (n=1484)

- Poly drug use: 23.60%
- Chemsex drug use: 21.80%
- Nitrites (poppers): 32.9%
- Cannabis: 21.0%
- Cocaine: 19.4%
- Mephedrone: 19.1%
- Erectile dysfunction drugs: 17.7%
- Ecstasy (MDMA): 13.0%
- GHB/GBL: 12.0%
- Ketamine: 8.4%
- Crystal methamphetamine: 6.4%
- Speed (amphetamine): 2.60%
- Steroids: 1.00%
- Other (heroin, c.cocaine, morphine, opium, khat, codeine, acid): 6.20%

Bar chart showing the percentage of people reporting recreational drug use in the past three months.
6.3.5  Correlates of poly drug use and chemsex drug use

Table 15 shows the association of sociodemographic and health and lifestyle factors with measures of poly drug use and chemsex drug use, in the past three months.

In univariable analysis, there were several sociodemographic characteristics that were associated with poly drug use in the past three months. Younger age (<45 years), non-university education, not being in an ongoing relationship, attending a clinic in London or the south, symptoms of depression, and higher risk alcohol drinking were associated with poly drug use (Table 15). White ethnicity (born in the UK or not) was associated with poly drug use but not with chemsex drug use.

This pattern was similar for chemsex drug use in univariable analysis. Younger age (in particular the two groups, 30-34 and 35-39) were significantly associated with chemsex drug use in the last three months, not being in an ongoing relationship, attending a clinic in London or the South, higher risk drinking and depressive symptoms. MSM who identified as gay were much more likely to report chemsex in unadjusted and adjusted analysis compared to those who identified as bisexual or straight.

After adjustment for age, ethnicity, sexual identity, education, relationship status, and study region, there were a number of sociodemographic and health and lifestyle factors that remained significantly associated with both poly drug use and chemsex drug use. Those that were non-university educated were nearly 40% more likely to report poly drug use (PR=1.39 95%CI: 1.15, 1.67) and over a third more likely to report chemsex drug use (PR=1.34 95%CI: 1.10, 1.63) compared to those that did attend university. Relationship status was also significantly associated with both poly and chemsex drug use, those not in an ongoing relationship being over a third more likely to report polydrug use (PR=1.35; 95%CI: 1.11, 1.65) and over half as likely to report chemsex drug use (PR=1.53 95%CI: 1.24, 1.89) than those in a relationship.

Geographically, attending a clinic in London was significantly associated with both poly and chemsex drug use in adjusted analyses. Attendees of clinics in the Midlands and the North were significantly less likely to report poly drug use (PR=0.42 95%CI: 0.24, 0.74) and chemsex drug use (PR=0.25 95%CI: 0.12, 0.55). Those that attended clinics in the South were also less likely to report poly or chemsex drug use, but the effect was less compared to clinic attendees in the North, poly drug use (PR=0.90 95%CI: 0.71, 1.14), chemsex drug use (PR=0.83 95%CI: 0.64, 1.09).

In terms of mental health and lifestyle factors, there was a strong association between depressive symptoms and high risk drinking with poly drug use and chemsex drug use.
Reporting current (at the time of questionnaire completion) symptoms of depression (self-reporting a PHQ-9 score \( \geq 10 \)) was significantly associated with both poly and chemsex drug use; those that had symptoms of depression were nearly one and a half times as likely to report poly drug use (PR=1.46; 95%CI: 1.15, 1.85) compared to those who did not report symptoms consistent with depression (i.e. scored less than 10 on the PHQ9 questionnaire), this was similar for chemsex drug use (PR=1.45; 95% CI: 1.13, 1.87). Reporting higher risk alcohol consumption was also significantly associated with both types of recreational drug use compared to those who did not. Participants who reported higher risk drinking were over one and a half times more likely to report poly drug use (PR=1.65 95%CI: 1.37, 2.00) and chemsex drug use (PR=1.58 95%CI: 1.29, 1.93) compared to those that did not report higher risk drinking, see Table 15.
Table 15 Unadjusted and adjusted associations of socio-demographic and lifestyle factors with measures of recreational drug use and chemsex drug use in the past 3 months (n=1484)

<table>
<thead>
<tr>
<th>N=1484 MSM</th>
<th>Poly drug use (use of 3 or more recreational drugs)</th>
<th>Use of least one ‘chemsex’ drug (crystal methamphetamine, mephedrone or GHB/GBL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>%</td>
</tr>
<tr>
<td>Age† (n=1464)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>254 (17.3%)</td>
<td>25.6%</td>
</tr>
<tr>
<td>25-29</td>
<td>372 (25.4%)</td>
<td>20.7%</td>
</tr>
<tr>
<td>30-34</td>
<td>277 (18.9%)</td>
<td>29.6%</td>
</tr>
<tr>
<td>35-59</td>
<td>193 (13.2%)</td>
<td>27.5%</td>
</tr>
<tr>
<td>40-45</td>
<td>143 (9.8%)</td>
<td>21.0%</td>
</tr>
<tr>
<td>45+</td>
<td>225 (15.4%)</td>
<td>17.3%</td>
</tr>
<tr>
<td>Born in the UK and white ethnicity† (n=1465)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>759 (51.8%)</td>
<td>24.9%</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>97 (6.6%)</td>
<td>16.5%</td>
</tr>
<tr>
<td>No, white</td>
<td>437 (29.8%)</td>
<td>24.9%</td>
</tr>
<tr>
<td>No, non-white</td>
<td>172 (11.7%)</td>
<td>17.4%</td>
</tr>
<tr>
<td>Sexual identity† (n=1479)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>1313 (88.8%)</td>
<td>24.1%</td>
</tr>
<tr>
<td>Bisexual</td>
<td>141 (9.5%)</td>
<td>19.9%</td>
</tr>
<tr>
<td>Other</td>
<td>25 (1.7%)</td>
<td>12.0%</td>
</tr>
<tr>
<td>Money to cover basic needs (n=1484)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All the time</td>
<td>1062 (71.8%)</td>
<td>23.5%</td>
</tr>
<tr>
<td>Most of the time</td>
<td>311 (21.0%)</td>
<td>22.2%</td>
</tr>
<tr>
<td>Sometimes/never</td>
<td>107 (7.2%)</td>
<td>29.9%</td>
</tr>
<tr>
<td>University education (n=1484)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>990 (66.7%)</td>
<td>21.5%</td>
</tr>
<tr>
<td>No</td>
<td>494 (33.3%)</td>
<td>27.7%</td>
</tr>
<tr>
<td>N=1484 MSM</td>
<td>Employment (n=1484)</td>
<td>Housing situation (n=1463) (†)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>1182 (79.6%)</td>
<td>302 (20.4%)</td>
</tr>
<tr>
<td></td>
<td>23.4%</td>
<td>24.5%</td>
</tr>
<tr>
<td></td>
<td>0.674</td>
<td>1.07 [0.85, 1.34]</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1.16*</td>
</tr>
<tr>
<td></td>
<td>21.8%</td>
<td>21.9%</td>
</tr>
<tr>
<td></td>
<td>0.992</td>
<td>0.992</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1.16 [0.89, 1.50]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*missing excluded †chi2 test *test for trend **Each factor considered in a separate model adjusted for age (continuous variable), ethnicity (white or non-white), sexual identity (gay or bisexual/other), university education, ongoing relationship status and study region †renting includes from a private landlord/council/housing association, Unstable includes temporary accommodation (hostel, shelter, squat), staying with partner/friends and homeless ***higher risk drinking is based on the first two questions of the WHO AUDIT questionnaire. Higher risk drinking is a score≥6 (276) PR prevalence ratio, CI confidence interval
6.3.6 Recreational drug use and sexual behaviour measures

To understand the relationship between poly drug use and chemsex drug use with sexual behaviour measures, I firstly explored the relationship in (i) univariable analysis, then (ii) multivariable analysis adjusted for sociodemographic factors (age, ethnicity, education, sexual identity, relationship status and study region) and finally (iii) adjusted for the previous factors plus depressive symptoms and alcohol use. For poly drug use I have detailed the individual values in Table 16 (to demonstrate how the numeric values equate to the corresponding figure) before displaying these values in Figure 15, for chemsex drug use I have only shown the associations in a figure, Figure 16.
### Table 16: Unadjusted and adjusted associations of poly drug use with eight measures of sexual behaviour among MSM in the AURAH study (n=1484)

<table>
<thead>
<tr>
<th>Measures of sexual behaviour</th>
<th>Poly drug use</th>
<th>Prevalence (N%) (95%CI)</th>
<th>p-value</th>
<th>Relative difference (95% CI)</th>
<th>p-value</th>
<th>Adjusted* PR (95%CI)</th>
<th>p-value</th>
<th>Adjusted** PR (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLS with one or more partners (past 3 months)</td>
<td>Yes</td>
<td>250 (71.4%) (66.4%, 75.9%)</td>
<td>&lt;0.001</td>
<td>1.34 (1.23, 1.46)</td>
<td>&lt;0.001</td>
<td>1.35 (1.23, 1.48)</td>
<td>0.001</td>
<td>1.35 (1.22, 1.48)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>603 (53.2%) (50.2%, 56.1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.35 (1.23, 1.46)</td>
<td>0.001</td>
</tr>
<tr>
<td>CLS with two or more partners (past 3 months)</td>
<td>Yes</td>
<td>166 (47.4%) (42.2%, 52.7%)</td>
<td>&lt;0.001</td>
<td>2.04 (1.75, 2.37)</td>
<td>&lt;0.001</td>
<td>1.88 (1.58, 2.24)</td>
<td>&lt;0.001</td>
<td>1.85 (1.55, 2.22)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>264 (23.3%) (20.9%, 25.8%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.86 (1.58, 2.21)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CLS with unknown/HIV+ status partner(1) (past 3 months)</td>
<td>Yes</td>
<td>174 (49.7%) (44.5%, 54.9%)</td>
<td>&lt;0.001</td>
<td>1.88 (1.62, 2.16)</td>
<td>&lt;0.001</td>
<td>1.86 (1.58, 2.19)</td>
<td>&lt;0.001</td>
<td>1.78 (1.51, 2.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>300 (26.5%) (23.9%, 29.1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.78 (1.51, 2.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-reported STI diagnosis (past year)</td>
<td>Yes</td>
<td>190 (54.3%) (49.0%, 59.5%)</td>
<td>&lt;0.001</td>
<td>1.65 (1.45, 1.87)</td>
<td>&lt;0.001</td>
<td>1.54 (1.43, 1.78)</td>
<td>&lt;0.001</td>
<td>1.49 (1.29, 1.72)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>373 (32.9%) (30.2%, 35.7%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.49 (1.29, 1.72)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Five or more new sexual partners (past year)</td>
<td>Yes</td>
<td>282 (80.6%) (76.1%, 84.4%)</td>
<td>&lt;0.001</td>
<td>1.46 (1.35, 1.56)</td>
<td>&lt;0.001</td>
<td>1.40 (1.28, 1.52)</td>
<td>&lt;0.001</td>
<td>1.38 (1.27, 1.50)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>627 (55.3%) (52.3%, 58.1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.38 (1.27, 1.50)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group sex (past 3 months)</td>
<td>Yes</td>
<td>231 (66.0%) (60.8%, 70.8%)</td>
<td>&lt;0.001</td>
<td>2.53 (2.23, 2.86)</td>
<td>&lt;0.001</td>
<td>2.42 (2.10, 2.79)</td>
<td>&lt;0.001</td>
<td>2.43 (2.10, 2.80)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>296 (26.1%) (23.6%, 28.7%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.43 (2.10, 2.80)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Adjusted model (i) age (continuous variable), ethnicity (white or non-white), sexual identity (gay or bisexual/other), university education, ongoing relationship status and study region

** Adjusted model (j) age (continuous variable), ethnicity (white or non-white), sexual identity (gay or bisexual/other), university education, ongoing relationship status and study region, depressive symptoms (PHQ-9≥10) and higher risk drinking. Missing values included with no in variables for adjusted models.

(1)excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART

*p value by Wald test

CI confidence interval, PR prevalence ratio, CLS condomless sex, STI sexually transmitted infection, PEP post exposure prophylaxis
6.3.6.1 Poly drug use

Comparing MSM who reported poly drug use in the past three months with MSM who did not, there was a strong and significantly higher prevalence of all measures of sexual risk behaviour in the past three months after adjustment for (i) sociodemographic factors, and (ii) sociodemographic factors plus depressive symptoms and higher risk drinking, with the exception of receptive CLS with partners of unknown status which was only significant in the univariable analysis. The largest effect was seen in the sexual behaviour measure ‘group sex’, MSM who reported poly drug use were over two and a half times more likely to report group sex (PR 2.43 95%CI: 2.10, 2.80) than those who did not report polydrug use, after adjustment for sociodemographic factors, depressive symptoms and higher risk drinking. The prevalence of self-reported bacterial STI diagnoses was also significantly higher in MSM that reported poly drug use, who were nearly one and a half times more likely to report a bacterial STI in the previous three months (PR 1.49 95%CI: 1.29, 1.72) after adjustment for sociodemographic factors, depression and higher risk drinking, see Table 16.

Figure 15 shows the associations between poly drug use, with the eight sexual behaviour measures. The prevalence ratios are shown as (i) unadjusted, (ii) adjusted for sociodemographic factors (age group, ethnicity, education, sexual identity, relationship status and study region) and (iii) adjusted for sociodemographic factors plus depression and alcohol. The figure shows the strong associations of poly drug use with all sexual behaviour measures. There was little attenuation after adjustment for sociodemographic factors plus depressive symptoms and alcohol use.
**Figure 15 Associations of poly drug use with eight measures of sexual behaviour among MSM in the AURAH study**

<table>
<thead>
<tr>
<th>Measure</th>
<th>PR 95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any CLS (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=853; 57.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS with 2+ partners (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=430; 29.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS with unknown/HIV+ partner(s)* (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=474; 31.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any receptive CLS with unknown partner (past 3 months)</td>
<td>0.027</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>(n=187; 12.6%)</td>
<td>0.047</td>
<td></td>
</tr>
<tr>
<td>Bacterial STI diagnosis (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=441; 29.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=212; 14.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11+ new sexual partners (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=506; 34.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group sex (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=527; 35.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unadjusted model [N=1484]  
Age**, ethnicity**, sexuality**, education, relationship, & study region [N=1458]  
Same as above plus higher risk drinking and depressive symptoms (PHQ-9≥10) [N=1454]

*Excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART.

**The model was fitted to include continuous age and dichotomous ethnicity (white or non-white) and self-reported sexual identity (gay or bisexual/other).

### 6.3.6.2 Chemsex drug use

The results were similar for chemsex drug use. There was a significant association between all measures of sexual behaviour and chemsex drug use in the past 3 months. The largest effect was seen with PEP use (past year), with those that reported chemsex drug use being more than two and a half times more likely to report PEP use in the past year (PR 2.78 95%CI 2.16, 3.58), followed by group sex (PR 2.73, 95%CI: 2.41, 3.09). Unlike the poly drug...
use results, receptive CLS with unknown HIV status partner(s) was also strongly associated with chemsex in and multivariable analyses (after both adjustments), see Figure 16.

**Figure 16 Associations of chemsex drug use with eight measures of sexual behaviour among MSM in the AURAH study**

N=1484 MSM

<table>
<thead>
<tr>
<th>Chemsex drug use (past three months)</th>
<th>PR 95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any CLS (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=853; 57.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS with 2+ partners (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=430; 29.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS with unknown/HIV+ partner(s)*</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(past 3 months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=474; 31.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any receptive CLS with unknown</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>partner (past 3 months)</td>
<td></td>
<td>0.010</td>
</tr>
<tr>
<td>(n=187; 12.6%)</td>
<td></td>
<td>0.017</td>
</tr>
<tr>
<td>Bacterial STI diagnosis (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=441; 29.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=212; 14.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11+ new sexual partners (past year)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=506; 34.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group sex (past 3 months)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=527; 35.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unadjusted model [N=1484]
Age**, ethnicity**, sexuality**, education, relationship, & study region [N=1454]
Same as above plus higher risk drinking and depressive symptoms (PHQ-9≥10) [N=1454]

*Excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART.

**The model was fitted to include continuous age and dichotomous ethnicity (white or non-white) and self-reported sexual identity (gay or bisexual/other)
6.4 Key points

The overall response rate from the AURAH study was good (60.0%) although there was some variation in response rates from individual clinics, (ranging from 35% to 93%). Potential reasons for this variation could have been due to literacy levels and English fluency levels of people attending the clinics, and the perceived amount of time that the study questionnaire would take to complete, as well as whether the clinic staff had time to recruit on different days.

Results from this chapter demonstrated that over half (55.7%) of the HIV negative MSM attending sexual health services during the AURAH study period (2013/2014) had reported use of one or more recreational drug in the past three months. Nearly a quarter (23.6%) of these men reported poly drug use and over a fifth (21.8%) reported use of at least one chemsex drug. There was a striking association between both poly drug use and chemsex drug use and all measures of CLS, and these associations did not diminish when adjusted for sociodemographic factors (age, ethnicity, education, sexual identity, relationship status, study region), or additionally adjusted for alcohol use and symptoms of depression. It was notable that the association between poly drug use and chemsex drug use with sexual behaviour measures did not diminish after adjustment for sociodemographic factors plus alcohol and depressive symptoms, as both alcohol and depressive symptoms have been shown to be independently associated with measures of sexual behaviour (208, 275, 281, 282, 284). The results therefore emphasised the strength of the independent association that poly drug use and chemsex drug use had with measures of sexual behaviour despite the consideration of alcohol use and depressive symptoms.

Among MSM in the AURAH study, the most commonly used recreational drug was poppers (since made illegal by the Psychoactive Substance Act 2016 (285)). Overall 32.9% of MSM reported use of poppers within the past three months which was in line with findings from EMIS 2010, the online European-wide study of MSM in 2010, which reported that the UK had the second highest prevalence (29%) of popper use (in the four weeks preceding response) after the Netherlands (34%), and considerably greater than the overall prevalence of popper use among the whole study sample (19%) from 38 countries (232).

6.4.1 Strengths and limitations

To the best of my knowledge, at the time AURAH was conducted, it was the largest study of its kind to investigate recreational drug use among HIV negative or undiagnosed MSM attending sexual health clinics in the UK. The results therefore provided useful and up to date (published in 2017) information on emerging drug preferences among HIV negative MSM to shape relevant, targeted substance use interventions.
An obvious limitation of the study was that reporting the use of chemsex drug(s) did not necessarily equate to engagement in chemsex; for example mephedrone use may be associated with clubbing or other social activities, however, as the AURAH study questionnaire was designed before chemsex was widely researched, it was impossible to predict that it would have become a topic of such interest and that the measurement of it would be so critiqued (286), as such, the paper-based questionnaire was only designed to capture information on recreational drug use rather than event-level chemsex. As a result of the interest and lack of data on chemsex, I decided to edit the questions for the online phase of the AURAH2 study, to accurately capture event-level participation in chemsex. In addition, AURAH did not collect information on personality traits associated with sensation seeking and compulsivity, or on factors such as childhood sexual abuse and intimate partner violence, which may influence drug use and with sexual risk behaviour (287) (288).

Furthermore, although potential causal mechanisms between certain drugs and associations with HIV/STIs have been identified and detailed in Chapter 2 (Section 2.3.6, pg.41), causality could not be determined in this cross-sectional study and it was important to recognise that both recreational drug use and sexual risk behaviour may be part of pre-disposition to risk in general (41).

6.4.2 Conclusion and Recommendations
The results of this chapter demonstrated a high proportion of HIV negative MSM attending sexual health clinics reported recent recreational drug use, including chemsex drug use, which was strongly associated with sexual behaviours that potentiate HIV transmission. The results indicated a clear need for cross-agency collaboration to provide non-judgemental, tailored services that are accessible to HIV negative MSM through sexual health services. MSM, particularly in London, are reportedly well engaged with sexual health services (277), which place services in an opportune position to offer education, screening and interventions for different types of drug use.
Chapter 7: Results: A comparison of recreational drug use, poly drug use and chemsex drug use, and sexual behaviours among MSM at baseline from the AURAH2 study (2014/15) with MSM from the AURAH study (2013/14)

7.1 Introduction

In this chapter, I compare the cross-sectional data from the AURAH study (2013/2014) with the baseline questionnaire data collected in the AURAH2 study (2015/2016) to explore changes in individual recreational drugs, poly drug use and chemsex drug use, and measures of sexual behaviour among different MSM participants that attended the same three sexual health clinics that took part in both studies. As this is the first results chapter to present data from the AURAH2 study, I initially provide a description of the study response rates (for the baseline questionnaire) from the three clinics that participated in the AURAH2 study. Next, the sociodemographic and lifestyle characteristics of MSM that completed an AURAH2 study baseline questionnaire are described and compared to MSM from the AURAH study. Then the differences in prevalence of ten measures of sexual behaviour between the two studies are reported; the eight measures that were investigated in Chapter 6, plus two additional measures, PrEP use and recent HIV test. I included PrEP use in this analysis as the PROUD study (76) had recruited from all three of the sexual health clinics during the time that the AURAH2 study had recruited baseline participants from the same clinics and I was interested to examine whether PrEP use had increased among MSM in the three clinics between the AURAH and AURAH2 studies. I also included HIV testing in the analysis as Public Health England reported that HIV testing had increased from 83% in 2012 to 89% in 2016, among any MSM attending a sexual health centre at least once during a calendar year, and I was interested to see whether an increase would also be seen in the AURAH and AURAH2 study data (289). Next use of individual drugs, poly drug use, and chemsex drug use are compared between the two studies. Finally, the associations of poly drug use and chemsex drug use are examined with the ten measures of sexual behaviour.

Evidence from two sexual health clinics in London (56 Dean street and St. George’s courtyard clinic) had described a high prevalence in the number of chemsex presentations (MSM presenting for sexual health care as a result of chemsex) in 2013 and 2014 by MSM (132, 290), and this pattern had also been described outside of major UK cities (145). Public Health England’s 2015/2016 action plan (8) to promote the health and well-being of MSM and the UK government 2017 Drug Strategy (291) both targeted chemsex and aimed to reduce it; however, the evidence on prevalence of chemsex drug use remained limited to only a few studies of men attending individual sexual health clinics (with the exception of the
AURAH study results, published in May 2017), and there was no evidence which compared prevalence of poly drug use or chemsex drug use among sexual health clinic attendees over time. Therefore, I planned to use the two sets of cross-sectional data provided by the AURAH study (2013/14) and baseline data from the AURAH2 study (2015/16) to compare prevalence of poly drug use, chemsex drug use and sexual behaviours among MSM attending different sexual health clinics in two cities, London and Brighton, from the two different periods of time that data were collected.

7.2 Methods

7.2.1 Recreational drug use

Individual recreational drug use and the two types of drug use, poly and chemsex were derived from the questionnaires in the same way as described in Chapter 6, Section 6.2.1, pg.140, using the responses from question D8 in the AURAH study male questionnaire (Appendix I), ‘In the past 3 months, have you used recreational drugs (e.g. poppers, cannabis, cocaine)? with the option of ‘Yes’ or ‘No’, followed by ‘If YES, which drugs have you used’? (please tick more than one box if applicable), with the options of eighteen drugs and space for free text after the option of ‘other’.

Poly drug use was defined in the same way as in Chapter 6, the use of three or more drugs within the past three months. Chemsex drug use was also defined in the same way, the use of one or more of crystal methamphetamine, mephedrone, or GHB/GBL in the past three months.

7.2.2 Sexual behaviour measures

In this chapter, I used the same eight measures of sexual behaviour as described in Chapter 6 with an additional two measures, PrEP use (past year) and recent HIV testing (past three months). In total the ten measures of sexual behaviour and related activities included; four measures of condomless sex (CLS) in the past three months:

(i) Any CLS (past three months)
(ii) CLS with two or more partners (past three months)
(iii) CLS with partners of unknown or HIV positive partners (excluding long term HIV positive partners with whom they thought the risks of catching HIV were low because their partner was on ART) (past three months)
(iv) receptive CLS with an HIV unknown status partner (past three months)
(v) diagnosis with a bacterial STI (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum, (LGV)) (past year)
(vi) post-exposure prophylaxis (PEP) use (past year)
The first additional measure used the questions from F6 ‘Have you ever taken PrEP’ with the answer options of ‘Yes’ or ‘No’ followed by ‘If YES, approximately how many days did you take PrEP in the last year?’ with the options of ‘between 1 and 4 days,’ ‘between 5 and 19 days’, ‘20 to 50 days’, ‘more than 50 days’. The next additional measure used the question F3 ‘Have you ever had an HIV test before?’ with the option of ‘Yes’ or ‘No’ and ‘If YES, approximately when was your last HIV test?’ with the options of ‘within the last 6 months’ more than 6 months ago and up to 2 years ago,’ ‘more than 2 years ago and up to 5 years ago’, ‘more than 5 years ago’. The two additional measures were as follows;

(ix) PrEP use (past year)
(x) recent HIV test (past 6 months).

7.2.3 Statistical Analysis
Initially I compared the sociodemographic characteristics of the AURAH and AURAH2 study populations. To do this I used the number that reported the specific characteristics over the total for each study population and carried out unadjusted analysis using chi square tests. I used this same method to determine the prevalence of individual recreational drugs and the two measures of recreational drug use, poly and chemsex drug use. I assessed the prevalence of poly drug use, chemsex drug use and specific drug use between the two studies firstly without adjustment and then with adjustment for the same sociodemographic factors that were adjusted for in Chapter 6, age (continuous variable), ethnicity (white, non-white), university education (yes, no/missing), sexual identity (gay, bisexual, other), ongoing relationship (yes, no/missing). For this analysis I did not adjust for study region (as the three sites were the same in both studies). I conducted univariable analysis using Pearson Chi-squared tests and Fishers exact tests where appropriate, and multivariable analysis using modified Poisson regression with robust error variances to produce partially adjusted prevalence ratios (PR)(280). I then compared the prevalence of sexual behaviour measures between the two studies with and without adjustment for the same factors. I applied the models to subjects with no missing values for all the variables included in the model.

I conducted an additional analysis to assess the association of drug use measures, poly drug use and chemsex drug use, with the ten measures of sexual behaviour among a restricted sample of AURAH2 MSM that reported anal sex in the past three months to specifically compare those having condom protected sex to those having CLS and the associations with poly drug use and chemsex drug use. As per the adjustments in
multivariable analysis that I applied to the analysis in Chapter 6, I adjusted for the same factors (i) age (continuous variable)(decided a priori), ethnicity (white, non-white), university education (yes, no/missing), sexual identity (gay, bisexual, other), ongoing relationship (yes, no/missing) and (ii) age (continuous variable)(decided a priori), ethnicity (white, non-white), university education (yes, no/missing), sexual identity (gay, bisexual, other), ongoing relationship (yes, no/missing) plus, higher risk drinking (WHO audit score ≥6) and depressive symptoms (PHQ-9 ≥10).

7.3 Results
7.3.1 Baseline questionnaire response rates for the AURAH2 study
Across the three clinics, 1866 eligible MSM participants were invited to take part and of those 982 (52%) agreed to do so. Completed baseline paper questionnaires were obtained from 887 (90%) of those agreeing to participate between March 2015 and April 2016. A further 144 participants had been recruited from the three clinics between October 2014 and March 2015 (after the recruitment extension had been granted for the three sites that would participate in the AURAH2 study to continue recruiting until the AURAH2 study opened for recruitment in March 2015). Finally, 136 participants joined the AURAH2 study from the AURAH study (recruitment route 1, described in Chapter 4, Section 4.7, pg.83), providing a total of 1167 participants, of which 854 (73.2%) were recruited from 56 Dean Street clinic, London, 176 (15.1%) were recruited from Mortimer Market clinic, London, and 137 (11.7%) were recruited from the Claude Nicol Centre, Brighton. The overall response rate for AURAH2 was 52% which was slightly lower than the AURAH study (60%).

The 136 individuals who participated in both the AURAH and AURAH2 studies were excluded from the AURAH2 sample for the analyses in this chapter. Of the 1484 MSM who participated in the AURAH study, 991 were from the same three clinics that participated in the AURAH2 study and were included in the analysis.

7.3.2 Sociodemographic and lifestyle characteristics of MSM that completed a baseline questionnaire for the AURAH2 study compared to MSM in the AURAH study
In total 1031 MSM from the AURAH2 study were included in this analysis. In terms of sociodemographic characteristics, the median age of the AURAH2 participants was 31 years (Interquartile range: 26, 39) with nearly a quarter of MSM being younger than 25 (24.5%). This contrasted with the AURAH study in which a smaller proportion of MSM were under 25 (14.8%) and in fact age was the only significant difference between the participants in the two studies in terms of sociodemographic characteristics, see Table 17. The majority of MSM in the AURAH2 study self-reported white ethnicity (n=830, 80.5%) which was similar to the AURAH study (81%), 956 (92.7%) self-identified as gay in the AURAH2 study (compared
with 89.9% in the AURAH study) and most reported having enough money to meet basic needs (n=789 (76.6%)) which was also similar to the AURAH study (74.4%). In terms of education and employment, the majority of participants in both studies were educated to university degree level (AURAH2 74.6%, AURAH 71.3%) and were employed (AURAH2 82.6%, AURAH 80.2%).

MSM in the AURAH2 study were marginally less likely to report higher risk alcohol consumption (9.0%) compared to men in the AURAH study (12.2%) and were significantly more likely to report clinically significant symptoms of anxiety (11.4%) compared to men in the AURAH study (8.7%), however there was no significant difference in prevalence of clinically significant depressive symptoms between MSM in the two studies, see Table 17.

Table 17 Sociodemographic and lifestyle factors of MSM participants in the AURAH cross sectional study (2013/14) and at baseline in the AURAH2 study (2014/15)

<table>
<thead>
<tr>
<th>Category</th>
<th>Classification</th>
<th>AURAH (2013/14) N=991 MSM n (%) (95% CI)</th>
<th>AURAH2 Baseline data (2015/16) N=1031 MSM n (%) (95% CI)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td></td>
<td>147 (14.8%) (12.8%, 17.2%)</td>
<td>253 (24.8%) (22.0%, 27.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td>244 (24.6%) (22.0%, 27.4%)</td>
<td>183 (17.7%) (15.5%, 20.2%)</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td>197 (19.9%) (17.5%, 22.5%)</td>
<td>205 (19.9%) (17.5%, 22.4%)</td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td>128 (12.9%) (10.9%, 15.1%)</td>
<td>139 (13.5%) (11.5%, 15.7%)</td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td>103 (10.4%) (8.6%, 12.4%)</td>
<td>105 (10.1%) (8.4%, 12.1%)</td>
<td></td>
</tr>
<tr>
<td>45+ missing^</td>
<td></td>
<td>160 (16.2%) (13.9%, 18.6%)</td>
<td>139 (13.4) (11.5%, 15.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 (1.2%) (0.7%, 2.1%)</td>
<td>7 (0.7%) (0.3%, 1.4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Born in the UK and white ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.543</td>
</tr>
<tr>
<td>Yes, white</td>
<td></td>
<td>493 (49.8%) (46.6%, 52.8%)</td>
<td>494 (47.9%) (44.9%, 50.9%)</td>
<td></td>
</tr>
<tr>
<td>Yes, non-white</td>
<td></td>
<td>57 (5.7%) (4.4%, 7.4%)</td>
<td>55 (5.3%) (4.1%, 6.8%)</td>
<td></td>
</tr>
<tr>
<td>No, white</td>
<td></td>
<td>309 (31.2%) (28.4%, 38.1%)</td>
<td>336 (32.6%) (29.7%, 35.5%)</td>
<td></td>
</tr>
<tr>
<td>No, non-white missing</td>
<td></td>
<td>120 (12.1%) (10.2%, 14.3%)</td>
<td>139 (13.5%) (11.5%, 15.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 (1.2%) (0.7%, 2.1%)</td>
<td>7 (0.7%) (0.3%, 1.4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Self-reported sexuality</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Gay</td>
<td></td>
<td>891 (89.9%) (87.7%, 91.6%)</td>
<td>956 (92.7%) (90.9%, 94.1%)</td>
<td></td>
</tr>
<tr>
<td>Bisexual/other missing</td>
<td></td>
<td>97 (9.8%) (8.1%, 11.8%)</td>
<td>66 (6.4%) (5.1%, 8.1%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 (0.3%) (0.09%, 0.9%)</td>
<td>9 (0.9%) (0.4%, 1.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>Money to cover basic needs</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.432</td>
</tr>
<tr>
<td>All of the time</td>
<td></td>
<td>737 (74.4%) (71.5%, 76.9%)</td>
<td>789 (76.6%) (73.8%, 79.0%)</td>
<td></td>
</tr>
<tr>
<td>Most of the time</td>
<td></td>
<td>199 (20.1%) (17.7%, 22.7%)</td>
<td>180 (17.4) (15.3%, 19.9%)</td>
<td></td>
</tr>
<tr>
<td>Sometimes/no missing</td>
<td></td>
<td>53 (5.3%) (4.1%, 6.9%)</td>
<td>61 (5.9) (4.6%, 7.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (0.2%) (0.05%, 0.8%)</td>
<td>1 (0.1%) (0.01%, 0.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>University education</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.238</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>706 (71.3%) (68.3%, 73.9%)</td>
<td>769 (74.6%) (71.8%, 77.2%)</td>
<td></td>
</tr>
<tr>
<td>No missing</td>
<td></td>
<td>284 (28.6%) (25.9%, 31.5%)</td>
<td>261 (25.3%) (22.7%, 28.1%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (0.1%) (0.01%, 0.7%)</td>
<td>1 (0.1%) (0.01%, 0.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>Employed</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.293</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>795 (80.2%) (77.6%, 82.6%)</td>
<td>852 (82.6%) (80.2%, 84.8%)</td>
<td></td>
</tr>
<tr>
<td>No missing</td>
<td></td>
<td>184 (18.6%) (16.3%, 21.1%)</td>
<td>171 (16.6%) (14.4%, 18.9%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 (1.2%) (0.6%, 2.1%)</td>
<td>8 (0.8%) (0.3%, 1.5%)</td>
<td></td>
</tr>
<tr>
<td><strong>Housing status^</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.51</td>
</tr>
<tr>
<td>Home owner</td>
<td></td>
<td>284 (28.6%) (25.9%, 31.5%)</td>
<td>272(26.6%) (23.7%, 29.1%)</td>
<td></td>
</tr>
<tr>
<td>Renting</td>
<td></td>
<td>565 (57.0%) (53.9%, 60.1%)</td>
<td>610 (59.8%) (56.1%, 62.1%)</td>
<td></td>
</tr>
<tr>
<td>Unstable/other</td>
<td></td>
<td>128 (12.9%) (10.9%, 15.2%)</td>
<td>139 (13.6%) (11.5%, 15.7%)</td>
<td></td>
</tr>
</tbody>
</table>
7.3.3 Prevalence of sexual behaviours, PEP, PrEP and HIV testing among MSM in the AURAH study and at baseline in the AURAH2 study

Similar to the AURAH study, the majority of MSM (64.4%) reported any CLS within the past three months, with over a third (35.4%) reporting CLS with more than two partners. Only a minority of MSM (12.4%) reported receptive CLS with unknown HIV status partner(s) in the past three months. There had been an increase in both PEP use in the past year between the data collection periods (21.7% in AURAH2 (2015/16) vs 15.2% in AURAH (2013/14)) and PrEP use (5.5% in AURAH2 vs 3.8% in AURAH). In fact, all measures of sexual behaviour plus PEP and PrEP use, and HIV testing (in line with PHE data from the same time period (289)), had increased from the AURAH to the AURAH2 study in varying degrees (see Table 18). Figure 17 demonstrates the differences in prevalence of the 10 measures of sexual behaviour that were assessed in the AURAH and AURAH2 study.
Figure 17 A comparison of the 10 measures of sexual behaviour between MSM in the AURAH (2013/14) and at baseline in the AURAH2 study (2015/16)

CLS condomless sex, PEP post exposure prophylaxis, PrEP pre-exposure prophylaxis *excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART

Whilst Figure 17 shows the absolute differences in prevalence of sexual behaviour measures between the two studies, Table 18 provides the unadjusted and adjusted prevalence ratios, using the AURAH study as the reference group.
Table 18 Prevalence of 10 sexual behaviour measures among MSM in the AURAH study (2013/14) (n=991) and AURAH2 baseline data (2015/16) (n=1031) and association of these measures with the study.

<table>
<thead>
<tr>
<th>Measures of sexual behaviour</th>
<th>Study</th>
<th>Prevalence (n%) (95% CI)</th>
<th>Unadjusted PR (95%CI) AURAH2 vs AURAH*</th>
<th>p value~</th>
<th>Adjusted** PR (95%CI)</th>
<th>p value~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any CLS (past 3 months)</td>
<td>AURAH</td>
<td>558 (56.3%) (53.2%,59.4%)</td>
<td>1.14 (1.07, 1.23)</td>
<td>&lt;0.001</td>
<td>1.14 (1.05, 1.24)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>664 (64.4%) (61.4%, 67.3%)</td>
<td>1.22 (1.08, 1.39)</td>
<td>0.002</td>
<td>1.23 (1.05, 1.41)</td>
<td>0.008</td>
</tr>
<tr>
<td>CLS with two or more partners (past 3 months)</td>
<td>AURAH</td>
<td>286 (28.8%) (26.1%, 31.8%)</td>
<td>1.00 (0.88, 1.44)</td>
<td>0.944</td>
<td>0.99 (0.85, 1.14)</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>365 (35.4%) (32.5%, 38.4%)</td>
<td>1.06 (0.84, 1.34)</td>
<td>0.624</td>
<td>0.98 (0.75, 1.28)</td>
<td>0.901</td>
</tr>
<tr>
<td>CLS with unknown/HIV-diagnosed partner(s)³ (past 3 months)</td>
<td>AURAH</td>
<td>310 (31.3%) (28.4%, 34.2%)</td>
<td>1.00 (0.88, 1.44)</td>
<td>0.944</td>
<td>0.99 (0.85, 1.14)</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>324 (31.4%) (28.7%, 34.3%)</td>
<td>1.06 (0.84, 1.34)</td>
<td>0.624</td>
<td>0.98 (0.75, 1.28)</td>
<td>0.901</td>
</tr>
<tr>
<td>Receptive CLS with unknown HIV status partner(s) (past 3 months)</td>
<td>AURAH</td>
<td>116 (11.7%) (9.8%, 13.8%)</td>
<td>1.00 (0.88, 1.44)</td>
<td>0.944</td>
<td>0.99 (0.85, 1.14)</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>128 (12.4%) (10.5%, 14.6%)</td>
<td>1.06 (0.84, 1.34)</td>
<td>0.624</td>
<td>0.98 (0.75, 1.28)</td>
<td>0.901</td>
</tr>
<tr>
<td>Self-reported bacterial STI diagnosis (past year)</td>
<td>AURAH</td>
<td>303 (30.5%) (27.8%, 33.5%)</td>
<td>1.30 (1.16, 1.48)</td>
<td>&lt;0.001</td>
<td>1.24 (1.08, 1.43)</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>411 (39.9%) (36.9%, 42.9%)</td>
<td>1.30 (1.16, 1.48)</td>
<td>&lt;0.001</td>
<td>1.24 (1.08, 1.43)</td>
<td>0.002</td>
</tr>
<tr>
<td>Eleven or more new sexual partners (past year)</td>
<td>AURAH</td>
<td>374 (37.7%) (34.8%, 40.1%)</td>
<td>1.07 (0.97, 1.20)</td>
<td>0.168</td>
<td>1.12 (0.98, 1.25)</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>420 (40.7%) (37.8%, 43.7%)</td>
<td>1.07 (0.97, 1.20)</td>
<td>0.168</td>
<td>1.12 (0.98, 1.25)</td>
<td>0.09</td>
</tr>
<tr>
<td>Group sex (past 3 months)</td>
<td>AURAH</td>
<td>388 (39.1%) (36.2%, 42.2%)</td>
<td>1.10 (0.99, 1.22)</td>
<td>0.07</td>
<td>1.10 (0.97, 1.24)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>438 (42.5%) (39.5%, 45.5%)</td>
<td>1.10 (0.99, 1.22)</td>
<td>0.07</td>
<td>1.10 (0.97, 1.24)</td>
<td>0.08</td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td>AURAH</td>
<td>151 (15.2%) (13.1%, 17.6%)</td>
<td>1.43 (1.18, 1.72)</td>
<td>&lt;0.001</td>
<td>1.50 (1.21, 1.88)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>224 (21.7%) (19.3%, 24.4%)</td>
<td>1.43 (1.18, 1.72)</td>
<td>&lt;0.001</td>
<td>1.50 (1.21, 1.88)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PrEP use (past year)</td>
<td>AURAH</td>
<td>38 (3.8%) (2.5%, 4.5%)</td>
<td>1.44 (0.96, 2.15)</td>
<td>0.074</td>
<td>1.31 (0.70, 1.82)</td>
<td>0.611</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>57 (5.5%) (4.3%, 7.1%)</td>
<td>1.44 (0.96, 2.15)</td>
<td>0.074</td>
<td>1.31 (0.70, 1.82)</td>
<td>0.611</td>
</tr>
<tr>
<td>Recent HIV test (past 6 months)</td>
<td>AURAH</td>
<td>631 (63.8%) (60.7%, 66.7%)</td>
<td>1.15</td>
<td>&lt;0.001</td>
<td>1.14</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Measures of sexual behaviour</td>
<td>Study</td>
<td>Prevalence (n%) (95% CI)</td>
<td>Unadjusted PR (95%CI) AURAH2 vs AURAH*</td>
<td>p value~</td>
<td>Adjusted** PR (95%CI)</td>
<td>p value~</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
<td>--------------------------</td>
<td>----------------------------------------</td>
<td>---------</td>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>AURAH2</td>
<td>757 (73.4%) (70.6%, 76.0%)</td>
<td>(1.09, 1.22)</td>
<td></td>
<td>(1.07, 1.21)</td>
<td></td>
</tr>
</tbody>
</table>

*AURAH is the reference group. **Adjusted model for age (continuous variable), ethnicity, sexual identity, university education, ongoing relationship status. missing values included with no in variables for adjusted models ~p values by Wald test. PR, prevalence ratio. CI, confidence interval. CLS, condomless sex; PEP, post-exposure prophylaxis, PrEP, pre-exposure prophylaxis* Excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART.
Of the ten sexual behaviour measures assessed, the results show that although the majority of measures had significantly increased from the AURAH to the AURAH2 study (any CLS, CLS 2+ partners, STI, PEP, PrEP, HIV testing), others had not (CLS with unknown/HIV+ status partner(s) and receptive CLS with unknown HIV status partner(s)) which were a very similar prevalence in both studies, see Figure 17.

The largest differences among the ten measures of sexual behaviour between the AURAH and AURAH2 study was in PEP use (past year), which had increased by 50% (PR 1.50, 95% CI 1.21 to 1.88), and the number of self-reported bacterial STI diagnoses (past year), which had increased by a quarter (PR 1.24, 95% CI 1.08 to 1.43) after adjustment for sociodemographic factors. Another notable increase was in the proportion of men who had recently tested for HIV in the AURAH2 study, which also remained significant after adjustment for study and sociodemographic factors (PR 1.14, 95% CI 1.07 to 1.21).

7.3.3.1 STI diagnoses among MSM in the AURAH2 study

This section details the STI diagnoses as self-reported by the MSM in the study. Of the 1031 MSM in AURAH2, 474 (45.9%) reported an STI in the past year, of which 411 (39.9%) were bacterial STIs. Similarly to the prevalence of individual STIs in the AURAH study (Chapter 6, Section 6.3.3.2, pg.146) among all MSM in AURAH2, the most common STI reported in the previous year at baseline was gonorrhoea (31.7%, n=327) followed by chlamydia (19.6%, n=202), however in AURAH2 syphilis was the third most common reported STI (6.3%, n=65). The least common STIs were new Hepatitis C (0.1% n=1) and trichomonas, (0.1% n=1). Table 19 shows the complete list of STIs in order of the most common, that were reported in the study.
Table 19 Prevalence of STIs among MSM at entry into the AURAH2 study in the past year

<table>
<thead>
<tr>
<th>Sexually Transmitted Infection(s)</th>
<th>All MSM (n=1031)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence n (%) (95% CI)</td>
</tr>
<tr>
<td>Self-reported STI (past year)</td>
<td>474 (45.9%) (42.9%, 49.0%)</td>
</tr>
<tr>
<td>Self-reported bacterial* STI (past year)</td>
<td>411 (39.9%) (36.9%, 42.9%)</td>
</tr>
<tr>
<td>Gonorrhoea</td>
<td>327 (31.7%) (28.9%, 34.6%)</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>202 (19.6%) (17.2%, 22.1%)</td>
</tr>
<tr>
<td>Syphilis</td>
<td>65 (6.3%) (4.9%, 7.9%)</td>
</tr>
<tr>
<td>Genital warts (new or recurrent)</td>
<td>55 (5.3%) (4.1%, 6.8%)</td>
</tr>
<tr>
<td>NSU/NGU</td>
<td>43 (4.1%) (3.1%, 5.6%)</td>
</tr>
<tr>
<td>Herpes (new or recurrent)</td>
<td>32 (3.1%) (2.2%, 4.3%)</td>
</tr>
<tr>
<td>LGV</td>
<td>4 (0.4%) (0.01%, 1.0%)</td>
</tr>
<tr>
<td>Hep B (new)</td>
<td>4 (0.4%) (0.01%, 1.0%)</td>
</tr>
<tr>
<td>Hep C (new)</td>
<td>1 (0.1%) (0.001%, 0.6%)</td>
</tr>
<tr>
<td>Trichomonas</td>
<td>1 (0.1%) (0.001%, 0.6%)</td>
</tr>
</tbody>
</table>

STI sexually transmitted infection, NSU non-specific urethritis, NGU non gonococcal urethritis, LGV lymphogranuloma venereum *bacterial STI-Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV)

The majority of MSM (54.0%, n=557) did not report an STI in the past year. However, of those that did, 25.5% reported one STI and 13.6% reported two. Only a small minority of MSM reported three STIs in the past year (4.4%), and this diminished for four (0.9%), five (0.2%) and six (0.3%) STIs in the past year, see Figure 18.

Figure 18 Number of STIs reported by MSM at baseline in the AURAH2 study (n=1031) past year

STI sexually transmitted infection.
Prevalence of recreational drug use among MSM in the AURAH2 study (2015/16) compared with MSM in the AURAH study (2013/14)

Overall, a large proportion of MSM at entry into the AURAH2 study reported use of one or more recreational drug(s) in the past 3 months (60.4%) which was marginally higher than that reported by MSM attending the same three sexual health clinics in the AURAH study (57.4%). Figure 19 demonstrates the prevalence of poly drug use, chemsex drug use and individual drug use in the two studies. There was an increase in polydrug use from the AURAH to AURAH2 study (PR 1.19, 95% CI 1.04 to 1.37, P=0.01); however, after adjustment for sociodemographic factors, the increase did not persist (PR 1.16, 95% CI 0.99 to 1.37, p=0.07), potentially due to the younger age, as this was the only significant difference in sociodemographic factors between the two studies. However, chemsex drug use had significantly increased by nearly a third from AURAH to AURAH2 (AURAH 24.2%, AURAH2 32.3%) and this increase remained significant after adjustment for sociodemographic factors (PR 1.30, 95% CI 1.11 to 1.53, P=0.002).

Across both studies, the most commonly used drug was nitrites (AURAH 35.2%, AURAH2 36.3%), but in AURAH2 use of mephedrone had significantly increased (AURAH 20.9%, AURAH2 28.8%) and was more commonly reported than cocaine and cannabis (in contrast to the AURAH study). The prevalence of cocaine use (AURAH 21.5%, AURAH2 23.9%), cannabis (AURAH 20.9%, AURAH2 20.1%) and MDMA (AURAH 14.1%, AURAH2 14.5%) was similar between the two studies, see Figure 19. The prevalence of injecting drug use had not significantly increased between the two studies (AURAH 2.4%, AURAH2 3.3%) (p=0.243) (not shown).

In terms of individual drugs, the most significant increase in chemsex drugs was seen in GHB/GBL which had increased by nearly half from the AURAH to AURAH2 (13.1% vs 19.8%) study after adjustment for sociodemographic factors (PR 1.47, 95%CI 1.15, 1.87) and crystal methamphetamine which had increased by over 40% (PR 1.42, 95%CI 1.01, 2.01). Looking at other drugs there was a large increase in the use of steroids from AURAH to AURAH2, although the absolute numbers reporting use of steroids were small. Notable due to its significant decrease from AURAH to AURAH2 study was the use of ketamine, which had decreased by nearly half (9.7% vs 6.1%) (PR 0.54, 95%CI 0.38, 0.78). Figure 19 shows the proportion of MSM reporting polydrug use, chemsex drug use, and individual drugs used in the AURAH and AURAH2 study.
Figure 19: Prevalence of poly drug use, chemsex drug use and individual drug use among MSM in the AURAH (2013/14) and AURAH2 (2015/16) studies

<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Percentage Reporting</th>
<th>Unadjusted PR (95% CI)</th>
<th>p value*</th>
<th>Adjusted PR** (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polydrug use (use of 3+ drugs)</td>
<td>25.7%</td>
<td>1.19 (1.04, 1.37)</td>
<td>0.01</td>
<td>1.16 (0.99, 1.37)</td>
<td>0.07</td>
</tr>
<tr>
<td>Chemsex drug use (use of mephedrone/GHB/GBL)</td>
<td>24.2%</td>
<td>1.32 (1.15, 1.53)</td>
<td>&lt;0.001</td>
<td>1.30 (1.11, 1.53)</td>
<td>0.002</td>
</tr>
<tr>
<td>Nitrites (poppers)</td>
<td>20.9%</td>
<td>1.03 (0.92, 1.16)</td>
<td>0.62</td>
<td>1.00 (0.87, 1.14)</td>
<td>0.93</td>
</tr>
<tr>
<td>Mephedrone</td>
<td>17.1%</td>
<td>1.37 (1.17, 1.60)</td>
<td>&lt;0.001</td>
<td>1.31 (1.10, 1.57)</td>
<td>0.002</td>
</tr>
<tr>
<td>Erectile dysfunction drugs</td>
<td>21.5%</td>
<td>1.26 (1.06, 1.49)</td>
<td>0.008</td>
<td>1.36 (1.12, 1.65)</td>
<td>0.002</td>
</tr>
<tr>
<td>Cocaine</td>
<td>17.1%</td>
<td>1.11 (0.94, 1.30)</td>
<td>0.20</td>
<td>1.02 (0.85, 1.23)</td>
<td>0.81</td>
</tr>
<tr>
<td>Cannabis</td>
<td>13.1%</td>
<td>0.98 (0.83, 1.17)</td>
<td>0.89</td>
<td>0.97 (0.79, 1.18)</td>
<td>0.78</td>
</tr>
<tr>
<td>GHB/GBL</td>
<td>13.1%</td>
<td>1.51 (1.23, 1.84)</td>
<td>&lt;0.001</td>
<td>1.47 (1.15, 1.87)</td>
<td>0.02</td>
</tr>
<tr>
<td>Ecstasy (MDMA)</td>
<td>14.1%</td>
<td>1.022 (0.82, 1.26)</td>
<td>0.84</td>
<td>0.96 (0.75, 1.22)</td>
<td>0.74</td>
</tr>
<tr>
<td>Crystal methamphetamine</td>
<td>6.6%</td>
<td>1.47 (1.09, 1.98)</td>
<td>0.01</td>
<td>1.42 (1.01, 2.01)</td>
<td>0.04</td>
</tr>
<tr>
<td>Ketamine</td>
<td>6.1%</td>
<td>0.63 (0.46, 0.86)</td>
<td>0.003</td>
<td>0.54 (0.38, 0.78)</td>
<td>0.001</td>
</tr>
<tr>
<td>Amphetamine</td>
<td>2.7%</td>
<td>1.28 (0.78, 2.01)</td>
<td>0.32</td>
<td>1.16 (0.66, 2.04)</td>
<td>0.61</td>
</tr>
<tr>
<td>Steroids</td>
<td>1.1%</td>
<td>2.27 (1.13, 4.45)</td>
<td>0.01</td>
<td>2.54 (1.16, 5.57)</td>
<td>0.02</td>
</tr>
<tr>
<td>Other (heroin, c.cocaine, opium, morphine, khat, codeine, acid)</td>
<td>4.9%</td>
<td>0.92 (0.61, 1.36)</td>
<td>0.68</td>
<td>1.01 (0.64, 1.61)</td>
<td>0.96</td>
</tr>
</tbody>
</table>

*p value from Chi-square
**Adjusted model: age (continuous variable), ethnicity, sexual identity, university education, ongoing relationship status
7.3.5 *Recreational drug use and measures of sexual behaviour among MSM in the AURAH2 study*

After restricting the AURAH2 baseline sample of MSM to those who had reported anal sex within the past three months (n=949), I examined whether poly drug use and chemsex were associated with the ten measures of sexual behaviour, as results from the AURAH study (Chapter 6) had demonstrated a strong association between sexual behaviour measures and both poly drug use and chemsex drug use. Similar to the results from Chapter 6, the only measure of sexual behaviour not associated with poly drug use or chemsex drug use was receptive CLS with unknown status partner. See Table 20.
Table 20 Associations of poly drug use and chemsex drug use with ten measures of sexual behaviour among MSM in the AURAH2 study who reported anal sex within the past three months at baseline (n=949)

<table>
<thead>
<tr>
<th>Measures of sexual behaviour</th>
<th>Poly drug use (past 3 months)</th>
<th>Chemsex drug use (past 3 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted PR (95%CI)</td>
<td>Adjusted (i) PR (95%CI)</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>p value</td>
</tr>
<tr>
<td>Any CLS (past 3 months)</td>
<td>1.30 (1.20, 1.40) ≤0.001</td>
<td>1.31 (1.21, 1.42) ≤0.001</td>
</tr>
<tr>
<td>CLS with two or more partners (past 3 months)</td>
<td>1.91 (1.64, 2.24) ≤0.001</td>
<td>1.93 (1.65, 2.25) ≤0.001</td>
</tr>
<tr>
<td>CLS with unknown/HIV-diagnosed partner a (past 3 months)</td>
<td>1.71 (1.44, 2.03) ≤0.001</td>
<td>1.69 (1.43, 2.02) ≤0.001</td>
</tr>
<tr>
<td>Receptive CLS with partner unknown HIV status (past 3 months)</td>
<td>1.37 (0.98, 1.89) 0.062</td>
<td>1.34 (0.97, 1.87) 0.07</td>
</tr>
<tr>
<td>Bacterial STI diagnosis (past year)</td>
<td>1.65 (1.43, 1.91) ≤0.001</td>
<td>1.66 (1.44, 1.91) ≤0.001</td>
</tr>
<tr>
<td>Eleven or more new sexual partners (past year)</td>
<td>1.64 (1.43, 1.89) ≤0.001</td>
<td>1.62 (1.41, 1.86) ≤0.001</td>
</tr>
<tr>
<td>Group sex (past 3 months)</td>
<td>2.41 (2.11, 2.75) ≤0.001</td>
<td>2.38 (2.08, 2.72) ≤0.001</td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td>2.16 (1.72, 2.71) ≤0.001</td>
<td>2.15 (1.71, 2.71) ≤0.001</td>
</tr>
<tr>
<td>PrEP use (past year)</td>
<td>2.46 (1.49, 4.01) ≤0.001</td>
<td>2.54 (1.54, 4.19) ≤0.001</td>
</tr>
<tr>
<td>Recent HIV test (past 6 months)</td>
<td>1.16 (1.08, 1.25) ≤0.001</td>
<td>1.16 (1.08, 1.25) ≤0.001</td>
</tr>
</tbody>
</table>

Adjusted model (i) age (continuous variable), ethnicity, sexual identity, university education, ongoing relationship status. Adjusted model (ii) age (continuous variable), ethnicity, sexual identity, university education, ongoing relationship status, higher-risk drinking, depressive symptoms (PHQ-9 ≥10) (missing values included in variables for adjusted models). *p values by Wald test. Excludes men who reported one HIV positive long-term CLS partner with whom they thought the risks were low because their partner was taking ART; CI confidence interval, PR prevalence ratio, CLS, condomless sex; PEP, post-exposure prophylaxis; PrEP, pre-exposure prophylaxis.
7.4 Key points

The response rate for the AURAH2 study was reasonable, just over 50%, but less than the AURAH study, potentially because participants were reluctant to provide contact information or did not want to commit to participating in an online study over a three-year period.

Results from this chapter demonstrated a high (60.4%) prevalence of recreational drug use reported by MSM that participated in the AURAH2 study in 2015/16, and a high rate of poly drug use (30.7%) and chemsex drug use (32.3%) which had significantly increased since the AURAH study which took place in the same three sexual health clinics in 2013/14 (poly drug use 23.6% and chemsex drug use 21.8%). There had been a striking increase in chemsex drug use between the two time periods, mainly driven by the substantial increase in use of two of the chemsex drugs, mephedrone and GHB/GBL. There had also been increases in the majority of the ten measures of sexual behaviour assessed, including CLS, PEP, and HIV testing, in line with increasing ever and repeat HIV testing in MSM in the UK over the same time period (292).

Whilst Poppers remained the most commonly used (36.3%) recreational drug in the past three months among MSM at baseline in the AURAH2 study, compared to the AURAH study, mephedrone use had increased in popularity over cocaine and cannabis use, as had erectile dysfunction drugs that are often used in chemsex.

7.4.1 Strengths and Limitations

The AURAH and AURAH2 studies are two of the largest studies from the UK to have investigated and compared prevalence of recreational drug use including chemsex drug use and measures of sexual behaviour, among HIV-negative MSM attending the same three sexual health clinics across two different time periods. However, I recognise that the different proportions in non-response between the AURAH and AURAH2 study could have biased the comparison, and unfortunately data were not collected on the characteristics of non-responders to assess this. In line with the previous chapter, it was important to consider that the reporting of chemsex drug use did not necessarily equate to use of drugs during sex and information was not collected on whether these drugs were used before or during sex. However, previous data have shown that 75% of mephedrone and 85% of GHB/GBL users said they used the drugs solely to facilitate sex (7), although the use of drugs outside of a sexual setting, such as in a social or clubbing environment, was also important to consider.

Additionally, the results from the AURAH and AURAH2 studies may not have been directly generalisable to the broader MSM population due to the sample of men being solely from sexual health clinics in London and Brighton, which have large gay communities, and may
not reflect behaviour and lifestyle choices of clinic attendees in other regions of England or outside metropolitan centres.

7.4.2 Conclusion and Recommendations

A high number of MSM reported polydrug use and chemsex drug use in the AURAH cross sectional study (2013/14) and at baseline entry into the AURAH2 study (2015/16). Additionally MSM also reported high proportions of PEP use, STI infection and clinically significant depression and anxiety symptoms, which highlight the complex needs of this population and support the view that sexual health services need to provide holistic clinical assessment and care, including drug services, to improve health and well-being in an acceptable environment for MSM (293, 294). The results of the cross-sectional comparison between two time points in this chapter indicated significant increases in chemsex drug use, individual drugs and some measures of sexual behaviour, however longitudinal analysis in which individual men are followed over time was needed to contextualise this data and to explore patterns and trends among individuals over time. However, the results indicated a clear need for investment to adequately resource and support sexual health clinics to collaborate with specialised drug services, to provide appropriate care that encompasses recreational drug use as well as sexual health.
Chapter 8: Results: Changes in chemsex and sexual behaviour over time (2015-2018), among MSM in the AURAH2 study

8.1 Introduction

In this chapter I used the longitudinal online data from the AURAH2 study to describe changes in chemsex, use of individual chemsex drugs, frequency of chemsex, and changes in sexual behaviour measures, among the cohort of MSM enrolled in the AURAH2 study over the three-year online follow-up period from March 2015 to March 2018. As this is the first results chapter to utilise the online follow-up data, I first describe the retention rate of the baseline AURAH2 study participants who went on to complete online questionnaires, before detailing online retention and engagement during the full three-year follow-up period. Initially I examine the differences between participants who did and did not join the online follow-up phase of the study, then detail the pattern of prevalence of chemsex and individual chemsex drugs over the duration of online follow-up, before describing the frequency of chemsex as self-reported by the online participants. Next, I describe the prevalence pattern of seven measures of sexual behaviour during online follow-up. Finally, I investigate whether results were affected by lost to follow-up over time (in the study) and whether lost to follow-up was associated with chemsex.

In 2018, there was evidence from cross-sectional studies, including the published results of my paper outlined in Chapter 7 (2), that indicated chemsex among MSM in the UK and Europe had increased in the years preceding and during the follow-up phase of the AURAH2 study (March 2015- March 2018) (2, 5, 136, 295-297). One of the largest studies to report a high prevalence estimate of chemsex among UK MSM was a European wide internet-based survey of over 50,000 MSM conducted in 2010, the European Men-Who-Have Sex-With-Men Internet Survey (EMIS) (231). EMIS 2010 reported that, out of forty-four cities across Europe, the use of four chemsex drugs (GHB/GBL, ketamine, crystal meth, or mephedrone) was highest in Brighton (16.3%), Manchester (15.5%) and London (13.2%) (136). However, data remained limited to cross-sectional studies, and was difficult to compare due to differing recall periods for chemsex, a consensus on chemsex definition, and the assumption that chemsex-related drug use was a perfect proxy measure for surveillance (31). Furthermore, whilst cross-sectional data can provide a snap shot of prevalence at a certain point in time, it cannot describe patterns or changes in chemsex among individuals over time. There was no longitudinal data from the UK or Europe to contextualise the cross-sectional data or to detect changes in frequency of chemsex at an individual level over time. Whilst mounting evidence demonstrated the strong associations between chemsex and measures of sexual risk behaviour (3, 61, 143), there was no data that placed chemsex in the context of sexual
behaviour patterns using the same recall period for both chemsex and measures of sexual behaviour.

8.2 Methods

8.2.1 Chemsex

This chapter used the responses collected from the four monthly online follow-up questionnaires and annual questionnaires in AURAH2 (see Appendix VI and Appendix VII), in which participants were asked to self-report whether they had had ‘used drugs before or during sex (chemsex)’ in the last three months, with the option of selecting ‘Yes’ or ‘No’. As described in Chapter 4, the adaptive functionality of the online questionnaires meant that only participants who answered ‘Yes’ to the question on chemsex (reported above) were directed to the next two questions, which were: ‘select which chemsex drugs from the following list: mephedrone, GHB/GBL, crystal methamphetamine, other (with space for free text)’ and ‘Approximately how often did you have chemsex in the last 3 months?’ with the answer options of, ‘Once’, ‘Monthly’ or ‘Weekly’.

8.2.2 Sexual behaviour measures

For this chapter I used seven measures of sexual behaviour all of which were captured in the four monthly online questionnaires as well as the annual questionnaires. All measures of sexual behaviour had the same recall period (three months) as the questions on chemsex. I did not include measures of PEP and PrEP use in this analysis as this information was not captured in the online four monthly questionnaires. Five of the measures of sexual risk behaviour were specifically around sexual activity; participants were asked, ‘Have you had anal sex with a man in the past 3 months? with the answer options of ‘Yes’ or ‘No’ (if the answer was ‘No’ then the questionnaire automatically skipped to the next section). If the participants answered ‘Yes’, participants were asked, ‘In the past 3 months how many men did you have anal sex with, without a condom?’ with the answer options of ‘None’ (in which case they were skipped to the next section), ‘One’, ‘2 to 4’, ‘5 to 10’, ‘11 to 49’, ‘More than 50’. Participants were then asked, ‘In the past 3 months when you had anal sex without a condom, did you know the HIV status of your partner(s)?’ with the answer options of ‘No, I did not know the status of any of my partners’ (in which case they skipped the next question), ‘Yes, I knew the status of some of my partners’, ‘Yes, I knew the status of all of my partners’. If participants had answered ‘Yes’ they were then asked, ‘In the past 3 months did you have anal sex without a condom with any men you knew were HIV positive?’ with the answer options of ‘Yes’, ‘No’, ‘Don’t know’, if a participant answered ‘Yes’, they were asked, ‘Were they on antiretroviral treatment?’ with the answer options of, ‘Yes, all of them’, ‘Yes, some of them’ and ‘No, none of them’. Participants were also asked, ‘In the past 3 months
have you had group sex (i.e. sex involving more than two people)?’ with the answer options of ‘Yes’ or ‘No’, if a participant answered ‘Yes’ they were asked ‘Last time you had group sex how many men were in the group?’ with the answer options of ‘3’, ‘4 to 5’, ‘6 to 10’, ‘More than 10’. From these questions I derived the following measures, all with a three month recall period;

(i) any anal sex  
(ii) any CLS  
(iii) CLS with two or more partners  
(iv) CLS with partners of unknown HIV status or HIV-diagnosed partners (excluding long-term HIV-diagnosed partners on treatment)  
(v) Group sex

I also used two further measures, also related to sexual behaviour, both with the same recall period of past three months and both collected at the online four monthly questionnaires. The first was derived from the question, ‘In the past 3 months have you been diagnosed with a sexually transmitted infection (STI)? With the answer option of ‘Yes’ or ‘No’, if a participant selected ‘Yes’ they were asked to select the STI(s) from the same list of STIs collected in the baseline questionnaire. The second additional measure was derived from the question, ‘Approximately when was your last HIV test’ with the option for the participant to select a date from the drop-down menu or to select the answer, ‘I have never tested for HIV before’.

(vi) diagnosis with a bacterial STI (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV))  
(vii) recent HIV test

8.2.3 Statistical analysis

Initially, in descriptive analyses, I carried out unadjusted analysis using chi square tests using data from the baseline questionnaire, to compare participants who only completed the baseline questionnaires against those who went on to complete online questionnaires. I examined any differences in sociodemographic characteristics, sexual behaviour or recreational drug use among MSM in the two groups.

For the next analysis, I used data from all MSM who completed an online questionnaire, using pooled data from all the online follow-up questionnaires; therefore multiple responses from individuals were included. The reasons for using the pooled online data for the longitudinal analyses, as opposed to the online data plus the baseline questionnaire data, were twofold. Firstly, a significant period of time had elapsed between the first round of data
collection in the AURAH study and the first set of online data subsequently collected by the AURAH2 study (maximum 21 months), and this lapse varied among individuals. Secondly, the baseline questionnaire used in the AURAH2 study asked participants to report on whether they had used recreational drugs in the last three months (and to select which ones from a list of eighteen which then allocated them to ‘chemsex drug use’ if they reported use of either mephedrone, GHB/GBL or crystal methamphetamine), but it did not specifically ask about chemsex at event-level, that is, whether chemsex drugs were used shortly before or during sex, it, which the online follow-up questionnaires did. Therefore, only data from the online follow-up questionnaires were used in an attempt to gain as accurate as possible reflection of prevalence patterns of event-level chemsex within the cohort. A footnote for each table details which questionnaires were used in the analysis presented (unless stated in the title). Using the pooled online data, I examined the associations of sociodemographic, lifestyle characteristics, PEP, PrEP, HIV status and time in the study with chemsex (binary dependent variable) using generalized estimating equations (GEE) Poisson model with robust variance estimation, with an exchangeable covariance matrix to produce prevalence ratios (PR). In these and subsequent analyses, baseline values of sociodemographic variables were used, as they were not collected subsequently in the follow-up questionnaires. For all other variables, information from the online follow-up questionnaires were used.

Next I carried out multivariable analysis, using pooled data from all the follow-up questionnaires, to assess the association between chemsex (binary, dependent variable) and the three individual chemsex drugs (mephedrone, GHB/GBL, crystal methamphetamine, each considered as binary), with time in the study. I adjusted for the same sociodemographic factors (all from baseline questionnaire data), that had been used in previous chapters and which could not be influenced by chemsex: age group (time-updated) (<25, 25–29, 30–34, 35-39, 40-44, ≥45 years), ethnicity (white UK born, non-white UK born, white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual/other), university education (yes or no/missing). I also adjusted for study site (56 Dean Street, Mortimer Market clinic and the Claud Nicole clinic) as I considered there to be some differences in service provision specifically relating to chemsex between the sites (of note 56 Dean street was one of the first clinics in the UK to offer a specific service for MSM engaging in chemsex which may have encouraged more MSM reporting chemsex to use the clinic).

To examine changes over time in chemsex and individual chemsex drugs, I considered the proportion of those who reported chemsex at each four monthly follow-up questionnaire, using the total number of questionnaires as the denominator. I also used this method to investigate frequency (no chemsex, once, monthly, weekly) of chemsex in the past three
months. Generalized estimating equations (GEE) Poisson model with robust variance estimation was used to see if the changes in chemsex and individual chemsex drugs over the follow-up period were statistically significant. This method was also used to investigate changes in the seven measures of sexual behaviour over time.

Finally, to better understand whether results were affected by lost to follow-up over time, I conducted a sensitivity analysis, and two additional analyses to aid interpretation of the primary analysis. The sensitivity analysis included only MSM who completed a questionnaire within the final six months of the study follow-up period (defined as being engaged in the study). The additional analyses investigated whether participating in chemsex predicted being lost to follow-up. In order to do this, I created two variables, ‘lost to follow-up’ defined as stopped completing online questionnaires and did not resume, and ‘missed the next questionnaire’, defined as missing the next questionnaire (but answered a subsequent one). The GEE Poisson model used in the main analysis was utilised to explore whether chemsex (time-updated) predicted being ‘lost to follow-up’ or ‘missed the next questionnaire’. Then for the next additional analysis, I carried forward the last observation for the chemsex variable in instances where online questionnaires were missing and then used the same adjustment and Poisson model as in the main analysis.

8.3 Results

8.3.1 AURAH2 baseline to online follow-up retention

In total 1167 MSM completed the AURAH2 study baseline questionnaire in clinic, and an additional seven completed and participated in the follow-up phase of the study however baseline questionnaires were not received at the study centre for these seven participants. Therefore the total number that participated in the baseline and online study was 1174. Of these, 136 participants were from the AURAH study. The number of MSM who completed at least one follow-up questionnaire was 622 (53.0% of all participants (n=1174)) and they contributed a total of 1423 person-years of follow-up (not including the time from the baseline questionnaire). Of these 622 MSM, 400 (64.3%) remained engaged with the study and completed a follow-up questionnaire within the last 6 months of the study follow-up period (i.e. between October 2017 and March 2018).

Over the course of online follow-up, 622 completed at least one online questionnaire, of these 487 (78.3%) completed at least two, 458 (73.6%) completed at least three, 417 completed at least four (67.0%), 395 (63.5%) completed at least five, 376 (60.5%) completed at least six, 282 (45.3%) completed at least seven, 168 (27.0%) completed at least eight and 72 (11.6%) completed nine (n=622 for all). However not all participants had the opportunity to complete the ninth questionnaire as the online phase of the study closed at the end of
March 2018 and therefore some participants (who joined the study after March 2015) would not have been scheduled to receive a final questionnaire (if their previous questionnaire was less than four months preceding the end of follow-up). In total the online participants provided a total of 3277 online questionnaires. The online retention rate was initially good in the first two years but dropped off in year three (questionnaire seven onwards).

8.3.2 Sociodemographic and lifestyle characteristics of online participants in the AURAH2 study

The median age among the 622 MSM who completed at least one online questionnaire was 34 years (standard deviation [SD]:11.3). Table 21 shows sociodemographic and lifestyle characteristics including alcohol use and mental health measures, and chemsex use among the online cohort in the AURAH2 study (n=622). A large majority, 579 (94.4%) identified as gay with 34 (5.6%) identifying as bisexual or other. Most, 511 (82.1%), were of white ethnicity and over half, 346 (55.6%) were born in the UK. A large proportion were economically stable; 509 (82.8%) reported having enough money to cover basic needs all the time, whilst only 25 (4.1%) reported that they did not, or only sometimes, have enough money to cover basic needs. Over three quarters of MSM (472, 76.7%) were educated to university level and there was a high rate of employment, 547 (88.9%) reported being in employment at the time of completing the baseline questionnaire. Around 10% or more reported either clinically significant depressive symptoms (12.2%) or clinically significant anxiety symptoms (9.3%) and over 10% reported higher risk alcohol consumption (13.0%).

8.3.3 Differences between AURAH2 participants who completed at least one follow-up questionnaire and those that completed only the baseline

A large proportion of MSM (47.3%) (n=552) who completed a baseline questionnaire did not go on to complete an online follow-up questionnaire. Therefore using baseline data, I compared MSM that completed at least one online follow-up questionnaire with those that only completed a baseline questionnaire, to see if there were any differences in terms of sociodemographic and lifestyle characteristics, as well as chemsex drug use between the two groups, see Table 21.

Age was significantly associated with whether an online follow-up questionnaire was completed and MSM who did not go on to complete at least one follow-up questionnaire tended to be younger, 26.1% (only baseline questionnaire) vs 21.2% (at least one follow-up questionnaire) aged <25’s, and 22.1% (only baseline questionnaire) vs 14.1% (at least one follow-up questionnaire) in the 25-29 age group. Median age for those that did not go on to complete an online follow-up questionnaire was 31 (standard deviation [SD]:10.4), whilst for those that did, the median age was 34 (standard deviation [SD]:11.3). At the other end of the
spectrum, 18.5% of MSM over 45 years completed a follow-up questionnaire vs 10.4% of MSM over 45 who only completed a baseline questionnaire (Table 21). Indicators of socio-economic stability such as ‘having sufficient money to cover basic needs’ and housing status were also significantly associated with completing a follow-up questionnaire. For example, having money to cover basic needs ‘all the time’ was significantly associated with completion of at least one online follow-up questionnaire, with 82.8% of those having sufficient money completed at least one follow-up questionnaire compared to 71.5% of those that only completed a baseline questionnaire. In terms of home ownership, 33.0% of those who completed at least one follow-up questionnaire owned their own home rather than renting or unstable/other accommodation, compared to 21.5% of those that only completed a baseline questionnaire. Education was also significantly associated with follow-up questionnaire completion, 76.7% of MSM who completed any follow-up questionnaire had attended university compared to 70.8% who only completed a baseline questionnaire. Employment was another factor significantly associated with follow-up questionnaire completion, however this was in the other direction with fewer (88.9%) MSM that completed at least one follow-up questionnaire being employed compared to 93.1% of MSM that only completed a baseline questionnaire. There were no significant differences between those that completed at least one follow-up questionnaire and those that did not in terms of relationship status, or mental health and well-being scores as measured by a PHQ-9 score >=10 or a GAD7 score >=10.

In terms of chemsex drug use or use of individual chemsex drugs in the last three months as reported at baseline, there were no significant differences between MSM that completed any follow-up questionnaire and those that did not. In fact, the prevalence of chemsex associated drug use at baseline among MSM who did not complete any follow-up questionnaires (30.8%) was almost the same as that among MSM that completed at least one follow-up questionnaire (30.7%). The prevalence of individual chemsex drugs that were reported among MSM who did not complete a follow-up questionnaire was also similar compared to those that did; mephedrone (27.5% vs 27.6%), GHB/GBL (17.9% vs 19.6%) and crystal methamphetamine (8.7% vs 10.4%) (see Table 21).
Table 21. Differences in sociodemographic and lifestyle factors, prevalence of chemsex drug use and individual chemsex drugs at baseline, among MSM that completed only the baseline questionnaire and those that completed at least one follow-up questionnaire, in the AURAH2 study.

<table>
<thead>
<tr>
<th>Factors* (n=1174)</th>
<th>Only baseline questionnaire (n=552)</th>
<th>At least one online questionnaire (n=622)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong> [n=1,158]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>143 (26.1%)</td>
<td>132 (21.6%)</td>
</tr>
<tr>
<td>25-29</td>
<td>121 (22.1%)</td>
<td>86 (14.1%)</td>
</tr>
<tr>
<td>30-34</td>
<td>105 (19.2%)</td>
<td>121 (19.8%)</td>
</tr>
<tr>
<td>35-39</td>
<td>70 (12.8%)</td>
<td>89 (14.6%)</td>
</tr>
<tr>
<td>40-44</td>
<td>52 (9.5%)</td>
<td>69 (11.3%)</td>
</tr>
<tr>
<td>45+</td>
<td>57 (10.4%)</td>
<td>113 (18.5%)</td>
</tr>
<tr>
<td>p&lt;0.001^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Born in the UK and white ethnicity</strong> [n=1,158]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>255 (46.5%)</td>
<td>317 (52.0%)</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>32 (5.8%)</td>
<td>29 (4.7%)</td>
</tr>
<tr>
<td>No, white</td>
<td>181 (33.0%)</td>
<td>194 (31.8%)</td>
</tr>
<tr>
<td>No, non-white</td>
<td>80 (14.6%)</td>
<td>70 (11.5%)</td>
</tr>
<tr>
<td>p=0.197^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Money to cover basic needs</strong> [n=1,166]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>394 (71.5%)</td>
<td>509 (82.8%)</td>
</tr>
<tr>
<td>Most of the time</td>
<td>115 (20.9%)</td>
<td>81 (13.2%)</td>
</tr>
<tr>
<td>Sometimes/no</td>
<td>42 (7.6%)</td>
<td>25 (4.1%)</td>
</tr>
<tr>
<td>p&lt;0.001^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>University education</strong> [n=1,167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>391 (70.8%)</td>
<td>472 (76.7%)</td>
</tr>
<tr>
<td>No</td>
<td>161 (29.2%)</td>
<td>143 (23.2%)</td>
</tr>
<tr>
<td>p=0.022^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employed</strong> [n=1,167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>514 (93.1%)</td>
<td>547 (88.9%)</td>
</tr>
<tr>
<td>No</td>
<td>38 (6.9%)</td>
<td>68 (11.1%)</td>
</tr>
<tr>
<td>P=0.013^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Housing status</strong> [n=1,155]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home owner</td>
<td>118 (21.5%)</td>
<td>200 (33.0%)</td>
</tr>
<tr>
<td>Renting</td>
<td>355 (64.7%)</td>
<td>328 (54.1%)</td>
</tr>
<tr>
<td>Unstable/other</td>
<td>76 (13.8%)</td>
<td>78 (12.9%)</td>
</tr>
<tr>
<td>p&lt;0.001^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sexuality</strong> [n=1,157]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>504 (92.6%)</td>
<td>579 (94.4%)</td>
</tr>
<tr>
<td>Bisexual/other</td>
<td>40 (7.4%)</td>
<td>34 (5.6%)</td>
</tr>
<tr>
<td>p=0.210^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ongoing relationship</strong> [n=1,167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>211 (38.2%)</td>
<td>257 (41.8%)</td>
</tr>
<tr>
<td>No</td>
<td>341 (61.8%)</td>
<td>358 (58.2%)</td>
</tr>
<tr>
<td>p=0.215^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Higher risk alcohol consumption (WHO AUDIT-C &gt;=6)</strong> [n=1,167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>71 (12.9%)</td>
<td>80 (13.0%)</td>
</tr>
<tr>
<td>No</td>
<td>481 (87.1%)</td>
<td>535 (87.0%)</td>
</tr>
<tr>
<td>p=0.941^</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clinically significant depressive symptoms (PHQ-9 score &gt;=10)</strong> [n=1,167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>67 (12.1%)</td>
<td>75 (12.2%)</td>
</tr>
<tr>
<td>No</td>
<td>485 (87.9%)</td>
<td>540 (87.8%)</td>
</tr>
<tr>
<td>p=0.976^</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 8.3.4 Prevalence of sexual behaviour measures among MSM who completed at least one online follow-up questionnaire in the AURA2 study

Measures of sexual behaviour among the 622 MSM that completed at least one online follow-up questionnaire were similar to that from the baseline AURA2 study. In the past three months (before completing the first online questionnaire), the majority of MSM had been sexually active, 562 (90.4%) reported any anal sex of which a large proportion was CLS (n=413 (66.4%)). Just under a third, 32.6% (n=203) of MSM reported group sex within the previous three months. A high proportion, 476 (76.5%) reported having had an HIV test within the previous three months and just over a quarter, 26.4% (n=164) reported having been diagnosed with a bacterial STI in the same time frame (see Table 22).
Table 22 Measures of sexual behaviour among MSM that answered at least one online follow-up questionnaire in the AURAH2 study (n=622)

<table>
<thead>
<tr>
<th>Sexual behaviour measures (past three months)*</th>
<th>All MSM Prevalence n(%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any anal sex</td>
<td>562 (90.4%) (87.7%, 92.4%)</td>
</tr>
<tr>
<td>Any CLS</td>
<td>413 (66.4%) (62.6%, 70.1%)</td>
</tr>
<tr>
<td>CLS with &gt;2 partners</td>
<td>243 (39.1%) (35.3%, 42.9%)</td>
</tr>
<tr>
<td>CLS with partners of unknown/HIV-diagnosed status*</td>
<td>210 (33.76%) (30.1%, 37.6%)</td>
</tr>
<tr>
<td>Self-reported bacterial^ STI diagnosis</td>
<td>164 (26.4%) (23.0%, 29.9%)</td>
</tr>
<tr>
<td>Group sex</td>
<td>203 (32.6%) (29.1%, 36.4%)</td>
</tr>
<tr>
<td>Recent HIV test</td>
<td>476 (76.5%) (73.0%, 79.6%)</td>
</tr>
</tbody>
</table>

*from first 4 monthly questionnaire data; CLS: Condomless sex, STI sexually transmitted infection; *excluding those that reported CLS with HIV-diagnosed partners on ART; ^bacterial STI (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV), missing included with no for all measures

8.3.5 Associations of sociodemographic and lifestyle characteristics, PEP, PrEP, HIV status, calendar year and time in the study, with chemsex.

Using pooled data from all the online follow-up questionnaires and sociodemographic data from the baseline questionnaire, I investigated factors significantly associated with chemsex. In unadjusted analysis, see Table 23, none of the sociodemographic characteristics were associated with chemsex, although there was a tendency for prevalence of chemsex to be higher among participants not born in the UK and among those not in an ongoing relationship (see Table 23). However, using data from the annual questionnaires, clinically significant symptoms of depression (PR 1.47; 95%CI: 1.08, 2.00) or anxiety (PR 1.49; 95%CI: 1.10, 2.01) were both associated with chemsex.

Using pooled data from the online annual questionnaire I further looked at whether the use of PEP and PrEP were associated with chemsex. Those who reported chemsex were significantly more likely to have used PEP in the last year (PR 1.43; 95%CI: 1.09, 1.86) and this effect was larger for PrEP use (PR 1.63; 95%CI: 1.28, 2.09), see Table 23.
Table 23 Unadjusted associations of sociodemographic and lifestyle characteristics, PEP, PrEP, HIV status, calendar year and time in the study, with chemsex during follow-up in the AURAH2 study.

| Factors^  
<table>
<thead>
<tr>
<th>(number of observations)</th>
<th>Prevalence Ratio (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age^ (years)</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3239)</td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>1</td>
</tr>
<tr>
<td>25-29</td>
<td>0.83 (0.66, 1.05)</td>
</tr>
<tr>
<td>30-34</td>
<td>0.95 (0.73, 1.26)</td>
</tr>
<tr>
<td>35-39</td>
<td>1.03 (0.76, 1.40)</td>
</tr>
<tr>
<td>40-44</td>
<td>1.00 (0.70, 1.44)</td>
</tr>
<tr>
<td>45+</td>
<td>0.76 (0.54, 1.08)</td>
</tr>
<tr>
<td>p=0.298*</td>
<td></td>
</tr>
<tr>
<td>p=0.278**</td>
<td></td>
</tr>
<tr>
<td><strong>Born in the UK and white ethnicity^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3239)</td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>1</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>0.90 (0.50, 1.64)</td>
</tr>
<tr>
<td>No, white</td>
<td>1.25 (0.97, 1.61)</td>
</tr>
<tr>
<td>No, non-white</td>
<td>1.46 (1.06, 2.00)</td>
</tr>
<tr>
<td>p=0.066*</td>
<td></td>
</tr>
<tr>
<td><strong>Money to cover basic needs^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3257)</td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>1</td>
</tr>
<tr>
<td>Most of the time</td>
<td>1.05 (0.77, 1.45)</td>
</tr>
<tr>
<td>Sometimes/no</td>
<td>1.06 (0.63, 1.77)</td>
</tr>
<tr>
<td>p=0.931*</td>
<td></td>
</tr>
<tr>
<td>p=0.716**</td>
<td></td>
</tr>
<tr>
<td><strong>University education^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3257)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>0.96 (0.74, 1.23)</td>
</tr>
<tr>
<td>p=0.546*</td>
<td></td>
</tr>
<tr>
<td><strong>Employed^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3257)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>1.12 (0.77, 1.63)</td>
</tr>
<tr>
<td>p=0.510*</td>
<td></td>
</tr>
<tr>
<td><strong>Housing status^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3211)</td>
<td></td>
</tr>
<tr>
<td>Home owner</td>
<td>1</td>
</tr>
<tr>
<td>Renting</td>
<td>0.96 (0.74, 1.23)</td>
</tr>
<tr>
<td>Unstable/other</td>
<td>1.02 (0.73, 1.44)</td>
</tr>
<tr>
<td>p=0.902*</td>
<td></td>
</tr>
<tr>
<td>p=0.828**</td>
<td></td>
</tr>
<tr>
<td><strong>Sexual identity^1</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 3247)</td>
<td></td>
</tr>
<tr>
<td>Bisexual/other</td>
<td>1</td>
</tr>
<tr>
<td>Gay</td>
<td>1.13 (0.69, 1.84)</td>
</tr>
<tr>
<td>p=0.628*</td>
<td></td>
</tr>
<tr>
<td><strong>Ongoing relationship^2</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 937)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>0.79 (0.62, 1.02)</td>
</tr>
<tr>
<td>p=0.068*</td>
<td></td>
</tr>
<tr>
<td><strong>Higher risk alcohol consumption^2 (modified WHO AUDIT-C &gt;=6)</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 942)</td>
<td></td>
</tr>
<tr>
<td>No/missing</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>0.94 (0.65, 1.38)</td>
</tr>
<tr>
<td>p=0.768*</td>
<td></td>
</tr>
<tr>
<td><strong>Clinically significant depressive symptoms^2 (PHQ-9 score &gt;=10)</strong></td>
<td></td>
</tr>
<tr>
<td>(observations 942)</td>
<td></td>
</tr>
<tr>
<td>No/missing</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>1.47 (1.08, 2.00)</td>
</tr>
<tr>
<td>p=0.014*</td>
<td></td>
</tr>
<tr>
<td>Factors(^\text{^a}) (number of observations)</td>
<td>Prevalence Ratio (95%CI)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Clinically significant anxiety symptoms(^2) (GAD&amp; score&gt;=10) (observations 942)</td>
<td>1.49 (1.10, 2.01) (p=0.008^*)</td>
</tr>
<tr>
<td>No/missing</td>
<td>Yes</td>
</tr>
<tr>
<td>PEP use(^2) (observations 942)</td>
<td>1.43 (1.09, 1.86) (p=0.009^*)</td>
</tr>
<tr>
<td>No/missing</td>
<td>Yes</td>
</tr>
<tr>
<td>PrEP use(^2) (observations 942)</td>
<td>1.63 (1.28, 2.09) (p&lt;0.001^*)</td>
</tr>
<tr>
<td>No/missing</td>
<td>Yes</td>
</tr>
<tr>
<td>HIV status (observations 3277)</td>
<td>0.87 (0.55, 1.38)</td>
</tr>
<tr>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Don’t know/missing</td>
<td>(P=0.8383^*)</td>
</tr>
<tr>
<td>Year (observations 3262)</td>
<td>0.82 (0.74, 0.90)</td>
</tr>
<tr>
<td>2015</td>
<td>2016</td>
</tr>
<tr>
<td>2017</td>
<td>0.73 (0.62, 0.87) (p&lt;0.001^*)</td>
</tr>
<tr>
<td>2018</td>
<td>0 months</td>
</tr>
<tr>
<td>4 months</td>
<td>0.79 (0.69, 0.89)</td>
</tr>
<tr>
<td>8 months</td>
<td>0.73 (0.95)</td>
</tr>
<tr>
<td>12 months</td>
<td>0.71 (0.61, 0.83)</td>
</tr>
<tr>
<td>16 months</td>
<td>0.70 (0.68, 0.89)</td>
</tr>
<tr>
<td>20 months</td>
<td>0.68 (0.56, 0.81)</td>
</tr>
<tr>
<td>24 months</td>
<td>0.54 (0.41, 0.70) (p&lt;0.001^*)</td>
</tr>
<tr>
<td>28 months</td>
<td>32 months</td>
</tr>
</tbody>
</table>

\(^{^a}\)missing excluded unless otherwise stated
\(^1\)time-updated \(^2\)from baseline questionnaire data; \(^*\)from annual questionnaire data; \(^*\)p value from Poisson GEE model; \(^**\)p value from Poisson GEE model including the predictors as continuous variable

### 8.3.5.1 Associations of chemsex and individual chemsex drugs with time (since the 1st online questionnaire) over the AURAH2 follow-up period.

In unadjusted analysis, Table 23, there was a strong negative association between time spent in the study and participating in chemsex; as time in the study passed, participants were significantly less likely to report chemsex. This was reflected in the year of the study also, as the year increased (from 2015) participants were significantly less likely to report chemsex. To further examine the association of time with chemsex and individual chemsex drugs, I carried out adjusted analysis (for age group (time-updated), ethnicity (white UK born,
non-white UK born, white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual/other), university education (yes or no/missing) and study site). See Table 24. In unadjusted analysis, there was a strong negative association between the use of mephedrone or GHB/GBL with time spent in the study, but not for crystal methamphetamine. After adjustment, the strength of this association remained for chemsex and use of mephedrone and GHB/GBL (see Table 24). Crystal methamphetamine use remained not significantly associated with chemsex (see Table 24).

Table 24 Associations of time since first online questionnaire with chemsex, and individual chemsex drugs, during follow-up in the AURAH2 study. Analysis used pooled data from all available follow-up questionnaires (n=3277)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Unadjusted* PR for visit (95% CI)</th>
<th>p value~</th>
<th>Adjusted* PR for visit**^ (95% CI)</th>
<th>p value~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemsex</td>
<td>0.95 (0.93, 0.97)</td>
<td>&lt;0.001</td>
<td>0.95 (0.93, 0.97)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mephedrone</td>
<td>0.89 (0.86, 0.92)</td>
<td>&lt;0.001</td>
<td>0.89 (0.86, 0.92)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GHB/GBL</td>
<td>0.96 (0.93, 0.98)</td>
<td>0.001</td>
<td>0.96 (0.93, 0.99)</td>
<td>0.003</td>
</tr>
<tr>
<td>Crystal Methamphetamine</td>
<td>1.02 (0.98, 1.06)</td>
<td>0.289</td>
<td>1.01 (0.97, 1.05)</td>
<td>0.564</td>
</tr>
</tbody>
</table>

*observations in each model: Unadjusted=3277, Adjusted =3229 **approximately 4 months; ~p value from poisson GEE model
No missing data for questions on chemsex at any online questionnaire among respondents. ^Adjusted for time-updated age (<25, 25–29, 30–34, 35–39, 40–44, ≥45 years), country of birth and ethnicity (white UK born, non-white UK born, white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual/other), university education (yes or no/missing) and study site (The Mortimer Market Centre, London; 56 Dean Street Clinic, London; The Claude Nicol Centre, Brighton)
CI: confidence interval; PR: prevalence ratio;

8.3.6 Changes in prevalence of chemsex and within-person frequency of chemsex over time in the study

8.3.6.1 Changes in prevalence of chemsex over time in the study

Initially, I examined the overall changes in prevalence of chemsex over the follow-up period in the study, using pooled data from all participants that completed any online questionnaires, from first to last (9th) questionnaire. There was a significant decline in chemsex prevalence from 31.8% (198/622) at the first follow-up questionnaire, to 11.1% (8/72; p<0.001) among MSM who completed the 9th questionnaire (+32 months) of follow-up, see Figure 20. Mephedrone use significantly declined from 25.2% (157/622) in the first follow-up questionnaire, to 9.7% (7/72) among MSM completing the 9th questionnaire (+32 months). GHB/GBL use also significantly declined from 19.9% (124/622) to 8.3% (67/72) (p=0.001). The use of crystal methamphetamine declined from 11.1% (69/622) to 6.9% (57/72) among MSM completing the 9th questionnaire (+32 months), but this was not significant (p=0.289), see Figure 20.
Figure 20 Prevalence of chemsex, and individual chemsex drugs over time in the study, among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277)*

Decr: decreasing;*No missing data for question on chemsex at any online questionnaire among respondents

p value from unadjusted Poisson GEE model:
chemsex <0.001 (decr)
mephedrone <0.001 (decr)
GHB/GBL 0.001 (decr)
crystal meth 0.289 (decr)
8.3.6.2 Within-person changes in frequency of chemsex over time in the study

Next, I looked at within-person changes in frequency of chemsex reported over the follow-up period from the 1st to the 9th questionnaire. Similar to the previous analysis that investigated the prevalence of chemsex over time in the study, this analysis used pooled data from all participants that completed any online questionnaires, and there was no missing data for any of the chemsex questions. I examined each chemsex frequency group based on the response to the first online questionnaire, ‘no chemsex’, ‘once’, ‘monthly’ and ‘weekly’.

The largest group was formed by participants that reported ‘no chemsex’ at the first online questionnaire (68.3%). Two thirds of MSM (n=425/622) (68.3%) reported no chemsex (in the past three months), and this increased to 90.3% (n=65/72) at the 9th questionnaire (+32 months). The second largest group were those that reported chemsex ‘monthly’ at the first online questionnaires (n=95/622 (15.3%)), however this decreased to 8.3% (n=6/72) at the 9th online questionnaire. The next largest group were those that reported chemsex ‘once’ at the first online questionnaire (n=70/622 (11.3%)), which also decreased, to 1.4% (n=1.4%) at the 9th online questionnaire. Finally, the smallest group were those that reported chemsex ‘weekly’ at the first online questionnaire, (n=32/622 (5.1%)) and this also decreased over time, to 0% at the 9th online questionnaire (see Figure 21).

Individuals varied frequency of chemsex over time in the study, but there was a general tendency for use to decline. The majority of MSM did not report chemsex in previous three months at the first questionnaire (68.3%) and over 65% continued to report no chemsex throughout the study. Of those that did report chemsex, the highest frequency of chemsex at the first online questionnaire for MSM was ‘Monthly’ (15.3%) and, of the 72 MSM that completed a 9th online questionnaire, 6.9% (5/72) reported it ‘Monthly’. The lowest frequency of chemsex at the first online questionnaire among MSM that reported any chemsex was ‘Weekly’, 5.1% (32/622) and of those that completed a 9th questionnaire, none reported it ‘Weekly’, most reported it either ‘Monthly’ or no chemsex at all (see Figure 21).
Figure 21 Within-person changes in frequency of chemsex over time in the study among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277 questionnaires)
8.3.7 Changes in measures of sexual risk behaviour, STI diagnoses and HIV testing over time in the study

The proportion of MSM reporting any anal sex within the past three months was high, with 90.4% (562/622) reporting any anal sex at the first online questionnaire, and this remained high throughout time in the study with 86.1% (62/72) reporting this at the 9th follow-up questionnaire (+32 weeks). The majority of MSM also reported CLS, 66.2% (412/622) at the first online questionnaire, and this marginally increased to 70.8% (51/72) at the 9th online questionnaire (p=0.03). Overall the measures of sexual behaviour and associated behaviours, tended to decline over time among the cohort (see Fig 22), with only those related to CLS slightly increasing, any CLS increased from 66.4% to 70.8% at the 9th questionnaire (+32 months). Reporting group sex declined significantly from 32.6% (203/622) at the first online questionnaire to 25.0% (18/72) at the 9th online questionnaire, see Figure 22.

Reporting a bacterial STI (within the past three months) significantly decreased from 26.4% (164/622) to 9.7% (7/72) over the follow up period (p<0.001). Reporting a recent HIV test (within the past 3 months) had also significantly declined over the follow-up period, although this data was not shown in Figure 22 as I wanted to only display the measures of sexual behaviour. However, over three quarters (76.5% (476/622)) of MSM reported a recent HIV test (within past three months) at the first online questionnaire, and nearly half reported having had one at the 9th online questionnaire (+32 months) (48.6% (35/72)).
Figure 22 Prevalence of sexual behaviours\(^1\) over time among MSM in the AURAH2 study using pooled data from all available follow-up questionnaires (n=3277 questionnaires) \(^*\)

\(^1\) Recent HIV test not shown *missing included with no ** excluding those that reported CLS with HIV-diagnosed partners on ART ^bacterial STI (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV). CLS condomless sex, STI sexually transmitted infection.
8.3.8 Sensitivity analysis and additional analyses: Chemsex, engagement, and lost to follow-up in the study over time

8.3.8.1 Sensitivity analysis: Engagement in the study

Initially, I defined those that remained engaged in the study as having answered a questionnaire within the last six months of the study end, March 2018. I chose this approach because some participants did not have the option of completing a 9th online questionnaire as the online follow-up closed at the start of March 2018. Furthermore, using six months as a cut off for lost to follow-up (before online questionnaires were closed) would also capture those that did not submit their questionnaire responses within the first two weeks of receiving the email invitation for the 8th online questionnaire but who nevertheless completed a questionnaire and might have gone on to complete a final one. The total number of MSM that completed a questionnaire within the final six months of online follow-up was 400. I adopted the same approach to investigate changes in prevalence of chemsex over time in the study among this group as I used in the main analysis (see Figure 20), which used the proportion of those who reported chemsex at each four monthly online questionnaire, using the total number who responded to that questionnaire as the denominator. The results remained similar, with a significant decline in chemsex from 31% at the first online questionnaire to 11.1% at the 9th online questionnaire (+32 months), and two of the three individual chemsex drugs, mephedrone (25.2% to 9.7%) and GHB/GBL (19.5% to 8.3%), and a marginal but not significant decrease in the use of crystal methamphetamine (9.3% to 6.9%), See Figure 23.
Figure 23 Proportion of MSM reporting chemsex and individual chemsex drugs, who completed a questionnaire in the last six months of online follow-up (n=400*) of the AURAH2 study.

Decr: decreasing. *No missing data for question on chemsex/individual chemsex drugs at any online questionnaire among respondents
8.3.8.2 Additional analysis 1: Chemsex and lost to follow-up

Next, I explored whether there was a selective loss over time of MSM engaging in chemsex in the study. In total there were 227 participants completely lost to follow-up. There were 418 occurrences where participants missed an online questionnaire but completed one at a later date. The results from this analysis demonstrated that there was no association between chemsex and being either lost to follow-up (PR 1.04 95%CI:0.89, 1.22) or missing the next online questionnaire (PR 1.02 95%CI:0.90, 1.16), see Table 25.

Table 25 Association of chemsex with 'lost to follow-up' or missing an online follow-up questionnaire, over time in the AURAH2 study*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>chemsex (n%)</th>
<th>PR (95%CI)</th>
<th>p value~</th>
</tr>
</thead>
<tbody>
<tr>
<td>lost to follow-up [n=2877]</td>
<td>Yes 222 (7.78%) No 2655 (92.3%)</td>
<td>1.04 (0.89, 1.22)</td>
<td>0.604</td>
</tr>
<tr>
<td>missing next visit [n=2877]</td>
<td>Yes 418 (14.5%) No 2459 (85.5%)</td>
<td>1.02 (0.90, 1.16)</td>
<td>0.72</td>
</tr>
</tbody>
</table>

~p value from unadjusted Poisson GEE model *pooled data from all available follow-up questionnaires. PR prevalence ratio

8.3.8.3 Additional analysis: Chemsex and lost to follow-up using last observation for missing data

Finally, to examine potential associations between chemsex and lost to follow-up further, if participants were missing a questionnaire or stopped completing them, I carried forward the last observation for the chemsex variable to fill in missing data and examined whether the decline in chemsex and individual chemsex drugs was still significant, as shown in Table 26. In both unadjusted and adjusted analyses, the decline over time since the beginning of the study in chemsex remained significant, PR 0.97 (95%CI: 0.97, 0.99), as did the decline in mephedrone, PR 0.93 (95%CI: 0.92, 0.96). However the decline in GHB/GBL was no longer significant and this continued to be the case for crystal methamphetamine, see Table 26.
Table 26 Associations of chemsex and individual chemsex drugs with lost to follow-up, over time*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Unadjusted PR for visit (95%CI)</th>
<th>p value</th>
<th>Adjusted*^ PR for visit** (95%CI)</th>
<th>p value~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemsex</td>
<td>0.97 (0.96, 0.99)</td>
<td>0.001</td>
<td>0.97 (0.97, 0.99)</td>
<td>0.002</td>
</tr>
<tr>
<td>Mephedrone</td>
<td>0.94 (0.91, 0.95)</td>
<td>&lt;0.001</td>
<td>0.93 (0.92, 0.96)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GHB/GBL</td>
<td>0.98 (0.96, 1.00)</td>
<td>0.082</td>
<td>0.99 (0.97, 1.00)</td>
<td>0.199</td>
</tr>
<tr>
<td>Crystal Methamphetamine</td>
<td>1.02 (0.99, 1.05)</td>
<td>0.063</td>
<td>1.02 (0.99, 1.05)</td>
<td>0.093</td>
</tr>
</tbody>
</table>

*observations in each model: Unadjusted=3277, Adjusted =3229 **approximately 4 months ~p value from Poisson GEE model No missing data for question on chemsex at any online questionnaire among respondents. *Adjusted for time-updated age (<25, 25–29, 30–34, 35-39, 40-44, ≥45 years), country of birth and ethnicity (white UK born, non-white UK born, white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual/other), university education (yes or no/missing) and study site (The Mortimer Market Centre, London; 56 Dean Street Clinic, London; The Claude Nicol Centre, Brighton). CI: confidence interval; PR: prevalence ratio

8.4 Key points

The retention rate from completing the baseline questionnaire in clinic to registering online and completing an online questionnaire was not optimal (52.9%) and was similar to the overall response rate to the AURAH2 study (52%). Potential reasons for this could include participants not being willing to engage in an online study but finding the paper-based questionnaire in-clinic acceptable, or, not having time to register and complete online questionnaires. It was reassuring that there were no significant differences between those that completed an online questionnaire and those that did not with regards to chemsex drug use as this indicated that it was not chemsex that was driving the non-response to the online questionnaires. The online retention of participants that did complete an online questionnaire was good, 64.3% (n=400) remained engaged with the study up to the final six months of online follow-up, although attrition in the third year of online follow-up was higher than in the first or second year. Potentially participants could have become disengaged with the questionnaires over time or found the study burden increased over time so that they stopped answering the questionnaires. There are no other longitudinal studies that have recruited MSM from sexual health clinics in the UK or Europe with which to compare retention rates from the AURAH2 study, and although there are studies similar in design from the USA and Australia (detailed in Chapter 10, Section 10.4.3, pg.232), they have not specifically examined changes in chemsex over time.
The results of this chapter provided the first longitudinal analysis of chemsex among a cohort of MSM from the UK and Europe. Overall the results indicate a decline in both the prevalence of chemsex, and the use of the chemsex drugs mephedrone and GHB/GBL over time among MSM in the study, indicating that individual men do not remain engaged in chemsex for long periods of time. This decline remained apparent even when restricted to those who continued to be engaged with the study over the three-year follow-up period, despite some selective drop-out of MSM who reported chemsex in the study. The decline is also reflected in patterns of reported frequency of chemsex at each online follow-up (‘No chemsex’, ‘Once’, ‘Monthly’, ‘Weekly’ (past three months) over the same period which showed an increase in MSM reporting ‘No chemsex’ from the first online questionnaire to the last. In sensitivity analyses, I found no association between chemsex and being lost to follow-up or missing the next study questionnaire.

The estimated prevalence of chemsex at the first follow-up questionnaire (31.8% of 622, 2015/16), was similar to the prevalence of chemsex-related drug use among MSM who completed the baseline questionnaire in-clinic in 2015/2016 (32.3%), presented in chapter 7. This prevalence is substantially higher than the prevalence of chemsex drug use observed in the cross-sectional AURAH study results from 2013/2014 (prevalence among MSM attending 20 sexual health clinics across England which was 21.8% (Chapter 6). Compared to other clinic based studies, the prevalence of chemsex at the first follow-up visit in the AURAH2 study is higher than that reported by a recent retrospective case note review from 2014/2015 among MSM (n=1734) attending two sexual health services in a south west London (16.5%) (298), and similar to that reported in a very small cross-sectional study among HIV positive MSM in-patients admitted to an HIV unit in 2014/2015 (31%, n=42) also in London (299).

8.4.1 Strengths and limitations
A major strength of the results in this chapter are the large sample size and regular recall period that was used to capture event-level data on chemsex. Collecting sensitive and personal information on drug use and sexual behaviour online may have reduced potential social desirability bias (300), but as with the previous results chapters, results may be influenced by recall bias, despite the time frame for chemsex and the sexual behaviour measures being within the past three months, the maximum period of recall recommended to obtain accurate self-reports (301). Potentially both a strength and limitation of the study was the recruitment of participants attending three sexual health clinics that had become renowned for their focus on integrating substance use services with sexual health services, and the location of these clinics being in large, urban centres, noted for their gay
communities, London and Brighton. Whilst understanding trends in chemsex and sexual behaviour among clinic attendees in these clinics may elucidate patterns in similar high-density areas populated by MSM, it limits the generalisability of the results to include smaller towns and cities and rural areas where service provision is required but often not supplied in the same capacity (302). Finally the results may not reflect trends in chemsex trajectories and patterns among MSM who are not engaged with sexual health services, where potential for problematic harms associated with chemsex may be greater, despite the risk group being potentially smaller (154).

8.4.2 Conclusion and recommendations

The declining trend in chemsex in this longitudinal analysis, by over half, from 31.8% to 11.1%, over the three year follow-up period of the AURAH2 study, indicated that MSM attending sexual health clinics who reported chemsex, would appear to do so for specific, relatively short periods of time, during which regular attendance at sexual health clinics for STI monitoring, HIV testing and access to PEP or PrEP would be highly beneficial. My results demonstrated that during the same time period that chemsex was reported, sexual behaviour measures, which potentiate the risk of contracting HIV and other STIs, such as CLS, were also high and remained high over the course of the study. Whilst the majority of MSM in the study did not report chemsex, the results indicated a clear need for integrated drug and sexual health services, with a focus on health promotion and HIV prevention, such as PEP and PrEP access, aimed at MSM who report chemsex. Such targeted interventions would be highly beneficial, potentially only necessary for relatively short periods of time for individuals and could have long term benefits such as HIV and STI prevention.
Chapter 9: Results: Factors associated with starting, stopping or initiating chemsex in the AURAH2 study

9.1 Introduction

This chapter explores factors associated with starting for the first time, stopping and initiating (which included starting for the first time and re-initiating) chemsex among the online cohort of HIV negative MSM in the AURAH2 study. Substantial amounts of evidence have shown that chemsex is strongly associated with a number of sexual risk behaviours that potentiate an HIV or other STI diagnosis (41, 98, 133, 143, 279, 298, 303, 304), such as CLS with multiple partners, group sex and diagnosis with a bacterial STI, (as reported in Chapters 6 and 7 (2, 3)). However there is little research into the predictors of starting or stopping chemsex, other than studies that examine individual chemsex drugs such as crystal methamphetamine use and socio-sexual risk factors, which showed that men age 30-49 are more likely to report use of crystal methamphetamine, that use of crystal methamphetamine is more concentrated among MSM in London than the rest of England, and that having any non-steady partners was associated with the likelihood of use (172, 305). A review from 2012 on substance use among the LGBT population in the UK described the complex array of factors that shape MSM’s (and the wider LGBT community) substance use pathways which include the influence of social networks, an HIV diagnosis and the shift in social spaces away from venues to online (209). Furthermore, qualitative research has ascribed some of the motivating factors for engagement in chemsex including: sexual exploration and adventure (62) and feelings of acceptance and belonging whilst participating in chemsex (306). However, to date there has been no quantitative research that explores predictors of starting or stopping chemsex. Potentially, identifying predictors for starting chemsex could enable service providers to recognise particular indicators that may increase an individual’s likelihood to engage in chemsex and thus provide timely and appropriate health information, support, and HIV prevention strategies (including PrEP) that could support an individual to navigate away from starting chemsex, or provide measures which support health and well-being whilst an individual chooses to engage in chemsex. In terms of stopping chemsex, understanding any factors that are subject to intervention such as improving mental health or feelings of isolation, may enable healthcare professionals to support an individual engaging in chemsex to address these, which could facilitate stopping or moderating chemsex.

Results from the AURAH study outlined in Chapter 6 demonstrated a strong association between chemsex drug use and relationship status (in an ongoing relationship/not in relationship); those who did not report being in an ongoing relationship were over 50% more likely to report chemsex after adjustment for age, ethnicity, sexual identity, university education and study region (PR 1.53 95%CI: 1.24, 1.89). Within the clinical setting, I have
also anecdotally observed when talking with sexual health clinic attendants, that a change in relationship status (particularly a break-down of a relationship) can be a trigger for chemsex. This was reflected in data collected by 874 MSM attending a specific chemsex walk-in service at 56 Dean street clinic, London (132), in which it was reported that chemsex behaviour tended to accelerate immediately after the break-up of a relationship, although the number attributing starting or accelerating chemsex to a relationship break-up was not provided. Potential reasons for this could be increased feelings of isolation and need for connection when a relationship has broken-down and the opposite could be the case when starting a new relationship (307). In this chapter I used data from the AURAH2 online follow-up questionnaires to explore whether being in a relationship (Yes/No) or a change in relationship status (in long-term relationship/change in relationship status/not in long-term relationship), as well as other sociodemographic characteristics, health and lifestyle factors and measures of sexual behaviour, are associated with starting (for the first time), stopping or initiating (including starting for the first time) chemsex.

9.2 Methods

9.2.1 Starting, stopping or initiating chemsex

This chapter uses data collected in the online follow-up questionnaires from the AURAH2 study with the use of two variables provided by the baseline questionnaire pertaining to relationship status (described in Section 9.2.2) and chemsex drug use. In total there were 622 participants that had at least one follow-up questionnaire and a total of 3277 questionnaires (2320 four monthly, 942 annual and 15 new positive questionnaires) over the three-year follow-up period.

I used the baseline variable of whether a participant had reported use of a chemsex drug in the past three months (defined as use of mephedrone or GHB/GBL or crystal methamphetamine) at baseline to select who to include in the three analyses, but I did not use include it in the main analysis. This was for two reasons; firstly because the question asked at baseline (‘which recreational drugs have you used in the past 3 months? Select from the following list of 18 drugs’) was different from the one that was asked during follow-up (‘have you used drugs before or during sex (chemsex) in the last 3 months?’). Secondly, the time between baseline questionnaire and first online questionnaire was different for participants who joined from the AURAH study (136 participants; median time 367.5 days) or directly from the AURAH2 study (486 participants; 78 days), therefore the long time lapse between the baseline questionnaire and first online questionnaire for those that joined from the AURAH study could have meant participants started or stopped chemsex in that time but not reported it.
I considered three outcomes: starting chemsex for the first time ever, stopping chemsex (this does not imply that they do not restart), and initiating chemsex (includes starting for the first time or re-starting). I investigated whether information at a current follow-up visit predicted any of the three outcomes at the next follow-up visit. Initially for all three analyses, I excluded all the final follow-up visits from the online questionnaires, as it was impossible to know whether a participant had started, stopped or (re)initiated chemsex after their final online questionnaire. I also excluded those who only answered one online questionnaire as one response was not able to indicate starting, stopping or initiating, at a subsequent visit.

9.2.1.1 Starting chemsex (for the first time)

In the analysis, ‘starting chemsex’ (for the first time) I included only participants who were at risk of starting chemsex, i.e. those that had not reported ‘chemsex drug use’ at baseline (participants were also excluded if they did not complete a baseline questionnaire (n=7 individuals /20 follow-up questionnaires). In addition, I included only individuals who had at least two follow-up visits for this analysis (only one follow-up visit could not indicate whether a participant started chemsex at the next follow-up visit) and I only included follow-up visits in which participants were at risk of starting chemsex (i.e. visits after a person had started chemsex for the first time were excluded and so were the final follow-up visits for the reason mentioned above, Section 9.2.1.)

9.2.1.2 Stopping chemsex

For stopping chemsex, I included in the analysis, all participants regardless of whether they reported ‘chemsex drug use’ at baseline (including those who did not reply to the question on ‘chemsex drug use’ at baseline), and who had at least two follow-up visits. I excluded the records/questionnaires in which they reported ‘No’ to chemsex at current visit, as they were not at risk of stopping chemsex at the next visit) and the last follow-up visit for the reasons mentioned above, Section 9.2.1.

9.2.1.3 Initiating chemsex (including starting for the first time)

For initiating chemsex, I included in the analysis, all the participants regardless of whether they reported ‘chemsex drug use’ at baseline (including those who did not reply to the question on ‘chemsex drug use’ at baseline), and who had at least two follow-up visits. I included only the visits in which participants were at risk of initiating or re-initiating chemsex (i.e. I excluded the follow-up visits in which a participant reported chemsex at the current visit (as they were not at risk of initiating) and all the last follow-up visits, for the same reason detailed in Section 9.2.1.

205
9.2.2 Relationship status

To investigate relationship status and its association with the three chemsex outcomes, I used responses from the question in the annual online questionnaire, ‘Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)?’, with the options of ‘Yes’ or ‘No’. To specifically look at whether a change in relation status was associated with starting for the first time, stopping or initiating chemsex, I created a relationship status variable with three categories, ‘in long-term relationship’, ‘change in relationship status’ and ‘not in long-term relationship’. To create the variable I used the answers to the annual online question, described above, and the same question which was asked in the baseline questionnaire (although answer options were ‘Yes, I am in a relationship and living with my partner’, ‘Yes, I am in a relationship and not living with my partner’, ‘No I am not currently in an ongoing relationship with a partner’ which were dichotomised in to ‘Yes’ or ‘No’). This question was not asked at the four monthly questionnaires.

The majority (n=478) of participants who joined the AURAH2 study directly answered the question, ‘Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)?’ at the baseline questionnaire completed in-clinic, up to four months before registering online. Therefore, for these participants, the answer that they provided in their baseline questionnaire for relationship status was used as the imputed response to the first online four monthly follow-up visit for relationship status (as the first online questionnaire was always the four-month questionnaire which did not ask about relationship status). For those that joined from the AURAH study (n=136), they completed an annual questionnaire at their second online follow-up questionnaire, therefore I backfilled the response to the question ‘Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)?’ for the value of their first follow-up visit.

The first variable I created for ‘change in relationship status’ had four categories: “ongoing relationship”, “new relationship”, “relationship break-up”, and “not in ongoing relationship”. However, due to the small sample sizes for the analyses on starting chemsex (n=335), stopping chemsex (n=175) and initiating chemsex (n=367), and the small number of observations in the categories “new relationship” (n=111) or “relationship break-up” (n=66) categories, there was not enough power to explore relationship status in four categories. I therefore combined the two smallest categories that indicated a change in relationship status, although I recognised that they were very different, “new relationship” and “relationship break-up” to create a category “change in relationship status” and used three categories for the relationship variable. For both variables I assumed that if a participant had answered ‘Yes’ or ‘No’ to the ongoing relationship status question at an annual questionnaire
then this was their relationship status until reported otherwise at the next annual questionnaire, (i.e. up to two values of missing data were imputed). If a participant missed an annual questionnaire or missed out the question in the annual questionnaire, their answer was carried forward until the question was answered again at the next visit, up to the last visit.

9.2.3 Sexual behaviour measures
For consistency, I investigated the same seven measures of sexual behaviour that I had previously used when exploring the changes in chemsex and sexual behaviour over time (since entering the study) among MSM in the AURAH2 study (Chapter 8). All measures of sexual behaviour and HIV testing history were collected at each online questionnaire, with a recall period of three months. The seven measures were,

(i) any anal intercourse
(ii) any CLS
(iii) CLS with two or more partners (CLS>2)
(iv) CLS with partners of unknown HIV status or HIV-diagnosed partners (excluding long-term HIV-diagnosed partners on treatment)
(v) self-reported diagnosis of an STI
(vi) group sex
(vii) recent HIV test

9.2.4 Statistical analysis
Pooled data from all the follow-up questionnaires were used. In univariable analysis I investigated the variable ‘change in relationship status’, the sociodemographic factors and the seven measures of sexual behaviour with three outcomes: starting chemsex for the 1st time, stopping, or initiating chemsex. Firstly, I calculated the percentage of online follow-up questionnaires at which chemsex was started, stopped or initiated. Then, in the statistical analysis related to starting chemsex for the first time, I used a Poisson model with robust standard errors, to produce a risk ratio (RR), as each individual could only start chemsex for the first time once. In the statistical analysis related to stopping and initiating chemsex in univariable analysis I used a generalized estimating equations (GEE) Poisson model with robust variance estimation, with an exchangeable covariance matrix to produce RR, as each individual could potentially stop or initiate chemsex multiple times.
In univariable analysis, I used the baseline values of sociodemographic variables; time-updated age (<25, 25–29, 30–34, 35–39, 40–44, ≥45 years), born in the UK and white ethnicity (white UK born, non-white UK born, white non-UK born, non-white non-UK born), sexuality (gay or bisexual/other), university education (yes or no/missing), and, the time-updated relationship status (in long-term relationship, change in relationship status, not in long-term relationship), heavy drinking (as defined by the WHO AUDIT-C score >=6 (276)) (yes or no/missing), PHQ-9 >=10 (yes or no/missing) and GAD-7>=10 (yes or no/missing) assessments. For the sexual behaviour variables, time-updated information from the four monthly follow-up questionnaires was used.

9.3 Results
9.3.1 Starting chemsex
Of the 622 participants who completed an online questionnaire, 198 were excluded from this analysis as they reported use of a chemsex drug at baseline, 82 were excluded as they only had one follow-up questionnaire and 7 were excluded as they did not complete a baseline questionnaire. In total, 335 participants were included in the starting chemsex analysis (amounting to 1596 observations), of which a minority, 38 (11.3%) participants started chemsex for the first time during the online phase of the study (follow-up questionnaires were excluded after a participant had started chemsex for the first time. Figure 24 shows the proportion of participants that started chemsex at each online follow-up questionnaire.

Figure 24 Number of observations among MSM in the starting chemsex (for the first time) analysis (n=38), and proportion (%) in which chemsex is started during follow-up in the AURAH2 study.
9.3.1.1 Starting chemsex and sociodemographic and lifestyle characteristics

There were no associations between starting chemsex for the first time and any of the sociodemographic characteristics as can be seen from Table 27. Starting chemsex was not associated with being in a relationship (Yes/No), or any of the categories of relationship status (long-term relationship, change in relationship status or not in long-term relationship).

Table 27 Unadjusted risk ratios of sociodemographic, health and lifestyle characteristics with starting chemsex for the first time among MSM in the AURAH2 study.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Starting chemsex (for the first time)</th>
<th>n/N (% )</th>
<th>Unadjusted RR</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*1 (1588 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>6/209 (2.8%)</td>
<td>1</td>
<td></td>
<td>0.837</td>
</tr>
<tr>
<td>25-29</td>
<td>8/311 (2.6%)</td>
<td>0.89 (0.32, 2.55)</td>
<td>0.917</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>9/297 (3.0%)</td>
<td>1.05 (0.38, 2.92)</td>
<td>0.647</td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>5/229 (2.2%)</td>
<td>0.76 (0.23, 2.45)</td>
<td>0.988</td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>4/138 (2.9%)</td>
<td>1.01 (0.29, 3.51)</td>
<td>0.249</td>
<td></td>
</tr>
<tr>
<td>45+</td>
<td>6/404 (1.5%)</td>
<td>0.52 (0.17, 1.58)</td>
<td>0.220^</td>
<td></td>
</tr>
<tr>
<td>Born in the UK and white ethnicity*2 (1588 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>20/867 (2.3%)</td>
<td>1</td>
<td></td>
<td>0.724</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>2/67 (2.9%)</td>
<td>1.29 (0.31, 5.42)</td>
<td>0.637</td>
<td></td>
</tr>
<tr>
<td>No, white</td>
<td>14/516 (2.7%)</td>
<td>1.18 (0.59, 2.31)</td>
<td>0.528</td>
<td></td>
</tr>
<tr>
<td>No, non-white</td>
<td>2/138 (1.5%)</td>
<td>0.63 (0.15, 2.66)</td>
<td>0.081</td>
<td></td>
</tr>
<tr>
<td>Sexuality2 (1596 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>34/1523 (2.2%)</td>
<td>0.41 (0.15, 1.12)</td>
<td>0.837</td>
<td></td>
</tr>
<tr>
<td>bisexual/other</td>
<td>4/73 (5.5%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University education2 (1596 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>30/1281 (2.3%)</td>
<td>0.92 (0.43, 1.99)</td>
<td>0.417</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8/315 (2.5%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a relationship*3 (452 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5/12 (41.6%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>236/440 (53.6%)</td>
<td>1.59 (0.51, 4.9)</td>
<td>0.021</td>
<td></td>
</tr>
<tr>
<td>Relationship status*3 (1595 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in long-term rltship</td>
<td>20/256 (2.7%)</td>
<td>1</td>
<td></td>
<td>0.485</td>
</tr>
<tr>
<td>change in rltship status</td>
<td>1/77 (1.3%)</td>
<td>0.49 (0.07, 3.61)</td>
<td>0.601</td>
<td></td>
</tr>
<tr>
<td>not in long-term rltship</td>
<td>17/762 (2.2%)</td>
<td>0.84 (0.45, 1.59)</td>
<td>0.082</td>
<td></td>
</tr>
<tr>
<td>Higher risk alcohol consumption (WHO AUDIT-C &gt;=6)*** (454 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3/12 (25.0%)</td>
<td>1.25 (1.24, 1.54)</td>
<td>0.834</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>29/442 (6.7%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinically significant depressive symptoms (PHQ-9 score &gt;=10)3 (454 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1/12 (8.3%)</td>
<td>0.87 (0.11, 6.58)</td>
<td>0.834</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>42/442 (9.5%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinically significant anxiety symptoms (GAD7 score &gt;=10)3 (454 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1/12 (8.3%)</td>
<td>1.24 (0.17, 9.31)</td>
<td>0.834</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>30/442 (6.8%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.3.1.2 Starting chemsex and measures of sexual behaviour

Nearly all of the sexual behaviour measures pertaining to CLS (but not ‘any anal intercourse’) were strongly associated with starting chemsex. Those that had CLS with one or more partners were three times more likely to start chemsex at the next questionnaire (RR 3.05 95%CI:1.35, 6.89), and twice as likely to report CLS with two or more partners (RR 2.14, 95%CI:1.13, 4.03) than those that did not start chemsex. Those that reported a bacterial STI or group sex were also nearly three times more likely to report starting chemsex (RR 2.82, 95%CI: 1.36, 5.86) (RR 2.86, 95%CI:1.50, 5.45). Having a recent HIV test (within the last 3 months) was not associated with starting chemsex (see Table 28).

Table 28 Unadjusted risk ratios of sexual behaviour measures with starting chemsex for the first time among MSM in the AURAH2 study.

<table>
<thead>
<tr>
<th>Measures of sexual behaviour*</th>
<th>Starting chemsex (for the first time)</th>
<th>n/N (%)</th>
<th>Unadjusted RR</th>
<th>p value&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any anal intercourse</td>
<td>Yes</td>
<td>36/1359 (2.7%)</td>
<td>3.13 (0.76, 12.95)</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2/237 (0.8%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS</td>
<td>Yes</td>
<td>31/945 (3.3%)</td>
<td>3.05 (1.35,6.89)</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>7/651(1.1%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS&gt; 2 partners</td>
<td>Yes</td>
<td>16/405 (3.9%)</td>
<td>2.14 (1.13, 4.03)</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>22/1191 (1.8%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS partners unknown/HIV-diagnosed status&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Yes</td>
<td>14/373 (3.8%)</td>
<td>1.91 (0.99, 3.66)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24/1223 (1.9%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Self-reported bacterial STI diagnosis&lt;sup&gt;3&lt;/sup&gt; group sex</td>
<td>Yes</td>
<td>9/158 (5.7%)</td>
<td>2.82 (1.36, 5.86)</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>29/1438 (2.0%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>recent HIV test (&lt;3 months)</td>
<td>Yes</td>
<td>14/270 (5.2%)</td>
<td>2.86 (1.50, 5.45)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>24/1326 (1.8%)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* collected at every online questionnaire 1- p value from unadjusted Poisson model <sup>2</sup> excluding those that reported CLS with HIV-diagnosed partners on ART <sup>3</sup>bacterial STI sexually transmitted infection (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV), missing included with no for all measures except for recent HIV test where missing was excluded, RR risk ratio, CLS condomless sex, n number of participants, N number of observations.

9.3.2 Stopping chemsex

Of the 622 participants who completed an online questionnaire, 424 were excluded as they did not report chemsex at a current visit (as they were not at risk of stopping), and of the remaining, 23 were excluded as they only had one follow-up questionnaire. A total of 175 participants were included in this analysis (amounting to 664 observations). There were 181
(27.3%) occasions where chemsex was stopped by 46 participants who all completed at least two online follow-up questionnaires. Figure 25 shows the proportion of participants that stopped chemsex at each online follow-up questionnaire.

Figure 25 Proportion of observations among MSM included in the stopping chemsex (at least once) analysis (n=175), and proportion that stopped chemsex at each online follow-up questionnaire during follow-up in the AURAH2 study.

### 9.3.2.1 Stopping chemsex and sociodemographic and lifestyle characteristics

In univariable analysis, two of the older age groups (35-39, and 40-44) were significantly less likely to report stopping chemsex than the youngest age group (<25), although this effect was not seen in the oldest age group (45+). There were no other sociodemographic variables, including relationship status or change in relationship status that were associated with stopping chemsex, see Table 29.
Table 29 Unadjusted risk ratios of stopping chemsex with sociodemographic, health and lifestyle characteristics among MSM in the AURAH2 study

<table>
<thead>
<tr>
<th>Factors</th>
<th>Stopping chemsex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N (%)</td>
<td>Unadjusted RR</td>
<td>p value^4</td>
<td></td>
</tr>
<tr>
<td>Age*1 (658 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>28/70 (40%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>40/101 (39.6%)</td>
<td>1.02 (0.72, 1.44)</td>
<td>0.904</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>32/115 (27.8%)</td>
<td>0.77 (0.52, 1.14)</td>
<td>0.200</td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>35/141 (24.8%)</td>
<td>0.65 (0.43, 0.97)</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>14/107 (13.1%)</td>
<td>0.38 (0.21, 0.69)</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>45+</td>
<td>31/124 (25.0%)</td>
<td>0.73 (0.47, 1.12)</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Born in the UK and white ethnicity*2 (obs 658)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>96/332 (28.9%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>11/25 (44.0%)</td>
<td>1.44 (0.79, 2.57)</td>
<td>0.226</td>
<td></td>
</tr>
<tr>
<td>No, white</td>
<td>50/220 (22.7%)</td>
<td>0.77 (0.56, 1.06)</td>
<td>0.111</td>
<td></td>
</tr>
<tr>
<td>No, non-white</td>
<td>23/81 (28.4%)</td>
<td>0.88 (0.61, 1.26)</td>
<td>0.481</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexuality*2 (obs 654)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>169/626 (27.0%)</td>
<td>0.78 (0.47, 1.29)</td>
<td>0.336</td>
<td></td>
</tr>
<tr>
<td>bisexual/other</td>
<td>10/28 (35.7%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University education* (obs 660)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>123/493 (24.9%)</td>
<td>0.77 (0.59, 1.01)</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>58/1109 (34.7%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a relationship*3 (164 obs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24/82 (29.3%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19/82 (23.1%)</td>
<td>0.87 (0.51, 1.48)</td>
<td>0.617</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship status*3 (obs 660)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in long-term relationship</td>
<td>78/279 (27.9%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>change in relationship status</td>
<td>9/33 (27.3%)</td>
<td>1.02 (0.63, 1.64)</td>
<td>0.944</td>
<td></td>
</tr>
<tr>
<td>not in long-term relationship</td>
<td>91/348 (26.1%)</td>
<td>0.95 (0.73, 1.23)</td>
<td>0.696</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher risk alcohol consumption (WHO AUDIT-C &gt;=6)** (obs 166)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1/8 (12.5%)</td>
<td>0.40 (0.05, 3.04)</td>
<td>0.379</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>42/158 (26.6%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinically significant depressive symptoms (PHQ-9 score &gt;=10)*3 (obs 166)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6/23 (26.1%)</td>
<td>1.01 (0.50, 2.06)</td>
<td>0.961</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>37/143 (25.8%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinically significant anxiety symptoms (GAD7 score &gt;=10)*3 (obs 166)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3/18 (16.7%)</td>
<td>0.59 (0.19, 1.79)</td>
<td>0.358</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>40/148 (27.0%)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 - time-updated, 2 - collected at baseline, 3 - collected at annual questionnaire, 4 - p value from unadjusted Poisson model, ^ test for trend *missing excluded. ** Higher risk drinking is based on the first two questions of the WHO AUDIT-C questionnaire, higher risk drinking is indicated by a score of ≥ 6 (276), RR Risk ratio, rltsh relationship, n number of participants, N number of observations.
9.3.2.2 Stopping chemsex and measures of sexual behaviour

In contrast to the results from starting chemsex, a minority (three) of the sexual behaviour measures were associated with stopping chemsex. Those that reported CLS with two or more partners were significantly less likely to report stopping chemsex, (RR 0.77 95%CI: 0.60, 0.98) than those who did not, and, those that reported a bacterial STI (RR 0.74 95%CI: 0.57, 0.96) were also significantly less likely to report stopping chemsex than those that did not. Finally, those that reported group sex were also significantly less likely to report stopping chemsex (RR 0.70 95%CI 0.54, 0.90), see Table 30.
Table 30 Unadjusted risk ratios of stopping chemsex with measure of sexual behaviour among MSM in the AURAH2 study.

<table>
<thead>
<tr>
<th>Measures of sexual behaviour* (obs 664 unless indicated)</th>
<th>Stopping chemsex</th>
<th>Unadjusted RR</th>
<th>p value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Any anal intercourse</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>177/649 (27.3%)</td>
<td>1.07 (0.49, 2.37)</td>
<td>0.858</td>
</tr>
<tr>
<td>No</td>
<td>4/15 (26.6%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>CLS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>155/567 (27.3%)</td>
<td>1.05 (0.71, 1.55)</td>
<td>0.818</td>
</tr>
<tr>
<td>No</td>
<td>26/97 (26.8%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>CLS &gt; 2 partners</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>106/439 (24.1%)</td>
<td>0.77 (0.60, 0.98)</td>
<td>0.037</td>
</tr>
<tr>
<td>No</td>
<td>75/225 (33.3%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>CLS partners unknown/HIV-diagnosed status^</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>83/330 (25.2%)</td>
<td>0.87 (0.69, 1.11)</td>
<td>0.282</td>
</tr>
<tr>
<td>No</td>
<td>98/334 (29.3%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>bacterial STI~</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>38/181 (20.9%)</td>
<td>0.74 (0.57, 0.96)</td>
<td>0.024</td>
</tr>
<tr>
<td>No</td>
<td>143/483 (29.6%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>group sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>86/383 (22.5%)</td>
<td>0.70 (0.54, 0.90)</td>
<td>0.006</td>
</tr>
<tr>
<td>No</td>
<td>95/281 (33.8%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>recent HIV test (&lt;3 months)</strong> (obs 629)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>129/484 (26.6%)</td>
<td>0.87 (0.69, 1.10)</td>
<td>0.250</td>
</tr>
<tr>
<td>No</td>
<td>47/145 (32.4%)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* collected at every online questionnaire ¹ p value from unadjusted Poisson model ^ excluding those that reported CLS with HIV-diagnosed partners on ART ~ bacterial STI sexually transmitted infection (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV), missing included with no for all measures except for recent HIV test where missing was excluded, RR risk ratio, CLS condomless sex, n number of participants, N number of observations.

9.3.3 Initiating chemsex (including starting for the first time)

Of the 622 participants who completed an online questionnaire, 198 participants were excluded as they reported chemsex at current visit (and were therefore not at risk of initiating) and a further 57 were excluded as they only had one follow-up questionnaire. A total of 367 participants were included in the initiating chemsex analysis (amounting to 1991 observations), in which chemsex was initiated on 141 (7.1%) occasions by 103 participants (of which 38 who was started for the first time). Figure 26 shows the proportion of participants that initiated chemsex at each online follow-up questionnaire.
Figure 26 Proportion of observations among MSM included in the initiating chemsex analysis (n=367), and proportion that started chemsex at each online follow-up questionnaire during follow-up in the AURAH2 study.

9.3.3.1 Initiating chemsex and sociodemographic and lifestyle characteristics

Similar to the starting chemsex results, there were no significant associations between any of the sociodemographic variables and initiating chemsex in the univariable analysis, including the variable in relationship (Yes/No) or change in relationship status, see Table 31.

Table 31 Unadjusted risk ratios of initiating chemsex with sociodemographic characteristics health and lifestyle characteristics among MSM in the AURAH2 study.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Initiating chemsex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N (%)</td>
</tr>
<tr>
<td>Age*1 (obs 1971)</td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>22/262 (8.4%)</td>
</tr>
<tr>
<td>25-29</td>
<td>32/393 (8.1%)</td>
</tr>
<tr>
<td>30-34</td>
<td>26/351 (7.4%)</td>
</tr>
<tr>
<td>35-39</td>
<td>26/293 (8.9%)</td>
</tr>
<tr>
<td>40-44</td>
<td>11/175 (6.3%)</td>
</tr>
<tr>
<td>45+</td>
<td>23/497 (4.6%)</td>
</tr>
<tr>
<td>Born in the UK and white ethnicity*2 (obs 1971)</td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>74/1092 (6.8%)</td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>9/98 (9.2%)</td>
</tr>
<tr>
<td>No, white</td>
<td>43/616 (6.9%)</td>
</tr>
<tr>
<td>No, non-white</td>
<td>14/165 (8.5%)</td>
</tr>
<tr>
<td>Sexuality*2 (obs 1980)</td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>131/1884 (6.9%)</td>
</tr>
<tr>
<td>bisexual/other</td>
<td>8/96 (8.3%)</td>
</tr>
<tr>
<td>University education* (obs 1982)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>100/1520 (6.6%)</td>
</tr>
<tr>
<td>No</td>
<td>40/462 (8.7%)</td>
</tr>
<tr>
<td>Factors</td>
<td>Initiating chemsex</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>(n=1991 obs unless indicated)</td>
<td>n/N (%)</td>
</tr>
<tr>
<td>In relationship*&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Yes 24/265 (9.1%)</td>
</tr>
<tr>
<td>(obs 583)</td>
<td>No 20/316 (6.3%)</td>
</tr>
<tr>
<td>Relationship status*&lt;sup&gt;3&lt;/sup&gt;</td>
<td>in long-term relationship 64/941 (6.8%)</td>
</tr>
<tr>
<td>(obs 1989)</td>
<td>change in relationship status 8/109 (7.3%)</td>
</tr>
<tr>
<td></td>
<td>not in long-term relationship 69/939 (7.4%)</td>
</tr>
<tr>
<td>Higher risk alcohol consumption (WHO AUDIT-C &gt;=6)*&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Yes 20/236 (8.5%)</td>
</tr>
<tr>
<td>(WHO AUDIT-C &gt;=6)</td>
<td>No 120/1746 (6.9%)</td>
</tr>
<tr>
<td>(obs 1982)</td>
<td></td>
</tr>
<tr>
<td>Clinically significant depressive symptoms (PHQ-9 score &gt;=10)*&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Yes 4/55 (7.3%)</td>
</tr>
<tr>
<td>(obs 583)</td>
<td>No 40/528 (7.6%)</td>
</tr>
<tr>
<td>Clinically significant anxiety symptoms (GAD7 score &gt;=10)*&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Yes 3/40 (7.5%)</td>
</tr>
<tr>
<td>(obs 1982)</td>
<td>No 41/543 (7.5%)</td>
</tr>
</tbody>
</table>

*1- time-updated, 2- collected at baseline; 3- collected at annual questionnaire; 4- p value from unadjusted Poisson model, ^ test for trend *missing excluded. ** Higher risk drinking is based on the first two questions of the WHO AUDIT-C questionnaire, higher risk drinking is indicated by a score of ≥ 6 (276). RR Risk ratio, rltsh relationship, n number of participants, N number of observations.

### 9.3.3.2 Initiating chemsex and measures of sexual behaviour

Similar to the starting chemsex results, the majority of sexual behaviour measures (with the exception of any anal intercourse, group sex and recent HIV test) were significantly associated with initiating chemsex. Those that reported any CLS or CLS>2 partners were both over one and a half more likely to report initiating chemsex ((RR 1.69 95%CI:1.23, 2.34) and (RR 1.55 95%CI: 1.13, 2.14) respectively) than those that did not, and those that reported a bacterial STI in the previous three months almost one and a half times more likely to initiate chemsex (RR 1.48 95%CI: 1.06, 2.07) than those that did not. Initiating chemsex was also strongly associated with CLS with partners of unknown HIV status and group sex, see Table 32.
Table 32 Unadjusted risk ratios of initiating chemsex with measures of sexual behaviour among MSM in the AURAH2 study

<table>
<thead>
<tr>
<th>Sexual behaviour measures* (obs 1991 unless indicated)</th>
<th>Initiating chemsex</th>
<th>Unadjusted RR</th>
<th>p value(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any anal intercourse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>128/1694 (7.6%)</td>
<td>1.49 (0.96, 2.32)</td>
<td>0.074</td>
</tr>
<tr>
<td>No</td>
<td>13/297 (4.4%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>106/1231 (8.6%)</td>
<td>1.69 (1.23, 2.34)</td>
<td>0.001</td>
</tr>
<tr>
<td>No</td>
<td>35/760 (4.6%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS&gt; 2 partners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>56/542 (10.3%)</td>
<td>1.55 (1.13, 2.14)</td>
<td>0.006</td>
</tr>
<tr>
<td>No</td>
<td>85/1449 (5.8%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CLS partners unknown/HIV-diagnosed status^</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>43/465 (9.3%)</td>
<td>1.34 (0.99, 1.81)</td>
<td>0.052</td>
</tr>
<tr>
<td>No</td>
<td>98/1526 (6.4%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>bacterial STI~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23/207 (11.1%)</td>
<td>1.48 (1.06, 2.07)</td>
<td>0.019</td>
</tr>
<tr>
<td>No</td>
<td>118/1784 (6.6%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>group sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>34/345 (9.8%)</td>
<td>1.39 (0.97, 1.99)</td>
<td>0.065</td>
</tr>
<tr>
<td>No</td>
<td>107/1646 (6.5%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>recent HIV test (&lt;3 months) (obs 1879)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>82/1091 (7.5%)</td>
<td>1.19 (0.92, 1.56)</td>
<td>0.177</td>
</tr>
<tr>
<td>No</td>
<td>44/788 (5.6%)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* collected at every online questionnaire
\(^1\) p value from unadjusted Poisson model
^excluding those that reported CLS with HIV-diagnosed partners on ART
~bacterial STI sexually transmitted infection (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum (LGV), missing included with no for all measures except for recent HIV test where missing was excluded.

RR risk ratio, CLS condomless sex, n number of participants, N number of observations.

9.4 Key points

The results from this chapter demonstrated that neither being in relationship (Yes or No) or a change in relationship status (in long-term relationship/change in relationship status/not in long-term relationship) were associated with either of the three chemsex outcomes, starting (for the first time), stopping, or initiating chemsex. However, other sociodemographic characteristics and measures of sexual behaviour were. The results of the analyses that assessed predictors of starting or initiating chemsex demonstrated that MSM who go on to start or initiate chemsex are already engaging in high risk sexual behaviour before they commence engagement in chemsex. For example, those that reported CLS or a bacterial STI were significantly more likely to report starting chemsex for the first time at the next online questionnaire. This pattern of behaviour could give healthcare professionals an indication of those who are at risk of starting chemsex and as such presents an opportunity to offer intervention to prevent HIV infection (through the provision of PrEP), encourage engagement with sexual health services and to discuss health promotion and potential harms concerning chemsex.

The results for stopping chemsex demonstrated the relationship between chemsex and age, whereby MSM in the middle age brackets (35-39, and 40-44) were significantly less likely to
report stopping chemsex than the younger age groups. This was similar to my results from the AURAH study that I outlined in Chapter 6 (as well as other studies) which demonstrated that MSM in the age groups over 30 (and younger than 45) were significantly more likely to report chemsex drug use (3, 136, 308). Given the positive relationship between measures of sexual behaviour and starting chemsex, it was not surprising that these results were also reflected, in reverse, for stopping chemsex. Those that reported CLS with more than two partners, or who reported a bacterial STI were significantly less likely to report stopping chemsex, and this was the same for group sex.

9.4.1 Strengths and Limitations

By restricting to a subset of records of the AURAH2 dataset at risk for the three events: starting, stopping and initiating chemsex the sample size was potentially too small to give adequate statistical power to examine an association between change in relationship status and the outcomes of starting, stopping or initiating chemsex. Additionally, relationship status was only captured annually through the online annual questionnaires, the methods I used to impute data in the questionnaires for which this information was not asked were not sensitive to all actual changes in relationship status at each online questionnaire during the course of the study.

As I detailed in the limitations in Chapter 8 (see Section 8.4.1, pg.201), the limitations of Chapter 9 are similar; the location of the clinics (London and Brighton) and the clinics themselves, which offer established chemsex services for MSM, meant that the results may not be generalisable to the wider MSM community. Potentially the renowned chemsex services, particularly at 56 Dean street, may have impacted on the results if MSM who engage in chemsex actively prefer to attend this service and obtained increased support that meant they decreased or stopped chemsex. Finally, the consideration of biases, such as recall bias and social desirability bias, which are inter-connected with self-completed questionnaires are important to account for, particularly when examining sensitive issues such as sexual behaviour and chemsex. Bias is discussed further in Chapter 10 (Section 10.6.1, pg.244).

9.4.2 Conclusions and recommendations

The results of this chapter emphasised the strong and significant associations between chemsex and measures of sexual behaviour which potentiate the risk of STI and HIV infection for HIV negative MSM, particularly CLS. Further work into predictors of starting chemsex, particularly qualitative research that could explore more personal and emotional reasons attributed to starting or stopping chemsex, would be useful. However, these results substantiated the evidence from previous chapters. Whilst it was only a minority (11.3%) of
MSM attending sexual health clinics that started chemsex in the AURAH2 study, the provision of integrated substance use services with sexual health services could aid in the management of sexual health, particularly as my results have indicated that increased sexual risk behaviour can predict the potential of an individual to engage in chemsex.
Chapter 10: Discussion of thesis findings and final conclusions.

10.1 My role in this thesis

As the coordinator of the AURAH and AURAH2 studies, I played a major role in the design and management of both studies. I designed and wrote the protocol and study documents (including the patient information sheets and consent forms) and led on the development of the study questionnaires, for each study in collaboration with the core group, Professor Alison Rodger, Professor Andrew Phillips, Dr Fiona Lampe and Dr Andrew Speakman. I attended the Research Ethics Committee meetings which led to the study approvals and undertook and coordinated study set up and training at the participating sexual health clinics (described in Chapters 3 and 4). This involved training presentations at each of the clinical sites to the study team of research nurses, nurses, doctors, health advisors and support staff. During the course of both the study recruitment periods, in collaboration with the study data manager (Dr Speakman), I monitored recruitment, visited sites and coordinated drop-off and collection of questionnaires. Once the studies had completed recruitment I coordinated with the clinics regarding the management and storage of site files and study materials. I wrote and published both study methodologies as detailed in Section 10.2 (Appendix XIII and Appendix XIV), under the supervision of my primary supervisor, Professor Alison Rodger.

For the AURAH2 study I worked with Dr Speakman and an external contractor, AN Computing, to coordinate the development of the AURHA2 website and online questionnaires which allowed the secure completion of collection of four-monthly follow-up data over a three-year period by a large number of participants. I also managed the initial email invitation to all the online cohort of AURAH2 participants and subsequent questions or issues reported by the online participants for the duration of the three-year follow-up period. During the AURAH2 online follow-up period, I also liaised closely with AN Computing to ensure the website operated effectively and that user issues were reported and resolved rapidly, with the exception of 11 months of maternity leave (June 2016 to May 2017), during which time Dr Speakman undertook this role. At the end of online follow-up, along with Dr Speakman, I managed the decommission of the website and the secure storage of the online AURAH2 data. I have undertaken all the statistical analyses presented in this thesis. For the first analysis of the AURAH study data (presented in Chapter 6), I worked in close collaboration with Dr Ada Miltz to analyse the data and was the lead author for the published paper (Appendix XV). For Chapter 7, I analysed the data with guidance from my secondary supervisor, Dr Valentina Cambiano, and wrote the paper (Appendix XVI). I also presented this work as a poster at the 2nd European Chemsex Forum in Berlin in 2018 (Appendix
I planned and performed the statistical analysis for the published results of Chapter 8 (see Appendix XVII) and Chapter 9, with statistical support from Dr Cambiano, and wrote the papers based on these chapters. Throughout my PhD I have attended and presented results and updates from the AURAH and AURAH2 study to the steering committees, participated and coordinated meetings with the site teams and provided support to colleagues working with the AURAH and AURAH2 datasets for their own PhDs.

10.2 Publications and other outputs arising from the thesis

Based on work conducted in this thesis, I published five manuscripts as first author: two based on the methods chapters (255, 309), Chapters 3 and 4, and three on the results chapters (2-4), Chapters 6, 7 and 8. The first methods paper (255) detailed the set-up, management and recruitment to the cross-sectional AURAH study, and was published in 2015. The title of this paper was: ‘A cross-sectional study on ‘Attitudes to and Understanding of Risk of Acquisition of HIV” (AURAH) study: Design, Methods and Participant Characteristics’ (Appendix XIII). The second paper (309) was published in 2016 and described the set-up and recruitment to the online prospective cohort study, AURAH2, with the title of: ‘Attitudes to and Understanding of Risk of Acquisition of HIV Over Time: Design and Methods for an Internet-based Prospective Cohort Study Among UK Men Who Have Sex With Men (the AURAH2 Study)’ (Appendix XIV). Both studies were the largest of their kind conducted in multi-site sexual health clinics across England. Results from Chapter 6 were published in 2017 (3), titled: ‘Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics’ (Appendix XV). The main results from Chapter 7 were published in 2018 (2), titled: ‘Changes in recreational drug use, drug use associated with chemsex, and HIV-related behaviours, among HIV-negative men who have sex with men in London and Brighton, 2013-2016’ (Appendix XVI). This paper was also presented at the 2nd European Chemsex Forum in Berlin 2018 (see Appendix XVIII). Most recently, I published the results outlined in Chapter 8 in 2019 (4), this paper was called: ‘Changes in chemsex and sexual behaviour over time, among a cohort of MSM in London and Brighton: Findings from the AURAH2 study’ (Appendix XVII). This paper was also presented as an oral presentation at the National HIV Nurses Conference in Manchester, June 2019. An additional paper using the results from Chapter 9 (Factors associated with starting, stopping or initiating chemsex in the AURAH2) is in preparation for submission.

10.3 Summary of thesis findings

This thesis provides unique prevalence estimates of recreational drug use, poly drug use and chemsex among HIV negative MSM engaged with sexual health clinics across England.
It provides the first evidence from the UK, and indeed Europe, regarding changes in chemsex over time among an online cohort of MSM at risk of HIV. In this final chapter I discuss the findings from each results chapter in the context of literature published during the course of this PhD (2014-2019), having summarised evidence prior to 2014 in Chapter 2. My results demonstrated that a large proportion (over half) of HIV negative MSM attending sexual health clinics were engaged in some form of recreational drug use, and that whilst the proportion engaged in chemsex was smaller, around a third had reported recent (past three months) chemsex drug use, which is significant in terms of vulnerability to HIV and STI infections (2-5, 298). My results from the AURAH study (Chapter 6 and 7) showed that recreational drug use and particularly chemsex was concentrated in, but not limited to large, urban areas, which could guide future service development or identify where sexual health systems require strengthening. I examined the evidence on the associations of poly drug use and chemsex, with a range of high risk sexual behaviours that potentiate HIV and STI transmission, particularly measures of CLS, as outlined in my results in Chapters 6 and 7, and publications from this work (2, 3). I also examined the relationship of poly drug use and chemsex drug use with mental health and wellbeing. Sexual and mental health are important components contributing to the significant disparity in health between MSM and the heterosexual population (8).

My results demonstrated the significant decline in prevalence of chemsex among HIV negative MSM over a short (three year) period of time from 2015 to 2018 (4), which was reflected in similar trends in a number of measures of sexual risk behaviours among MSM in the AURAH2 study. Additionally, my results have implications for intervention strategies. The identification of those participating in chemsex and the subsequent offer of heightened levels of support and engagement with integrated sexual health and drug services, during periods of time when MSM are involved in chemsex, could help to prevent HIV infection and promote general sexual health. There is the potential to provide holistic care and advice for MSM reporting high risk sexual behaviours, that may indicate propensity for future chemsex engagement. MSM, particularly in London are well-engaged with sexual health services (308) and therefore integrated sexual health and drug services provide an ideal location to offer HIV preventative measures, such as PrEP, and regular sexual health screening, as well as education and support on other physiological and psychological issues that are related to recreational drug use and chemsex, enabling MSM to proactively manage their health, sexual health and wellbeing.

The aims of this thesis were to describe the prevalence of recreational drug use, poly drug use and chemsex among HIV negative MSM attending sexual health clinics, and to examine whether these types of drug use had changed over time. In contrast to the majority of
research on recreational drug use and chemsex among MSM, this thesis focussed specifically on HIV negative MSM. In doing so it has developed and substantiated evidence that will support recommendations for HIV prevention strategies and broader general health, among a specific group of MSM who are at high risk of HIV infection. The findings can contribute valuable evidence and recommendations to support the government commitment of ending HIV transmission in England by 2030 (310).

10.4 **Prevalence of recreational drug use, poly drug use and chemsex, and associations with measures of sexual behaviour, in the AURAH and AURAH2 studies.**

In Chapter 2, I reviewed published evidence from the UK on prevalence of recreational drug use among MSM and the (then) emerging phenomenon of chemsex. My review of available literature highlighted gaps in the evidence specifically related to HIV negative MSM which informed development of my PhD which commenced in October 2014. Since 2014, research in this area has increased and in order to place the results of my thesis in the context of more recent evidence I conducted an updated literature search (detailed in Chapter 2, Section 2.2, pg.24) from October 2014 to October 2019 (for results see Appendix XIX). In the following sections, I discuss my results in light of the updated literature as well as current international evidence to place my results in context.

10.4.1 **Prevalence of recreational drug use among MSM**

The AURAH study demonstrated that over half (54.7%) of HIV negative MSM attending twenty clinics across England reported use of one or more recreational drugs in the past three months in 2013/14. This was marginally higher when restricted to MSM who attended three sexual health clinics in London and Brighton (57.4%). One year later (2015/16), the prevalence among HIV negative MSM participating in the AURAH2 study and attending the same three clinics in London and Brighton, was marginally higher again, 60.4%, as detailed in Chapter 7. The comparison of MSM from the three clinics that self-reported recreational drug use in the AURAH study (2013/14) with the AURAH2 baseline data (2015/16) provided the largest evaluation of two sets of data from HIV negative MSM in the UK. Whilst there was no other UK data specifically from HIV negative MSM to compare prevalence with, my results were similar to the prevalence estimate (54.2%) from Pufall et al in a large (n=532) study of HIV-diagnosed individuals attending 30 HIV clinics across England and Wales which also collected data in 2014 (311), although the recall period for this study was 1 year (311). Interestingly, despite the different recall periods (12 months vs three months in both AURAH and AURAH2) and the wide geographical diversity in clinical sites between the two studies (30 sites including smaller towns and clinics across England and Wales compared to three sites in London and Brighton (AURAH and AURAH2 comparison)), the prevalence
estimates of recreational drug use between HIV negative MSM in the AURAH and AURAH2 studies and the study of HIV-diagnosed MSM are similar, although other published evidence suggests that recreational drug use (and in particular chemsex, as discussed in Section 10.4.2) is generally higher among HIV-diagnosed individuals (133, 221, 311, 312). One potential reason for the slightly higher estimates from the comparison of the AURAH study data (restricted to three sites in London and Brighton) and the AURAH2 baseline data could be found in the specific locations of the clinics, in London and Brighton, both large urban areas, where large proportions of the MSM community reside and socialise (313), and where access to, and obtaining of drugs is relatively straightforward (133), compared to smaller towns and rural areas.

In total there have been ten UK studies (5, 6, 298, 314-320) in the past five years that recruited participants (not disaggregated by HIV status) from sexual health clinics with which to compare my thesis results to. These studies have generated a wide range of prevalence estimates of recreational drug use among MSM, within which the prevalence estimates of the AURAH study (2013/14) and AURAH2 baseline data (2015) lie at the higher end, and in the case of the AURAH2 baseline data, provide the highest prevalence estimate of any of the studies at 60.4%, see Figure 27. Prevalence ranged from 18.0% for recreational drug use (current reporting of) in a retrospective case note review of MSM (HIV-diagnosed and HIV negative) (n=357) attending three sexual health clinics across Manchester during 2014 (320), to 60% of MSM that reported ever using drugs in a small (n=150) sexual health survey in one London sexual health clinic in 2015 (314). However, confidence intervals for the latter were not reported and, due to the small sample size, were likely to have been wide. Potentially the lowest (18.0%) prevalence estimate in the range could in part reflect the design of the study which was a retrospective case note review in which self-report of drug use during a face-to-face clinic appointment was assessed, thus increasing the potential for social desirability bias if a participant did not feel comfortable reporting drug use to the healthcare professional (320). This measure is also subject to a certain amount of missing data if individual healthcare professionals ask about recreational drug use whilst others do not. Similar to my results from the comparison of the AURAH and AURAH2 baseline data, the high prevalence estimate in the small survey in a London sexual health clinic could also be in part be explained by the location of the clinic being in London which had documented an increase in recreational drug use among MSM attendees since 2013 (314). In fact, nearly half (n=11/24) of the studies conducted in the UK in the last five years that have investigated recreational drug use among MSM, including the AURAH2 study, have been in London or Brighton. Although this likely reflects the areas with the highest burden of drug use (3, 296) and thus a natural focus for research, it may limit the generalisability of the results to the
wider MSM population that live and socialise outside of these cities. There is limited data between 2014 and 2019 on recreational drug use from other cities outside of London and Brighton. Recently three studies have reported on chemsex prevalence in Manchester (136, 321) which is discussed further in Section 10.4.3, pg.232, and one study of sexual health clinic attendees (across three Manchester clinics, detailed above) provided the prevalence estimate of 18.0% (the lowest in the range for recreational drug use) of MSM engaged in recreational drug use in 2017 (320). Figure 27 shows the prevalence of recreational drug use among MSM from published studies in the last three years. The figure only includes studies from the last three years (as opposed to five) to provide the most recent prevalence estimates for recreational drug use, poly drug use and chemsex, it also includes estimates for sexualised drug use.
Figure 27 Prevalence of recreational drug use, poly drug use, sexualised drug use and chemsex among MSM in the UK 2017-2019³

<table>
<thead>
<tr>
<th>Study</th>
<th>Recall Period</th>
<th>Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewell et al 2018³</td>
<td>Event level</td>
<td>MSM, online, nationwide, UK</td>
</tr>
<tr>
<td>Elliot et al 2017</td>
<td>Current use</td>
<td>new HIV+ MSM, in-patient admissions, London</td>
</tr>
<tr>
<td>Hegazi et al 2017</td>
<td>Event level</td>
<td>MSM, sexual health clinics, London</td>
</tr>
<tr>
<td>Melendez Torres 2017</td>
<td>Event level</td>
<td>MSM, online, nationwide, UK</td>
</tr>
<tr>
<td>Ottaway et al 2013/14</td>
<td>Last year</td>
<td>MSM, sexual health service, Brighton</td>
</tr>
<tr>
<td>Ottaway et al 2015</td>
<td>Last year</td>
<td>MSM, sexual health service, Brighton</td>
</tr>
<tr>
<td>Rosinska et al 2018</td>
<td>Last year</td>
<td>MSM, sexual health clinics, London</td>
</tr>
<tr>
<td>Pufall et al 2018</td>
<td>Last year</td>
<td>HIV+ MSM, HIV clinics, England &amp; Wales</td>
</tr>
<tr>
<td>Frankis et al 2018</td>
<td>Last year</td>
<td>MSM, sexual health clinics, London</td>
</tr>
<tr>
<td>Sewell et al 2019</td>
<td>Last year</td>
<td>MSM, sexual health services, London &amp; Brighton</td>
</tr>
</tbody>
</table>

³ Data from specialist drug services not included
*Prevalence from baseline AURAH2 study
*Prevalence from 1st online questionnaire reported in AURAH2 study
The inclusion of twenty clinical sites from across England in the AURAH study provided a more diverse sample of MSM than any other study that recruited from sexual health clinics in the past five years (the majority of studies collected data from either individual (6, 314-316) or two to three sexual health clinics (5, 6, 298, 316-320) (maximum six sites (317)). Therefore my results are potentially more generalisable to the wider MSM population engaged with sexual health services, than studies that only used a few clinical sites (Appendix XIX). My results showed that a substantial proportion of MSM attending sexual health clinics in London (55.2%), and Brighton and the South (59.8%), had used recreational drugs within the past three months, whilst just over a third reported recreational drug use in the Midlands and the North (34.4%).

Similar to the prevalence estimates of recreational drug use obtained from the AURAH study (restricted to three clinics 57.4%) and AURAH2 baseline comparison (60.4%) in specific sexual health clinics, the Gay Men’s Sex Survey (GMSS), the largest online survey of community MSM in the UK (n=15,360), conducted in 2014, estimated that 52.6% of MSM surveyed had ever used drugs (despite the different recall periods AURAH2 used three months, GMSS used a range of recall periods including ‘ever use’) (296). The GMSS used a wide range of online recruitment sources, including gay hook-up/dating apps and different websites, Twitter and Facebook and, the large sample size and online accessibility meant it was more likely to be reflective of the broader MSM population than the studies that solely recruited from sexual health clinics. Although the use of ‘any drugs’ and ‘ever used’, captured a wide range of drug use which does not indicate current or recent use, the survey potentially reached a wider proportion of MSM compared to studies that rely upon recruitment from sexual health services, and provided a bigger sample size. Despite the differences in sample and recall period (ever vs three months), there was not a large difference in prevalence of recreational drug use (52.6%) among MSM (both HIV negative and HIV-diagnosed) in GMSS compared with HIV negative MSM attending sexual health clinics (54.7%) in the AURAH study 2013/14 (3), which is surprising, given the broader spectrum for drug use plus the inclusion of HIV-diagnosed MSM in the GMSS, which potentially could have increased the prevalence estimate. However the similarity in prevalence may be explained by the tendency for men recruited from sexual health clinics to provide an overestimation of risk behaviour in MSM as a whole, due to the high risk population that such clinics usually recruit (322, 323).

The prevalence range across all studies of recreational drug use among MSM recruited online between 2014 to 2019 was smaller than the range in studies that recruited from
sexual health clinics (18.0% (320) to 60.0% (314)). The prevalence from online studies ranged from 42.9% in a large (n=2142) longitudinal study (324) published in 2016, to 52.6% among MSM that participated in the GMSS in 2014 (296), which my results from the AURAH study and the AURAH2 baseline data lie more closely to. Comparisons between studies with different recall periods should be made with caution. However, one reason for the narrower range in the online studies could be the larger sample sizes that were recruited which enable more precise results. However, whilst online surveys potentially capture a wider sample of MSM than studies using sexual health clinic attendees, and are possibly less subject to social desirability bias, they are at risk of other biases such as over-representing gay-identified MSM due to recruitment techniques used (325), and may over-estimate levels of risk behaviour when compared to general population probability surveys of MSM (326, 327).

There are three sources of national data that monitor recreational drug use in the UK with which my results could be compared to, although there are limitations with comparisons due to differences in sampling frameworks, design and (current) data availability. The first is the National Drug Treatment Monitoring Surveillance system (NDTMS) which, since 2017, has disaggregated data by sexuality but not specifically between men and women, rather gay/lesbian or bisexual (328). The 2018 data showed that 4% (n=570/16775) of presentations to services for non-opiate drug use were by people identifying as gay/lesbian in 2017, although as this was the first data point it is unknown whether this has changed from previous years (328). Furthermore the survey is conducted among people in contact with drug and alcohol services, predominantly drugs such as opiates, crack cocaine and alcohol (328) which many recreational or chemsex drug using MSM would fail to identify with (7, 152). The second source of national data is the annual unlinked anonymous monitoring survey of people who inject drugs (who are engaged with specialist services) (n=2690 in 2018), the results of which are not disaggregated by sexuality (329). The third source is an update to an existing surveillance system, the Genitourinary Medicine Clinic Activity Dataset (GUMCAD) which collects surveillance on STI diagnoses, tests and services from commissioned sexual health services in the UK, and which in 2018 was updated to (GUMCADv3) to collect information on recreational drug use, types of drugs used, whether used during sex and injecting drug use (330). Clearly this will be a useful source with which to compare the AURAH study and AURAH2 baseline data, and to monitor trends in drug use and sexual health over time. However, data on recreational drug use since the update is not yet available, this is planned for release in 2020.

In terms of international literature with which to compare my reported prevalence of recreational drug use from the AURAH study and the AURAH2 baseline data, there are several sources of varying design. A recent (2019), large, cross-sectional, multi-centre (n=33
sites) study among HIV-diagnosed individuals (n=1401) in Spain revealed a lower prevalence (49.5%) (331) of recreational drug use (in past year) than shown among HIV negative MSM in the AURAH study (54.7%) or the AURAH2 baseline data (60.4%). This is despite a longer recall period for drug use (12 months vs three months) and the sample being HIV-diagnosed MSM in the Spanish study. There are no similar studies to mine within the HIV negative population in Europe. A better comparison, in terms of HIV negative status is provided by several studies from the USA that have reported prevalence of recreational drug use among HIV negative MSM, the most recent (2019) being in the context of PrEP use (332). This study was a prospective cohort study of MSM prescribed PrEP at sexual health clinics in Connecticut (n=172). Use of one or more drugs (from a list of marijuana, cocaine, methamphetamine, poppers (amyl nitrate), MDMA/ecstasy/molly, ketamine (special K), heroin, opioids and benzodiazepines) was reported by 57% of MSM (in the past three months), with the majority of use of cannabis (41%) and poppers (26%) (332), although further examination of types of drug use (such as poly drug use or chemsex) were not investigated. Despite the small sample size of the study, it highlighted further that contact with HIV negative MSM in sexual health clinics provides a prime opportunity to assess for recreational drug use, particularly in the context of starting PrEP. At a national level in the USA, the Centers for Disease Control conducts behavioural surveillance among persons at high risk for HIV infection in rotating, annual cycles among three different populations of those at increased risk for HIV; the MSM cycle (gay, bisexual and other men who have sex with men); the injection drug use cycle (Persons who inject drugs (PWID)); and the HET cycle (heterosexually active persons at increased risk for HIV infection). During each cycle, the National HIV Behavioural Surveillance (NHBS) survey recruits over 10,000 participants from across the USA for an interview and an HIV test (333). Results from the past three MSM cycles have shown that there has been an increasing trend in non-injecting recreational drug use (in the past year), from 49% in 2011 (228), to 55.7% in 2014(228), to 55.9% in 2017 (334). This high national prevalence of non-injecting recreational drug use (55.9%), which is thought to be broadly reflective of use in MSM across the USA, due to the large sample size (2017 n=10,104) drawn from cities in states across the USA, was slightly lower prevalence compared to that of MSM in the baseline AURAH2 study (60.4%). However methodological differences between the two studies are important to consider, NHBS used venue-based sampling (for example bars and clubs), and a recall period of one year, compared with AURAH2 clinic-based sampling and a three month recall period (2).

10.4.2 Prevalence of poly drug use among MSM

The results for poly drug use among MSM in the AURAH study and AURAH2 baseline data reflected the pattern of recreational drug use in the two studies. Nearly a fifth (23.6%) of
MSM in the AURAH study (2013/14) reported poly drug use, which marginally increased to 25.7% when restricted to those that attended three sexual health clinics in London and Brighton, and increased a year later, to 30.7% among MSM in the AURAH2 study (2015/16). However, as I detail in Chapter 7, the increase in poly drug use in the three clinics between the AURAH (2013/14) and AURAH2 baseline data (2015/16) was not found to be significant after adjustment for sociodemographic factors (age, ethnicity, sexual identity, university education, ongoing relationship status). As per recreational drug use, the results from Chapter 6 (Section 6.3.5, pg.151) also demonstrated that geographical location was significantly associated with poly drug use; those that attended a clinic in the Midlands and the North were less than half as likely to report poly drug use (PR 0.42 95%CI: 0.24, 0.74) compared to those attending a clinic in London or the South.

Possibly due to enhanced media and academic interest in chemsex in the past five years (discussed further in Section 10.4.3), there have been few studies and less research focus on poly drug use (which I defined in AURAH and AURAH2 as the use of three or more drugs within the last three months), outside of chemsex drug use, despite it emerging as a prominent trend among drug using MSM in the 1980’s and 90’s and the strong associations with sexual risk behaviours that potentiate HIV and STI transmission (as detailed in Chapter 2, Section 2.3.6, pg.41). Other than my results from the AURAH study, detailed in Chapter 6, and my comparison of poly drug use among MSM in the AURAH study with AURAH2 baseline data, Chapter 7, only two studies (5, 299) have reported prevalence of poly drug use in in the UK (see Appendix XIX), one of which was in the context of chemsex. This study retrospectively reviewed case notes of 818 MSM that attended two sexual health clinics in London in 2014/15, and estimated poly drug use prevalence of 67.3% but this study did not define poly drug use (5). Notably the authors estimated prevalence of poly drug use among those that reported chemsex rather than the total number of case notes reviewed which explains the considerably higher prevalence estimate due to the higher likelihood of chemsex drugs being taken in combination (5). The other (much smaller, n=59) study, which recruited in 2014/15, was an opt-out survey of new HIV admissions to an acute medical assessment ward and London's largest HIV in-patient unit (Chelsea and Westminster hospital) (299). Poly drug use was defined as 'more than one drug in the same time period' and estimated prevalence was 53% (299), however the sample size of the study was very small, and the difference in participants recruited (HIV-diagnosed, in-patients) meant it was also a poor comparator for the AURAH study results (HIV negative, sexual health clinic attendees).

As my results from both Chapter 6 and Chapter 7 demonstrated, poly drug use was significantly associated with the majority of measures of sexual behaviour among MSM,
specifically measures of CLS and bacterial STI diagnoses within the past three months, which could increase the likelihood of HIV or STI transmission (2), discussed further in Section 10.4.4, pg. 237. Therefore, poly drug use should warrant remaining on the research agenda alongside chemsex. This finding is complimented by results from a recently published (2018), large (n=16,814) analysis that used data from the 2014 Gay Men’s Sex Survey, to examine patterns of recent drug use (defined as last 12 months) among gay men to develop a typology of drug use and explore the difference in socio-sexual characteristics of MSM in each class of use (335). Similar to the results from the AURAH and AURAH2 baseline data, this study identified a sizeable number of poly drug-using MSM and pointed out the need to consider drug-related harms outside of chemsex drugs that have become increasingly the focus of most drug related research in MSM (335). In fact the authors posited that the greater number of sexual encounters that could lead to HIV transmission could well occur outside of the smaller (but higher risk) chemsex drug using class and should not be overlooked in terms of prevention strategies (335).

An action plan from Public Health England (2015/16) recognised and sought to address the disparity in health and wellbeing that exists between MSM and the heterosexual population, with a focus on both recreational drug use and sexual health, as well as mental health, alcohol and wider determinants of health (45). However the AURAH and AURAH2 studies were the only studies (with the exception of a study which investigated chemsex prevalence among PEP attendees (6)) to specifically investigate recreational drug use, poly drug use and chemsex (discussed in Section 10.4.3) among HIV negative MSM in the past five years. The majority of other research studies either did not disaggregate by HIV status (5, 61, 136, 155, 296, 298, 314-319, 321, 324, 335-340), or specifically only included HIV-diagnosed MSM (299, 311). Whilst previous research has demonstrated the high proportion of recreational drug use among HIV-diagnosed MSM (221), my results demonstrate this is also true for HIV negative MSM, who form a significant proportion (>90%(83)) of the MSM population. HIV negative MSM have been under represented in research into recreational drug use and for whom the potential benefits of targeted prevention initiatives, particularly HIV prevention ones, are high. My results from Chapters 6 and 7 also highlight that a substantial number (over one in five in 2015/16) of MSM attending sexual health clinics are poly drug-using, which is also significantly associated with measures of high-risk sexual behaviour such as CLS. The fact that the proportions of recreational and poly drug use are high among MSM attending sexual health clinics demonstrates the opportunity that sexual health services have to engage, discuss and provide support on issues related to drug use. The findings also suggest that the integration of drug services, specifically for MSM, would be optimally placed within the sexual health setting as it is clearly within this setting that a
considerable number of MSM present for sexual health screening and treatment, who may not be engaged with any other services.

10.4.3 Prevalence of chemsex among MSM

In Chapters 6 and 7 I outlined the results from the AURAH study which estimated the prevalence of chemsex drug use in MSM attending the twenty clinic sites to be 21.8% (3) in 2014/15. The estimate was slightly higher when restricted to the three clinics that also participated in the AURAH2 study (24.2%) and higher again among AURAH2 participants (at baseline) in 2015/16, at 32.3% (2). The AURAH2 baseline estimate (32.3%) was similar to prevalence of event-level chemsex at completion of the first questionnaire among the online participants of the AURAH2 study, 31.8% (4), as detailed in Chapter 8. This suggests, in line with other studies (155, 286) that the use of chemsex drug use (within the past three months) may be an acceptable proxy for chemsex. In parallel with my results on recreational drug use, chemsex prevalence, particularly from the AURAH2 baseline data (restricted to three clinics) (24.2%) and the online data from the AURAH2 participants (34.3%), was higher compared with the majority of other studies (discussed further in this section) conducted among sexual health clinic attendees within the past five years, but were similar to prevalence estimates found in two studies of HIV-diagnosed MSM. Firstly from the large (n=532) study conducted across 30 out-patient clinics across England and Wales (29.5%) (311) and secondly among new HIV-diagnosed in-patients (31%) (299), both described in Section 10.4.1, pg.223 (see Appendix XIX). Similar to my results from the comparison of the cross-sectional AURAH study (in three clinics) and AURAH2 baseline data, which demonstrated an increase in chemsex over a three-year period, were the results from another study which also specifically sampled HIV negative MSM. This small (n=152) study conducted a case note review of attendees at a sexual health service for PEP in Brighton in 2013 to 2015 (6) over two different four-month periods in three years (6). The study reported an increase in PEP attendances related to sexualised drug use from 18% (n=9/51) in 2013/14 to 41% (n=41/101) in 2015 (6). The small sample size and use of a single clinical site indicated that the results should be interpreted with caution, as findings may not be generalisable to MSM outside of Brighton and those not engaged with sexual health services or aware of PEP. However, in line with my results from Chapter 7 (2), the results of this study also indicated an increase in chemsex participation among MSM attending sexual health services, sampled within the same time frame as the AURAH study and AURAH2 baseline data, and from one of the same clinics that participated in the AURAH2 study.
Another more recent (2018) study demonstrated a lower prevalence estimate of chemsex, despite being conducted in London. The study further emphasised the risk of HIV transmission among MSM engaged in chemsex. Prevalence of 'current use' of chemsex reported by a retrospective case note review of MSM (both HIV-diagnosed and negative) attending two sexual health clinics in London in 2014/15 (n=1850), was 16.5% (n=286/1734) (298), and the study found that those reporting chemsex participation had five times higher odds (AOR 5.06; 95%CI: 2.56-10.02) of being newly diagnosed with HIV infection than those that did not report chemsex participation (298). However, the study did not define a recall period, only 'current chemsex participation' and disclosed considerable amounts of missing data as a result of the retrospective design. Added to this participants were asked about chemsex participation face-to-face in the context of a routine appointment, and therefore data may have been subject to a far greater degree of social desirability bias if participants were reluctant to disclose a potentially stigmatising behaviour to a healthcare provider (298), which is likely to provide some explanation for the disparity between results with the AURAH2 study in which the self-completed, anonymous (identified only by study ID) baseline questionnaire may have reduced social desirability bias.

Of the seventeen publications that investigated chemsex in the past five years, eight (5, 61, 298, 299, 311, 315, 336, 339) provided an estimate of chemsex prevalence. There was a wide range of estimates from 9.3% of MSM in Brighton (recruited through venues and respondent driven sampling, n=411 in Brighton) in a large (n=4266) European wide survey of MSM (339), to 41% in the retrospective case note review of sexual health clinic attendees for PEP in a Brighton clinic (6), which in part explains the high prevalence estimate as PEP attendees are likely to have sought PEP for an identified high risk sexual encounter. As with the results of recreational and poly drug use, my results from Chapters 6 and 7 provide prevalence estimates towards the higher end of the spectrum for chemsex prevalence, which could partly be attributed to the clinic locations and the fact that participants were recruited from sexual health clinics, but could also reflect an actual increase in chemsex among MSM attending sexual health clinics over the time periods studied. However, the high prevalence of chemsex drug use that I described in the baseline data of the AURAH2 study (32.3%) (Chapter 7), and at the first online questionnaire among the online participants (31.8%) (Chapter 8), was not reflected in results from online community studies reported in the past five years. My results from the AURAH2 baseline data in 2015/16 (32.3%) were over double the prevalence compared to a large (n=1648) online sample of UK MSM that were recruited in 2018 (336) and reported a prevalence of 15% in last year. Of note, this online study recruited online through Facebook advertising and social media posts, which may have been limited in terms of reaching potential participants who did not use social
media or the specific community groups which the study was advertised on. My results from both the AURAH study (in three clinics) (24.2%) and AURAH2 baseline data (32.3%) were also considerably higher than another large (n=2328) online study that recruited men across Scotland, Ireland, Wales and N. Ireland via socio-sexual networking sites and estimated chemsex prevalence to be 18.5% (recall period ‘ever used chemsex drugs’) (155), which again may not be representative of MSM who do not use social media, but does provide a wide sample of MSM, outside of London and Brighton, and is not limited to MSM engaged with sexual health services. One potential reason for the disparity between my results and the results from the other online studies could be the geographical location (as already discussed) where MSM reside, socialise and engage in chemsex, which is generally concentrated in large, urban areas, further indicating where targeted services are best placed for optimal access by those that need them.

Differences in prevalence estimates between other published studies and my own results are indicative of a number of heterogeneities in study design (online samples vs clinic samples), recall periods (a range of recency of use or event-level) and how chemsex has been defined. These issues mean it is hard to gauge the actual scale of chemsex within the UK, and this has been highlighted by three literature reviews published within the past two years which sought to synthesise data on sexualised drug use or chemsex (286, 341, 342). Two of the reviews examined international literature (342, 343) and one focused on UK literature (286). Edmundson et al’s review of the UK literature (from January 2007 and August 2017) focused on sexualised drug use and included my paper which presented the results from Chapter 6 (3). This review found that the majority of studies were one-off cross sectional studies, which were able to provide a snapshot of prevalence from the population that was sampled, but unable to identify trends or temporal relationships between chemsex and other risk behaviours (286). This review also noted that prevalence data for chemsex and sexualised drug use was predominantly from large urban areas (the majority in London) and mainly from populations recruited from sexual health clinics, and that the differing recall periods and definitions of chemsex by studies meant that prevalence estimates varied considerably with few studies reporting event-level chemsex (286). This review was conducted before I analysed and published the results of Chapters 7 (2) and 8 (4), but concluded by recommending that longitudinal event-level data for chemsex and sexualised drug use were needed (286) and that a standardised measure for chemsex (event-level) should be utilised, both of which I addressed in Chapter 8.

The increased attention on sexualised drug use and chemsex among MSM in the past five years has not been limited to the UK. An indication of the increased attention that chemsex in particular has warranted, notably in Europe, was highlighted by the first European
chemsex forum which took place in London in 2016. The purpose of the forum was to engage international cross-sector sexual health workers, drug workers, psychologists, researchers, policy makers and commissioners, community leaders, service users and community advocates in dialogue around chemsex, and to explore trends across Europe and share good practice. There were over 200 attendees at the first forum, and it has since been followed by two more which have taken place in Berlin in 2018 and in Paris in 2019 respectively. I presented the results of Chapter 7 at the Berlin meeting in 2018 (Appendix XVIII).

Additionally, there have been several European studies in the last five years that have examined prevalence of chemsex among MSM. Geographically, the studies within the closest proximity to the UK have been from Ireland, of which the largest was conducted in 2015 (344). This study used an online, community recruited, nationally promoted survey for MSM that recruited over 3000 participants (344). It demonstrated that in the past year, 33% of MSM had used recreational drugs, 7% of MSM had used chemsex drugs, and that MSM with HIV (5% of the sample) were significantly more likely to report use of either recreational drugs or chemsex compared to MSM who had never tested. Similar to the AURAH study results in Chapters 6 and 7, this study used chemsex drug use as a proxy for chemsex. However the low prevalence of chemsex drug use described in the study results was much lower than the AURAH study results (21.8%), potentially due to the difference in sample (community vs sexual health clinic) and because chemsex may not be an established part of the Irish gay social scene as it now is in cities across England (136). The low prevalence of chemsex drug use from this study was also significantly lower than in another study of MSM attending sexual health clinics in Dublin (18–27%) (345), and another more recent (2019) study that specifically examined chemsex among MSM in a specific sexual health clinic in Dublin, which reported a prevalence of chemsex (event-level) of 27% (n=131/486), closer to the prevalence in my results from the AURAH2 baseline survey (32.3%) (2). The disparity between the results of these studies could partly be explained by the difference in sampling (online vs sexual health clinics), but may also reflect the lower prevalence of chemsex outside urban areas, as the results (7% had used chemsex drugs in the past year) were similar to an online survey of 2328 MSM across Ireland, Northern Ireland, Scotland and Wales (Appendix XIX), which reported that 8% of respondents had used chemsex drugs in the last year (155). Both of the online studies that were conducted outside of England are more likely to be reflective of the wider MSM population in Ireland, Northern Ireland, Scotland and Wales, due to the large and diverse sample that they each recruited (155, 344), and effectively demonstrate the need to tailor specific services for certain areas so
that signposting to chemsex support services is available in areas where an integrated sexual health and drug service may not be warranted.

Evidence from two other large, multi-country studies has demonstrated that prevalence of chemsex in cities in the UK is higher than in many other European cities (136, 339). The European MSM Internet Survey (EMIS)⁴ recruited 174,209 men from 38 countries to an anonymous online questionnaire in 25 languages in 2010 (136). The study found that use of four chemsex drugs (GHB/GBL, ketamine, crystal methamphetamine, mephedrone) in the past four weeks was highest in Brighton (16.3%), Manchester (15.5%), London (13.2%), Amsterdam (11.2%). Although this study estimates a much lower chemsex prevalence in cities across the UK compared with the AURAH and AURAH2 study estimates, the EMIS results may be subject to considerable change since data collection was in 2010 (EMIS 2017 has yet to publish results on drug use from specific countries), but the results do further emphasise the relationship between MSM engaged in chemsex and large, urban areas (136). A more recent (2014), smaller (n=4266) survey from thirteen European cities, also found that use of chemsex drugs (same drugs as in EMIS, recall period – last sexual encounter) was highest in Brighton (9.3%) after Brussels (13.9%) (339). Both studies focused on large, urban areas to sample MSM. In contrast, a study from the Netherlands (2018) showed that a high proportion 35% (n=87/250) of MSM attending sexual health clinics outside of Amsterdam reported chemsex (event-level) in the last six months, and that the proportion of chemsex was comparable between MSM living in an urban-area and MSM living in a non-urban area (36% vs. 33%) (346). Although chemsex was defined as the use of one or more of a wide range of drugs (listed as cocaine, crystal meth, designer drugs, GHB/GBL, ketamine, mephedrone, speed, XTC/MDMA) before or during sex, this study found that the use of the three typical chemsex drugs were used by 26% of MSM visiting clinics outside of the major cities in the Netherlands, which mainly reflected the use of GHB/GBL (346). Whilst recruitment of MSM from sexual health clinics in this Dutch study may have captured a high risk group of MSM, the study results provide a reminder in line with my results from the AURAH study presented in Chapter 6, that chemsex may be concentrated in, but not limited to major cities (3, 346). Furthermore, whilst chemsex specific services (integrated in sexual health clinics) would be optimally placed within larger urban connotations, resources and training for sexual healthcare professionals providing care in smaller cities and towns outside of ones that are less prominent in the gay community, should not be overlooked.

⁴ EMIS 2017 was published in 2019 and prevalence of chemsex was reported at 10% (in last 12 months) across the included countries (n=50 European countries), specific country/city comparisons were not detailed.
10.4.4 Associations of recreational drug use, poly drug use and chemsex with sexual behaviour, and other related physical and mental health harms

My results that were outlined in both Chapters 6 and 7 demonstrated the strong associations of both poly drug use and chemsex with measures of sexual behaviour that potentiate the risk of HIV or STI transmission (2, 3). In addition both chapters showed that a large burden of STIs were carried by less than half of MSM (in the studies) attending clinics (36.9% in the AURAH study and 46% in the AURAH2 study). My results that demonstrated the association between poly drug use and chemsex with measures of sexual behaviour are common to chemsex research identified in the UK literature from the past five years (5, 6, 61, 155, 298, 311, 315, 316, 318, 324, 336, 337) (Appendix XIX) and are also true for poly drug use, for which much of the evidence dates from before 2014 (See Chapter 2, Section 2.3.7, pg.44).

Whilst the use of drugs in chemsex is primarily to enhance or prolong sexual experiences, the association with sexual risk is foreseeable but not always a purposeful consequence (62). The clear relationship between chemsex and sexual risk behaviour indicates that MSM participating in chemsex should be optimally supported to engage with sexual health services, but it is also important to consider that a sexual health service may be a point of contact for MSM which provides an opportunity to address other physical and mental harms that may or not be related to chemsex.

The literature on the complex relationship between recreational drug use, mental health and sexual behaviour is varied. Whilst some studies indicated an association between recreational drug use and depressive symptoms (207, 208), other studies have shown that poor mental health was generally not associated with either illicit drug use or sexual behaviour (347, 348). One large (n=3017) online cohort study from Australia concludes that MSM use drugs to enhance sexual pleasure and that neither substance use nor sexual behaviour was seemingly driven by mental health issues (347). However the authors noted that, MSM who considered their substance use to be problematic were more likely to experience symptoms of both anxiety and depression (347).

A recent (2019) systematic review from the USA reviewed efficacy of interventions to address substance use and risk behaviour among MSM who use methamphetamine. The review found that, of the 26 different interventions assessed, psychosocial interventions (n=20) showed the most promise in terms of reducing substance use and sexual risks, and that pharmacological interventions (n=5) had limited efficacy in addressing either substance use or sexual risk (349). The review only included studies of MSM using methamphetamine, which, in the comparison of the AURAH and AURAH2 baseline data and the AURAH2 follow-up data (at first online questionnaire), was used by a smaller proportion of MSM
(AURAH 6.6%, AURAH2 9.8%, AURAH2 follow-up 11.1%) than those taking mephedrone (AURAH 20.9%, AURAH2 28.8%, AURAH2 follow-up 25.2%) or GHB/GBL (AURAH 13.1%, AURAH2 19.8%, AURAH2 follow-up 19.9%). Methamphetamine is often considered a ‘harder’ drug in terms of how it is taken, as it is usually injected. Interestingly, as my results in Chapter 8 detail, crystal methamphetamine was the only drug in which the decline of self-reported use over time in the study was not found to be significant (11.1% (69/622) to 6.9% (5/72) (p=0.289)), which potentially reflect its more addictive nature (350), although the numerical decline may well have been significant with larger numbers. Similar to my conclusions from Chapters 7 and 8 that point to the benefits of integrating sexual health and drug services for MSM (2, 3), the review from the USA provided compelling evidence that integrating interventions to address both drug and sexual related harms was effective and that a combination of interventions that concomitantly address psychological and social processes, and an individual’s drug use, were more likely to sustain reductions in drug and sexual related risk (349).

The strong associations between measures of sexual behaviour and poly drug use or chemsex drug use, as described in my results from Chapters 6 and 7, demonstrate the interplay between sexual health and recreational drug use, and are particularly emphasised in chemsex practices. However other studies described above (and in Chapter 2, Section 2.3.8, pg.46) have demonstrated the important, but not fully understood, overlap with mental health. The interrelationship between sexual health, mental health and substance use is more distinct in MSM compared with heterosexual men (351) and this ‘syndemic’ is thought to substantially drive the health disparities observed in this population, which Public Health England sought to address in their 2015/16 action plan (45). Along with sexual health, and the other potential physical harms (such as overdose, withdrawal and death) and mental health harms associated with chemsex (discussed in Chapter 2, Section 2.3.8, pg.46), the health disparities experienced by MSM should be addressed through services that are acceptable to MSM and with which they engage routinely, such as sexual health services. Nationally there has been an increase of 11% in sexual health service provision for MSM from 2017 to 2018, continuing the increasing trend from 2015 (352), despite cuts in funding, although it was estimated that less than half of MSM (42%) had had an HIV test in a sexual health service in 2017 (83). Nevertheless, the integration of drug use services with sexual health have been shown to be an acceptable and preferable place for MSM to access services (152, 302) and thus inter-sector collaboration between sexual health, drug and psychology services could provide substantial health and wellbeing benefits to gay men, beyond HIV and STI prevention, and should be prioritised in funding considerations that seek to address the inequalities in health experienced by MSM.
10.5 Longitudinal data on chemsex among MSM and predictors of starting or stopping chemsex.

10.5.1 Changes in chemsex over time among MSM.

My results from the AURAH2 study outlined in Chapter 8 and published in 2019 (4), provide the only data from the UK and Europe to describe changes in the prevalence of chemsex at event-level among MSM, over time. My results from the analysis of online participants from the AURAH2 study showed that chemsex prevalence (at the first online questionnaire) among HIV negative MSM participating in the AURAH2 study was higher than the majority of other studies that published prevalence estimates from the same time (155, 298, 336, 339), see Figure 27. As I described in Chapter 8, event-level chemsex significantly declined over the AURAH2 online follow-up period, from 31.8% at the first online questionnaire to 11.1% by the 9th questionnaire (4). This was reflected in within person changes in frequency of chemsex (in the past three months) whereby the number of participants reporting ‘no chemsex’ increased from 68.3% to 90.3% at the final questionnaire, and the more frequent users that reported chemsex ‘weekly’ decreased from 5.1% at the first online questionnaire to 0% at the 9th. The high prevalence of chemsex at the start of the study and subsequent decline could be partly explained by the clinics that MSM were recruited from, which (particularly 56 Dean Street) are renowned for their specialised chemsex support services. This may have both attracted more MSM engaging in chemsex to attend these clinics, explaining the initial high prevalence, but also have provided an experienced service to manage and decrease chemsex behaviour, explaining the decline over time, despite some selective loss to follow-up of MSM engaged in chemsex.

As expected among sexual health clinic attendees, the prevalence of any anal intercourse among MSM in the AURAH2 study was high at the first online questionnaire (90.4%) and remained high at the 9th (86.1%), as was CLS, which actually increased over time, 66.2% at the first online questionnaire, to 70.8% at the 9th online questionnaire (p=0.03). However, the majority of sexual behaviour measures, notably reporting a bacterial STI, also significantly decreased over the AURAH2 follow-up period (26.4% to 9.7%) which is contra to recent data from Public Health England which showed a resurgence in STIs with a disproportionate number of new infections found within MSM in 2017/18 (353). This opposing trend in STI incidence could reflect engagement with sexual health clinics by MSM in the AURAH2 study, as over half that completed a final follow-up questionnaire in AURAH2 reported having had a recent (within three months) HIV test. My results could also be a regression to the mean, whereby as a result of recruiting MSM from sexual health clinics, which is presumably a time of high risk, risk would tend to fall subsequently. This could have
contributed to trends, although it is unlikely to be the only factor as some measures of sexual activity did not fall and actually increased over time.

There remains limited event-level data available that describes the prevalence of chemsex among MSM (n=three studies) in the past five years from the UK with which to compare my results. Whilst two of the studies were cross-sectional and therefore could only provide a snapshot of chemsex prevalence (among MSM in Brighton-9.3% (339), and in the community 14.2% (61), detailed in Section 10.4.3 pg.237), the other study used longitudinal data but did not investigate changes in chemsex prevalence over time, and instead focused on within subject encounter-level association between sexualised drug use and condomless anal intercourse in MSM (324). As observed by Edmundson et al’s review of UK literature (286), there is a lack of event-level data for chemsex with which to understand the scale of the issue among MSM, particularly as drugs such as mephedrone are commonly used in social situations outside of chemsex. There is a distinct need for a standardised measurement of chemsex, which is best captured by ‘event-level’ measurement which should be used by future studies as the optimal measure for data collection (286).

In terms of longitudinal data on recreational drug use or chemsex patterns and trajectories among MSM at an international level, there is a large (n=2260) study from Australia with obvious similarities to the AURAH2 study. The Australian, Following Lives Undergoing Change (Flux) Study, is an online prospective cohort study that commenced in 2014/2015 and collected biannual data on illicit drug use among Australian MSM recruited online through social media, gay community websites and gay sexual networking websites (354). It commenced recruitment of participants in the same year as the AURAH2 baseline study (2015) with (ongoing) six-monthly follow-up. Using data from the Flux study to investigate perceived social norms towards drug use among MSM, baseline data analysis revealed a similarly high prevalence of recreational drug use (61%, last six months) to baseline data from the AURAH2 study (60.4%, last three months) (2), despite the differences in study design compared to the AURAH2 study. These differences include the Flux study recruiting through online advertising, a recall period of six months, and the location of the participants being unrestricted by urban areas or attendance at sexual health clinics (354). Recent (2018) results from the Flux study have described an increase over calendar time in concurrent use of methamphetamine, Viagra and other erectile dysfunction medications, and Truvada as PrEP (355), and shown that MSM reporting crystal methamphetamine use are more likely to be taking PrEP than those that do not, making a comparatively higher risk group of MSM better protected against HIV than those not using crystal methamphetamine (355). Other data from Flux has detailed the high (19.5%) history (ever use) of GHB/GBL use, of which 5.4% of MSM reported use within the past six months (180), reflecting the
difference in popularity of certain drugs between Australia and the UK (GHB/GBL use was 19.9% in past three months at the start of the online questionnaires in AURAH2). Further analysis of the Flux data has thus far been used to explore a range of topics including prevalence and correlates of injecting drug use among the cohort (356), a measure of drug-use sensation seeking (357), age-related prevalence and twelve-month incidence of illicit drug use (358) as well as, more recently (2019) PrEP uptake (359). Potentially Flux data could provide a useful comparison with longitudinal data from the AURAH2 study to examine whether the decline in chemsex that was found among MSM in the AURAH2 study is seen in the Flux cohort.

There have been several longitudinal studies from the USA that have investigated patterns of drug use among individuals over time. Similar to my results, these studies have found a decline in drug use over time among a cohort of MSM. However two of the studies are relatively old (published over five years ago) and both focussed more on individual drug use such as methamphetamine or other club-drugs, rather than the use of drugs during, or to facilitate, sex. The EXPLORE trial was a randomised controlled trial that examined whether individualised counselling sessions reduced HIV infection rates compared with standardised HIV testing and counselling, and although reducing recreational drug use was not a primary study outcome, some components of the intervention addressed drug use (360), and thus could partly explain the decline seen over time. However, the study found that, among both arms of the trial, drug use (methamphetamines, poppers, or sniffed cocaine) decreased over time (48 months follow-up) and that participants were at increased risk of engaging in high-risk sexual behaviour during the periods they reported increased drug use (360). In the same year, a study of 450 club-drug using MSM in New York who were recruited from gay venues across New York and followed up over a year in four appointments (113), also found that methamphetamine use declined over time. However there was a high rate of attrition (30%) over the year and the study was limited by specific recruitment of MSM who reported six-instances of drug use in the past year which therefore excluded MSM using drugs at a lower rate (113). The more recent (2016) ‘One thousand strong’ study was a longitudinal prospective cohort study that recruited over a thousand MSM from across the USA though email invitation to complete six monthly computer-assisted self-interviews plus provide a self-sample for HIV testing, and urine sample and self-swab for chlamydia/gonorrhoea testing, over a three year period (361). This study collected information at different time points on drug and alcohol use and sexual behaviour, although the focus of the study was not on recreational drug use. As yet there have been no published results relating to the cohort on recreational drug use with which to compare my results from the AURAH2 study.
My results outlined in Chapter 8 provided the largest investigation into changes in chemsex over time among HIV negative MSM at an international level, and demonstrated that chemsex declined over time among the cohort (despite some attrition, 35.7%), potentially due to available support through the sexual health clinics that participants attended, or potentially because a high risk behaviour such as chemsex is only sustainable for a relatively short period of time before lifestyle changes are made, or it becomes problematic and support is sought (or not). However, with limited data with which to compare my results to, added to the limitations of the study such as participants being recruited solely from sexual health clinics in London and Brighton (discussed in detail in Section 10.6, pg.248), and a relatively short follow-up period (three years) it is difficult to determine whether this pattern would be reflected in the wider MSM population engaged with chemsex. Additionally it is not known whether participants who stopped chemsex re-started after the study follow-up period finished.

10.5.2 Predictors of starting or stopping chemsex

My results outlined in Chapter 9 used the online longitudinal data from MSM in the AURAH2 study to investigate predictors of starting (for the first time), stopping or initiating (including starting for the first time) chemsex. My hypothesis, that a break up or change in relationship status can be a trigger for starting or initiating chemsex, is not supported by the results from this Chapter, which found no indication that a change in relationship status predicted starting chemsex, though this analysis may have been underpowered to detect an association. However my results showed that participants reporting high risk sexual behaviour are more likely to subsequently go on to engage in chemsex, which further imply that healthcare providers in sexual health services are well placed to identify those at risk through routine sexual health appointments which regularly capture sexual risk behaviour. There is limited data from the UK with which to contextualise my results, and no international data to the best of my knowledge, which is reflective of the relatively new concept of chemsex in the literature.

Only two studies from the UK have explored predictors of, or factors associated with chemsex in the past five years (305, 336). One cross-sectional study from 2016 used data from the Gay Men’s Sex Survey 2014 (detailed in Section 10.4.2, pg.230) (296), and found that age (30-49 years), region of residence (London), HIV status (HIV-diagnosed) and an increased number of casual sexual partners were the strongest factors associated with crystal methamphetamine use (305). Whilst the large, national sample (n=16,565) was potentially reflective of the wider MSM community, the cross-sectional design meant that predictors or causality could not be examined. The other cross-sectional study from 2018
(n=1649) recruited MSM using Facebook, to investigate factors associated with sexualised drug use (336). This study also found that age (being over 35 years), and greater partner numbers were associated with sexualised drug use, but furthermore that a recent HIV diagnosis, recent attendance at a GUM clinic and having a lower satisfaction with life and greater sexual satisfaction were all associated with sexualised drug use (336). Whilst limited to MSM who have social media accounts, the study recruited a large sample of MSM from across the UK, but was similarly limited in its cross-sectional design to examine predictors or causality with sexualised drug use (336). My results outlined in chapter 9 therefore currently provide the only analysis to date, using longitudinal data, of predictors of starting or stopping (and initiating) chemsex among MSM. Although my univariable analysis in Chapter 9 did not identify any individual sociodemographic, lifestyle or mental health and wellbeing characteristics associated with starting (for the first time) or initiating (including starting for the first time) chemsex. The results did demonstrate, similar to those from the cross-sectional studies described, that both starting and initiating chemsex were strongly associated with high risk sexual behaviour, particularly measures of CLS and a bacterial STI diagnosis. In contrast to the starting or initiating chemsex, there were several sociodemographic characteristics associated with stopping chemsex in univariable analysis. Being in an older age group (35-44 years) and reporting a clinically significant depressive score (PHQ 9>10) were both associated with stopping chemsex, which is in contrast to previously described studies that investigated mental health and chemsex (305, 336). In terms of sexual behaviour measures, in line with my results for starting or initiating chemsex, those who reported certain measures of CLS and bacterial STI infection were significantly less likely to report stopping chemsex at the next online questionnaire. My results in Chapter 9 provide a unique examination of predictors of starting and stopping chemsex which could be utilised by sexual health practitioners to help identify those at risk of engaging in chemsex and who may benefit from an increased level of support with sexual health and HIV prevention services.

10.6 Study limitations

10.6.1 AURAH study limitations

The cross-sectional, AURAH study captured a wide range of data on a multitude of topics. However, several limitations of the study are important to consider. The AURAH study questionnaire collected information on recreational drug use within the past three months. Whilst the structure of the questionnaire itself (see Appendix II) enabled estimation of prevalence of types of recreational drug use and individual drug use, it did not capture event-level data for chemsex. The recall period of ‘past three months’ was chosen for two reasons, firstly, because previous research has demonstrated that three months is the maximum
period of recall recommended to obtain accurate self-reports for sexual risk behaviour and to minimise recall bias (301); and secondly for ease of data comparison with HIV-diagnosed MSM that participated in the ASTRA study which used ‘past three months’ as a recall period when data was collected in 2011/12 (236). However, as highlighted by recent literature reviews (286, 341, 342), and in Chapter 2 (Section 2.3.9, pg.45), there has been no consistent or standardised use of a specific recall period for capturing recreational drug use or sexual behaviour measures, which has meant that comparisons with other studies are limited.

The definition of poly drug use that I used in my results was initially created for comparison with the ASTRA study (use of three or more drugs in previous three months) (362). However, I have since recognised the potential for cross-over with chemsex drug use (defined as the use of one or more of mephedrone, GHB/GBL or crystal methamphetamine) as use of the three chemsex drugs were not excluded from the definition of poly drug use. Since the definitions of poly drug use and chemsex drug use were defined for the AURAH study (Chapter 3) in 2013/14, it has been established that often chemsex drugs are often taken in conjunction with one another, particularly mephedrone and GHB/GBL (133) and thus the high prevalence of poly drug use reported in the AURAH and AURAH2 baseline results may have been partly driven by the high prevalence of chemsex drug use. Upon reflection a better estimation of poly drug use would have been to exclude the use of any of the three chemsex drugs, or to examine poly drug use of chemsex drugs in a separate analysis, so that I could provide an insight into poly drug use and associations with sexual behaviour that did not include the three drugs most commonly used in chemsex in the UK.

As with any study recruiting participants from a clinical setting there may have been a degree of sampling bias in the AURAH and AURAH2 studies, whereby those recruited to the study may not have been representative of the demographic of the clinic (322). To minimise this, research staff at the clinical sites were specifically asked to approach consecutive patients attending the sexual health clinics involved in the study over the recruitment time period. However issues such as time, private space for consent, sickness or absence by research staff may have impacted upon this. Despite this, participation rates for both studies (AURAH 60.0%, AURAH2 52%) was reasonable. Further sources of bias relate to questionnaire completion although the anonymous nature of the questionnaire attempted to minimise social desirability bias, whereby response to questions are influenced by how the participant wants to be perceived, and it has been shown that self-completion methods typically elucidate higher rates of sensitive behaviours than face to face interviews (322).
The AURAH study was designed to capture data specifically from MSM attending sexual health clinics, to provide recommendations for service provision and improvement. Nevertheless recruiting from sexual health clinics is likely to have provided an over-estimate of higher risk behaviours, such as recreational drug use and CLS, due to MSM attending having potentially identified an episode of sexual behaviour that warranted attendance, and having access to a clinic (322, 363). Whilst there is evidence that particularly within London, a large proportion of MSM are engaged with sexual health services (277), the generalisability of the study was limited and could not extend beyond MSM attending sexual health clinics, which excluded a key sub-group of the population at risk and not-engaged with services. Another issue with regards to generalisability was the location of the twenty participating clinics in the AURAH study. Whilst efforts were made to include clinics outside of large, urban, metropolitan locations, all of the clinic sites were within towns and cities, rather than in rural areas, thus somewhat limiting the generalisability of the results to MSM in urban as opposed to rural settings.

10.6.2 AURAH2 study limitations
Baseline data collection for the AURAH2 study was subject to the same limitations as outlined above for the AURAH study. However planning for the online data collection phase of the study allowed for a change in question construction (in particular to collect data on event-level chemsex) and allowed a more streamlined questionnaire design and content that was tailored for the individual participant. This was likely to have improved completion rates of the online questionnaires and engagement of MSM in the study (see Chapter 8). There is also some evidence to suggest that collecting sensitive and personal information on drug use and sexual behaviour online may reduce social desirability bias (300). Nevertheless, limitations unique to cohort studies are also important to consider. Although the attrition rates were moderate in the online phase of the AURAH2 study (over 60% of MSM were still engaged with the questionnaires in the last six months of the study), and there was no difference in terms of chemsex drug use between those that did and did not enter the online phase of the study, there was some selective drop-out of those that reported chemsex over the duration of the study (as I described in Chapter 8, Section 8.3.8, pg.197). The study also administered repeat questionnaires which may confer intervention-like effects on study participants by causing participants to reflect or change their behaviour as a result of regular questioning (364). Evidence suggests that engagement with questionnaires that encourage reflection on behaviour may play a factor in study participants becoming more conscious of the consequences of their choices, which could have led to behaviour change (364), and may partly explain the decline in chemsex and individual chemsex drug use witnessed in this cohort.
Another potential limitation of the AURAH2 study was the recruitment of participants attending sexual health clinics renowned for their focus on integrating substance use services with sexual health services. This may partly explain the decline in chemsex among the online AURAH2 participants if they became engaged with chemsex support services or were more aware of issues relating to chemsex through exposure to information in clinic. Two of the clinics that participated in the AURAH2 study, 56 Dean Street and Mortimer Market Clinic, are specialist centres of chemsex support in London where chemsex awareness is robust and specific psychosocial interventions are offered frequently to high-risk MSM. The Claude Nicol clinic in Brighton also offers a service specifically for MSM that includes one to one support and advice around chemsex and drug use. The increased awareness and community engagement around chemsex within the study clinics may have resulted in a larger proportion of those engaging in chemsex opting to attend them, which firstly may account for an overestimation of chemsex in this population and secondly may not be a true reflection of chemsex trajectories among MSM attending sexual health clinics that do not have integrated specialist services, or indeed among MSM engaged with chemsex who do not attend sexual health services.

10.7 Recommendations for future work

Whilst the UK body of literature in the area of drug use in MSM, and in particular chemsex had doubled (n=24 studies identified) (Appendix XIX) during the period of my PhD from 2014 to 2019, compared to 2000 to 2014 (n=12 studies), gaps remain in the evidence base, as well as methodological issues that persist in published studies. Current data on prevalence of recreational drug use and chemsex among MSM is based upon a multitude of independent studies that are unique to the specific groups of MSM recruited to each study. Thus, methodological differences exist in individual study design such as measurement of recreational drug use and recall periods. A standardised framework for capturing certain information, such as using event-level data to capture chemsex, or a specific time-frame for recency of drug use, would have enabled synthesis of data from multiple studies and improve inter-study comparisons. Moving forward, a standardised definition for types of drug use, the use of a standard recall period or inclusion of event-level data alongside different recall periods would allow better synthesis of study data.

The majority of published studies, including my results outlined in this thesis demonstrated that the number of MSM engaging in recreational drug use and specifically chemsex are in a minority, but due to the strong and significant associations with high risk sexual behaviours, place this group of HIV negative gay men at significant risk of STI and HIV infection, as well as other physical and psychological harms. A better understanding of chemsex outside of
London and Brighton is needed so that integrated services and targeted funding can support sexual health services to deliver adequate care. There is a large disparity between data collection in large, urban areas, with smaller towns and rural areas. Whilst this may in part be due to evidence suggesting that chemsex is more prevalent in large, urban communities (3, 133), it is important to understand the scale of the issue within the whole MSM community, so that responses are tailored specifically where they will be of most benefit. Large national surveys using online data collection may help to address this, supplemented with data from sexual health services or community HIV testing services that are engaged with MSM. Additionally, research that uses data from both MSM attending sexual health clinics (such as GUMCAD) and online studies that can potentially capture those not engaged with sexual health services, could provide a more accurate reflection of overall behaviours than studies that recruit from one or the other.

There has been some qualitative work on values and motivators (62, 144, 365) attributed to engagement in chemsex, and it is important to understand the socio-psychological drivers that mean whilst some individuals engage in chemsex, a large proportion of MSM do not, despite how pervasive chemsex has become on the gay scene, and the apparent ease which it can be arranged, particularly in London (133). Qualitative work to extrapolate an understanding of what motivate or influences MSM to not engage in chemsex could be used to inform and tailor services within the sexual health setting, or community organisations, to equip MSM to circumnavigate chemsex, despite how accessible and prevalent it is. Community initiatives such as the Dean street well-being programme and social nights such as ‘Let’s talk about gay sex & drugs’ in London are already providing an open resource for MSM to discuss and learn about chemsex in a social, accessible setting which may be contributing to some individual decision-making around engagement in chemsex.

Due to the relatively new phenomenon of chemsex at the time this thesis commenced in 2014, I did not seek to differentiate between problematic and non-problematic chemsex, but rather to estimate prevalence, associations and changes over time, among all HIV negative MSM engaged with chemsex in the AURAH and AURAH2 studies. However, upon reflection, the longitudinal design of the AURAH2 study presented a unique opportunity to examine changes over time in problems associated with chemsex, such as sick-days from work, changes or deteriorations in relationships with social and familial networks as well as physical (such as drug dependence) or psychological issues that are commonly reported by MSM engaged in problematic chemsex, but which were unfortunately not captured by the online questionnaires (7). Such information could be useful to inform healthcare professionals to ask the right questions around chemsex to help identify those for which casual engagement is becoming more problematic and to offer interventions at support.
Aside from my results published from the AURAH and AURAH2 studies, there is a distinct lack of data on recreational drug use and chemsex specifically among HIV negative MSM, a group for whom targeted prevention strategies that include chemsex support would be highly beneficial and are likely to be different to the needs of HIV-diagnosed MSM. Future work that either specifically recruits HIV negative or undiagnosed MSM, or disaggregates by HIV status, particularly in large, online studies that have the potential to reach a wide range of participants, could provide information to strengthen chemsex support as well as HIV and STI prevention strategies, including PrEP. Furthermore, the AURAH2 study is the only study from the UK to have investigated longitudinal patterns and trends on chemsex among MSM, and research with extended follow-up time (beyond three years) would help to contextualise this data and provide a better understanding of long-term patterns of chemsex and sexual behaviour outcomes. This could help to target STI and HIV prevention strategies, as well as harm reduction needs and psychological support for those that might benefit from them most, and help to address the inequalities in sexual, mental and physical health highlighted by Public Health England’s action plan to promote the health and well-being of MSM (45).

10.8 Conclusion

With HIV incidence declining among MSM in the UK (81) there is a clear need to focus prevention efforts on potential transmission risk, that remains among a small group of HIV negative MSM with risk behaviours. However, with budget cuts to sexual health services at an all-time high (366), and with rising STI incidence such as syphilis and gonorrhoea among MSM, it is essential that service provision is targeted towards those that most need it. The results from my thesis demonstrate that MSM engaged in recreational drug use, and in particular chemsex, are at significant risk of both STI and HIV infection, as well as other harms, and should be a focus for targeted prevention interventions such as regular HIV and STI testing and treatment, PrEP initiation and chemsex support which is potentially only necessary for select, and relatively short periods of time. Such targeted interventions could be cost-effective for the NHS in the long-term if HIV infections are prevented and the cost of lifetime HIV treatment is averted. Furthermore, integrated drug and sexual health services provide an opportunity to engage with a population who may not present to other services, and for whom specialist drug services that can manage addiction, psychological support and harm reduction would be highly beneficial, and should not be overlooked from a funding perspective by commissioners.
Appendix I. AURAH study Patient Information Sheet and Consent form.

Attitudes to and Understanding of Risk of Acquisition of HIV:

The AURAH Study

Patient Information Sheet and Consent Form

Version 2. 13/06/2013.

REC Ref: 13/LO/0246

We would like to invite you to take part in a research study. Please take some time to read this information about the study and decide whether or not to take part. Please ask the person who invited you to take part if anything is unclear or if you have any other questions.

What is the study about?

This is a questionnaire study, looking at the experiences and opinions of HIV negative individuals. The questionnaire asks about your health, quality of life and lifestyle, and your knowledge about HIV and HIV treatment. It also asks about your views on the risks of getting HIV. The study will help us understand more about risks of getting infected with HIV amongst people attending sexual health clinics.

Who is taking part?

This study is being conducted at a number of sexual health clinics in the UK. All individuals who are not diagnosed with HIV and who are attending these clinics for a routine sexual health screen and/or an HIV test are eligible to take part. We would like as many people as possible to participate; by taking part you would be making a valuable contribution to medical research.

What will I have to do?

If you agree to take part, you will be asked to complete a questionnaire about your health and well-being and your lifestyle. The questionnaire includes some personal questions about your sex life. You can complete the questionnaire on your own. It should take 15 to 30 minutes to complete.

When will I complete the questionnaire?

We would like you to complete the questionnaire today, while you are here in the clinic, either before or after seeing the doctor. There is a private space available for you to complete your questionnaire, if you would prefer this. The study nurse will make sure you don’t miss your appointment with the doctor.
Will my questionnaire responses be confidential?

Yes, completely. Your name will NOT be written on the questionnaire. Your answers will NOT be seen by the doctors and nurses in the clinic. Your completed questionnaire can be placed in a sealed envelope which will not be opened by the clinic staff.

What clinical information will be recorded?

If you agree to take part in the study, we will record the results of any STI or HIV tests that take place today in the clinic.

Will any other information about me be gathered?

You will be asked if you are willing to provide contact information. This is for reminders about this study, to ask if you want to take part in future research in this area and to notify you if you win a monthly prize draw for a £100 shopping voucher. You do not have to agree to this, and you can still participate in the study if you do not agree.

If you agree, we will only use this information to contact you by email or by text. Any messages sent will be non-specific ones such as “You may recall you gave us permission to contact you. We would like to know if you are interested in taking part in a study which leads on from the AURAH study. Please reply if you are still interested.”

If you consent to providing your contact details then this information will be sent to the research team at the research centre. If you agree now but change your mind, you can reply to any message and ask us to remove you from the contact list. If you decide not to participate in future research, we will delete all contact details after a period of two years.

What will happen to the information?

Your anonymised responses will be added to everyone else’s responses. The information you give will be transferred to the Research Department of Infection & Population Health at University College London (UCL) and analysed by computer. The data will only be analysed for groups and not for individuals. The findings will be submitted to medical journals and national and international health conferences. Details of publications from this study will be made available on the study website (www.astra-study.org/aurah).

Do I have to take part?

No. It is up to you to decide whether or not to take part. If you do decide to take part you may keep this information sheet and you will be asked to sign the consent form. If you agree to take part you can still change your mind and decide not to complete and submit the questionnaire. If you choose not to take part in the study, this will not affect the standard of care you receive.
Are there any risks in taking part?

There is no risk to you in taking part in the study. If you find the questionnaire raises issues that concern you, or that you would like to discuss further, please ask the nurse to arrange for you to speak to the site lead researcher (see below) who will do their best to answer your questions.

What are the possible benefits of taking part in the study?

What we learn from this study will help us form better interventions for people at risk of acquiring HIV. You may benefit from this personally through the results of the study which may help you evaluate your own decisions on safer sex and practices.

What if there is a problem? (the following is standard advice that we give for all potential participants in research studies)

If you have a concern about any aspect of this study, you should ask to speak to the site lead researcher (see below) who will do their best to answer your questions. If you remain unhappy and wish to complain formally you can do this by contacting the Patient Advice and Liaison Service (see below).

National Health Service or UCL complaints mechanisms are available to you. Please ask the site lead researcher if you would like more information on this.

In the unlikely event that you are harmed by taking part in this study, compensation may be available.

If you suspect that the harm is the result of the Sponsor’s (University College London) or the hospital's negligence then you may be able to claim compensation. After discussing with your site lead researcher, please make the claim in writing to Alison Rodger who is the Chief Investigator for the research and is based at UCL Research Department of Infection and Population Health, Royal Free Campus, Rowland Hill Street, London, NW3 2QG. The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

Who is leading this research?

A team of HIV specialists and researchers from around the UK is leading this study. The study is being coordinated by the UCL Research Department of Infection and Population Health, and is funded by the National Institute for Health Research. This study has been reviewed and approved by a research ethics committee.

Will I be paid expenses for taking part?

There will be no reimbursement of expenses for participants.
Who can I contact for any further information about the study?

You can get more information about the study from your doctor or nurses at the clinic or contact the site lead researcher (see below).

Site lead researcher and contact details

..................................................

Site Patient Advice and Liaison Service contact details

..................................................
CONSENT FORM for AURAH Questionnaire Study.

Clinic ID: __________________

AURAH Study ID: __________________

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Please initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I confirm that I have read and understand the information sheet (version 2 and 13.06.2013) for this study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.</td>
<td>☐</td>
</tr>
<tr>
<td>2.</td>
<td>I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.</td>
<td>☐</td>
</tr>
<tr>
<td>3.</td>
<td>I agree to take part in this study.</td>
<td>☐</td>
</tr>
<tr>
<td>4.</td>
<td>I understand that the information I give will be transferred to the research team at the UCL Research Department of Infection and Population Health.</td>
<td>☐</td>
</tr>
<tr>
<td>5.</td>
<td>I agree / do not agree to give my contact details (name and either email address or mobile number for texts) to study staff and by doing this I agree that I may be contacted for reminders or to take part in future research in this area. This information will be transferred and stored securely at the UCL Research Department of Infection and Population Health.</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>(email)</td>
<td>(number for text messages)</td>
</tr>
</tbody>
</table>

________________________       __ __ /__ __ / __ __ __ __         __________________
Name of patient                Date                                  Signature

________________________       __ __ /__ __ / __ __ __ __         ________________
Name of person taking consent  Date                                  Signature

When completed: 1 for participant; 1 for researcher site file; 1 (original) to be kept in medical notes
Appendix II. AURAH study questionnaire (male)

See overleaf.
Thank you for agreeing to complete this confidential questionnaire. Please answer all the questions as fully as you can. You are free to leave any question you do not want to answer – although we hope that you will answer all those that apply to you.

Please do NOT write your name on this questionnaire. Your answers will NOT be seen by the doctors and nurses in the clinic.

If you have any questions or need any help, please ask the person who gave you this questionnaire.

Please place your completed questionnaire in the envelope, seal the envelope and put in the box at reception, or give it back to the staff member who gave it to you.

If you have already completed this questionnaire recently, thank you. There is no need for you to complete it again.

Thank you for your help!

Study No. [Redacted] Date: ___ / ___ / ___
SECTION A: GENERAL INFORMATION

A1. Are you:

☐ Male
☐ Transgender (Female → Male)

A2. How old are you?

Please write in either the year of your birth: 19 __ __

Or your age in years: __ __

A3. Which ethnic group best describes you? (Please tick ONE ONLY)

A. White
☐ White British
☐ White Irish
☐ White other

D. Mixed
☐ White and Black African
☐ White and Black Caribbean
☐ White and Asian
☐ Mixed other

B. Black or Black British
☐ Black African
☐ Black Caribbean
☐ Black other

E. Chinese or other ethnic group
☐ Chinese
☐ Any other ethnic group

C. Asian or Asian British
☐ Indian
☐ Pakistani
☐ Bangladeshi
☐ Asian other

A4. Were you born in the UK?

☐ Yes — IF YES, PLEASE GO TO QUESTION A5
☐ No

If NO, which country were you born in? ____________________
When did you first move to the UK?
- Less than 1 year ago
- 1 to 5 years ago
- More than 5 years ago

How well do you speak English?
- Very well / fluent
- Quite well
- Not at all well

How well can you read English?
- Very well / fluent
- Quite well
- Not at all well

<table>
<thead>
<tr>
<th>A5. What is your current work situation? (Please tick ONE ONLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Employed or self-employed FULL-TIME (at least 30 hours per week)</td>
</tr>
<tr>
<td>- Employed or self-employed PART-TIME (less than 30 hours per week)</td>
</tr>
<tr>
<td>- Full time student / education / training</td>
</tr>
<tr>
<td>- Unemployed and registered for benefits</td>
</tr>
<tr>
<td>- Unemployed, NOT registered for benefits</td>
</tr>
<tr>
<td>- Permanently sick / disabled (for 3 months or more)</td>
</tr>
<tr>
<td>- Temporarily sick / disabled (for less than 3 months)</td>
</tr>
<tr>
<td>- Looking after home / family / dependants full-time</td>
</tr>
<tr>
<td>- Retired</td>
</tr>
<tr>
<td>- Other (please specify) ..........................................................</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A6. What is your current housing situation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Own my own home (including with mortgage / loan / shared ownership)</td>
</tr>
<tr>
<td>- Renting from the council or housing association</td>
</tr>
<tr>
<td>- Renting from private landlord</td>
</tr>
<tr>
<td>- Temporary accommodation (hostel, shelter, bed &amp; breakfast, squat)</td>
</tr>
<tr>
<td>- Staying with partner / friend(s) / family</td>
</tr>
<tr>
<td>- Homeless</td>
</tr>
<tr>
<td>- Other (please specify) ..........................................................</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A7. Do you have enough money to cover your basic needs? (e.g. food, heating)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Yes, all of the time</td>
</tr>
<tr>
<td>- Yes, most of the time</td>
</tr>
<tr>
<td>- Yes, some of the time</td>
</tr>
<tr>
<td>- No</td>
</tr>
<tr>
<td>A8. What is your current level of education? (Please tick ONE ONLY)</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>□ Finished education with no qualifications</td>
</tr>
<tr>
<td>□ O levels / GCSEs (or equivalent qualifications at age 16)</td>
</tr>
<tr>
<td>□ A levels (or equivalent qualifications at age 18)</td>
</tr>
<tr>
<td>□ University degree or above</td>
</tr>
<tr>
<td>□ Other qualifications (please specify)</td>
</tr>
</tbody>
</table>

| A9. Are you currently in an ongoing relationship with a partner (wife or civil partner or girlfriend / boyfriend)? |
|-----------------------------------------------------------------------------------------------------------------
| □ Yes, I am in a relationship and living with my partner                                                       |
| □ Yes, I am in a relationship but not living with my partner                                                     |
| □ No, I am currently in an ongoing relationship with a partner                                                   |

If YES, overall, how long have you been in this relationship?
□ Less than 1 year                                                
□ Between 1 and 3 years                                           
□ More than 3 years                                               

If YES, is your partner HIV positive*?
*this means he/she has had an HIV test and been diagnosed with HIV
□ Yes                                                             
□ No                                                              
□ Don’t know                                                       

<table>
<thead>
<tr>
<th>A10. Do you have any children?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes</td>
</tr>
<tr>
<td>□ No</td>
</tr>
</tbody>
</table>
## SECTION B: YOUR WELLBEING

In this part of the questionnaire, we are using some standard sets of questions to ask you about your wellbeing. We apologise if some of the questions seem repetitive, but please take the time to answer each section, as each one is important. If you are worried about any symptoms, please talk to your doctor. The answers from this survey will not be seen by anyone involved in your care. Thank you for your help!

B1. Below is a list of symptoms. Did you have any of these symptoms during the PAST 2 WEEKS? Please tick one box in each row to tell us whether you have had the symptom and, if so, how much it DISTRESSED or BOTHERED you.

<table>
<thead>
<tr>
<th>Did you have any of these symptoms during the PAST 2 WEEKS?</th>
<th>No did not have the symptom</th>
<th>Yes, had symptom but it DID NOT BOTHER ME</th>
<th>Yes, had symptom and was bothered / distressed A LITTLE BIT</th>
<th>Yes, had symptom and was bothered / distressed QUITE A BIT</th>
<th>Yes, had symptom and was bothered / distressed VERY MUCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trouble remembering things</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>2. Pain</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>3. Headache</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>4. Numbness, tingling or pain in hands/feet</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>5. Muscle aches or joint pains</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>6. Nausea</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>7. Vomiting</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>8. Diarrhoea</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>9. Constipation</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>10. Feeling bloated</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>11. Dizziness</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>12. Sweats/fever</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>13. Cough</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>14. Shortness of breath</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>15. Problems with sexual interest/activity</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>16. Skin problems (rash, itching, dryness)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>17. Lack of appetite</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>18. Weight loss</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
### B2. Over the PAST 2 WEEKS, how often have you been bothered by any of the following problems? Please tick one box in each row.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little interest or pleasure in doing things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling down, depressed, or hopeless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling nervous, anxious or on edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not being able to stop or control worrying</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worrying too much about different things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Becoming easily annoyed or irritable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble relaxing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being so restless that it is hard to sit still</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling afraid as if something awful might happen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble falling or staying asleep, or sleeping too much</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling tired or having little energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor appetite or overeating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling bad about yourself—or that you are a failure or have let yourself or your family down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moving or speaking so slowly that other people could have noticed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoughts that you would be better off dead, or of hurting yourself in some way</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you were bothered by any of these problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

- Not at all difficult
- Somewhat difficult
- Very difficult
- Extremely difficult
B3. Please indicate which statements best describe your own state of health TODAY. (Please tick one box in each section)

Mobility
- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

Self-care
- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

Usual activities (e.g. work, study, housework, family or leisure activities)
- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

Pain / discomfort
- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain and discomfort

Anxiety / depression
- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed

B4. Here is a list of some things that other people do for us that may be helpful or supportive. Please read each statement carefully and place a tick in the column that is closest to your situation. (Give only one answer for each row)

<table>
<thead>
<tr>
<th></th>
<th>As much as I would like</th>
<th>Almost as much as I would like</th>
<th>Some, but would like more</th>
<th>Less than I would like</th>
<th>Much less than I would like</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I have people who care what happens to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) I get love and affection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) I get chances to talk to someone I trust about my personal problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) I get invitations to go out and do things with other people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) I get help when I am sick in bed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SECTION C: YOUR GENERAL HEALTH

**C1. Have you EVER been told by a doctor that you have any of the following conditions?**
(Please tick all those that apply)

- [ ] Cancer (not including non-melanoma skin cancer)
- [ ] Diabetes
- [ ] Stroke
- [ ] Heart disease / Coronary artery disease (e.g. heart attack, angina)
- [ ] High cholesterol requiring drug treatment
- [ ] Epilepsy
- [ ] High blood pressure requiring drug treatment
- [ ] Mental health condition (please specify)

- [ ] Any other major condition (please specify)

**C2. Are you receiving medical treatment or therapy for DEPRESSION?**

- [ ] Yes
- [ ] No

**C3. Are you receiving medical treatment or therapy for any other MENTAL HEALTH condition?**

- [ ] Yes → If YES, please specify mental health condition
- [ ] No

**C4. Do you have either of the following conditions?**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic (long-term) Hepatitis B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic (long-term) Hepatitis C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SECTION D: YOUR LIFESTYLE

### D1. Do you smoke cigarettes regularly (at least 1 per day)?
- **Yes → If YES, please give approximate number smoked per day**
- **No → I am an ex-smoker (given up smoking)**
- **No → I have never smoked**

### D2. How often do you have a drink that contains alcohol?
- **Never → IF NEVER, PLEASE GO TO QUESTION D8**
- **Monthly or less**
- **2 to 4 times a month**
- **2 to 3 times a week**
- **4 or more times a week**

### D3. How many units of alcohol* do you drink on a typical day when you are drinking?

*One unit = HALF a pint of beer / cider or a SMALL glass of wine or a SINGLE measure of spirits

- **1 or 2**
- **3 or 4**
- **5 or 6**
- **7 to 9**
- **10 or more**

### D4. Have you ever felt you should cut down on your drinking?

- **Yes**
- **No**

### D5. Have people annoyed you by criticising your drinking?

- **Yes**
- **No**

### D6. Have you ever felt bad or guilty about your drinking?

- **Yes**
- **No**

### D7. Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover?

- **Yes**
- **No**

---

8
D8. In the PAST 3 MONTHS, have you used recreational drugs (e.g. poppers, cannabis, cocaine)?

☐ Yes  ☐ No → IF NO, PLEASE GO TO QUESTION D9

If YES, which drugs have you used? (Please tick MORE THAN ONE box, if applicable)

☐ Acid / LSD / magic mushrooms  ☐ Ketamine (K)
☐ Anabolic steroids  ☐ Khat (chat)
☐ Cannabis (marijuana, grass)  ☐ Mephedrone
☐ Cocaine (coke)  ☐ Morphine
☐ Crack  ☐ Opium
☐ Codeine  ☐ Poppers (amyl nitrate)
☐ Crystal meth (methamphetamine)  ☐ Speed (amphetamine)
☐ Ecstasy (E)  ☐ Viagra
☐ GHB (liquid ecstasy)  ☐ Other (please specify)
☐ Heroin

D9. In the past 3 months, have you injected recreational drugs (e.g. heroin, crystal meth)?

☐ Yes  ☐ No → IF NO, PLEASE GO TO QUESTION E1

If YES, did you use needles, syringes or ‘works’ previously used by another person?

☐ Yes  ☐ No
SECTION E: YOUR SEXUAL HEALTH

E1. Why are you attending the clinic today? (Please tick all that apply)
☐ To get symptoms of infection checked or treated
☐ For a routine screening test
☐ To get contraception or contraceptive advice
☐ Other reasons (please specify)

E2. In the past year (BEFORE TODAY), have you been diagnosed with a sexually transmitted infection?
☐ Yes
☐ No — IF NO, PLEASE GO TO QUESTION E3

If YES, have you had any of the following in the PAST YEAR? (Please tick MORE THAN ONE box, if applicable)
☐ Syphilis
☐ Gonorrhoea
☐ Chlamydia
☐ LGV
☐ New (acute) Hepatitis B
☐ New (acute) Hepatitis C
☐ Genital herpes (new or recurrent)
☐ Genital warts (new or recurrent)
☐ Trichomonas
☐ NSU (Non Specific Urethritis)
☐ NGU (Non Gonococcal Urethritis)
☐ Other (please specify)

E3. Do you currently have any of the following symptoms? (Please tick all that apply)
☐ Abnormal discharge from penis
☐ Anal discharge
☐ Pain on passing urine
☐ Pain in the genital area or anus
☐ Sores or rash on the genital area or anus

E4. Are you circumcised?
☐ Yes  ☐ No
SECTION F: HIV

This section asks about Human Immunodeficiency Virus (HIV). A person known to be HIV positive has had an HIV test and been diagnosed with HIV. For HIV positive people, the viral load is a measure of HIV levels in the body.

F1. Are you HIV positive?

☐ No
☐ Don’t know
☐ Yes → If YES, this survey is only for people who have never been diagnosed with HIV. Please do not complete the rest of the questionnaire.

F2. Are you having an HIV test today?

☐ Yes
☐ No
☐ Don’t know / not sure

F3. Have you ever had an HIV test before?

☐ Yes
☐ No → IF NO, PLEASE GO TO QUESTION F4

If YES, approximately when was your last HIV test?

☐ Within the last 6 months
☐ More than 6 months ago and up to 2 years ago
☐ More than 2 years ago and up to 5 years ago
☐ More than 5 years ago

If YES, how many times have you had an HIV test in the past two years?

☐ Once
☐ Twice
☐ 3 or 4 times
☐ More than 4 times
### F4. Here are some statements about HIV. Please read each statement carefully and place a tick in the box that is closest to your viewpoint. (Give only one answer for each row)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Tend to agree</th>
<th>Undecided / no opinion / not relevant to me</th>
<th>Tend to disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I worry about getting HIV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) If I had HIV, I would feel comfortable telling others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Modern HIV medications are easy to take and have few side effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) If I had HIV and was being treated with modern HIV drugs, I would expect to have a normal lifespan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) If a person with HIV has an 'undetectable HIV viral load' this makes them less infectious to a sexual partner than if they had a high viral load</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) When HIV viral load is undetectable, a condom is not needed to prevent HIV transmission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Post Exposure Prophylaxis (PEP)
This means taking antiretroviral (anti-HIV) drugs soon AFTER unprotected sex for 4 weeks to reduce the risk of becoming infected with HIV.

F5. Were you aware that you can take PEP to try to prevent HIV infection after sex without a condom?
☐ Yes  ☐ No

Have you ever taken post exposure prophylaxis PEP?
☐ Yes  ☐ No → IF NO, PLEASE GO TO QUESTION F6

If YES, approximately how often did you take PEP in the last year?
☐ Never
☐ Once
☐ 2 to 3 times
☐ More than 3 times

Pre-Exposure Prophylaxis (PREP)
This means taking antiretroviral (anti-HIV) drugs (usually a daily pill) to reduce the risk of becoming infected with HIV.

F6. Were you aware that you can take PREP to try to prevent HIV infection?
☐ Yes  ☐ No

Have you ever taken PREP?
☐ Yes  ☐ No

If YES, approximately for how many days did you take PREP in the last year?
☐ Between 1 and 4 days
☐ Between 5 and 19 days
☐ 20 to 50 days
☐ More than 50 days

If it were more widely available, would you be interested in taking PREP (or more PREP if you have taken it before) to try to prevent HIV infection?
☐ Yes  ☐ No  ☐ Don’t know / need more information
### SECTION G: YOUR SEXUAL IDENTITY

**G1. How would you describe your sexuality?**

- □ Straight / heterosexual → IF YOU SELECT THIS OPTION, PLEASE GO TO QUESTION H1
- □ Gay / homosexual
- □ Bisexual
- □ Other (please specify) ...........................................................................................

**QUESTIONS G2 to G3 are for Gay or Bisexual Men**

**G2. What proportion of the following groups know that you are gay, bisexual and/or attracted to men?**

<table>
<thead>
<tr>
<th></th>
<th>All or almost all</th>
<th>More than half</th>
<th>About half</th>
<th>Less than half</th>
<th>Few or none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close family</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Friends</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Workmates</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

**G3. How often do you:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Often (4+ times a month)</th>
<th>Sometimes (2-3 times a month)</th>
<th>Occasionally (Once a month)</th>
<th>Rarely (Less than once a month)</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go to gay cafes, pubs, bars, nightclubs/discos</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Go to gay saunas</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Go to cruising areas where men meet for sex with men</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Use gay social networking websites or apps (e.g. Grindr, gay.com, gaydar.com)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
SECTION H: SEXUAL LIFESTYLE

This section asks about your recent sexual encounters. Remember this information is completely confidential. Your name or clinic number is NOT written on this questionnaire and your answers will NEVER be seen by the clinic staff.

H1. In the past 3 months, have you had sex* (vaginal or anal sex) with a woman?

*sex means either vaginal sex (your penis in a woman’s vagina) or anal sex (your penis in a woman’s anus)

☐ Yes
☐ No → IF NO, PLEASE GO TO QUESTION H2

If YES, did any of the sex within the last 3 months take place without a condom?

☐ Yes
☐ No → IF NO, PLEASE GO TO QUESTION H2

If YES:

(i) In the past 3 months, how many women did you have sex with, without a condom?

☐ One
☐ 2 to 4
☐ 5 to 10
☐ More than 10

Was this woman or one of these women your long-term partner?

☐ Yes
☐ No
☐ I don’t have a long-term partner

(ii) In the past 3 months, did you have ANAL sex with a woman without a condom?

☐ Yes, at least once
☐ No, never

(iii) In the last 3 months, when you had sex (vaginal or anal sex) without a condom, were the reasons for not using a condom in the following list? (Please tick all that apply)

☐ Trying for pregnancy
☐ Didn’t think about using a condom or did not have a condom
☐ Don’t like using condoms or it’s more enjoyable / close without a condom
☐ My partner didn’t want to use a condom
☐ Felt unable to discuss condom use
☐ Got carried away or was under the influence of alcohol or drugs
☐ Difficult to keep erection or ejaculate when using a condom

(iv) In the last 3 months, when you had sex without a condom, did you consider the risks of HIV infection?

☐ Yes
☐ No, I did not think about the risks at all
If YES, do any of these statements apply to you? (Please tick all that apply)
☐ I thought there was a very low risk of being infected with HIV
☐ I knew there was a risk of getting HIV but I am not so concerned about HIV that it made me
want to have sex using a condom

(v) In the past 3 months, when you had sex without a condom, did you know the HIV
status of your partner(s)?
☐ No, I did not know the HIV status of any of my partner(s) → IF NO, GO TO QUESTION H2
☐ Yes, I knew the HIV status of all my partner(s)
☐ Yes, I knew the HIV status of some of my partner(s)

(vi) In the past 3 months, did you have sex without a condom with a woman you knew
was HIV positive?
☐ Yes ☐ No → IF NO, PLEASE GO TO QUESTION H2

If YES, how many HIV positive women did you have sex with, without a condom, in the
past 3 months?
☐ One ☐ Two ☐ 3 or more

If YES, was this woman or one of these women your long-term partner?
☐ Yes ☐ No ☐ I don’t have a long-term partner

If YES, does the following statement apply to any of your HIV positive partners?
I thought the risks of catching HIV were low because my partner was taking anti-
retroviral therapy
☐ Yes ☐ No

H2. In the past 3 months, have you had anal sex* with a man?
*anal sex means your penis in a partner’s anus (rectum or back passage), OR a partner’s penis
in your anus (rectum or back passage).
☐ Yes ☐ No → IF NO, PLEASE GO TO QUESTION H3

If YES, did any of the anal sex within the last 3 months take place without a condom?
☐ Yes ☐ No → IF NO, PLEASE GO TO QUESTION H3

If YES:

(i) In the past 3 months, how many men did you have anal sex with, without a condom?
☐ One ☐ 2 to 4 ☐ 5 to 10 ☐ More than 10

Was this man or one of these men your long-term partner?
☐ Yes ☐ No ☐ I don’t have a long-term partner
(ii) In the past 3 months, when you had anal sex without a condom, which partner were you?
☐ Always the insertive / top partner (your penis was inside your partner)
☐ Always the receptive / bottom partner (your partner’s penis was inside you)
☐ Sometimes the insertive / top partner and sometimes the receptive / bottom partner

(iii) In the last 3 months, when you had anal sex without a condom, were the reasons for not using a condom in the following list? (Please tick all that apply)
☐ Didn’t think about using a condom or did not have a condom
☐ Don’t like using condoms or it’s more enjoyable / close without a condom
☐ My partner didn’t want to use a condom
☐ Felt unable to discuss condom use
☐ Got carried away or was under the influence of alcohol or drugs
☐ Difficult for me / partner to keep erection or ejaculate when using a condom

(iv) In the last 3 months, when you had anal sex without a condom, did you consider the risks of HIV infection?
☐ Yes
☐ No, I did not think about the risks at all

If YES, do any of these statements apply to you? (Please tick all that apply)
☐ I thought there was a very low risk of being infected with HIV
☐ I knew there was a risk of getting HIV but I am not so concerned about HIV that it made me want to have sex using a condom

(v) In the past 3 months, when you had anal sex without a condom, did you know the HIV status of your partner(s)?
☐ No, I did not know the HIV status of any of my partner(s) → IF NO, GO TO QUESTION H3
☐ Yes, I knew the HIV status of all my partner(s)
☐ Yes, I knew the HIV status of some of my partner(s)

(vi) In the past 3 months, did you have anal sex without a condom with a man you knew was HIV positive?
☐ Yes
☐ No → IF NO, PLEASE GO TO QUESTION H3

If YES, how many HIV positive men did you have anal sex with, without a condom, in the past 3 months?
☐ One
☐ 2 to 4
☐ 5 to 10
☐ More than 10

If YES, was this man or one of these men your long-term partner?
☐ Yes
☐ No
☐ I don’t have a long-term partner
If YES, does the following statement apply to any of your HIV positive partners?
I thought the risks of catching HIV were low because my partner was taking anti-retroviral therapy
☐ Yes  ☐ No

H3. In the past 12 months, have you had any NEW* sexual partners?
*this means people you have not had sex with before
☐ Yes  ☐ No

If YES, how many NEW sexual partners have you had in the past 12 months?
☐ One  ☐ 2 to 4  ☐ 5 to 10  ☐ 11 to 49  ☐ 50 to 99  ☐ 100 or more

H4. How much do you agree / disagree with the following statements? (Please give only one answer per row)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Tend to agree</th>
<th>Undecided / no opinion / not relevant to me</th>
<th>Tend to disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I feel confident that, if I want to, I can make sure a condom is used during sex with any partner, in any situation</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) I’d expect to ask any new partner their HIV status before we have sex</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) I would expect a new partner to tell me if they’re HIV positive before we have sex</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) I find it difficult to discuss condom use with any new sexual partner</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e) I am less likely to use a condom with a casual partner</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

H5. In the past 3 months, have you used the internet to find a sexual partner?
☐ Yes  ☐ No
### H6. In the past 3 months, have you undertaken any of the following sexual practices?

<table>
<thead>
<tr>
<th>Practice</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of sex toys</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If YES to either of the above, did bleeding occur during sex as a result?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### H7. In the past 3 months, have you participated in group sex*?  
*This means sex with more than one other person on the same occasion

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### H8. In the past 3 months, have you received money or drugs for having sex?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### H9. Would you be interested in receiving further information about safer sex and protecting yourself from HIV infection?  
(Please note you will NOT be contacted if you answer any of these questions)

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If YES, please tell us your preferred information sources by selecting from the possibilities below. (Please tick all that apply)

- Reading general information ...
  - on websites
  - in leaflets
  - other (please specify)

- Being on a distribution list to receive information ...
  - by email
  - by text message
  - by post
  - by phone call
  - other (please specify)

- Arranging to talk to a professional such as a ...
  - doctor
  - nurse
  - community worker
  - other (please specify)
Talking to others in the community such as...
- a group of people like me
- a person like me with training
- other (please specify) .................................................................

Please use the space below if you want to comment on question H9 or you want to raise any other issues
Thank you very much for completing this questionnaire. Please either seal the questionnaire in the envelope provided and put it in the box at reception or, if you took the questionnaire away to complete it, please post it back using the pre-paid envelope.

Further information, advice and support services about HIV and AIDS are available from the Terence Higgins Trust:

THT DIRECT HELPLINE: 0808 802 1221

From 10am to 8pm Mon to Fri

Website: http://www.tht.org.uk

This project is coordinated by the Research Department of Infection and Population Health, University College London, in collaboration with our clinical partners. For further details see the AURAH website at:

http://www.astra-study.org/aurah

This project is funded by the National Institute for Health Research.
Appendix III. AURAH study Protocol

AURAH Protocol

A cross sectional questionnaire study of sexual risk behaviour, attitudes to HIV transmission, antiretroviral treatment for prevention and wellbeing in HIV-negative individuals at risk of HIV-infection recruited from sexual health clinics

Attitudes to and Understanding of Risk of Acquisition of HIV:

AURAH Study

Version 2.0 24/04/2014 REC Ref: 13/LO/0246

AURAH Study Group

Core group:

- Dr Alison Rodger
- Dr Fiona Lampe
- Prof Andrew Phillips
- Dr Andrew Speakman

(Department of Infection and Population Health, UCL, Royal Free Campus)

HIV clinic leads / teams:

- Dr Richard Gilson (Mortimer Market Clinic, London)
- Dr Martin Fisher/ Nicky Perry (Brighton and Sussex University Hospital)
- Dr David Asboe/Dr Nneka Nwokolo/ Dr Rachael Jones/Christopher Scott (Chelsea and Westminster/Dean St Clinic/West London Sexual Health Centre)
- Dr Rebecca O’Connell (Newham Sexual Health Centre)
- Dr Michael Brady (Kings)
- Dr Dan Ivens (Royal Free Hospital)
- Prof Jane Anderson (Homerton)
- Dr Sris Allen (Coventry)

Advisory Group (additional collaboraters): Prof Lorraine Sherr (Department of Infection and Population Health, UCL, Royal Free Campus), Prof Graham Hart (Department of Infection and Population Health, UCL), Simon Collins (HIV i-Base), Prof Anne Johnson (Department of Infection and Population Health, UCL), Dr Alec Miners (Health Services Research Unit, London School of Hygiene and Tropical Medicine), Prof Jonathan Elford (Department of Public Health, City University, London)

Coordinating centre: HIV Epidemiology and Biostatistics Group, Research Department of Infection and Population Health, UCL, Royal Free Campus

Sponsor: UCL
1 BACKGROUND AND RATIONALE

During 2010, 6660 people were newly diagnosed with HIV in the UK, and the estimated number of people living with HIV in the UK was 91,500 by the end of that year [1] Although the annual number of new diagnoses has not risen since 2005 in the UK population overall, this figure is increasing among men who have sex with men (MSM), and among heterosexuals believed to be infected within the UK, suggesting that the number of new infections occurring within the UK is rising. [2]

Evidence of on-going or increasing HIV transmission among MSM [1-4] is consistent with evidence of increases in sexual risk behaviour in this group. Studies of MSM in the UK [3, 5-10] and elsewhere [11-14] have found increases in the prevalence of unprotected anal intercourse among MSM since the mid-1990s – coincident with the widespread use and success of combination antiretroviral treatment for HIV in developed countries. There have also been increases in diagnoses of other sexually transmitted infections over this period. [15-17].

Sexual transmission risk arises as a result of the negotiation of sex practices, or lack thereof, between HIV positive and HIV negative individuals – involving the perceptions and behaviours of both and which often differ according to serostatus. Hence strategies aimed at reduction of HIV transmission need to address differences in both HIV positive and negative individual’s perceptions, choices and behaviours [18]. This is particularly relevant when considering how the Swiss statement [19] (which stated that that HIV-positive individuals on effective ART with undetectable VL for at least six months and without sexually STIs are sexually non-infectious) and also the HPTN 052 study [20] (which demonstrated a reduction of heterosexual transmission in the immediate ART treatment arm of 96%), might have reached and influenced HIV negative persons in different ways to their HIV positive counterparts. Reports from outside Europe suggest (even before the Swiss Statement was released) that HIV negative MSM perceive a number of sexual practices with HIV positive MSM on ARVs as less risky than with HIV positive MSM not on ARVs (18). More recently an increased likelihood in HIV negative MSM to engage in risky sexual practices (e.g. unprotected anal sex) in serodiscordant relationships where their partner reports an undetectable viral load has been described [21]. Current data from the UK which inform on these themes from the perspective of HIV negative MSM –in particular attitudes to unprotected sex with individuals of unknown HIV status - and describes them in the context of mental/general health features, STI history, alcohol and drug use (and similarities/differences with counterpart data from HIV positive MSM), are limited.

The ASTRA study (undertaken by the AURAH investigators in 2011/12) investigated current levels of sexual risk behaviour, beliefs about viral suppression and transmission risk, the role of ART use and other factors in transmission risk behaviours and beliefs in a large (n=3100) unselected sample of HIV-infected patients under care in the UK, and among key demographic subgroups (MSM; Black African men and women; recently diagnosed people).
The AURAH study will examine similar themes in a cohort of UK HIV negative individuals (using identical or similar questions to ASTRA, as relevant given the different serostatus) to assess knowledge of, and attitudes to HIV transmission risks and the role of ART, and to assess the prevalence of medical and psychological symptoms (e.g. hepatitis C, depression and anxiety), quality of life, lifestyle factors (e.g. drug and alcohol use) and their possible links to sexual risk behaviours.

Data from this study will additionally contribute to an understanding of how knowledge of ART and detectable/undetectable viral loads in HIV negative individuals may affect their attitudes and perceptions which lead to sexual risk behaviours with partners of unknown and/or known HIV status in the UK. A subgroup comparison between the MSM HIV negative and MSM HIV positive groupings will also allow identification of similarities and differences in lifestyle features between the two groups e.g. alcohol/drug use, psychiatric and medical comorbidities etc. Previous studies have illustrated high prevalence rates of depression, anxiety, drug and alcohol use in MSM [22]. Comparison of the two groups will facilitate estimation of the specific effect of HIV and HIV treatments on health, wellbeing and lifestyle among MSM.

While it is important to understand patterns of sexual risk behaviour and attitudes to HIV transmission in HIV negative at risk groups through the AURAH study, it is also important to study longitudinally the incidence and predictors of new infections among groups at particular at risk of HIV, and to assess changes over time risk behaviour within individuals. The rising incidence of HIV in MSM in the UK clearly points to a need for research in this group. In particular, little is known regarding changes in sexual behaviour during crucial periods such as primary HIV-infection and immediately following an HIV-diagnosis nor on variability in sexual risk behaviour over time at an individual level (including on the duration of periods of very high risk). Although there are cohort studies of MSM that provide some limited information on these issues [23-26] there have been no studies among individuals at risk of HIV infection in the UK. Additional funding to follow up a prospective cohort study of HIV-negative MSM at risk of HIV infection, recruited from UK sexual health clinics has been obtained through an NIHR Programme Grant. Information from this study will contribute to understanding of patterns of HIV transmission in the UK, provide information for modelling studies of the UK epidemic, and help to inform prevention efforts. Participants in this AURAH cross sectional study who provide consent to be contacted will be approached about possible participation in the prospective study. For those that are willing to enrol to this prospective study, the AURAH study questionnaire will comprise baseline data for the prospective study. For this reason, once the target recruitment of 1000 MSM has been reached in the baseline cross sectional AURAH study we will then only recruit MSM at baseline who are willing to be contacted to request that they participate in the prospective follow up study.

2 STUDY AIMS AND OBJECTIVES

2.1 Aims
1. To assess patterns of sexual behaviour, and attitudes to sexual risk, among HIV negative adults at risk of HIV-infection, and any associations with socio-demographic factors such as sexuality, ethnicity, age and social class.
2. To compare HIV-negative individuals at risk of HIV infection to HIV-positive outpatients, with respect to sexual risk and attitudes, beliefs about HIV transmission risk, physical and psychological symptoms, quality of life, lifestyle and health and wellbeing.
3. To recruit an HIV negative MSM sample who will be approached to be asked to take part in a longitudinal follow up to study the incidence and predictors of new infections among MSM in particular at risk of HIV, and to assess changes over time of risk behaviour within individuals over a 3 year period.

2.2 Objectives

1. To estimate levels of high-risk sexual behaviour (recent condomless (unprotected) vaginal or anal sex) in HIV negative individuals attending GUM sexual health clinic according to demographic groups (sexuality; ethnicity).
2. Among those who have had high-risk sex, to describe the distribution of: number of sexual partners; number of times had sex; type of sex; reasons for not using condom
3. To assess, in HIV negative subjects, the prevalence of psychological and physical symptoms (i.e. depression, anxiety) and lifestyle factors (i.e. drug and alcohol use) and whether demographic/social factors, psychological and physical symptoms, quality of life and lifestyle factors are associated with high-risk sexual behaviours
4. To investigate the association between HIV status and health and lifestyle factors by comparing these factors between the HIV-positive and HIV-negative study groups
5. To investigate HIV negative individuals beliefs regarding the effect of ART in HIV positive individuals, and undetectable viral load, on HIV transmission risk (transmission risk beliefs)
6. To assess whether transmission risk beliefs in HIV negative subjects are linked to sexual behaviour
7. To investigate attitudes to starting immediate ART including attitudes to starting ART to reduce transmission risks to other, if they became HIV infected

3. METHODS

3.1 Study design

A cross-sectional self-administered questionnaire study. AURAH will use a modified version the ASTRA self-administered questionnaire and will be conducted among HIV negative individuals attending for routine sexually transmitted infection (STI) and/or HIV testing in 10 UK GUM clinics

3.2 Setting
Adults attending selected sexual health clinics in the UK (Mortimer Market Clinic, Dean St Clinic, West London Clinic, The Kobbler Centre, Brighton Sexual Health Centre, Kings Sexual Health Centre, Newham Sexual Health Centre, Royal Free-Marlborough clinic, Coventry Sexual Health Centre, Homerton Sexual Health Centre).

3.3 Study population

Each centre will attempt to include a representative sample of patients attending for STI screening. However, particular attention will be paid to recruiting target numbers of HIV-negative MSM and Black African participants, in order to recruit from the demographic groups at greatest risk of HIV in the UK, and among whom HIV incidence may be increasing.

**Once target recruitment of 1000 MSM has been reached we will then only recruit MSM willing to be contacted for possible participation in the prospective follow up study from Mortimer Market Clinic, Chelsea and Westminster hospital Foundation Trust and Brighton Sexual Health Centre.**

**Overall inclusion criteria:**

HIV negative (or undiagnosed) subjects aged >= 18 years, attending for routine sexually transmitted infection (STI) or HIV testing in GUM clinics

**Overall exclusion criteria:** Unable to complete questionnaire in English due to language difficulties; already diagnosed as HIV positive

3.4 Sample size

The study will ascertain a large amount of information to enable us to address objectives set out in section 2. Three of the main objectives are to

(i) Ascertain the proportion of individuals who report that they have had condomless sex in the past 3 months with a partner of unknown or positive status and that one of the reasons for this was “I knew there was a risk of acquiring HIV but I am not so concerned about having the disease that it made me want to have sex using a condom.” This will be calculated as a proportion of all study participants and as a proportion of all participants reporting condomless sex.

(ii) Ascertain the proportion of individuals who report that they have had condomless sex in the past 3 months with a positive partner who give a reason as” I thought the risks of catching HIV were low because my partner was taking anti-retroviral therapy.”

(iii) Compare the prevalence of PHQ-9 depression between HIV+ve and HIV-ve individuals, separately for HIV negative MSM, heterosexual men and women, black African men and women

With 2000 total sample size, 1000 MSM, 1000 heterosexuals (500 men and 500 women), of whom 600 are Black African, the study will be able to estimate the proportions relating to objective (i) above, with the precision shown in table A below, for estimated response.
proportions of 5%, 10%, 15% and 20%, within the major demographic subgroups. For objective (ii) the denominator will be the number of subjects who report condomless sex in the past 3 months (estimated to be 50% of the total number), and the estimated proportion is expected to be lower, so precision is shown in Table B for proportions of 5% and 10%. For objective iii the study will have 80% power to detect the differences in prevalence of depression shown in Table C for the major demographic subgroups, with 5% 2-sided significance level

TABLE A. Precision for 95% confidence intervals for a single proportion according to major demographic subgroups

<table>
<thead>
<tr>
<th></th>
<th>Target number in AURAH</th>
<th>95% Confidence interval for prevalence of 5%</th>
<th>95% Confidence interval for prevalence of 10%</th>
<th>95% Confidence interval for prevalence of 15%</th>
<th>95% Confidence interval for prevalence of 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSM</td>
<td>1000</td>
<td>+/- 1.35</td>
<td>+/- 1.86</td>
<td>+/- 2.22</td>
<td>+/- 2.48</td>
</tr>
<tr>
<td>All Heterosexual men</td>
<td>500</td>
<td>+/- 1.90</td>
<td>+/- 2.63</td>
<td>+/- 3.15</td>
<td>+/- 3.51</td>
</tr>
<tr>
<td>Black African heterosexual men</td>
<td>300</td>
<td>+/- 2.45</td>
<td>+/- 3.40</td>
<td>+/- 4.05</td>
<td>+/- 4.53</td>
</tr>
<tr>
<td>All women</td>
<td>500</td>
<td>+/- 1.90</td>
<td>+/- 2.63</td>
<td>+/- 3.15</td>
<td>+/- 3.51</td>
</tr>
<tr>
<td>Black African women</td>
<td>300</td>
<td>+/- 2.45</td>
<td>+/- 3.40</td>
<td>+/- 4.05</td>
<td>+/- 4.53</td>
</tr>
</tbody>
</table>

TABLE B. Precision for 95% confidence intervals for a single proportion according to major demographic subgroups

<table>
<thead>
<tr>
<th></th>
<th>Target number in AURAH</th>
<th>95% Confidence interval for prevalence of 5%</th>
<th>95% Confidence interval for prevalence of 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated final numbers in ASTRA</td>
<td>Target number in AURAH</td>
<td>(ii) Difference in prevalence of depression that could be detected, comparing HIV+ve with HIV-ve individuals, assuming 25% prevalence in HIV+ve people (in all groups)</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------</td>
<td>------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MSM</td>
<td>2250</td>
<td>1000</td>
<td>4.5%</td>
</tr>
<tr>
<td>All Heterosexual men</td>
<td>400</td>
<td>500</td>
<td>7.5%</td>
</tr>
<tr>
<td>Black African heterosexual men</td>
<td>200</td>
<td>300</td>
<td>10.0%</td>
</tr>
<tr>
<td>All women</td>
<td>700</td>
<td>500</td>
<td>6.8%</td>
</tr>
<tr>
<td>Black African women</td>
<td>450</td>
<td>300</td>
<td>8.5%</td>
</tr>
</tbody>
</table>

**TABLE C. Differences between two proportions detectable with 80% power at 2-sided 5% significance level, according to major demographic subgroups**

### 3.5 Recruitment

The AURAH study will recruit in 10 UK specialist GUM clinics until the target number of patients has been enrolled or until the study endpoint of **August 2014**. It is anticipated that recruitment will start in **May 2013**. Consecutive subjects attending the GUM clinic will be identified, approached and invited to take part. Each centre will identify specific clinics each week at which subjects will be recruited, aiming to ensure a representative study population (with target recruitment for MSM and black African subjects). **During the consenting process, it will be reiterated that the study is for HIV undiagnosed individuals only.**
Once the target recruitment of 1000 MSM has been reached in the baseline study recruitment will be restricted to MSM in 3 centres (Mortimer Market, Dean Street Clinic and Brighton Sexual Health Centre) who indicate they would be willing to be contacted to be asked to participate in a 3 year follow up questionnaire study.

3.6 Consent

All subjects who are invited to participate will be given an information sheet about the study. Those who agree to complete the questionnaire will be asked to sign a consent form. The form will include a section for consent to be contacted about reminders, prize draw results and where appropriate for prospective follow up as part of a new study. Participants who agree to be contactable will be asked for their preferred contact details (email address and mobile number for SMS contact). The consent form will note that their contact details will only be used for these purposes and will be held securely outside the clinic as part of the central study records but will be deleted after a period of two years after the appropriate study recruitment period is completed.

3.7 Data collection

The study questionnaire will be self-administered. Participants will be invited to complete the paper-based questionnaire while waiting for their GUM appointments, or directly following their appointment, whichever is most convenient for the patient and/or appropriate for each particular clinical centre. Participants will be asked to complete the questionnaire on the same day, in the clinic. If this cannot be done, it will be possible for participants to take away the questionnaire, which can be completed at a later time and posted back in the pre-paid envelope to the research team. However, in order to maximise the study response rate, completion of the questionnaire in the clinic is the greatly preferred option, and will be encouraged as far as possible.

3.7.1 Study questionnaire

There will be separate versions of the questionnaire (A5 booklet size) for men and women. Each questionnaire will have a study number pre-completed on the first page. Participants will be given a questionnaire, pen and envelope. A private area within the clinic will be available for completion of questionnaires, if desired. Once completed, the questionnaires can be placed in a sealed envelope and put in a box in the clinic. For participants who take the questionnaire away to complete at a later time and have consented to be contacted, the study nurse will reiterate to the patient that a maximum of 2 reminders will be sent to the supplied contact details if the questionnaire has not been received within a month. The questionnaire will not be available in any languages other than English.

3.8 Role of clinic based study staff

The study nurse or research assistant in each clinic will have a major role, being responsible for the day-to-day running and co-ordination of the study within each clinical centre.
3.8.1 Documents held by study nurse/research assistant

- Information sheets
- Consent forms
- Study log (including email addresses/mobile numbers for consenting participants)
- Numbered paper questionnaires (and pens)
- Pre-paid envelopes addressed to research team

3.8.2 Study nurse/research assistant tasks

In each centre, the study nurse/research assistant will undertake the following tasks:

- Together with the clinical and research team, deciding on clinics/days to recruit to the study
- Together with the clinical and research team, deciding on how best to organise study recruitment and completion of questionnaires
- Ensuring, as far as possible, systematic selection of patients invited to participate
- Inviting subjects to participate and distributing the study information sheet
- Obtaining subjects written informed consent to participate, with or without additional written consent for longitudinal follow up
- Completing the study log (see section 3.9.1)
- Distributing paper questionnaires to participants
- Identifying a suitable private space for participants to complete the paper questionnaire, if desired
- Entering the study number and date on paper questionnaires
- Ensuring completed questionnaires in sealed envelopes are placed in the box provided
- Encouraging questionnaire completion in the clinic
- Liaising with the core group at the research department regarding any necessary reminders for participants
- Returning a copy of the study log to the coordinating centre each week
- Having paper questionnaires available for collection by courier or other means (monthly)
- Communicating with the core group regarding study progress and any problems identified
- Storing the study log and consent forms securely in the clinic

3.9 Measurements

3.9.1 Study log

At each clinic at which recruitment takes place, the study nurse/research assistant will complete a study log containing the following information for each subject approached:

- Date and clinic (am/pm)
- Clinic number and name and surname Study number (using the pre-assigned number on the questionnaire)
• Whether the subject is eligible for the study and, if not, the reason for ineligibility
• Whether the subject refuses to participate and, if supplied, the reason for refusal

For each participating subject, the nurse will record:

• Gender
• Type of consent (anonymous or contactable) and contact details if the patient has opted for this
• Whether patient completed the questionnaire in clinic or has taken it away
• The final result of the HIV test taken at the study visit/STI screen (or at a subsequent date if deferred?)

3.9.2 Questionnaire

The questionnaire will include the following sections to be completed by the participant:

i) Study number and date: a unique number containing a code for the clinical centre, and type of questionnaire (men’s/women’s). This will be pre-completed. Date of questionnaire completion.

ii) Demographic/social factors: gender; date of birth; ethnicity; country of birth; time resident in UK; employment; housing; poverty; education; religion; sexuality; partnership status; number of children; immigration status

iii) Psychological and physical symptoms (using a modified version of the Memorial Symptom Assessment Scale Short-Form [24,25])

iv) Depression (using the PHQ-9 [26])

v) Health-related quality of life (using the EuroQoL 5D [27])

vi) Social support (using a modified version of the Duke–UNC Functional Social Support Questionnaire - FSSQ) [28]

vii) Relevant medical history: recent history of sexually transmitted infection; previous HIV testing history; use of PrEP or PEPSE; current symptoms of sexually transmitted infection; hepatitis C diagnosis; treated depression; other mental health treatment; pregnancy status for women plus other major diagnoses

viii) Transmission risk beliefs (in relation to ART and risk of transmission from HIV positive individuals)

ix) Lifestyle factors: smoking history; alcohol consumption / dependency; recreational drugs; injecting drug use; whether shared injecting drug-use equipment with known HIV positive person or person of unknown status

x) Sexual activity
All questions below relate to activity *in the past three months*. ‘Sex’ refers to vaginal or anal intercourse unless specified. ‘Discordant partner’ is referred to in the questionnaire as a person “who has HIV or a person whose HIV-status you did not know”.

For men having sex with women: had sex in past 3 months and whether this was with a regular or short term partner; number of partners; type of sex; had sex using condom; had condomless penetrative sex with HIV positive partner or unknown status partner s; number of times condomless penetrative sex; reasons for not using condom with last partner of positive or unknown status; extent to which they discuss HIV status with partners; if the partner was assumed HIV negative did they know when partner has last tested.

For men having sex with men: had anal sex in past 3 months and whether this was with a regular or short term partner; number of partners; type of sex; had sex using condom; had condomless penetrative anal sex (receptive/insertive) with HIV positive partner or unknown status partner s; number of times condomless penetrative sex; reasons for not using condom with last partner of positive or unknown status; extent to which they discuss HIV status with partners; if the partner was assumed HIV negative did they know when partner has last tested; had oral sex without condom; number of partners; undertook fisting, group sex or other high risk sexual activities.

For women having sex with men: had sex in past 3 months and whether this was with a regular or short term partner; number of partners; type of sex; had sex using condom; had condomless penetrative sex with HIV positive partner or unknown status partner s; number of times condomless penetrative sex; reasons for not using condom with last partner of positive or unknown status; extent to which they discuss HIV status with partners; if the partner was assumed HIV negative did they know when partner has last tested.

For all participants: self-efficacy regarding condom use; discussion of HIV-status of partner with new partners; discussion of condom use; whether used internet to find sexual partner; whether participated in group sex; whether received money for sex; whether had taken PrEP / PEPSE (antiretroviral drugs before or after sex to prevent HIV transmission).

3.9.3 Clinic data

The result of the HIV and STI tests taken at the same time of questionnaire completion will be recorded (or later date if deferred). No other clinical data will be recorded.

3.10 Data analysis

3.10.1 Transfer of data to the coordinating centre

Questionnaires will be transferred from each clinical centre to the coordinating centre approximately every month. The study log will also be sent to the coordinating centre each week. Clinic numbers will be removed from the study log prior to transfer to the coordinating centre. However the study logs will contain names and contact details for those participants who consent to be contacted (see section 4.4 for safeguarding of this information). The core...
group will also request additional data from the clinical centres including the total number of individuals seen over the study period in each centre.

3.10.2 Data entry

Data from questionnaires will be double entered into an appropriate data entry package.

3.10.3 Statistical methods

Response rates will be calculated for each clinic. The proportion of patients seen in the clinic who were invited to participate in the study will also be calculated. Logistic regression analyses will be used to investigate associations of sexual risk behaviour and transmission risk beliefs and other factors. Study clinic will be considered as a stratification factor. Analyses will be conducted in the study population as a whole, and in key subgroups, including MSM, Black African men and women. Tests for interaction will be used to determine if differences between associations in different subgroups are statistically significant. Data from HIV positive subjects obtained through the ASTRA study will be compared to HIV negative subjects from AURAH with regard to a range of lifestyle and health-related factors, using logistic regression analyses.

3.11 Pilot study

A small pilot study will be conducted before the main study starts. This will be done at one or two clinics, at each of the clinical centres, with the aim of recruiting 5-10 patients at each centre. Procedures will be identical to the main study. The purpose of the pilot study is: (i) to check how well the study procedures work in each clinic (including recruitment, consent, completion of questionnaires, the role of the study nurse), and (ii) to assess the quality and completeness of the data from the questionnaires. These aims will be achieved by examining the data from the pilot questionnaires and discussing the success of study procedures with the clinic study staff and clinicians. If any changes to the protocol or questionnaire are required, these will be made before the main study starts, and submitted for ethical approval as an amendment.

4. ETHICAL CONSIDERATIONS

4.1 Ethics review

Prior to the initiation of the study, the protocol, patient information sheet, informed consent form, and study questionnaire will be submitted for ethical review. Any future amendments to the study protocol will be also submitted. The pilot study will commence once ethical approval has been granted.

4.2 Patient information

The information sheet clearly states that the questionnaire will include personal questions on sexual lifestyle. It states that if the questionnaire raises any issues or concerns, participants can ask the nurse to arrange for them to speak to an appropriate professional. It also
specifies that participants are free to withdraw consent for the study at any time, including after completing the questionnaire **or at any point during any follow up.**

**4.3 Confidentiality**

Private areas in the clinic will be available for completion of questionnaires, if preferred. The questionnaires themselves will contain a study number only, with no identifying information. The patient’s name and clinic number will not be recorded on the questionnaire. Participants will be able to place their completed paper questionnaires in a sealed envelope in a box in the clinic. Participants will be informed that their questionnaire responses will not be seen by clinical staff or recorded in their clinical notes. In the clinics the study log will be the only document linking study number with clinic number and/or names. Clinic numbers will be removed from the study log before these data are transferred to the coordinating centre.

At the coordinating centre information will be treated as completely confidential. The personal identifiable information from the study logs (names and contact details) will only be used for the consented purposes. The data from the questionnaires will be kept separately from the study log information and will be identified by study number only. No individual subject will be able to be identified in any results that are presented or published from the study.

**4.4 Data security**

The study datasets will be held in the research department (HIV Biostatistics and Epidemiology Group, Research Department of Infection and Population Health, Royal Free Campus) and will be securely stored on centrally managed servers or on encrypted PC and laptop drives. Paper forms (including questionnaires and copies of the study log) will be stored securely in locked cabinets. Patient’s clinic numbers will not be recorded in any of the study datasets held by the research department, including the datasets transferred from each centre to the coordinating centre. Participant contact details will be securely stored in encrypted form in a manner compliant with the Data Protection Act and only used for the consented purposes. Once the the contact information has been used for the consented purposes or after the period indicated in the consent form has expired the contact details will be permanently deleted.

**5. STUDY MANAGEMENT**

The study will be managed by the core group at the research department. The protocol and all study material will be reviewed and approved by all members of the AURAH study group.

University College London holds insurance against claims from participants for harm caused by their participation in this clinical study. Participants may be able to claim compensation if they can prove that UCL has been negligent. However, if this clinical study is being carried out in a hospital, the hospital continues to have a duty of care to the participant of the clinical study. University College London does not accept liability for any breach in the hospital’s duty of care, or any negligence on the part of hospital employees. This applies whether the hospital is an NHS Trust or otherwise.
5.1 Setting up study procedures

Prior to the pilot study, members of the core group will visit each clinical centre in order to discuss study procedures and recruitment with the study nurse/s and the clinical team.

5.2 Funding for the study in each centre

It is envisaged that clinics will be paid £40 per each completed questionnaire from the clinic to reach the UCL study group.

5.3 Incentives for participants

The study burden for participants is minimal (15-20 minutes to complete the questionnaire). However, in order to improve recruitment, subjects will be asked if they wish to take part in a regular prize draw for the chance to win a £100 shopping voucher every month for the duration of the study.

5.4 Monitoring of recruitment

Paper questionnaires and the study logs will be regularly transferred to the research team (see section 3.8.2), who will provide frequent updates to the clinical centres on recruitment and response rates. In particular, recruitment of MSM and African subjects will be monitored to ensure these groups are adequately represented and meet recruitment targets. Each site will be expected to recruit and complete the study for at least 100 subjects.

5.5 Data monitoring

Throughout the recruitment period, regular audits of study data will be performed to check data completeness and data quality. The data manager will undertake data checks and data cleaning prior to statistical analysis.

5.6 Data analysis and publications

Statistical analyses will be performed at the coordinating centre by the core group. All material submitted for publication or presentation will be circulated to all members of the AURAH study group for comments. The primary publications from the study will be authored by the ‘AURAH study group’ (including all site members).

6. TIMETABLE

AURAH

April 2013: Ethics approval obtained

May 2013: Pilot study at all clinics and amendments to questionnaire and protocol based on findings of pilot study.

June 2013: Recruitment starts

June 2013 to August 2014: Data entry; data audit; recruitment updates
August 2014: Recruitment ends for all except MSM willing to be contacted to be asked to take part in the prospective component of the study

September 2014 onwards: Data analysis; dissemination of findings for AURAH baseline study

Dec 2014: Recruitment of MSM for prospective study completed.

Reference


7. Dodds J, Mercey D, Parry J, Johnson A. Increasing risk behaviour and high levels of undiagnosed HIV infection in a community sample of MSM. Sex Transm Infect 2004; 80:236–240;


10. Dodds JP, Johnson AM, Parry JV, Mercey DE. A tale of three cities: persisting high HIV prevalence, risk behaviour and undiagnosed infection in community samples of men who have sex with men, Sex Transm Inf 2007; 83: 392-396

11. Chen 2002;


24. Heijman T, Geskus RB, Davidovich U, Coutinho RA, Prins M, Stolte IG. Less decrease in risk behaviour from pre-HIV to post-HIV seroconversion among MSM in the combination antiretroviral therapy era compared with the pre-combination antiretroviral therapy era. AIDS. 2012 Feb 20;26(4):489-95


Appendix IV. AURAH2 online Patient Information Sheet and Consent

Thank you for registering to join the AURAH2 study, which will help us to inform improvements in health care for gay men and other men who have sex with men.

Before proceeding we need to make sure that you understand what is involved in the study and that you are comfortable with participating.

Please take a minute to read through the information sheet and complete the consent form at the bottom so that you can proceed to your questionnaire.

Online Participant Information Sheet AURAH2 - version 0.6

18/11/2014

REC ref: 14/LO/1881

What is the study about?

This is a questionnaire study for gay men who are HIV negative. The study is looking to gather experiences and opinions from over 1000 gay men over a 3 year period.

The study will help us understand more about HIV transmission amongst gay men and how this changes over time. The results will also help us to develop specific strategies for gay men to remain healthy.

Who is taking part?

Gay men who are not diagnosed with HIV and who attended specific sexual health (GUM) clinics in London and Brighton are eligible to take part in AURAH2.

This includes those who took part in the original AURAH1 study and we would like as many of them as possible to participate. By taking part you would be making a valuable contribution to medical research.

What will I have to do?

The study will only entail answering brief online questions using a secure website approximately every four months (which will take 3-5 minutes to complete) with a slightly more detailed online questionnaire to complete annually (which will take around 20 minutes to complete).

You will not need to visit a clinic to answer questions for the AURAH2 study.

The study will continue for up to 3 years or as long as you are willing to participate in the study.
If you participate and were to receive a positive HIV test result at any point during the study, we would help to ensure that you get linked into an HIV clinic if you wanted this, but we would still like you to continue to participate in the study for its full 3 year term.

At the end of the study we also intend to see if the details of any of the participants in AURAH2 are also in the UK national HIV diagnosis database, or other UK national health databases, this will confirm their HIV status, or other health outcome. During the registration process we will ask for and securely store your name and date of birth to enable us to make this check.

**When will I complete the online questionnaires?**

The study coordinators will contact you by email to remind you and give you further information on when you should visit the secure website to answer the questions and this will happen approximately every four months. For each 4 month period you will receive a maximum of two reminders by email and, if necessary, one reminder by text. If you wish to withdraw from the study at any point or have any questions about the study you can contact the study researchers (see below).

**Will my questionnaire responses be confidential?**

Yes, completely. The online questionnaires will be made available on a secure website which can only be accessed using a link sent to your email address. After you have initially registered for the study, the website questionnaires will not ask you to enter any identifying personal details such as name, address or date of birth and will only be linked by a study number. Your answers to the online questionnaires will be stored in a confidential and secure manner.

**What clinical information will be recorded?**

If you agree to take part in the study, we will store the result of any HIV test that you did when you completed the original AURAH1 baseline questionnaire and during the time you are included in the study.

**Will any other information about me be gathered?**

The consent form asks you to provide contact information in the form of an email address and mobile phone number. This is to send you reminders and information about completing the online questionnaires. The contact details will also be used to notify you if you win an annual £1000 prize draw for people who participate in this study. You will also be asked to provide your name and date of birth to enable us to check the HIV status of all participants against the UK national HIV diagnosis database and other national health databases during and at the end of the study (as described above).

Any personally identifiable information that you provide will be securely stored, separately from the main study data, and used solely for the purposes described in this information sheet. After the study has finished and the data collected, all personal details (name, date of birth, email address and mobile number) will be deleted and the final study datasets will not include any of these details. If you decide to withdraw from the study we will, at your request, delete your details and will not contact you further.

**What will happen to the information?**
The information you give will be transferred to the Research Department of Infection & Population Health at UCL and analysed by computer. Your anonymised questionnaire responses will be added to everyone else’s who has taken part in the study. The data will only be analysed for groups and not for individuals. The findings will be submitted to medical journals and national and international health conferences. Details of publications from this study will be made available on the study website (see below).

**Do I have to take part?**

It is up to you to decide whether or not to take part. If you do decide to take part you will be asked to sign the consent form at the bottom of this page.

If you agree to take part you can still change your mind later and decide not to complete the study or to leave the study at any point without explanation. If you choose not to take part in the study, this will not affect the standard of care you receive.

If you wish to withdraw from the study at any point or have any questions about the study you can email the research team at:

**Contact person:** Janey Sewell
**Email:** info@aurah2.org
**Telephone:** 020 7794 0500 extension 34673
**Study website:** www.aurah2.org

**What if I want to withdraw from the study?**

You can withdraw or stop participating in the study by emailing ‘STOP’ to info@aurah2.org

This will not affect the care that you receive at any sexual health centre.

You do not need to give us a reason for leaving the study. We will remove your email address from our email list and not contact you any further.

**Are there any risks in taking part?**

There is no risk to you in taking part in the study. If you find the questionnaire raises issues that concern you, or that you would like to discuss further, please contact your sexual health clinic.

**What are the possible benefits of taking part in the study?**

What we learn from this study will help us develop better interventions to protect people from getting HIV. You may benefit from this personally through the results of the study although this is not guaranteed. In addition all participants will be entered in an annual £1000 prize draw that will be established to encourage people to participate in this study.

**What if there is a problem? (The following is standard advice that we give for all potential participants in research studies)**
National Health Service or UCL complaints mechanisms are available to you. In the unlikely event that you are harmed by taking part in this study, and if you suspect that the harm is the result of the negligence of the Sponsor (University College London) or of the clinic where you originally completed the AURAH1 questionnaire, then you may be able to claim compensation. After discussing with the study researchers (see below for contact details, please make any claim in writing to Alison Rodger who is the Chief Investigator for the research and is based at UCL Research Department of Infection and Population Health, Royal Free Campus, Rowland Hill Street, London, NW3 2QG. The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

**Who is leading this research?**

A team of HIV specialists and researchers from around the UK is leading this study. The study is being coordinated by the UCL Research Department of Infection and Population Health, and is funded by the National Institute for Health Research. This study has been reviewed and approved by a research ethics committee.

**Will I be paid expenses for taking part?**

There will be no reimbursement of expenses for participants.

**Who can I contact for any further information about the study?**

You can get more information about the study using the following contact details:

Contact person: Janey Sewell  
Email: info@aurah2.org  
Telephone: 020 7794 0500 extension 34673  
Study website: www.aurah2.org
• I confirm that I have read and understand the information sheet (version 0.6) for this study
  o Yes
• I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
  o Yes
• I agree to take part in this study
  o Yes
• I understand that the information I give will be transferred to the research team at the UCL Research Department of Infection and Population Health
  o Yes
• I agree that the information from the AURAH study questionnaire that I previously completed can be used in this study
  o Yes
• I agree to enter my personal details below and understand that these will only be used for the purposes described in the information sheet
  o Yes

Name ................................................................. (Full name)

Date of birth ...................................................... (D-M-Y)

Email address ....................................................... (For reminders and information)

Mobile number .................................................... (For reminder texts only)

(Your mobile number will only be used to send you one text to remind you to log-in to complete a questionnaire if you have not done so after being sent two email reminders.
If you would prefer not to be contacted by text please leave this blank.)
Appendix V. AURA\textsuperscript{H2} in-clinic Patient Information Sheet and Consent form

\textbf{Attitudes to and Understanding of Risk of Acquisition of HIV over Time:}

The AURAH\textsuperscript{2} Study

Patient Information Sheet and Consent Form

V 0.5 18/11/2014

REC Ref: 14/LO/1881

We would like to invite you to take part in a research study. Please take some time to read this information about the study and decide whether or not to take part. Please ask the person who invited you to take part if anything is unclear or if you have any other questions.

\textbf{What is the study about?}

This is a questionnaire study for gay men who are HIV negative or unaware of their HIV status. The study is looking to gather experiences and opinions from over 1000 gay men for up to a 3 year period.

The study will help us understand more about HIV transmission amongst gay men attending sexual health clinics and how this changes over time. The results will also help us to develop specific HIV prevention strategies for gay men to remain healthy.

\textbf{Who is taking part?}

Gay men who are not diagnosed with HIV and who attend specific sexual health (GUM) clinics in London and Brighton are eligible to take part in AURAH\textsuperscript{2}.

We would like as many men as possible to participate; by taking part you would be making a valuable contribution to medical research and provide gay men with more information on how to live healthily.

\textbf{What will I have to do?}

If you agree to take part you will be asked to complete a baseline questionnaire about your health and lifestyle at this visit. The questionnaire includes some personal questions about your sex life. You can complete the questionnaire on your own. It should take 15 to 20 minutes to complete.

The study will then entail answering brief online questions using a secure website approximately \textbf{every three to four months} (which will take less than 5 minutes to complete) with a slightly more detailed online questionnaire to complete \textbf{annually} (which will take less than 15 minutes to complete).

\textit{You will not need to visit a clinic to answer the online questions for the AURAH\textsuperscript{2} study.}
The online questionnaires will continue for up to 3 years or as long as you are willing to participate in the study.

If you participate and were to receive a positive HIV test result at any point during the study from the GUM clinic that you attend, or through any other service, we would help to ensure that you get linked into an HIV clinic if you wanted this, but we would still like you to continue to participate in the study for its full 3 year term.

Both during and at the end of the study we also intend to check if the details of any of the participants in AURAH2 are in the UK national HIV diagnosis database to confirm their HIV status, or other UK national health databases, this will confirm their HIV status, or other health outcome. We will ask for and securely store your name and date of birth to enable us to make this check.

When will I complete the questionnaires?

We would like you to complete the first AURAH baseline questionnaire today, while you are here in the clinic, either before or after seeing the healthcare professional. There is a private space available for you to complete your questionnaire, if you would prefer this. The study nurse will make sure you don't miss your appointment in clinic.

The study coordinators will then contact you by email to remind you and give you further information on when you should visit the secure website to answer the questions and this will happen approximately every three months.

For each 3 -4 month period you will receive a maximum of two reminders by email and, if necessary, one reminder by text. If you wish to withdraw from the study at any point or have any questions about the study you can contact the study researchers (see below).

Will my questionnaire responses be confidential?

Yes, completely. Your name will NOT be written on the baseline questionnaire and your answers to it will NOT be seen by the doctors and nurses in the clinic. Your completed questionnaire can be placed in a sealed envelope which will not be opened by the clinic staff.

The online questionnaires will be made available on a secure website which can only be accessed using a link sent to your email address. The website questions will not ask you to enter any identifying personal details such as name, address or date of birth. Your answers to the online questionnaires will be stored in a confidential and secure manner.

What clinical information will be recorded?

If you agree to take part in the study, we will record the results of any HIV test that takes place today and during the time you are included in the study.

Will any other information about me be gathered?

The consent form asks you to provide contact information in the form of an email address and mobile phone number. This is to send you reminders and information about completing the online questionnaires. The contact details will also be used to notify you if you win an annual
£1000 prize draw for people who participate in this study. You will also be asked to provide your name and date of birth to enable us to check the HIV status of all participants against the UK national HIV diagnosis database and other national health databases during and at the end of the study (as described above).

Any personally identifiable information that you provide will be securely stored, separately from the main study data, and used solely for the purposes described in this information sheet. After the study has finished and the data collected, all personal details (name, date of birth, email address and mobile number) will be deleted and the final study datasets will not include any of these details. If you decide to withdraw from the study we will, at your request, delete your details and will not contact you further.

What will happen to the information?

Your anonymised responses will be added to everyone else’s responses. The information you give will be transferred to the Research Department of Infection & Population Health at University College London (UCL) and analysed by computer. The data will only be analysed for groups and not for individuals. The findings will be submitted to medical journals and national and international health conferences. Details of publications from this study will be made available on the study website (see below).

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign the consent form.

If you agree to take part you can still change your mind later and decide not to complete the study or to leave the study at any point without explanation. If you choose not to take part in the study, this will not affect the standard of care you receive.

If you wish to withdraw from the study at any point or have any questions about the study you can email the research team at:

Contact person: Janey Sewell
Email: aurah2@ucl.ac.uk
Telephone: 020 7794 0500 extension 34673
Study website: http://www.aurah2.ucl.ac.uk/

Are there any risks in taking part?

There is no risk to you in taking part in the study. If you find the questionnaire raises issues that concern you, or that you would like to discuss further, please ask the person who invited you to take part to arrange for you to speak to the site lead researcher (see below) who will do their best to answer your questions.

What are the possible benefits of taking part in the study? What we learn from this study will help us develop better interventions to protect people from getting HIV. You may benefit
from this personally through the results of the study although this is not guaranteed. In addition all participants will be entered in an **annual £1000 prize draw** that will be established to encourage people to participate in this study.

**What if there is a problem? (The following is standard advice that we give for all potential participants in research studies)**

If you have a concern about any aspect of this study, you should ask to speak to the site lead researcher (see below) who will do their best to answer your questions. If you remain unhappy and wish to complain formally you can do this by contacting the Patient Advice and Liaison Service (see below).

National Health Service or UCL complaints mechanisms are available to you. In the unlikely event that you are harmed by taking part in this study, and if you suspect that the harm is the result of the negligence of the Sponsor (University College London) or of this clinic, then you may be able to claim compensation. After discussing with the site lead researcher, please make any claim in writing to Alison Rodger who is the Chief Investigator for the research and is based at UCL Research Department of Infection and Population Health, Royal Free Campus, Rowland Hill Street, London, NW3 2QG. The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

**Who is leading this research?**

A team of HIV specialists and researchers from around the UK is leading this study and the data from the study will make up part of a PhD at UCL for student Janey Sewell. The study is being coordinated by the UCL Research Department of Infection and Population Health, and is funded by the National Institute for Health Research. This study has been reviewed and approved by a research ethics committee.

Research Ethics Committee: Hampstead, London.

**Will I be paid expenses for taking part?**

There will be no reimbursement of expenses for participants.

**Who can I contact for any further information about the study?**

You can get more information about the study from your doctor or nurses at the clinic or contact the site lead researcher (see below).

Site lead researcher and contact details ..................................................................................

Site Patient Advice and Liaison Service contact details..........................................................
**Research Department of Infection and Population Health, University College London.**

**CONSENT FORM for AURAH2 Questionnaire Study.**

Clinic ID: __________________

AURAH2 Study ID: __________________

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I confirm that I have read and understand the information sheet (version 0.5 dated 18/11/2014) for this study.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please initial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3. I understand that relevant sections of my medical notes and data collected during the study may be looked at by individuals from UCL, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I understand that the information I give will be transferred to the research team at the UCL Research Department of Infection and Population Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. I agree to take part in the study and by consenting to take part I agree to enter my personal details below and understand that these will only be used for the purposes described in the information sheet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Full name:**

**Date of birth:**

.................................................................

**(Email address)**

.................................................................
(Mobile phone number for text messages)

Please turn over the page to complete the consent process.

________________________       __ __ /__ __ / __ __ __ __         __________________

Name of patient          Date          Signature

________________________       __ __ /__ __ / _ __ __ __ __         __________________

Name of person taking consent   Date          Signature

When completed: 1 copy for participant if requested; 1 for researcher site file.
Appendix VI. AURAH2 study four month online HIV negative questionnaire

AURAH2 online: 4 monthly HIV Negative V1.0 (recall period 3 months)

1A) Approximately when was your last HIV test?
   • …… (enter optional month and year) → 1Ai) What prompted you to test? (please select all that apply)
     • I test on a regular basis
     • I had condomless sex and was concerned
     • I went to a clinic to get PEP and was offered a test
     • A partner told me I should get tested
     • I was offered one in a clinic or hospital
     • 1Ai_other) Other ……………

   • I have never had an HIV test → 1Aii) Is there a reason you have not tested before? (please select all that apply)
     ▪ Not enough time
     ▪ Don’t feel I need to
     ▪ Worried about testing
     ▪ Sexual health centre is too far or inconvenient
     ▪ 1Aii_other) Other ……………

→Only show question 1B if there has been a previous HIV test

1B) What was the result?
   • Negative
   • Positive → Skip to first positive questionnaire
   • Don’t know

3A) Have you had anal sex with a man in the past 3 months?
   • Yes
   • No → Skip to next section

3B) In the past 3 months how many men did you have anal sex with, without a condom?
   • None → Skip to next section
   • One
   • 2 to 4
   • 5 to 10
   • 11 to 49
   • More than 50

3D) In the past 3 months when you had condomless anal sex, were you?
   • Only insertive (top)
   • Only receptive (bottom)
- Sometimes insertive / sometimes receptive

3E) In the past 3 months when you had anal sex without a condom, did you know the HIV status of your partner(s)?

- No, I did not know the status of any of my partners → Skip to question 3j
- Yes, I knew the status of some of my partners
- Yes, I knew the status of all of my partners

3F) In the past 3 months did you have anal sex without a condom with any men you knew were HIV positive?

- Yes → 3Fi) Were they on antiretroviral treatment?
  ▪ Yes, all of them
  ▪ Yes, some of them
  ▪ No, none of them
- No
- Don’t know

3J) In the past 3 months have you had group sex (i.e. sex involving more than two people)?

- Yes → 3Ji) Last time you had group sex how many men were in the group?
  ▪ 3
  ▪ 4 to 5
  ▪ 6 to 10
  ▪ More than 10
- No

4A) In the past 3 months have you been diagnosed with a sexually transmitted infection (STI)?

- Yes
- No → Skip to next section

4B) Do you know what STI it was? (please select all that are applicable)

- Syphilis
- Gonorrhoea → 4Bi) where was the infection? (select all that are applicable)
  Throat/rectum/penis
- Chlamydia → 4Bii) where was the infection? (select all that are applicable)
  Throat/rectum/penis
- LGV
- New Hepatitis B
- New Hepatitis C
- Genital herpes (new or recurrent)
- Genital warts /HPV (new or recurrent)
- Trichomonas
- NSU (Non Specific Urethritis)
- NGU (Non Gonococcal Urethritis)
- Shigella
7B) Have you used drugs before or during sex (chemsex) in the last 3 months?

- Yes → 7Bi) Which chemsex drugs have you used? (select as many as applicable)
  - Crystal meth/Tina
  - Mephedrone
  - GHB/GBL
  - 7Bi_other) Other (please specify)………………………

- No → Finish

7Bii) Approximately how often did you have chemsex in the last 3 months?

- Once
- Monthly
- Weekly

Finish - Thank you for completing your questionnaire – your answers are really valuable. We’ll email you again in 4 months to remind you to log-in for your next questionnaire – Thanks for your time!
Appendix VII. AURAH2 study annual online HIV negative questionnaire

AURAH2 online: Annual HIV negative V1.0 (recall period 12 months unless otherwise stated)

Section 1 HIV tests
1a) Approximately when was your last HIV test?
   - ...... (month/year) → 1ai) What prompted you to test?
     - I test on a regular basis
     - I had unprotected sex and was concerned
     - I accessed PEP
     - A partner told me I should get tested
     - Other ............

   - I have never had an HIV test → 1aii) Is there a reason for not testing?(please select)
     ▪ not enough time
     ▪ don’t feel I needed to
     ▪ worried about testing
     ▪ too far to sexual health centre
     ▪ Other.............

1b) What was the result?
   - Negative
   - Positive → go to first positive
   - Don’t know

1c) In the last year when you last tested for HIV, did you test at home?
   - Yes → 1ci) Was that
     ▪ self-testing (i.e. doing the test and getting the result yourself)
     ▪ self-sampling (i.e. taking a sample and receiving the result at a later date)
   - No

1d) Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)?
   - Yes
   - No

Section 3: Sex life
3a) Have you had anal sex with a man in the past 3 months?
3b) In the past 3 months how many men did you have anal sex with, without a condom?

- None → Skip to next section
- One
- 2 to 4
- 5 to 10
- 11 to 49
- More than 50

3bii) Was this man, or one of these men, your long-term (ongoing relationship) partner?

- Yes
- No

3c) How many of these men were new partners (i.e. ones that you had not had condom-less anal sex with before)?

- None
- One
- 2 to 4
- 5 to 10
- 11 to 49
- More than 50

3d) In the past 3 months when you had anal sex without a condom, were you?

- Only insertive (top)
- Only receptive (bottom)
- Sometimes insertive /sometimes receptive

3e) In the past 3 months when you had anal sex without a condom, did you know the status of your partner(s)?

- No, I did not know the status of any of my partners
- Yes, I knew the status of some of my partners
- Yes, I knew the status of all of my partners

3f) In the past 3 months did you have anal sex without a condom with any men you knew were HIV positive?

- Yes
- No
- Don’t know

3j) In the past 3 months have you had group sex (i.e. with more than 2 people)?

- Yes → Last time you had group sex how many men were in the group?
  - 3
3m) Where are you most likely to meet new partners? (Please select as many as appropriate)
   • Cafes/pubs/bars/nightclubs
   • Saunas
   • Cruising areas
   • Internet (e.g. Grindr/Manhunt/Gaydar/Scruff)
   • Other – please specify ...........

Section 4 STI’s

4a) In the past 3 months have you been diagnosed with an sexually transmitted infection (STI)?
   • Yes
   • No

4b) If Yes, do you know what it was? (please select more than one box if applicable)
   • Syphilis
   • Gonorrhoea \( \rightarrow \) where was the infection? (select all that are applicable)
     Throat/rectum/penis
   • Chlamydia \( \rightarrow \) where was the infection? (select all that are applicable)
     Throat/rectum/penis
   • LGV
   • New Hepatitis B
   • New Hepatitis C
   • Genital herpes (new or recurrent)
   • Genital warts /HPV (new or recurrent)
   • Trichomonas
   • NSU (Non Specific Urethritis)
   • NGU (Non Gonococcal Urethritis)
   • Shigella
   • Don’t know
   • Other (please specify) ......................................................

Section 5 PEP

Post Exposure Prophylaxis (PEP)
*This means taking antiretroviral (anti-HIV) drugs soon AFTER unprotected sex for 4 weeks to reduce the risk of becoming infected with HIV.*

5a) Have you taken post exposure prophylaxis PEP in the past 12 months?
   • Yes
   • No
5b) Approximately how often did you take PEP in the last year?
   • Once
   • 2 to 3 times
   • More than 3 times

5c) In the past year did you take PEP following chemsex (sex whilst taking drugs?)
   • No, never
   • Yes, once
   • Yes, 2 to 3 times
   • Yes, more than 3 times

Section 6 PrEP

**Pre Exposure Prophylaxis (PrEP)**
This means taking antiretroviral (anti-HIV) drugs (usually a daily pill) to reduce the risk of becoming infected with HIV.

6a) Have you taken PrEP in the past 12 months?
   • Yes → 6a(i) Where did you access PrEP from? (please select any that are applicable)
     ▪ From a clinic
     ▪ From the internet
     ▪ From a research study
     ▪ From a friend
     ▪ Other ...........................................
   • No → Skip to next section

6b) Approximately how much of the time were you on PrEP in the last 12 months?
   • Less than 3 months
   • 3 to 6 months
   • 6 to 9 months
   • More than 9 months

6c) In the last 12 months, how many men did you have anal sex with, without a condom and without being on PrEP?
   • None
   • One
   • 2 to 4
   • 5 to 10
   • More than 10

Section 7 Drugs

7a) In the past 3 months have you used recreational drugs?
   • Yes
   • No→8a

7b) Which drugs have you used? (please select as many as appropriate)?
   • Acid/LSD/ magic mushrooms
   • Anabolic steroids
• Cannabis (marijuana, grass)
• Cocaine (coke)
• Crack
• Codeine
• Crystal meth (methamphetamine)/ Tina
• Ecstasy (E)
• GHB/GBL (liquid ecstasy)
• Heroin
• Ketamine (K)
• Khat (chat)
• Mephedrone
• Morphine
• Opium
• Poppers (amyl nitrate)
• Speed (amphetamine)
• Viagra (Cialis)
• Other (please specify) ..............................................

7b) Have you used drugs before or during sex (chemsex) in the last 3 months?

- Yes → 7b(i) Which chemsex drugs have you used? (select as many as applicable)
  - Crystal meth/Tina
  - Mephedrone
  - GHB/GBL
  - Cocaine
  - Poppers (amyl nitrate)
  - Ketamine (K)
  - Ecstasy (E)
  - Viagra/Cialis
  - Other ..............................

- No → 7d

7b(ii) Approximately how often did you have chemsex in the last 3 months?

- Once
- Monthly
- Weekly

7d) In the past 3 months have you slammed/injected recreational drugs?

- Yes
- No → Go to question 7f

7e) Do you slam (inject) yourself or is it done by others?

- Self
- Others
- Both
7f) Over the last 3 months approximately how much of your sex life was chemsex?

- None
- Some of it
- Most of it
- All of it

Section 8 Alcohol

8a) In the last 12 months,

Did you have a drink that contained alcohol?

- Never → 9a
- Monthly or less
- 2 to 4 times a month
- 2 to 3 times a week
- 4 or more times a week

8b) How many units of alcohol did you drink on a typical day last year when you were drinking? (One unit = HALF a pint of beer/ cider or a SMALL glass of wine or a SINGLE measure of spirits)

- 1 or 2
- 3 or 4
- 5 or 6
- 7 to 9
- 10 or more

8c) Scoring system

<table>
<thead>
<tr>
<th>Score</th>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or almost daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Only show the following 3 questions if the answer above is Never (0), Less than monthly (1) or Monthly (2).

- How often during the last year have you failed to do what was normally expected from you because of your drinking?

- How often during the last year have you been unable to remember what happened the night before because you had been drinking?

- Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?

Section 9 Health and Well-being
9a) How much do you agree / disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Tend to agree</th>
<th>Undecided / no opinion / not relevant to me</th>
<th>Tend to disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I feel confident that, if I want to, I can make sure a condom is used during sex with any partner, in any situation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) I’d expect to ask any new partner their HIV status before we have sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) I would expect a new partner to tell me if they’re HIV positive before we have sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) I find it difficult to discuss condom use with any new sexual partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) I am less likely to use a condom with a casual partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9b) Please indicate which statements best describe your own state of health TODAY? (Please select one box in each section)

**Mobility**

- I have no problems in walking about
- I have some problems walking about
- I am confined to bed

**Self-care**

- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

**Usual activities (e.g. work, study, housework, family or leisure activities)**

- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

**Pain/discomfort**

- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

**Anxiety/depression**

- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed

9c) Over the past 2 weeks, how often have you been bothered by any of the following problems?
<table>
<thead>
<tr>
<th>Question</th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Little interest or pleasure in doing things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Feeling down, depressed, or hopeless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Feeling sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Feeling nervous, anxious or on edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Not being able to stop or control worrying</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Worrying too much about different things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Becoming easily annoyed or irritable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Trouble relaxing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Being so restless that it is hard to sit still</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Feeling afraid as if something awful might happen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Trouble falling or staying asleep, or sleeping too much</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Feeling tired or having little energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Poor appetite or overeating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14) Feeling bad about yourself—or that you are a failure or have let yourself or your family down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15) Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16) Moving or speaking so slowly that other people could have noticed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17) Thoughts that you would be better off dead, or of hurting yourself in some way</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If you were bothered by any of these problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?</td>
<td>◯ Not at all difficult</td>
<td>◯ Somewhat difficult</td>
<td>◯ Very difficult</td>
<td>◯ Extremely difficult</td>
</tr>
</tbody>
</table>

9cii) Are you receiving medical treatment or therapy for depression?

- Yes
- No

9ciii) Are you receiving medical treatment or therapy for any other mental health conditions?

- Yes
- No

3h) Finally, Please think back over the last year, how many men have you had anal intercourse with without using a condom?

.................................... (Range: 0-997)
Appendix VIII. Newly diagnosed online first HIV positive questionnaire

**AURAH2 online: 1st HIV positive questionnaire 4.0**

Section 2 Engagement in care

2a) Have you been seen by a doctor or specialist healthcare professional since your diagnosis?
   - Yes
   - No

2b) Are you now taking antiretroviral treatment for HIV?
   - Yes → When did you start? Month/year
   - No

Section 3: Sex life:

3g) In the 3 months before your HIV diagnosis did you have anal sex with a man?
   - Yes
   - No → Skip to next section

3h) In the 3 months before your HIV diagnosis, how many men did you have anal sex with, without a condom?
   - None → Skip to next section
   - One
   - 2 to 4
   - 5 to 10
   - 11 to 49
   - More than 50

3i) In the 3 months before your HIV diagnosis, how many of these were men new partners (i.e. partners that you had not had condom-less anal sex with before)?
   - None
   - One
   - 2 to 4
   - 5 to 10
   - 11 to 49
   - More than 50

Section 4 STI’s

4ai) In the past 3 months before your HIV diagnosis had you been diagnosed with a sexually transmitted infection (STI)?
   - Yes
4b) Do you know what STI it was? (please select all that are applicable)

- Syphilis
- Gonorrhoea → where was the infection? (select all that are applicable)
  Throat/rectum/penis
- Chlamydia → where was the infection? (select all that are applicable)
  Throat/rectum/penis
- LGV
- New Hepatitis B
- New Hepatitis C
- Genital herpes (new or recurrent)
- Genital warts /HPV (new or recurrent)
- Trichomonas
- NSU (Non Specific Urethritis)
- NGU (Non Gonococcal Urethritis)
- Shigella
- Don’t know
- Other (please specify) ..........................................................

Section 7 Drugs/chemsex (shorter version)

7c(ii) In the 3 months before your HIV diagnosis did you use drugs before or during sex (chemsex)?

- Yes → 7c(iii) If yes, which chemsex drugs did you use before your diagnosis (please select any that you have used)?
  - Crystal meth/Tina
  - Mephedrone
  - GHB/GBL
  - Cocaine
  - Poppers (amyl nitrate)
  - Ketamine (K)
  - Ecstasy (E)
  - Viagra/Cialis
  - Other.....................

- No

7c(iv) Approximately how often did you have chemsex in the 3 months before your HIV diagnosis?

- Once
- Monthly
- Weekly

7(ii) Do you believe you became HIV positive whilst you were using drugs during chemsex?

- Yes
7iii) Has your drug use changed since your HIV diagnosis?

- No

- Yes →
  - increased
  - decreased

- No
Appendix IX. AURAH2 study four month online HIV-diagnosed questionnaire

AURAH2 online: 4 monthly HIV Positive V3 (recall period 3 months)

Section 2 Engagement in care

2c) Have you been seen by an HIV doctor or specialist healthcare professional since you were diagnosed HIV positive?
   - Yes
   - No

2b) Are you now taking antiretroviral treatment for HIV?
   - Yes → Approximately when did you start? Month/year
   - No → Skip to next section

2e) Do you know your viral load?
   - Yes → Is it?:
     - Undetectable (<40 copies/ml)
     - Detectable (>40 copies/ml)
   - No

Section 3: Sex life:

3a) Have you had anal sex with a man in the past 3 months?
   - Yes
   - No → 4a

3b) In the past 3 months how many men did you have anal sex with, without a condom?
   - None → Skip to next section
   - One
   - 2 to 4
   - 5 to 10
   - 11 to 49
   - More than 50

3e) In the past 3 months when you had anal sex without a condom, did you know the HIV status of your partner(s)?
   - No, I did not know the status of any of my partners → Skip to question 3j
   - Yes, I knew the status of some of my partners
   - Yes, I knew the status of all of my partners

3e(i) In the past 3 months, have you had anal sex without a condom, with a man you knew also had HIV?
• Yes
• No

3e(ii) If Yes, how many HIV positive men have you had sex with, without a condom in the past 3 months?
• One
• 2 to 4
• 5 to 10
• 11 to 49
• More than 50

3e(iii) In the past 3 months, have you had anal sex, without a condom, with a man who did not have HIV or whose HIV status you didn’t know?
• Yes
• No

3e(iv) If Yes, in the past 3 months, how many men who did you have anal sex with, without a condom, who did not have HIV or whose HIV status you didn’t know?
• One
• 2 to 4
• 5 to 10
• 11 to 49
• More than 50

3e(v) In the past 3 months when you had anal sex without a condom with men who are HIV negative or whose HIV status you did not know, were you?
• Only insertive (top)
• Only receptive (bottom)
• Sometimes insertive / sometimes receptive

3j) In the past 3 months have you had group sex (i.e. sex involving more than two people)?
• Yes → Last time you had group sex how many men were in the group?
  ▪ 3
  ▪ 4 to 5
  ▪ 6 to 10
  ▪ More than 10
• No

Section 4 STI’s

4a) In the past 3 months have you been diagnosed with a sexually transmitted infection (STI)?
• Yes
• No

4b) Do you know what STI it was? (please select all that are applicable)
• Syphilis
• Gonorrhoea → where was the infection? (select all that are applicable)
  Throat/rectum/penis
• Chlamydia → where was the infection? (select all that are applicable)
  Throat/rectum/penis
• LGV
• New Hepatitis B
• New Hepatitis C
• Genital herpes (new or recurrent)
• Genital warts /HPV (new or recurrent)
• Trichomonas
• NSU (Non Specific Urethritis)
• NGU (Non Gonococcal Urethritis)
• Shigella
• Don’t know
• Other (please specify) ..............................................

Section 7 Drugs/chemsex (shorter version)

7bshort) Have you used drugs before or during sex (chemsex) in the last 3 months?

• Yes → 7b(i) Which chemsex drugs have you used? (select as many as applicable)
  ▪ Crystal meth/Tina
  ▪ Mephedrone
  ▪ GHB/GBL
  ▪ Cocaine
  ▪ Poppers (amyl nitrate)
  ▪ Ketamine (K)
  ▪ Ecstasy (E)
  ▪ Viagra/Cialis
  ▪ Other .................................

• No

7b(ii) Approximately how often did you have chemsex in the last 3 months?

  ▪ Once
  ▪ Weekly
  ▪ Monthly
Appendix X. AURAH2 study annual online HIV-diagnosed questionnaire

Annual HIV positive V3 (recall period up to 12 months unless otherwise stated)

Section 2 Engagement in care

2d) Do you regularly attend an HIV unit for care (i.e. at least every 6 months or annually?)
   - Yes
   - No

2b) Are you now taking antiretroviral treatment for HIV?
   - Yes → Approximately when did you start? Month/year
   - No

2e) Do you know your viral load?
   - Yes → Is it?:
     ▪ Undetectable (<40 copies/ml)
     ▪ Detectable (>40 copies/ml)
   - No

1d) Are you currently in an ongoing relationship with a partner (husband/civil partner/boyfriend)?
   - Yes
   - No

Section 3: Sex life:

3a) Have you had anal sex with a man in the past 3 months?
   - Yes
   - No → 3a

3b) In the past 3 months how many men did you have anal sex with, without a condom?
   - None → Skip to next section
   - One
   - 2 to 4
   - 5 to 10
   - 11 to 49
   - More than 50

3bii) Was this man, or one of these men, your long-term (ongoing relationship) partner?
   - Yes
   - No
3c) How many of these men were new partners (i.e. ones that you had not had condom-less anal sex with before)?

- None
- One
- 2 to 4
- 5 to 10
- 11 to 49
- More than 50

3e) In the past 3 months when you had anal sex without a condom, did you know the HIV status of your partner(s)?

- No, I did not know the status of any of my partners → Skip to question 3j
- Yes, I knew the status of some of my partners
- Yes, I knew the status of all of my partners

3e(i) In the past 3 months, have you had anal sex without a condom, with a man you knew also had HIV?

- Yes
- No

3e(ii) If Yes, how many HIV positive men have you had sex with, without a condom in the past 3 months?

- One
- 2 to 4
- 5 to 10
- 11 to 49
- More than 50

3e(iii) In the past 3 months, have you had anal sex, without a condom, with a man who did not have HIV or whose HIV status you didn’t know?

- Yes
- No

3e(iv) If Yes, in the past 3 months, how many men who did you have anal sex with, without a condom, who did not have HIV or whose HIV status you didn’t know?

- One
- 2 to 4
- 5 to 10
- 11 to 49
- More than 50

3e(v) In the past 3 months when you had anal sex without a condom with men who are HIV negative or whose HIV status you did not know, were you?
• Only insertive (top)
• Only receptive (bottom)
• Sometimes insertive / sometimes receptive

3j) In the past 3 months have you had group sex (i.e. sex involving more than two people)?

• Yes ➔ Last time you had group sex how many men were in the group?
  ▪ 3
  ▪ 4 to 5
  ▪ 6 to 10
  ▪ More than 10
• No

3m) Where are you most likely to meet new partners? (Please select as many as appropriate)

• Cafes/pubs/bars/nightclubs
• Saunas
• Cruising areas
• Internet (e.g. Grindr/Manhunt/Gaydar)
• Other – please specify ………..

Section 4 STI’s

4a) In the past 3 months have you been diagnosed with a sexually transmitted infection (STI)?

• Yes
• No

4b) Do you know what STI it was? (please select all that are applicable)

• Syphilis
• Gonorrhoea ➔ where was the infection? (select all that are applicable)
  Throat/rectum/penis
• Chlamydia ➔ where was the infection? (select all that are applicable)
  Throat/rectum/penis
• LGV
• New Hepatitis B
• New Hepatitis C
• Genital herpes (new or recurrent)
• Genital warts / HPV (new or recurrent)
• Trichomona
• NSU (Non Specific Urethritis)
• NGU (Non Gonococcal Urethritis)
• Shigella
• Don’t know
• Other (please specify) ……………………………………….
7a) In the past 3 months have you used recreational drugs?

- Yes
- No → Skip to next section

7b) Which drugs have you used? (Please select as many as appropriate)?

- Acid/LSD/ magic mushrooms
- Anabolic steroids
- Cannabis (marijuana, grass)
- Cocaine (coke)
- Crack
- Codeine
- Crystal meth (methamphetamine)/ Tina
- Ecstasy (E)
- GHB/GBL (liquid ecstasy)
- Heroin
- Ketamine (K)
- Khat (chat)
- Mephedrone
- Morphine
- Opium
- Poppers (amyl nitrate)
- Speed (amphetamine)
- Viagra / Cialis
- Other (please specify) ..................................................

7bshort) Have you used drugs before or during sex (chemsex) in the last 3 months?

- Yes → which drugs have you used before or during sex (chemsex)?
  - Crystal meth/Tina
  - Mephedrone
  - GHB/GBL
  - Cocaine
  - Poppers (amyl nitrate)
  - Ketamine (K)
  - Ecstasy (E)
  - Viagra/Cialis
  - Other ..............................
- No → go to 7d)

7b(ii) Approximately how often did you have chemsex in the last 3 months?

- Once
- Monthly
- Weekly

7d) In the past 3 months have you slammed/injected recreational drugs?
• Yes
• No  → Go to question 7g

7e) Do you slam (inject) yourself or is it done by others?

• Self
• Others
• Both

7f) Over the last 3 months approximately how much of your sex life was chemsex?

• None
• Some of it
• Most of it
• All of it

Section 8 Alcohol

8a) In the last 12 months, how often did you have a drink that contained alcohol?

• Never  → Go to next section
• Monthly or less
• 2 to 4 times a month
• 2 to 3 times a week
• 4 or more times a week

8b) How many units of alcohol did you drink on a typical day last year when you were drinking? (One unit = HALF a pint of beer/ cider or a SMALL glass of wine or a SINGLE measure of spirits)

• 1 or 2
• 3 or 4
• 5 or 6
• 7 to 9
• 10 or more

8c) 

<table>
<thead>
<tr>
<th>Scoring system</th>
<th>Your score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Never</td>
</tr>
<tr>
<td>1</td>
<td>Less than monthly</td>
</tr>
<tr>
<td>2</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Weekly</td>
</tr>
<tr>
<td>4</td>
<td>Daily or almost daily</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often have you had 8 or more units of alcohol on a single occasion in the last year?</th>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or almost daily</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Only show the following 3 questions if the answer above is Never (0), Less than monthly (1) or Monthly (2).</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often during the last year have you failed to do what was normally expected from you because of your drinking?</td>
</tr>
</tbody>
</table>

326
How often during the last year have you been unable to remember what happened the night before because you had been drinking?

<table>
<thead>
<tr>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or almost daily</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes, but not in the last year</td>
<td>Yes, during the last year</td>
<td></td>
</tr>
</tbody>
</table>

Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?

| No | Yes, but not in the last year | Yes, during the last year |

Section 9 Health and Well-being

9a) How much do you agree / disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Tend to agree</th>
<th>Undecided / no opinion / not relevant to me</th>
<th>Tend to disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I feel confident that, if I want to, I can make sure a condom is used during sex with any partner, in any situation</td>
<td>☐ ☐ ☐ ☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) I’d expect to ask any new partner their HIV status before we have sex</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) I would expect a new partner to tell me if they’re HIV positive before we have sex</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) I find it difficult to discuss condom use with any new sexual partner</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e) I am less likely to use a condom with a casual partner</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

9b) Please indicate which statements best describe your own state of health TODAY? (Please select one box in each section)

**Mobility**
- I have no problems in walking about
- I have some problems walking about
- I am confined to bed

**Self-care**
- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

**Usual activities (e.g. work, study, housework, family or leisure activities)**
- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

**Pain/discomfort**
- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

**Anxiety/depression**
- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed

9c) Over the past 2 weeks, how often have you been bothered by any of the following problems?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Little interest or pleasure in doing things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Feeling down, depressed, or hopeless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Feeling sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Feeling nervous, anxious or on edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Not being able to stop or control worrying</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Worrying too much about different things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Becoming easily annoyed or irritable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Trouble relaxing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Being so restless that it is hard to sit still</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Feeling afraid as if something awful might happen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Trouble falling or staying asleep, or sleeping too much</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Feeling tired or having little energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Poor appetite or overeating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14) Feeling bad about yourself—or that you are a failure or have let yourself or your family down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15) Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16) Moving or speaking so slowly that other people could have noticed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17) Thoughts that you would be better off dead, or of hurting yourself in some way</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you were bothered by any of these problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

- Not at all difficult
- Somewhat difficult
- Very difficult
- Extremely difficult

9cii) Are you receiving medical treatment or therapy for depression?
- Yes
- No

9ciii) Are you receiving medical treatment or therapy for any other mental health conditions?
- Yes
- No
Appendix XI. AURAH2 study website homepage
Appendix XII. AURAH2 study Protocol

AURAH2 Protocol

A prospective study of sexual behaviour and risk of HIV acquisition in HIV-negative men who have sex with men.

Attitudes to and Understanding of Risk of Acquisition of HIV over Time:

AURAH2 Study

REC ref: 14/LO/1881

V 1

AURAH2 Study Group

Core group:

- Dr Alison Rodger
- Dr Fiona Lampe
- Prof Andrew Phillips
- Dr Andrew Speakman
- Janey Sewell

(Department of Infection and Population Health, UCL, Royal Free Campus)

HIV clinic leads / teams:

- Dr Richard Gilson (Mortimer Market Clinic, London)
- Dr Amanda Clarke (Brighton and Sussex University Hospital)
- Dr David Asboe/Dr Nneka Nwokolo (Chelsea and Westminster, 56 Dean St Clinic)

Advisory Group (additional collaborators): Tony Nardone (Public Health England), Prof Lorraine Sherr (Department of Infection and Population Health, UCL, Royal Free Campus, Prof Graham Hart (Department of Infection and Population Health, UCL, Dr Valerie Delpech (Public Health England, Simon Collins (HIV i-Base), Prof Anne Johnson (Department of Infection and Population Health, UCL, Susan Michie (University College London), Prof Jonathan Elford (School of Health Sciences, City University London)

Coordinating centre:

HIV Epidemiology and Biostatistics Group, Research Department of Infection and Population Health, UCL, Royal Free Campus

Sponsor: University College London
1. BACKGROUND AND RATIONALE

During 2012, 6360 people were newly diagnosed with HIV in the UK, and the estimated number of people living with HIV in the UK was 91,500 by the end of that year [1]. Although the annual number of new diagnoses has not risen since 2005 in the UK population overall, this figure is increasing among men who have sex with men (MSM) [2] and, in 2012 reached an all-time high of 3,250 new diagnoses in the year for this risk group [1].

Evidence of on-going or increasing HIV transmission among MSM [1-4] is consistent with evidence of ongoing sexual risk behaviour in this group. Studies of MSM in the UK [3, 5-11] and elsewhere [12-16] have found increases in the prevalence of condomless anal intercourse among MSM coincident with the widespread introduction and use of successful combination antiretroviral treatment for HIV in developed countries during the late 1990’s and in to the early 2000’s. There have also been increases in diagnoses of other sexually transmitted infections over this period [17, 18]. This increase in risk behaviour that became apparent in the late 90’s has now reportedly stabilised, recent data from the Natsal-3 survey shows that over the last decade there has been no change in sexual risk behaviour or risk perception in MSM although HIV testing has increased among this group [19]. Despite this report, and other research demonstrating that sexual risk behaviour has plateaued over the last decade [19, 20] the HIV incidence in MSM has increased and this is not completely justified by changes in HIV testing [21].

Sexual transmission risk arises as a result of the negotiation of sex practices, or lack thereof, between HIV positive and HIV negative individual. It involves the perceptions and behaviours of both individuals which often differ according to sero-status. Hence strategies aimed at reduction of HIV transmission need to address differences in both HIV positive and negative individuals’ perceptions, choices and behaviours [22]. This is particularly relevant when considering how the 2008 Swiss statement [23] (which stated that HIV-positive individuals on effective ART with undetectable VL for at least six months and without sexually STIs are sexually non-infectious) and also the HPTN 052 study [24] (which demonstrated a reduction of heterosexual transmission in the immediate ART treatment arm of 96%), might have reached and influenced HIV negative persons in different ways to their HIV positive counterparts. The PARTNER study recently presented interim transmission estimates of zero in heterosexuals and MSM for condomless sex where the positive partner was on suppressive ART, albeit with a high upper confidence limit in MSM [25], and this kind of data may also influence HIV negative persons in different ways to their HIV positive counterparts. The PARTNER study recently presented interim transmission estimates of zero in heterosexuals and MSM for condomless sex where the positive partner was on suppressive ART, albeit with a high upper confidence limit in MSM [25], and this kind of data may also influence HIV negative persons in their understanding and perception of HIV transmission. Reports from outside Europe suggest (even before the Swiss Statement was released) that HIV negative MSM perceive a number of sexual practices with HIV positive MSM on ARVs as less risky than with HIV positive MSM not on ARVs [22]. More recently, it has been noted that there is an increased likelihood in HIV negative MSM to engage in risky sexual practices (e.g. unprotected anal sex) in sero-discordant relationships where their partner reports an undetectable viral load [26]. Evidence from Australia demonstrates that the behavioral response of MSM to the risk of HIV transmission has evolved considerably over time and that ‘risk reduction’ strategies such as sero-sorting, strategic positioning, negotiated safety and withdrawal are now commonly used to reduce the risk of transmitting or acquiring HIV while engaging in condomless anal intercourse (UAI) [27-29]. In another Australian study in HIV negative MSM, strategic positioning was not associated with a significantly increased risk of acquiring HIV compared to those who reported no condomless anal intercourse [30].
HIV prevention approaches have mainly focused on condom use. This remains critically important but additional approaches are needed, not least because while condom use is common, strategies other than exclusive condom use are emerging in MSM communities [11]. Other approaches include pre-exposure prophylaxis, although at present this is not widely used by UK MSM as it is not generally available. Frequency of HIV testing among MSM in the UK also remains low (estimated 30% never tested, 75% not in past year) [2]. Approximately 25% of HIV positive MSM are unaware of their HIV infection and disproportionately contribute to onward transmission (60% to 80% of new HIV transmissions come from people not diagnosed) [31] as well as presenting late with consequent increased risk of death. There are likely to be many different ways to have an HIV test in the near future including self-testing where you take the sample and do the test yourself, which takes about 5 minutes. Increased HIV testing may also be likely to have prevention benefits as people diagnosed with HIV may be more likely to use condoms though this data is currently lacking for UK MSM.

Current data from the UK which inform on these themes from the perspective of HIV negative MSM are limited. It is important to understand in particular attitudes to unprotected sex with individuals of unknown HIV status and describe this risk behaviour in the context of mental/general health features, STI history, alcohol and drug use (and similarities/differences with counterpart data from HIV positive MSM).

The AURAH study (REC ref: 13/LO/0246, referred to here as AURAH1) used a cross sectional questionnaire to assess knowledge of, and attitudes to HIV transmission risks and the role of ART, and to assess the prevalence of medical and psychological symptoms (e.g. hepatitis C, depression and anxiety), quality of life, lifestyle factors (e.g. drug and alcohol use) and their possible links to sexual risk behaviours, in a large sample of HIV-negative patients attending Genito-Urinary Medicine (GUM) clinics in the UK, and among key demographic subgroups (MSM; Black African men and women). The AURAH2 study builds on the work of AURAH1 by providing further longitudinal data on HIV transmission risk in a group of initially HIV negative MSM.

It is important to study longitudinally the incidence and predictors of new infections among this group at particular risk of HIV infection, and to assess changes over time of the risk behaviour within individuals. Since there is no evidence that HIV incidence is decreasing among MSM in the UK, there is clearly a need for research among this group. In particular, little is known regarding changes in sexual behaviour during crucial periods such as primary HIV-infection and immediately following an HIV-diagnosis nor on variability in sexual risk behaviour over time at an individual level (including on the duration of periods of very high risk). Although there are cohort studies of MSM that provide some limited information on these issues [32-34] there have been no studies among individuals at risk of HIV infection in the UK. The longitudinal component of this study will be highly relevant to HIV prevention efforts among MSM, and help to inform national policies aimed at reducing HIV incidence in the UK and to increase HIV testing in the UK.

AURAH 2 will also provide data for the cost effectiveness component of the programme grant PG (RP-PG-1212-20006) which aims to assess the cost-effectiveness of strategies for preventing HIV in MSM. Areas of uncertainty for which definitive UK data are needed for the
cost-effectiveness analysis are on longitudinal patterns of condom-less sex around the time of infection and as a result of diagnosis. Such information is needed to inform the key parameters of the simulation model which will assess the cost effectiveness of HIV prevention strategies, including HIV testing interventions, to determine the cost-effectiveness (from an NHS perspective with outcomes as Quality-Adjusted Life-Years) of strategies for preventing HIV transmission, alone and in combination.

Impact of the research

The high level of on-going transmission of HIV in the UK, among MSM in particular, means that HIV prevention is a priority research area. Although people newly diagnosed with HIV in the UK can now expect a near-normal life expectancy, due to current combination antiretroviral treatments [35,36], living with HIV and taking lifelong treatment may nevertheless have considerable and lasting impact on an individual’s physical and mental health, as well as their social circumstances. On-going HIV transmission in the UK is also associated with substantial cost to the NHS [37]. This project will provide a unique dataset combining socioeconomic, health and lifestyle information with detailed information on sexual activity, prevention approaches and preferences, HIV testing behaviours and HIV risk, among MSM who as a group are particularly affected by HIV in the UK. Therefore the results will contribute to understanding the social, psychological and health-related factors that are linked to high risk sexual and HIV-testing behaviours, and therefore to on-going transmission of HIV. The results will also provide important information on the acceptability of pre-exposure prophylaxis for HIV (PrEP), a possible prevention strategy under consideration in pilot studies among high-risk MSM in the UK.

AURAH 2 will also underpin our economic assessment of prevention approaches by providing information about longitudinal changes in risk behaviour. Insights from the AURAH2 study will be highly relevant to HIV prevention efforts among MSM, and help to inform national policies aimed at reducing HIV incidence in the UK. In particular, results should provide information useful in developing and targeting potential interventions to reduce high risk sexual behaviour and to increase HIV testing in the UK.

2 STUDY AIMS AND OBJECTIVES

a. Aims

The aim of the AURAH2 study is to study the incidence and predictors of new infections among HIV negative MSM at risk of acquiring HIV, and to assess changes over time in risk behaviour and testing practices within individuals

b. Objectives

1. Provide longitudinal assessment of:
   i. changes over time in high risk sexual behaviours including numbers of condomless sex partners, sex with casual partners and partners of unknown HIV-status, numbers of new partners, specific high risk sexual activities, and low self-efficacy for ensuring or discussing condom use,
   ii. number of condom-less sex partners before, during and after the estimated period of primary HIV-infection, and time of HIV diagnosis.
   iii. frequency of HIV testing over time
iv. type of HIV testing accessed over time; provided by GUM service, self-testing, GP surgery, hospital, other health care provider

2. Assess the extent to which baseline demographic, socio-economic, health and lifestyle factors, and attitudes to HIV are predictive of subsequent levels of condomless sex, incident HIV infection and HIV-testing behaviours

3. Assess the relationship of attitudes to HIV transmission, disclosure, treatment and prognosis, with high-risk sexual behaviours and acquisition of HIV

4. Assess factors which are linked to HIV-testing practices among MSM at high risk of HIV

5. Assess the associations of participant characteristics, sexual behaviour and attitudes with reported use of, and willingness to consider use of, post exposure prophylaxis (PEP), PrEP. In particular attitudes to PrEP will be evaluated among those who are at very high risk of HIV-infection.

3. METHODS

3.1 Study Design
Prospective study of UK MSM at high risk of HIV infection. Information collected on each participant through the AURAH1 baseline questionnaire (REC ref: 13/LO/0246) on demographics, ethnicity, psychological health and well-being, knowledge and understanding of HIV and antiretroviral treatment will be supplemented by a shorter risk assessment completed online by participants no more frequently than every 3-4 months over a 3 year follow up period.

3.2 Study population and recruitment
HIV negative MSM adults that attend sexual health clinics at three sites in the UK for STI screening or HIV testing at: Mortimer Market Clinic, London, Chelsea and Westminster Hospital Foundation Trust, London and Brighton Sexual Health Centre, Brighton, will be approached to take part in the study. Two groups of participants will be recruited to the AURAH2 longitudinal study through different recruitment routes:

Recruitment route 1. This group will consist of HIV undiagnosed MSM who were enrolled in the AURAH1 cross sectional study (REC ref: 13/LO/0246) from the clinics detailed above during 2013 to 2014 who reported condomless anal sex with positive or unknown HIV status partner(s) in the 3 months prior to completing the baseline questionnaire and who consented to be contacted for longitudinal follow. These participants will be contacted by the UCL AURAH1 study team and will be sent information about the AURAH2 study and given the opportunity to enrol in the longitudinal component. If they agree, they will be consented to take part in AURAH2 (see below for details of consent procedures).

Recruitment route 2. This group will consist of HIV undiagnosed MSM who will be prospectively recruited in person through the 3 clinic sites until the target of 1000 MSM are recruited to the study. This group will be asked to complete the baseline AURAH1 paper questionnaire on site as part of their enrolment.

Inclusion criteria:
HIV negative (or HIV positive but undiagnosed i.e. men who may have become positive since their last test and men who have never had an HIV test) MSM subjects aged >= 18 years, attending or who have previously attended for routine sexually transmitted infection (STI) or HIV testing in the study clinics, willing to be contacted for longitudinal follow-up for up to a 3 year period.

Exclusion criteria: Unable to complete questionnaire in English due to language difficulties; already diagnosed as HIV positive; not willing to participate in future follow-up; under 18; not self-defining as MSM

3.3 Consent

Consent for the study will be gained through two different mechanisms, according to the recruitment route. Initial contact for consent will be made by a study nurse or doctors who are members of the clinical care team.

Recruitment route 1) Subjects who participated in AURAH1 and consented to being contacted in the future about further research by UCL will be sent information about the study, using the email address or phone number that they provided at the time of their consent for AURAH1. They will be emailed or texted (depending on which form of contact details they provided) a maximum of 3 times over a 6 week period. If there is no response after 3 attempts at contact, the participant will not be contacted further for the study. If the participant agrees to take part in AURAH2, the email will direct them to a secure website where they will be asked to view an information page and then complete an online consent form. As part of the consent process they will be asked to enter their full name and date of birth. They will also be asked to agree that the data from the original AURAH1 study (including logged information, test results and questionnaire data) can be included in the AURAH2 study.

Recruitment route 2) Participants recruited in person in clinic to AURAH 2 will be given a patient information sheet by the recruiter and given the opportunity to ask any questions about the study. If they consent to join the study they will complete the baseline AURAH paper questionnaire on site. They will also be notified that the results of any HIV test taken on the day of questionnaire completion will be included as part of the study data.

Recruitment time will be as long as the participant needs to decide whether they would like to enrol in the study but this will be limited to the time that they spend in the clinic for their appointment as they will not be expected to return at a later date to complete consent. This consent process was used in the AURAH study and had a good response rate.

For both recruitment routes the consent process will have the following common elements:

- Participants will be made aware participation means they are expected to complete a brief online questionnaire about sexual behaviour and HIV testing on a regular basis over a 3 year period
- Participants will be asked to provide their email address and mobile phone number and consent to receive reminders to complete the online questionnaires via email and/or text message – but also told that there will be a maximum of two reminders by email followed by 1 text message if they do not respond
• Participants will also be asked to provide their full name and date of birth and made aware that this information will be used to find out if there is matching data in UK national clinical databases (see section 3.9.5)
• Participants will be made aware that the study researchers will be securely storing all personal information securely and separately from the main study questionnaire data
• Participants will be made aware that they can withdraw from the study at any point and ask for their personal data to be deleted and that this would not affect their care at their GUM clinic.
• Participants will be advised that should they wish to withdraw from the study they should send an email to a specified contact address to make this request
• During the consenting process, it will be reiterated that the study is recruiting HIV undiagnosed individuals only.

3.4 Data collection

Baseline data collection and measurements

Baseline data: The AURAH1 baseline study questionnaire (REC ref: 13/LO/0246) is self-administered and will be completed for all participants either as part of their participation in AURAH1 (if recruited through route 1) or at the time of enrolment for AURAH2 in clinic (if recruited through route 2).

Extensive baseline data is collected through the AURAH1 baseline questionnaire (including demographic, social, lifestyle, physical and psychological symptoms, attitudes to HIV transmission, disclosure, treatment, use of PEP and PreP, attitudes to PreP, HIV-testing preferences and recent sexual behaviour).

Participants entering the study through route 2 will be invited to complete the paper based questionnaire while waiting for their GUM appointments, or directly following their appointment, whichever is most convenient for the patient and/or appropriate for each particular clinical centre. Each questionnaire will have a study number pre-completed on the first page. Participants will be given a questionnaire, pen and envelope. A private area within the clinic will be available for completion of questionnaires, if desired. Once completed, the questionnaires can be placed in a sealed envelope and put in a box in the clinic. Participants are asked to complete the questionnaire on the same day, in the clinic. The questionnaire will not be available in any languages other than English.

3.5 Participant online questionnaires

Regular data collection will consist of a brief online questionnaire to be completed approximately 4 monthly to assess risk behaviour and testing experience and history in the preceding months. A more detailed questionnaire will also be undertaken no more frequently than annually

Individuals will initially be sent an email or text message with an individualised link to register an account on the secure website. Use of this link to access the questionnaire pages will enable the researchers to ensure that only known participants recruited in clinic can register. Once registered, users will login to complete the first brief online questionnaire and will then
be reminded to return subsequently and login as required to complete questionnaires in
future.

The online questionnaires will collect information on sexual behaviour and any HIV tests
undertaken (see section 3.9.3 for details), but they will not ask users to enter any personally
identifying details. If a participant reports that they have tested positive for HIV, they will be
directed to questions specific to newly infected individuals. Participants who become HIV
positive will also be reminded that they can continue to participate in the AURAH2 study for
its full duration. The importance of remaining in the study after a positive HIV test result will
be reiterated at the baseline consent by the research nurse to ensure the longitudinal data
collection on patterns of condom-less sex around the time of infection and as a result of
diagnosis.

3.6 Sample size:

Sample size calculation is based on objective 1ii) assessing within-person changes in
sexual behaviour after receiving an HIV diagnosis which, along with predictors of incident
HIV is more constrained by power than other objectives because it relies on comparisons
within the group who are infected with HIV during follow-up. Considering sexual behaviour
classified as whether or not a man reports > 3 condom-less sex partners in the past 3
months, 85 new HIV diagnoses would be needed to detect, with 80% power and 5%
significance level, the following changes: 17 (20%) of men newly diagnosed switching from
>3 to ≤3 condom-less sex partners pre to post- diagnosis, and 4 (5%) of men newly
diagnosed switching from ≤3 to >3 condom-less sex partners pre to post- diagnosis. With
1000 HIV-negative men initially enrolled in the study sample, assuming an annual HIV
incidence of 4% (as reported in high risk MSM) and a drop-out rate of 15% per year, 96 new
HIV infections would be expected to accrue over a three year period. This sample size
should provide adequate power for the other objectives.

3.7 Analysis plan:

Standard statistical approaches for analysis of cohort data with time updated covariates. In
addition, we will estimate the change after HIV diagnosis in men who report 3 or more
condom-less sex partners in the past 3 months. Predictors of having 3 or more condom-less
sex partners in the past 3 months will be assessed using random effects models that include
the number of condom-less partners in the previous 3 month period. These results will all be
compared with similar analyses conducted on the model simulated population in order to
inform model calibration.

3.8 Role of clinic based study staff

The study nurse or research assistant in each clinic will have a major role in recruiting to the
study via recruitment route 2, including consenting participants, collecting contact details and
administering the baseline questionnaire

3.8.1 Documents held by study nurse/research assistant

- Information sheets
- Consent forms
• Study log (including clinic numbers, study numbers, full name, date of birth and email addresses)
• Numbered paper questionnaires (and pens)
• Pre-paid envelopes addressed to research team

3.8.2 study nurse/research assistant tasks

In each centre, the study nurse/research assistant will undertake the following tasks:

• Together with the clinical and research team, deciding on clinics/days to recruit to the study
• Together with the clinical and research team, deciding on how best to organise study recruitment and completion of questionnaires
• Inviting subjects to participate and distributing the study information sheet
• Obtaining subjects written informed consent to participate including longitudinal follow up
• Discussion/demonstration of study website and how to log-in as a participant (can be done on mobile or laptop)
• Completing the study log (see section 3.9.1)
• Distributing paper questionnaires to participants
• Identifying a suitable private space for participants to complete the paper questionnaire, if desired
• Entering the study number and date on paper questionnaires
• Ensuring completed questionnaires in sealed envelopes are placed in the box provided
• Encouraging questionnaire completion in the clinic
• Returning a copy of the study log to the coordinating centre each week
• Having paper questionnaires available for collection by courier or other means (monthly)
• Communicating with the core group regarding study progress and any problems identified
• Storing the study log and consent forms securely in the clinic

3.9 Measurements

3.9.1 Study log

At each clinic at which recruitment takes place, the study nurse/research assistant will complete a study log containing the following information for each subject approached:

• Date and clinic (am/pm)
• Whether the subject is eligible for the study and,
• Whether the subject refuses to participate and, if supplied, the reason for refusal

For each participating subject, the nurse will record:

• Consent status of the participant
• Relevant identifying details - clinic number, study number, full name, date of birth, email address and mobile phone number
• The final result of any HIV test taken at the study visit

3.9.2 Baseline questionnaire

The AURAH1 questionnaire includes the following sections completed already or to be completed by new participants:

Demographic/social factors, Psychological and physical symptoms (using a modified version of the Memorial Symptom Assessment Scale Short-Form [38,39]), Depression (using the PHQ-9 [40]) and anxiety (GAD-7 anxiety score scale) [41], Health-related quality of life (using the EuroQoL 5D [42]), Social support (using a modified version of the Duke–UNC Functional Social Support Questionnaire - FSSQ) [43], Detecting alcoholism (CAGE questionnaire) [44] Relevant medical history, Transmission risk beliefs (in relation to ART and risk of transmission from HIV positive individuals), Lifestyle factors and Sexual activity.

MSM who have had anal sex in past 3 months will be asked whether this was with a regular or short term partner; number of partners; type of sex; had sex using condom; had condomless penetrative anal sex (receptive/insertive) with HIV positive partner or unknown status partners; number of times condomless penetrative sex; reasons for not using condom with last partner of positive or unknown status; extent to which they discuss HIV status with partners; if the partner was assumed HIV negative did they know when partner has last tested; had oral sex without condom; number of partners; undertook fisting, group sex or other high risk sexual activities;

For all participants: self-efficacy regarding condom use; discussion of HIV-status of partner with new partners; discussion of condom use; whether used internet to find sexual partner; whether participated in group sex; whether received money for sex; whether had taken PrEP / PEP (antiretroviral drugs before or after sex to prevent HIV transmission)

3.9.3 Online questionnaires

The regular secure online questionnaire will comprise a limited number of questions about sexual behaviour and HIV testing:

Participants will be asked to report their last HIV test result (if ever tested) and to describe the number of sexual partners, number of new partners; type of sex; had sex using condom; had condomless penetrative anal sex (receptive/insertive) with HIV positive partner or unknown status partners; number of times condomless penetrative sex.

If a participant reports a positive HIV test result during the course of the study, the questionnaire will ask whether they have been linked to care as well as similar risk behaviour questions to the above.

Participants will be asked to complete a more extensive questionnaire no more frequently than annually, which will take a maximum of 15 minutes to complete. The annual questionnaire will include the HIV risk assessment questions as well as questions on social factors, physical symptoms, Depression (using the PHQ-9 [37]), Health-related quality of life (using the EuroQoL 5D [39]).
3.9.4 Clinic data

The result of any HIV test taken at the same time as the baseline questionnaire completion will be stored as part of the study records. No other clinical data will be recorded.

3.9.5 Linkage with national clinical databases

At the end of and during the study period, the participants’ full name, date of birth and sexual health clinic number will be used (in collaboration with Public Health England) to check for corresponding records and data in national clinical databases such as HARS (HIV diagnoses), GUMCAD (sexual health) and ONS (mortality).

3.10 Data analysis

3.10.1 Transfer of clinic data to the coordinating centre

Route 2 consent: Questionnaires will be sealed in envelopes and transferred from each clinical centre to the coordinating centre approximately every month. The study log will also be sent to the coordinating centre each week using secure NHS.net email addresses. Clinic numbers will be removed from the study log prior to transfer to the coordinating centre. However the study logs will contain full names, dates of birth, mobile phone numbers and email addresses (see section 4.4 for safeguarding of this information). The core group will also request additional data from the clinical centres including the total number of eligible, approached individuals seen over the study period in each centre.

3.10.2 Data entry and download

Data from paper questionnaires will be double entered into an appropriate data entry package. Personal details supplied as part of the online consent process and questionnaire data will be regularly and securely downloaded from the secure website and copies stored at the study centre. Once downloaded any personal details will then be deleted from the secure website.

3.10.3 Statistical methods

Logistic regression analyses will be used to investigate associations of sexual risk behaviour and transmission risk beliefs and other factors. Study clinic will be considered as a stratification factor. Analyses will be conducted in the study population as a whole.

4. ETHICAL CONSIDERATIONS

4.1 Ethics review

Prior to the initiation of the AURAH2 study, the protocol, patient information sheet, informed consent form, and study questionnaire will be submitted for ethical review. Any future amendments to the study protocol will also be submitted.

4.2 Patient information

The information sheet for clinic based recruitment (route 2) clearly states that the baseline questionnaire and follow-up risk assessment questionnaire will include personal questions on sexual lifestyle. It states that if the questionnaire raises any issues or concerns,
participants can ask the recruiter to arrange for them to speak to an appropriate professional. It also specifies that participants are free to withdraw consent for the study at any time, including after completing the baseline questionnaire or at any point during the follow up period.

Appropriate study information web pages will be made available online providing all the information available in the patient information sheet. The information will be context specific and accessible to users when consenting via recruitment route 1 and when returning to complete the brief, regular online follow-up questionnaires. The information will include access to general HIV related resources (the Terrence Higgins Trust website and helpline) and specific contact details if there are queries about participating or withdrawing from the AURAH2 study.

4.3 Confidentiality

Private areas in the clinic will be available for completion of paper questionnaires, if preferred. The questionnaires themselves will contain a study number only, with no identifying information. The patient’s name and clinic number will not be recorded on the questionnaire. Participants will be able to place their completed paper questionnaires in a sealed envelope in a box in the clinic. Participants will be informed that their questionnaire responses will not be seen by clinical staff or recorded in their clinical notes. In the clinics the study log will be the only document linking study number with clinic number and/or names. Clinic numbers will be removed from the study log before these data are transferred to the coordinating centre.

The online questionnaire pages will be made available on a secure public website exclusively via an individual user account whose password will be known only to the person invited to participate. For recruitment route 1 (previous participants in AURAH1) there will be an initial consent form to fill in that will ask the participant to enter full name and date of birth as part of the consenting process. However for all other subsequent questionnaire pages, the information collected will not include any data items that would allow a person to be individually identified.

At the coordinating centre, information will be treated as completely confidential. The personal identifiable information (names, dates of birth, mobile numbers and email addresses) collected during the consent process will only be used for the consented purposes. The data from the questionnaires will be kept separately from the study log and from the personal information and will be linked by study number only. No individual subject will be able to be identified in any results that are presented or published from the study.

4.4 Data security

The online questionnaire web pages will be hosted on a secure web server. All procedures and processes for online data collection and storage will be assessed against the requirements of the NHS Information Governance Toolkit and any recommendations will be acted on.

The study result datasets will be held on IT facilities at University College London and will be securely stored on centrally managed servers or on encrypted PC and laptop drives. Paper forms (including questionnaires and copies of the study log) will be stored securely in locked
cabinets. Any participant personal identifiable details will be securely stored in encrypted form or within a secure environment for handling personally identifiable data in a manner compliant with the Data Protection Act and only used for the consented purposes. Once the personally identifiable information has been used for the consented purposes, and after the period of 6 months as indicated on the consent form has expired, the personal details will be permanently deleted.

4.5 Data transfer (handling, processing and storage)

In the study, the full name, date of birth and contact details (email address and telephone number) will be collected from consented participants in accordance with the patient consent form, patient information sheet and sections 3.3, 3.4 and 3.5 of this protocol.

These personally identifiable details will be handled appropriately and securely by study staff acting on behalf of the Department of Infection and Population Health, Royal Free Hospital, Rowland Hill Street, London, NW3 2PF. In particular the study Data Manager and Study Coordinator will process, store and dispose of personal identifiable information in accordance with all applicable legal and regulatory requirements, including the Data Protection Act 1998 and any amendments thereto.

6. STUDY MANAGEMENT

The study will be managed by the core group at the research department. The protocol and all study material will be reviewed and approved by all members of the AURAH2 study group.

University College London holds insurance against claims from participants for harm caused by their participation in this clinical study. Participants may be able to claim compensation if they can prove that UCL has been negligent. However, if this clinical study is being carried out in a hospital, the hospital continues to have a duty of care to the participant of the clinical study. University College London does not accept liability for any breach in the hospital’s duty of care, or any negligence on the part of hospital employees. This applies whether the hospital is an NHS Trust or otherwise.

5.1 Setting up study procedures

At the start of the AURAH2 study, members of the core group will visit each clinical centre in order to discuss study procedures and recruitment with the study nurse/s and the clinical team. As the AURAH2 study follows a similar procedure for recruitment and will be taking place in 3 sites that are familiar with the AURAH study, the protocol, patient information sheet and changes to the consent process can also be discussed over email or telephone with the clinic research team.

5.2 Funding for the study in each centre

As per the AURAH1 study, the 3 clinics will continue to be paid £40 per each completed baseline questionnaire from a study participant that reaches the UCL study group. The study has been funded by an NIHR programme grant.

Neither the Chief Investigator nor any other investigator/collaborator has any direct personal involvement (e.g. financial, shareholding, personal relationship etc.) in the organisations sponsoring or funding the research that may give rise to a possible conflict of interest.
5.3 Incentives for participants

The study burden for participants is minimal (15-20 minutes to complete the baseline questionnaire and 5 minutes on an approximately 3 monthly basis for follow-up, with an annual 15 minute questionnaire). However in order to improve recruitment, subjects will be notified that as participants they will entered into an annual prize draw for the chance to win up to £1000 each year for the duration of the study.

5.4 Monitoring of recruitment

Online and clinic based recruitment will be monitored and information will be provided to the clinical centres on recruitment and response rates.

5.5 Data monitoring

Throughout the recruitment period, regular audits of study data will be performed to check data completeness and data quality. The data manager will undertake data checks and data cleaning prior to statistical analysis.

5.6 Data analysis and publications

Statistical analyses will be performed at the coordinating centre by the core group. All material submitted for publication or presentation will be circulated to all members of the AURAH2 study group for comments. The primary publications from the study will be authored by the ‘AURAH 2 study group’ (including all site members).

6.0 Insurance

University College London holds insurance against claims from participants for harm caused by their participation in this clinical study. Participants may be able to claim compensation if they can prove that UCL has been negligent. However, if this clinical study is being carried out in a hospital, the hospital continues to have a duty of care to the participant of the clinical study. University College London does not accept liability for any breach in the hospital’s duty of care, or any negligence on the part of hospital employees. This applies whether the hospital is an NHS Trust or otherwise.

7.0 TIMETABLE

AURAH2

October 2014: Ethics approval

March 2015: 3 study sites switch from AURAH1 to AURAH2 protocol and recruit to AURAH2 only. Previous AURAH participants that consented to be contacted for future follow up by the UCL AURAH study team will be contacted and consented to take part in AURAH2

August 2015: Recruitment ends for baseline AURAH 2 participants

December 2014-December 2017: Ongoing follow-up of participants via email.

December 2017: Data analysis; dissemination of findings for AURAH 2

References


7. Dodds J, Mercey D, Parry J, Johnson A. Increasing risk behaviour and high levels of undiagnosed HIV infection in a community sample of MSM. Sex Transm Infect 2004; 80:236–240;


10. Dodds JP, Johnson AM, Parry JV, Mercey DE. A tale of three cities: persisting high HIV prevalence, risk behaviour and undiagnosed infection in community samples of men who have sex with men. Sex Transm Inf 2007; 83: 392-396


34. Heijman T, Geskus RB, Davidovich U, Coutinho RA, Prins M, Stolte IG. Less decrease in risk behaviour from pre-HIV to post-HIV seroconversion among MSM in the combination antiretroviral therapy era compared with the pre-combination antiretroviral therapy era. AIDS. 2012 Feb 20;26(4):489-95
Appendix XIII. The AURAH study methods paper “A Cross-Sectional Study on Attitudes to and Understanding of Risk of Acquisition of HIV: Design, Methods and Participant Characteristics”.

See overleaf.
A Cross-Sectional Study on Attitudes to and Understanding of Risk of Acquisition of HIV: Design, Methods and Participant Characteristics

Janey Sewell1, RNurs; Andrew Speakman1, PhD; Andrew N Phillips1, PhD; Fiona C Lampe1, PhD; Ada Miltz1, MSc; Richard Gilsin1, MBBS, David Aspoc2, MBBS, Nnuka Nwokolo2, MBBS, Christopher Scott2, MBBS; Sara Day2, MBBS; Martin Fisher1, MBBS; Amanda Clarke1, MBBS; Jane Anderson1, MBBS, Rebecca O’Connell1, MBBS; Vanessa Apea1, MBBS; Rageshri Dharayyan1, MBBS; Mark Gompels2, MBBS; Piyamaher Farzamand1, MBBS; Sris Allan1, MBBS; Susan Mann2, MBBS; Jyoti Dhan11, MBBS; Alan Tang2, MBBS; S Tariq Sadiq13, MBBS; Stephen Taylor11, MBBS; Simon Collins11, Lorraine Sherr1, PhD; Graham Hart1, PhD; Anne M Johnson1, MBBS; Alec Miseres11, PhD; Jonathan Eiford13, PhD; Alison Rodger1, MBBS.

1Institute of Epidemiology and Health Care, Research Department of Infection and Population Health, UCL, London, United Kingdom
2Chelsea and Westminster NHS Foundation Trust, London, United Kingdom
3Brighton and Sussex University Hospitals NHS Trust, Brighton, United Kingdom
4Hounslow University Hospital NHS Foundation Trust, London, United Kingdom
5Barts Health NHS Trust, London, United Kingdom
6Barking, Havering and Redbridge University Hospitals NHS Trust, London, United Kingdom
7North Bristol NHS Trust, Bristol, United Kingdom
8Cader Idris and Ffestiniog NHS Foundation Trust, Huddersfield, United Kingdom
9Coventry and Warwickshire Partnership NHS Trust, Coventry, United Kingdom
10King’s College Hospital NHS Foundation Trust, London, United Kingdom
11Staffordshire and Stoke on Trent Partnership NHS Trust, Leicester, United Kingdom
12Royal Berkshire NHS Foundation Trust, Reading, United Kingdom
13Institute for Infection and Immunity, St George’s, University of London, London, United Kingdom
14Heart of England NHS Foundation Trust, Birmingham, United Kingdom
15HIV iBase, London, United Kingdom
16London School of Hygiene and Tropical Medicine, London, United Kingdom
17City University London, London, United Kingdom
18Deceased

Corresponding Author:
Janey Sewell, RNurs
Institute of Epidemiology and Health Care
Research Department of Infection and Population Health
UCL
Royal Free Hospital
London, NW3 2PF
United Kingdom
Phone: 44 20 7794 0500
Fax: 44 20 3108 2079
Email: j.sewell@ucl.ac.uk

Abstract

Background: The annual number of new human immunodeficiency virus (HIV) infections in the United Kingdom among men who have sex with men (MSM) has risen, and remains high among heterosexuals. Increasing HIV transmission among MSM is consistent with evidence of ongoing sexual risk behavior in this group, and targeted prevention strategies are needed for those at risk of acquiring HIV.

https://www.researchprotocols.org/2018/2/e1416/
Objective: The Attitudes to and Understanding of Risk of Acquisition of HIV (AURA) study was designed to collect information on HIV negative adults at risk of HIV infection in the United Kingdom, based on the following parameters: physical and mental health, lifestyle, patterns of sexual behaviour, and attitudes to sexual risk.

Methods: Cross-sectional questionnaire study of HIV negative or undiagnosed sexual health clinic attendees in the United Kingdom from 2013-2014.

Results: Of 2,630 participants in the AURA study, 2,064 (78%) were in the key subgroups of interest; 580 were black Africans (325 females and 255 males) and 1,484 were MSM, with 27 participants belonging to both categories.

Conclusions: The results from AURAH will be a significant resource to understand the attitudes and sexual behaviour of those at risk of acquiring HIV within the United Kingdom. AURAH will inform future prevention efforts and targeted health promotion initiatives in the HIV negative population.

(JMIR Res Protoc 2016;5(2):e58) doi:10.2196/resprot.4873

KEYWORDS
HIV infection; HIV negative; HIV undiagnosed; HIV transmission; HIV testing; men who have sex with men; black Africans; sexual risk behaviour; health and wellbeing.

Introduction

Background

During 2013, 6,000 people were newly diagnosed with human immunodeficiency virus (HIV) in the United Kingdom (UK), and the estimated number of people living with HIV in the United Kingdom was 107,800 by the end of that year [1]. Despite no reported rise in the annual number of new diagnoses since 2005 in the overall UK population, there is evidence that HIV incidence is increasing among men who have sex with men (MSM) [2], and in 2013 the number of new HIV diagnoses remained high in black African men and women, who constitute two thirds of all heterosexuals living with HIV in the United Kingdom [1].

An estimated 38,700 black Africans were living with HIV in the United Kingdom in 2013. Despite a decline in new diagnoses among people born in sub-Saharan Africa, black Africans form the second largest social group affected by HIV in the United Kingdom [1]. The combination of high prevalence of HIV in the black African community [1] and the high proportion of undiagnosed infection as a consequence of late presentation [3] means that the potential for onward transmission of HIV is high within this community. Although the proportion of late HIV diagnoses has declined overall in the last decade, late diagnosis was highest among black African men (69%) and women (57%) in 2013 [1]. Research into factors that affect attitudes towards HIV and access to HIV testing and services is important. The African Health and Sex survey in 2013-2014 demonstrated a low level of awareness of HIV prevalence within black African people living in the United Kingdom, and poor knowledge of HIV treatment and care availability [4], which may impact on access to HIV testing services and sexual risk behavior. Furthermore, previous research into late presentation among black Africans demonstrated that HIV awareness did not translate into individual perception of risk or use of services, and that major structural barriers such as stigma, confidentiality and migration issues inhibit the uptake of HIV testing and services [5].

Evidence of ongoing, and likely increasing, HIV transmission among MSM [1,26-1] is consistent with evidence of ongoing sexual risk behavior in this group and there is evidence that the prevalence of condomless sex among MSM in the United Kingdom may have changed over the last few decades. In the United Kingdom the extensive research carried out in community-venue and clinic based studies [6-8-15] has indicated an increase in the prevalence of condomless anal intercourse among MSM during the late 1990s and early 2000s, coincidant with the widespread introduction and use of successful combination antiretroviral treatment (cART) for HIV in developed countries. Research from the United States [16,17] and Europe [18-21] also describes an increase in diagnoses of other sexually transmitted infections (STI) over this time. It has been suggested that the increase in condomless sex that occurred in the late 1990s in the Western world may now have plateaued [9], and recent data from NATSAL-3 (a large representative survey of sexual behavior in the UK general population from September 2010 to August 2012) described no change in prevalence of condomless sex or risk perception in MSM over the last decade [22]. However, the incidence of HIV in MSM in the United Kingdom appears to have increased [2]. This increase cannot be explained by changes in HIV testing alone [23], but would be compatible with a modest ongoing increase in condomless sex among MSM [2].

Sexual transmission risk arises as a result of perceptions and behaviors which may differ depending on the HIV status of individuals. Strategies aimed at reducing HIV transmission need to address differences in both HIV positive and negative individuals' perceptions, choices, and behaviors [24]. As increasing evidence shows that a suppressed HIV viral load (VL) greatly reduces the risk of onward transmission of HIV to sexual partners [25,26], it is important to consider how this research might have reached and influenced HIV negative persons in different ways to those who are HIV positive. The PARTNER study recently presented transmission estimates of zero in heterosexuals and MSM for condomless sex where the positive partner was on suppressive ART, albeit with a high upper confidence limit in MSM [27]. These data may also influence HIV negative persons in understanding and perception of HIV transmission risks. Research from the United States suggests that HIV negative MSM perceive a number of sexual practices with HIV positive MSM on ART as less risky than
with HIV positive MSM who are not on ART [24]. Furthermore, evidence from Australia has demonstrated that a behavioral response by MSM to the risk of HIV transmission has evolved considerably over time [28]. Risk reduction strategies such as using HIV VI to negotiate condom use [28], serowerging (using HIV status as a decision-making point in choosing a sexual partner [29,30]), strategic positioning (choosing a different sexual position or practice depending on the serostatus of a partner [31]), negotiated safety (choosing not to use condoms with a primary partner and establishing specific rules for sex outside of the primary relationship [32]), and withdrawal are now commonly used to reduce the risk of transmitting or acquiring HIV during condomless anal intercourse.

Current data from the United Kingdom that inform on these themes from the perspective of HIV negative MSM and black Africans are limited. In particular, information is needed on HIV testing behavior and preferences, patterns of sexual behavior, prevalence of specific types of condomless sex (to capture possible risk reduction strategies), attitudes to condomless sex with individuals of known and unknown HIV status, and associations with factors such as mental/general health, STI history, and alcohol and drug use. Data from the Attitudes to and Understanding of Risk of Acquisition of HIV (AURAHS) study will contribute to an understanding of how knowledge of ART and detectable/undetectable VLs among HIV negative individuals may affect attitudes and perceptions which lead to condomless sex with partners of unknown and/or known HIV status in the United Kingdom.

Uptake and frequency of HIV testing among MSM in the United Kingdom remains inadequate (an estimated 35% never tested [33]), so it does in black Africans (an estimated 40% never tested [34]). Therefore, improving efforts to expand testing outside sexual health clinics is a priority, and it is a key recommendation from Public Health England to reduce the burden of undiagnosed HIV in these two groups [1]. The first self-testing HIV kit featuring is KiteMark (a UK product and service quality certification) was released in the United Kingdom in April 2015 [34]. Although the majority of HIV tests are currently conducted in sexual health clinics, emerging evidence suggests that HIV self-testing is highly acceptable to both MSM and black Africans in low and high income settings [35,36]. HIV self-testing may remove some of the barriers around accessing sexual health services that are experienced by black Africans and MSM, and may help to improve access to HIV testing. However, there is a need to assess HIV testing preferences in HIV negative individuals, given the recent expansion of testing options to include HIV self-testing [34], and to need to increase HIV testing in the most at-risk populations in the United Kingdom. Results from the AURAHS study will seek to inform on HIV testing preferences and acceptability of HIV testing outside of the traditional sexual health clinic setting.

The AURAHS study will allow comparison of HIV negative or undiagnosed MSM and black Africans with HIV positive participants from the Anti-retroviral, Sexual Transmission Risk and Attitudes (ASTRA) study [37], a previous questionnaire study undertaken in 2011-2012 by the same group. The ASTRA study focused on patients with HIV under care within the United Kingdom, and asked many of the same questions as the AURAHS about sexual behavior, attitudes, and health and lifestyle factors. The ASTRA study aimed to assess sexual risk behaviors, beliefs about HIV transmission risk, and attitudes towards the use of ART in this population [37]. Previous studies have illustrated high prevalence rates of depression, anxiety, and drug and alcohol use in MSM [38], whilst black and minority ethnic groups in the UK’s general population are also more likely to be diagnosed with mental health problems and experience poorer outcomes from treatment than other ethnic groups [39,40]. There is some evidence that depression in MSM is associated with higher levels of condomless sex and higher risk behaviors [41] but there is limited data on mental health and wellbeing, and sexual behavior, among MSM or black Africans in the United Kingdom. Data from the AURAHS study will allow insights into these issues. Furthermore, comparison between HIV positive and negative individuals in both MSM and black Africans will help to elucidate the specific effect of HIV and HIV treatments on health, wellbeing, and lifestyle among MSM and black Africans.

This paper describes key aspects underlying the AURAHS study, including its rationale, design, methods and response rates. A description of the participant characteristics is also outlined. Details of both response rates and participant characteristics may be of use in the comparison to other studies in sexual health clinics or outpatient settings, and inform future design and planning of subsequent studies. Further publications will address detailed research questions based on the data collected from the participants in the AURAHS study.

Aims and Objectives

The primary aim of the AURAHS study was to assess patterns of sexual behavior, and attitudes to sexual risk, among HIV negative adults at risk of HIV infection, and to investigate associations with demographic, socio-economic, health, and lifestyle factors.

Study Objectives

The detailed objectives of the AURAHS study were to assess the following in HIV negative (not known to be HIV positive) sexual health clinic attendees:

1. Levels of recent condomless vaginal or anal sex according to demographic groups (sexuality, ethnicity).
2. Among those who have had condomless sex, the distribution of number of sexual partners, type of partners, knowledge of HIV status of partners, number of times had condomless sex, type of condomless sex, and reasons for not using condom.
3. Among those having condomless sex with partners of positive or unknown HIV serostatus, the prevalence of risk-reduction measures such as seroadjusting.
4. The prevalence of psychological and physical symptoms (ie, depression, anxiety) and lifestyle factors (ie, drug and alcohol use), and whether demographic/social factors, psychological and physical symptoms, quality of life, and lifestyle factors are associated with condomless sex.
5. Beliefs regarding the effect of ART in HIV positive individuals, and undetectable VL on HIV transmission risk.
transmission risk beliefs) and the association of such beliefs with sexual behavior.

6. Attitudes towards testing for HIV in different settings (i.e., sexual health clinic, general practitioner, community based testing), type of testing (i.e., self-sampling, self-testing) and preferred sample type for HIV self-testing (i.e., saliva based or finger-prick sample of blood).

Methods

Study Design

AURAH was a cross-sectional self-administered questionnaire study in individuals attending 20 sexual health (Genito-Urinary Medicine) clinics, in 15 clinical centers (National Health Service trusts) across the United Kingdom. The recruitment period was 17 months, commencing June 2013.

Population and Setting

AURAH was conducted among individuals attending sexual health clinics for routine STI or HIV testing. The inclusion criteria were as follows: HIV negative (or undiagnosed) subjects aged 18 years or over, attending for routine STI or HIV testing in sexual health clinics. Individuals not known to be HIV positive at the time of recruitment to AURAH, but testing positive on that (or a subsequent) clinic visit were retained in the AURAH sample.

The 20 clinical centers were situated across England, and details of the locations and clinics are listed in the Acknowledgements section. The sites were selected on the understanding that they could provide access to large numbers of HIV negative patients attending clinics for STI screening and HIV testing, including the key demographic at risk subgroups in the United Kingdom (MSM and black Africans). Most clinics were able to provide a mixed demographic of study participants but a few clinics recruited large numbers of one type only. For example, the St James Street clinic and the Mortimer Market Centre recruited a large number of MSM to the study. Similarly, there were other centers that provided a larger number of black African male and female participants for the study, including the Greenway Center, City of Coventry Healthcare Center, and the Sydenham Center, Barking, London.

Sample Size

The AURAH study adopted a recruitment target of 2000 total sample size, of which 1000 would be MSM, and 1000 heterosexuals, of whom 600 would be black African. After calculations the study would have sufficient power to:

1. Ascertain the proportion of individuals who report that they have had condomless sex in the past 3 months with a partner of unknown or positive HIV status and that one of the reasons for this was “I knew there was a risk of acquiring HIV but I am not so concerned about having the disease that it made me want to have sex using a condom.” This would be calculated as a proportion of all study participants and as a proportion of all participants reporting condomless sex.

2. Ascertain the proportion of individuals who report that they have had condomless sex in the past 3 months with a positive partner who gave a reason as “I thought the risks of catching HIV were low because my partner was taking anti-retroviral therapy.”

3. Compare the prevalence of depression on the Patient Health Questionnaire (PHQ-9) scale [42] between HIV positive and HIV negative individuals, separately for HIV negative MSM, heterosexual men and women, and black African men and women.

For objectives (1) and (2), the planned sample size of 1000 MSM would allow estimation of a 5% prevalence (95% CI 3.65-6.35), a 10% prevalence (95% CI 8.65-11.35), and a 20% prevalence (95% CI 17.52-22.48). For the planned sample size of approximately 300 black African men (or women), prevalences of 5% (95% CI 2.55-7.45), 10% (95% CI 6.60-13.4) and 20% (95% CI 15.47-24.53) would be estimated.

For objective (3), given approximately 2250 MSM, 200 black African men and 450 black African women in the ASTRA sample [37], and assuming a prevalence of depressive symptoms of 25% among each of these groups, the study would have 80% power (with 5% 2-sided significance level) and absolute difference in prevalence of 4.5% for MSM, 10.0% for black African men, and 8.5% for black African women.

Recruitment

Recruitment to the study took place between June 2013 and November 2014 during different periods at the 20 clinics. A flowchart of recruitment procedures for the study is included (see Figure 1).

Initial recruitment in the clinics was not restricted. Each site identified specific clinics each week, at which subjects were recruited, aiming to ensure a reasonably representative study population. Consecutive subjects attending each clinic were identified, approached, and invited to take part. It was more feasible to initially recruit in this unstructured way, and the intent was to modify recruitment strategy as necessary to recruit a sufficient number of MSM and black Africans. After 6 months of unrestricted recruiting, targeted recruitment was implemented across all study sites, and clinic staff were asked to identify and recruit only MSM or those of black ethnicity. Once the recruitment target of 1000 MSM had been met (11 months into the study), 15 clinics were asked to concentrate on recruiting only those known to have specifically black African ethnicity before finishing recruitment, and the 5 sites that had recruited the largest number of MSM continued with sole recruitment of MSM to increase the power for some research questions.
Consent

All subjects who were invited to participate were given an information sheet about the study. Those who agreed to complete the questionnaire were asked to sign a consent form. The form included an optional section for participants to provide details to allow contact regarding study reminders and, in the future, to invite participants to join future research studies. Participants were informed that consent to be contacted was optional but that those who provided contact details would be entered into a monthly draw offering a prize of £100 of shopping vouchers. Participants who agreed to be contacted were asked for their preferred contact details (email address and mobile phone number for short message service contact). The consent form noted that participants’ contact details would only be used for these purposes and would be held securely at the study management center as part of the study records, but would be deleted after a period of two years. During the consent process, it was reiterated that the study was for HIV negative or undiagnosed individuals only. Participants were told that the questionnaire would take between 15 and 30 minutes to complete and were given an envelope to seal it in, so that their answers were not available to clinic staff. There was an option for participants to take the questionnaire off-site for completion, and postage paid envelopes were provided to return the questionnaire directly to the study management center if required. The option of taking the questionnaire off-site was aimed at including participants who did not have time to complete the questionnaire before they were called for their clinic appointment. Participants were encouraged to complete the questionnaire on-site if possible, to minimize non-return of questionnaires by consented participants.
Clinical Data
Participants were made aware that their participation included supplying information on the results of any STI or HIV tests that took place in the clinic on the day they were enrolled in to the study. The study log was used to record whether any HIV or STI tests were undertaken and to record the result of any HIV test (negative/positive) performed on the day of enrolment.

Data Processing
Completed questionnaires were collected in the clinic and transferred regularly to the study management center. Questionnaires were identified only by a unique study number. Participants were instructed not to write their name or clinic number on the questionnaire to maintain their anonymity.

Details of all clinic attendees approached for the study were collected in a study log maintained securely and updated daily at each clinic site. The study log contained study numbers, clinic identifiers and details of consent status for all patients invited to participate in the study, whether or not HIV and other STI tests had been done, and the result of any HIV test. Contact details of participants were also entered in the log if participants consented to being contacted about future research. Selected information from the study log at each clinic center was securely transferred on a regular basis to the study management center. At the study management center, contact details for future research were kept securely and separately from the questionnaire data.

Regular reports were sent from the study management center to each site during the recruitment period, detailing trends and overall progress in recruitment for each of the study sites. In addition, regular checks were made on the completeness and quality of the study log and its concordance with received questionnaires.

Questionnaires received at the management center were digitized by an external data processing contractor. Each paper questionnaire was checked for legibility, digitally scanned, and the resulting images were used as the source for two manual data entry rounds with subsequent quality checking. The completed data entry batches delivered by the contractor were checked for accuracy at the study management center by fully examining a 5% sample.

The original anonymized study datasets, including scanned images of the questionnaires, were stored at the study management center in an encrypted digital format. They were preserved by being duplicated and stored on managed servers with regular backup and professional administration. The original paper questionnaires were stored securely in locked cabinets. The study datasets will be made freely and readily available to the research community after a suitable interval in a form that ensures that participant anonymity and confidentiality is maintained.

Study Questionnaire
The questionnaire was based on the design of the ASTRA study questionnaire, a cross sectional study that took place among HIV positive participants attending outpatient HIV clinics across the United Kingdom in 2011-2012 [37] that aimed to include a representative sample of outpatients attending for care at each center. The AURAH study questionnaire was adapted to capture relevant information from HIV negative participants. A preliminary questionnaire design was printed in A5 booklet format and piloted at one study site in June 2013, using the recruitment procedures described above. Following feedback from participants and research staff, minor revisions were made to the final questionnaire, the patient information sheet, the consent form, and an insert was designed to attain further information on preferences for HIV testing. These changes were submitted as amendments for ethical approval and were incorporated into the final version employed during the main recruitment period, which commenced in July 2013.

The final questionnaire consisted of a printed A5 booklet, with versions for men (34-page questionnaire) and women (39-page questionnaire). The pilot study indicated that the questionnaire took roughly 20-25 minutes to complete. The questionnaire sought detailed information on the following factors:

1. **Demographic and social factors:** including gender, age or year of birth, ethnicity, education, employment, housing, financial status, sexuality, relationship status (whether in long-term partnership and HIV-status of partner), country of birth, and number of children.

2. **Health and well-being:** including psychological and physical symptoms (modified version of Medical Symptom Assessment Scale Short Form [43,44]), depression (PHQ-9 [42]), anxiety (Generalized Anxiety Disorder 7 [45]), health-related quality of life (EuroQol-5L [46]), and social support (modified version of the Duke-UNC Functional Social Support Questionnaire [47]).

3. **Health and relevant medical history:** including any major medical conditions, recently diagnosed STIs, symptoms of STIs, diagnosis of hepatitis B and C, treatment for depression, treatment for other mental health problems, pregnancy status for women, and whether circumcised for men.

4. **HIV-related information:** including HIV status (participants reporting HIV positive status on the questionnaire were excluded from the study), history of any HIV tests, beliefs about transmission risk in relation to ART and undetectable VL, knowledge and history of use of FEP and PEP, and attitudes towards HIV self-testing and clinic based tests.

5. **Lifestyle factors:** including cigarette smoking status, usual alcohol intake, evidence of alcohol dependency (the CAGE questionnaire [48]), recent use of recreational drugs (with details), and recent use of injecting drugs.

6. **Sexual lifestyle:** MSM participants were asked about disclosure of their sexuality to others and involvement in the gay social scene.

7. **Sexual activity:** sexual activity (vaginal or anal sex) during the previous 3 months was ascertained separately for (i) men having sex with women, (ii) men having sex with men, and (iii) women having sex with men. For those participants who reported condomless sex in the past 3 months, there were questions on number of partners, type of partners (long-term or other), attitudes to the risk of HIV infection, and knowledge of the HIV status of partners. There were additional questions on the number and type of partners if the participant reported condomless sex with people known
to be HIV positive. All participants were also asked about the use of the Internet to find sexual partners, different sex practices and group sex, attitudes towards disclosure of HIV status to sexual partners and negotiation of condom use, their total number of new sexual partners in the past year, and preferred information sources (if any) about safer sex.

8. HIV testing preferences: participants were asked to rank different ways of testing for HIV. Ranking from least to most appealing on a scale of 1-4, the options were (i) in a sexual health clinic, (ii) general practitioner, (iii) self-sampling; and (iv) self-testing. Participants were also asked to indicate a preference for saliva or blood based self-testing options.

**Ethics Statement**

The research protocol and all versions of the study documents for the AURAH study (information sheet, consent form, questionnaires and insert) were approved by the designated Research Ethics Committees (REC) (National Research Ethics Service committee London-Hampstead, ref. 13/LO/092-40). Based on these documents, the study subsequently received permission for clinical research at all participating National Health Service (NHS) sites from local Research & Development (R&D). The REC (NRES committee London-Hampstead) further approved the protocol and study documents for the AURAHZ study in November 2014 (REC ref: 14/LO/1881) and subsequent permission by local R&D for clinical research at the three NHS clinic sites in March 2015.

**Study Management**

The study was managed on a day-to-day basis by a core group of five staff at the study management center: the HIV Epidemiology and Biostatistics Group, Research Department of Infection and Population Health, Royal Free Campus, University College London.

An advisory group was also established at the start of the study to provide guidance and support. The advisory group consisted of representatives from University College London, HIV iBase, the London School of Hygiene and Tropical Medicine and City University London.

**Results**

Over the 17-month study period a total of 4303 eligible patients were approached and asked to participate in this study. Of those approached, 3340 (76.03%) gave consent to take part in the study. The number of completed questionnaires finally collected was 2630 and thus the response rate was 59.87% (2630/4303) of eligible patients approached, and 78.74% (2630/3340) of those who gave consent. The majority of respondents (1432/2630, 54.44%) agreed to provide their contact details for participation in future research.

Eighteen of the 20 participating clinics were able to provide estimates of the number of outpatients seen in all clinical sessions over the same period, and the numbers of these in the key groups (MSM and black Africans). More than 288,000 patients were found to have attended these 18 clinics at some point during the respective recruitment periods. Of the combined total attending the clinics, it was estimated that approximately 7.6% were black African and 13.6% were MSM. Table 1 shows the patient population recruited to AURAH and response rates for the 20 clinical centers.

**Characteristics of Those Recruited**

The mean age (of the 2630 participants who supplied details) at the time of questionnaire completion was 32 years (SD 10, range 18-80) years. Overall, 1954 (74.30%) participants were men and 676 (25.70%) were women. Of the 1939 male participants whose sexuality was known, 1444 (76.53%) self-classified as MSM and 455 (23.47%) as heterosexual. Of the 1484 MSM participants, 965 (65.03%) agreed to provide their contact details for participation in future research, whereas only 36.02% (140/455) of heterosexual males and 43.30% (202/467) of females agreed to provide these details.

In terms of ethnic origin, 1505 of the 2630 (57.22%) participants self-classified as white, 580 participants (22.02%) as black African ethnicity, 249 (9.47%) as other black ethnicity, 264 (10.04%) as other ethnicity, and ethnic status was missing for 32 (1.22%). Of 548 people of black African ethnicity, 323 (58.9%) were female and 225 (41.1%) were male. Of 250 men of black African ethnicity whose sexuality was known, 50 (12.0%) self-classified as MSM and 200 (88.0%) as heterosexual. Of the 580 participants of black African ethnicity, 213 (36.7%) agreed to provide contact details for participation in future research.

Overall, 2535 of the 3340 consenting participants (75.90%) took an HIV test on the day they were approached in clinic. Of those tested, 18 of 2535 (0.71%) received a positive result that they were unaware of at the time. Of these 18 participants, nine returned completed questionnaires (these are retained in the AURAH sample). All nine of these cases were male of which five were MSM and four were black heterosexuals. Clinics reported that 2624 of the 3340 consenting (78.56%) also tested for STIs on the day, although information on the nature of each test and the results were not collected for this study.

The characteristics of those recruited at the 20 clinical centers in terms of gender, sexual orientation, relevant ethnic status and testing are detailed in Table 2.
Table 1. Recruitment results for the 20 AURAH study clinical centers, 2013-2014.

<table>
<thead>
<tr>
<th>Site</th>
<th>Length of study period in days</th>
<th>Individual patients attending during recruitment period</th>
<th>Eligible patients approached</th>
<th>Patients consenting (as % of approached)</th>
<th>Patients responding (complete questionnaires received as % of approached)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking</td>
<td>335</td>
<td>5475</td>
<td>64</td>
<td>59 (92%)</td>
<td>34 (53%)</td>
</tr>
<tr>
<td>Baths</td>
<td>31</td>
<td>*</td>
<td>16</td>
<td>13 (81%)</td>
<td>11 (69%)</td>
</tr>
<tr>
<td>Birmingham</td>
<td>127</td>
<td>*</td>
<td>25</td>
<td>49 (92%)</td>
<td>33 (62%)</td>
</tr>
<tr>
<td>Brighton</td>
<td>482</td>
<td>11941a</td>
<td>283</td>
<td>240 (89%)</td>
<td>237 (83%)</td>
</tr>
<tr>
<td>Bristol</td>
<td>312</td>
<td>1021</td>
<td>59</td>
<td>58 (98%)</td>
<td>55 (93%)</td>
</tr>
<tr>
<td>Calderdale &amp; Huddersfield</td>
<td>428</td>
<td>13602</td>
<td>92</td>
<td>82 (99%)</td>
<td>73 (79%)</td>
</tr>
<tr>
<td>Coventry</td>
<td>337</td>
<td>11218</td>
<td>260a</td>
<td>256 (93%)</td>
<td>246 (91%)</td>
</tr>
<tr>
<td>Dean Street</td>
<td>473</td>
<td>51882d</td>
<td>1384</td>
<td>895 (65%)</td>
<td>604 (44%)</td>
</tr>
<tr>
<td>Hemepton</td>
<td>300</td>
<td>25312</td>
<td>159</td>
<td>149 (94%)</td>
<td>121 (77%)</td>
</tr>
<tr>
<td>John Burner</td>
<td>450</td>
<td>28236e</td>
<td>235</td>
<td>151 (56%)</td>
<td>84 (36%)</td>
</tr>
<tr>
<td>Kings</td>
<td>283</td>
<td>15500</td>
<td>305</td>
<td>204 (67%)</td>
<td>168 (55%)</td>
</tr>
<tr>
<td>Leicester</td>
<td>84</td>
<td>5173</td>
<td>69</td>
<td>66 (96%)</td>
<td>48 (70%)</td>
</tr>
<tr>
<td>Merthyr Market</td>
<td>332</td>
<td>13652a</td>
<td>382</td>
<td>370 (97%)</td>
<td>313 (82%)</td>
</tr>
<tr>
<td>Newham</td>
<td>320</td>
<td>9203</td>
<td>168</td>
<td>119 (71%)</td>
<td>113 (67%)</td>
</tr>
<tr>
<td>Reading</td>
<td>405</td>
<td>14807</td>
<td>82</td>
<td>75 (91%)</td>
<td>75 (93%)</td>
</tr>
<tr>
<td>Royal Free</td>
<td>416</td>
<td>33216</td>
<td>137</td>
<td>126 (97%)</td>
<td>108 (74%)</td>
</tr>
<tr>
<td>St George's</td>
<td>333</td>
<td>17041</td>
<td>110</td>
<td>90 (82%)</td>
<td>81 (74%)</td>
</tr>
<tr>
<td>The London</td>
<td>247</td>
<td>13747</td>
<td>40</td>
<td>35 (88%)</td>
<td>33 (83%)</td>
</tr>
<tr>
<td>WILCSH</td>
<td>463</td>
<td>19094a</td>
<td>492</td>
<td>270 (58%)</td>
<td>164 (35%)</td>
</tr>
<tr>
<td>Whipps Cross</td>
<td>314</td>
<td>5933</td>
<td>64</td>
<td>53 (83%)</td>
<td>44 (69%)</td>
</tr>
<tr>
<td>TOTALS</td>
<td>-</td>
<td>288090</td>
<td>4393</td>
<td>2346 (70%)</td>
<td>2630 (60%)</td>
</tr>
</tbody>
</table>

*aClinic unable to supply data on total clinic attendance
bClinic was unable to supply data about those declining to participate – value derived from 95% consent rate estimated by the clinic
cCovers 73% of the recruitment period only
dCovers 90% of the recruitment period only
eCovers 55% of the recruitment period only
The AURAH study recruited 2630 participants from 20 UK sexual health clinics during 2013-2014. The initial rate for consent (2630/3340, 78.74%) was relatively high in this study, and the overall response rate (questionnaires received) was 59.87% (2630/4393) of eligible patients approached. However, there was considerable variation between the clinics in the response rate achieved (ranging from 35% to 93%). The difference in response rates between the clinics could be due to a number of reasons. When researchers at the sites with low response rates were asked about potential barriers to participation they noted education and literacy levels, level of English fluency, and the perceived amount of time that the study questionnaire would take to complete, among clinic attendees at their sites. It was felt that the monthly prize draw had not had a significant effect as an incentive to participate but potentially a smaller cash sum might have, however the study did not seek ethical approval for this due to time restraints.

The intention of this study was also to recruit large numbers within the key demographic sub-groups most affected by HIV in the United Kingdom, namely MSM and black African men and women. The study succeeded in this aim, and there were 2034 individuals in these groups of interest: 1484 MSM participants and 550 black African participants, with 30 individuals (1.47%) falling into both of these categories.

It is difficult to compare the overall study response rate with other studies of HIV negative MSM, as many Internet or venue-based studies have no records of numbers not agreeing to participate, and therefore response rate cannot be calculated. Our response rate is comparable with other surveys taking place outside the clinical context that have investigated sexual behavior (70% [49], 65% [50]), and with the previous ASTRAAH study on HIV positive patients whose response rate was 65% [37]. Many of the 1746 non-responding eligible patients were those who directly refused to participate (1156/1746, 99.2%). However, the remaining 710 were consenting participants who took a questionnaire away but did not return it (710/1746, 40.66% of non-responders). Although the option of taking a questionnaire off-site for completion was intended to maximize participation, some of the non-response in this study can be attributed to factors impacting upon questionnaire completion and postage after the questionnaires had been taken away from the study site. For example, lack of time or continued motivation.
to complete and post the questionnaire. However, overall the consent rate was slightly lower than in the comparable ASTRA study and this may reflect the differences between the respective clinic populations in terms of potential ongoing engagement with care, and familiarity with the clinic research staff among those attending HIV and general sexual health clinics.

The average age of AURAH study participants was 32 years and, as expected, this was much younger than the average (45 years) of the ASTRA (HIV diagnosed) study participants [37]. The lower mean age for AURAH is consistent with the study’s intention to sample from large numbers of currently HIV negative but at risk individuals, who could be expected to be younger than the HIV positive population.

The study population was not a random sample of those attending the clinics, as targeted recruitment was implemented after 6 months of recruitment. It should be noted that the target number for MSM recruitment (1000) was exceeded and that the target was reached early in the study. Recruitment was continued because it was desirable to increase power for some research questions. The number of black Africans recruited was 548, however this took a long time to achieve and required selective recruitment in 15 centres. A similar pattern of relative difficulty of recruitment in these two respective populations was observed in the ASTRA study (on HIV diagnosed individuals) [37] where it was found that MSM were over-represented in its sample in relation to the national HIV positive population, and conversely black Africans were under-represented. However, the relative difficulty of recruitment in AURAH may also be a reflection of the different proportions within the populations attending the sexual health clinics, with the overall proportion of MSM (13.6%) being almost double the proportion of black Africans (7.5%).

The number of study participants diagnosed as HIV positive in-clinic during this study was 18 (0.71%, 95% CI 0.38-1.04, of 2535 consenting and tested). The selective nature of our sampling means this is not a meaningful prevalence estimate but, as might be expected in those attending sexual health clinics, this is very much higher than the general UK population HIV estimate for undiagnosed HIV of 0.07% [1]. However, it should be noted that in those identifying as MSM, there were 5 HIV positive cases out of 1484 (0.34%, 95% CI 0.04-0.63) in this study, which is a relatively low value when compared with the estimated 0.94% for the prevalence of undiagnosed HIV in the UK MSM population as a whole [1]. This could reflect the fact that MSM who regularly attend STI clinics are likely to test more frequently for HIV than MSM in the United Kingdom overall.

Conclusions

In summary, the AURAH study includes a substantive but selective sample of those considered to be at risk of being infected with HIV in the United Kingdom. AURAH will give insights into the relationships between socio-demographic factors, psychological and physical symptoms, lifestyle factors, health-related quality of life, and sexual behavior in this population.

The results of the AURAH study will be relevant for understanding the process of HIV transmission within the United Kingdom, and for targeting of national prevention efforts. The data from AURAH will contribute to understanding the social, psychological and health-related factors that are linked to high risk sexual and HIV testing behaviors, and therefore to ongoing transmission of HIV in the two most at risk groups of people in the United Kingdom.

Acknowledgments

We would like to thank all the study participants for their time and effort. We gratefully acknowledge the 20 participating sites and the contributions and efforts of the following at each site: Bartling- Sydenham Center, Bartling, Havering and Redbridge University Hospitals NHS Trust, London (Dr Sharmin Oyeseyeseten); Barts – Barts Sexual Health Center. Barts Health NHS Trust, London (John Saunders); Birmingham – Birmingham Heartlands Hospital, Heart of England NHS Foundation Trust (Cerry Gilliver, Cathy Streten); Brighton – Claude Nicol Center, Brighton and Sussex University Hospitals NHS Trust (Wicky Perry, Elayne Youssell, Celia Richardson, Louise Kerr, Mark Roche, David Stacey, Sarah Kirk); Bristol – Broom Unit, North Bristol NHS Trust (Louise Jennings, Caroline Holder, Katie-Anne Baker); Calderdale & Huddersfield – Princess Royal Community Health Center, Calderdale and Huddersfield NHS Foundation Trust (Matthew Robinson, Dr Emma Street); Coventry – City of Coventry Healthcare Trust, Coventry and Warwickshire Partnership NHS Trust (Abayomi Shomosoye); Dean Street – Dean Street, Chelsea and Westminster Hospital NHS Foundation Trust, London (Ali Ogilvy); Hammersmith – Clifton Center, Hammersmith University Hospital NHS Foundation Trust, London (Sfinio Mguni, Rebecca Clark, Cynthia Sajani, Veronika Epa); John Hunter – John Hunter Clinic, Chelsea and Westminster Hospital NHS Foundation Trust, London (Ali Ogilvy, Sarah Laddi); Kings – King’s College Hospital NHS Foundation Trust, London (Jonathan Syed, Lisa Hanzu, Lucy Campbell, Emily Wandsko, Janagan Alagarajah); Leicester – Leicester Royal Infirmary, University Hospitals of Leicester NHS Trust (Linda Mathangwanyika, Sally Baham); Mortimer Market – The Mortimer Market Center, Central and North West London NHS Foundation Trust, London (Rita Trombin, Ana Milinkovic, Clare Oakland); Newham – Greenway Center, Newham Hospital, Barts Health NHS Trust, London (Nyasha Makoka); Reading – Florey Unit, Royal Berkshire NHS Foundation Trust, Reading (Ruth Wilson, Elizabeth Green, Sheila O’Connor, Sarah Kempster, Katie Keating-Fedderly); Royal Free – Marborough Clinic, Royal Free Hospital NHS Foundation Trust, London (Nicola Tyrell, Jemima Rogers, Silvia Belbondo, Marjat Schall); St George’s – Courtyard Clinic, St George’s Healthcare NHS Trust, London (Wendy Majewska, Anne Patterson, Olimako Okolo, David Cox, Mariam Tarik, Charlotte Jackson, Jeannette Honigsbaum, Clare Boggon, Simone Glish, Bernard Kelly, Renée Arney); The London – Ambrose King Centre, The London Hospital, Barts Health NHS Trust, London (James Hanl, Nyasha Makoka); WCLSH – West London Center.

https://www.researchprotocols.org/2014/2/e1636/
for Sexual Health, Chelsea and Westminster Hospital NHS Foundation Trust, London (Ali Ogilvy); Whips Cross - Whips Cross Hospital. Barts Health NHS Trust, London (Monica Lascar, Nyasha Maloka, Elias Phiri, Zadile Maseko); the CAPRA grant Advisory Board: Nicci Partridge, Kay Orton; Anthony Nardone; Anu Sullivan.

Authors’ Contributions

Conflicts of Interest
AJ is the Governor of the Wellcome Trust. Funding and support: The AURAH study presents independent research funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research funding scheme (PGPR-PG-0608-10142). The AURAH Study Group acknowledges the support of the NIHR, through the Comprehensive Clinical Research Network. The views expressed in this presentation are those of the authors and not necessarily those of the NHS, the NIHR, or the Department of Health.

References


Abbreviations

ART: antiretroviral treatment
ASTRA: Antiretrovirals, Sexual Transmission Risk and Attitudes
AURAHL: Attitudes to and Understanding of Risk of Acquisition of HIV
HIV: human immunodeficiency virus
MSM: men who have sex with men
NHS: National Health Service
NRES: National Research Ethics Service
PEP: post-exposure prophylaxis
PHQ: Patient Health Questionnaire
PrEP: pre-exposure prophylaxis
R&D: Research and Development
REC: Research Ethics Committee
STI: sexually transmitted infection
UK: United Kingdom
VL: viral load
©Jency Sewell, Andrew Speakman, Andrew N Phillips, Fiona C Lampe, Ada Miliz, Richard Gibson, David Asboe, Nacita Nwokolo, Christopher Scott, Sara Day, Martin Fisher, Amanda Clarke, Jane Anderson, Rebecca O'Connell, Vanessa Apea, Rageshri Dhandayunan, Mark Gompels, Paymane Forazmand, Sriz Alian, Susan Mann, Jyoti Dhar, Alan Tang, S Tariq Sadiq, Stephen Taylor, Simon Collins, Lorraine Sherr, Graham Hart, Anne M Johnson, Alec Miners, Jonathan Elford, Alison Rodger. Originally published in JMIR Research Protocols (http://www.researchprotocols.org), 18.04.2016. This is an open-access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/2.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in JMIR Research Protocols, is properly cited. The complete bibliographic information, a link to the original publication on http://www.researchprotocols.org, as well as this copyright and license information must be included.
Appendix XIV. The AURAH2 study methods paper “Attitudes to and Understanding of Risk of Acquisition of HIV Over Time: Design and Methods for an Internet-based Prospective Cohort Study Among UK Men Who Have Sex With Men (the AURAH2 Study).”

See overleaf.
Attitudes to and Understanding of Risk of Acquisition of HIV Over Time: Design and Methods for an Internet-based Prospective Cohort Study Among UK Men Who Have Sex With Men (the AURAH2 Study)

Janey Sewell1, RN, Andrew Speakman2, PhD; Andrew N Phillips1, PhD; Valentina Cambiano3, PhD; Fiona C Lampe4, PhD; Richard Gilson4, MBBS; David Abose5, MBBS; Nneka Nwokolo6, MBBS; Amanda Clarke1, MBBS; Ali Ozilvy7, BN, Simon Collins8, Alison J Rodger9, MBBS

1Department of Infection and Population Health, UCL, London, United Kingdom
2Chelsea and Westminster Hospital and NHS Foundation Trust, London, United Kingdom
3Brighton and Sussex University Hospitals NHS Trust, Brighton, United Kingdom
4HIV iBase, London, United Kingdom

Corresponding Author:
Janey Sewell, RN
Department of Infection and Population Health
UCL
Royal Free Campus
London, NW3 2PF
United Kingdom
Phone: 44 07792096376
Fax: 44 20 7996 3001
Email: j.sewell@ucl.ac.uk

Abstract

Background: The annual number of new human immunodeficiency virus (HIV) infections among men who have sex with men (MSM) has risen in the United Kingdom and, of those who are HIV positive, the proportion undiagnosed is high.

Objective: The prospective AURAH2 study aims to assess factors associated with HIV acquisition among MSM in the United Kingdom and to investigate changes overtime within individuals in sexual behavior and HIV-testing practices.

Methods: AURAH2 is a prospective study among MSM without diagnosed HIV, aiming to recruit up to 1000 sexually active MSM attending sexual health clinics in London and Brighton in the United Kingdom. Participants complete an initial paper-based questionnaire, followed by online follow-up questionnaires every 4 months collecting sociodemographic, health and behavioral data, including sexual behavior, recreational and other drug use, HIV testing practices, and pre-exposure prophylaxis use, over a planned 3-year period.

Results: The study is ongoing.

Conclusions: The results from AURAH2 study will provide important insight into established and emerging risk behaviors that may be associated with acquisition of HIV in MSM in the United Kingdom, changes overtime within individuals in sexual behavior, and information on HIV testing practices. These data will be crucial to inform future HIV prevention strategies.

(JMIR Res Protoc 2016;5(2):e128) doi: 10.2196/resprot.5582

KEYWORDS
HIV infection; HIV negative; HIV transmission; HIV testing; men who have sex with men; sexual risk behaviour; pre-exposure prophylaxis; recreational drug use; chemsex; HIV self-testing; health and well-being; study design
Introduction

Background

In 2014, the number of men who have sex with men (MSM) that were newly diagnosed with human immunodeficiency virus (HIV) continued to rise with 3360 new diagnoses in the United Kingdom [1]. Currently, there are an estimated 43,500 MSM living with HIV, of whom around 16% are undiagnosed [2]. It is thought that MSM unaware of their HIV infection disproportionately contribute to onward transmission (66-82%) of new transmissions come from people not diagnosed [3,4] and that delay in diagnosis and treatment is associated with increased risk to health [5]. HIV prevention approaches have historically focused on condom use, which, if correctly and consistently used, is a reliable and established method to reduce transmission [6]; however, consistent condom use is difficult to achieve [7,8]. There is a clear need for improved HIV prevention and testing strategies targeted at HIV-negative MSM to reduce the number of new HIV infections and increase HIV testing rates.

The AURAH study was a cross-sectional questionnaire study that collected data from 2013-2014 in a large sample of HIV-negative patients attending Genital-Urinary Medicine (GUM) clinics in the United Kingdom with a focus on two populations: Black Africans and MSM [9]. It used a self-completed questionnaire to assess knowledge of and attitudes to HIV transmission risks and the role of antiretroviral therapy (ART), and to assess the prevalence of medical and psychological symptoms (eg, depression and anxiety), quality of life, lifestyle factors (eg, drug and alcohol use), and possible links to sexual risk behaviors. The AURAH2 study will build on the work of the AURAH study and is the first large prospective observational study of MSM in the United Kingdom. It will provide longitudinal data on HIV transmission risk in a group of HIV-negative (at enrollment) MSM using online questionnaires for data collection over a 3-year period. It will collect baseline socioeconomic, health and lifestyle information (including recreational drug use and chemsex) with longitudinal information on sexual activity, HIV testing, sexual behavior, and occurrence of new HIV infections among UK MSM.

Understanding attitudes of HIV negative or undiagnosed MSM towards condomless sex with individuals of unknown HIV status, and examining risk behavior in the context of psychological or general health status, history of sexually transmitted infection (STI), alcohol and drug use, could elucidate reasons for the observed ongoing HIV transmission among the UK MSM population. Studies have consistently found associations between increased sexual risk behavior such as condomless anal sex and group sex [9-13], with recreational drug use, and longitudinal data has highlighted the bi-directional relationship between sexual pleasure and drug use [14]. Longitudinal data from Australia has demonstrated an association between drug use and increased risk of HIV infection, in particular the use of oral erectile dysfunction medication in combination with methamphetamine to enhance sexual pleasure [12], and similar evidence was recently reported from a US study that showed a clear link between increased sexual risk behavior and starting methamphetamine use [15]. Although not a new concept in the United States [16-18], a recent UK report on “chemsex” [19] which is defined as the use of certain sexually disinhibiting recreational drugs for facilitating or enhancing sex, has highlighted a need for more research into behaviors that put MSM at high risk of HIV and STI acquisition as a public health priority. Longitudinal data on recreational drug use, chemsex and associations with high risk sexual behaviors, such as group sex, in HIV negative or undiagnosed MSM would provide valuable insight into potential causes for the observed increases in HIV and STI acquisition among MSM in the United Kingdom.

Reducing the large proportion of MSM with undiagnosed HIV that potentially contribute to onward transmission of HIV is a public health priority [20], and data from HIV-negative or undiagnosed MSM in the United Kingdom are currently needed to inform and develop better provision of HIV testing options. Despite high coverage (86%) of HIV testing among MSM attending sexual health clinics [21], generally the frequency of HIV testing among UK MSM remains low (estimated 30% never tested, 75% not in past year) [4], and alternative ways to test for HIV, other than through sexual health clinics, are urgently required [1]. HIV self-testing (HIVST) was made legal in the United Kingdom in April 2015 [22] and is defined by the test being collected, performed, and interpreted in private by the individual who wants to know their HIV status [23]. HIVST has the potential to alleviate some of the perceived barriers to other forms of HIV testing, such as stigma, discrimination, and inaccessibility of health services [24], due to the environment the test is performed in, which may encourage more people to test. Increased HIV testing and resulting diagnoses could have prevention benefits if newly diagnosed men are more likely to use condoms and have fewer sexual partners after diagnosis [25,26]. However, it is not known whether the availability of HIVST will increase the diagnosis rates of HIV in the United Kingdom. The AURAH2 study will seek to collect information on the acceptability and uptake of HIVST as it becomes more widely available.

The expansion of HIV testing options is also of particular relevance since it was demonstrated that HIV transmission is preventable through ART in 2011 [27]. Evidence that ART greatly reduces onward sexual transmission of HIV in MSM [28], as well as heterosexuals [27,29], was demonstrated through the interim results of the PARTNER study [28]. Furthermore, the concept of treatment as prevention (TasP) has been widely explored as an HIV prevention strategy and is recommended in the British HIV Association’s treatment guidelines to prevent onward transmission [30]. However, access to and uptake of ART is dependent on a person knowing their HIV status and, in the United Kingdom, research has shown that although widespread ART coverage among MSM at a population level may reduce HIV infectivity, it is unlikely to reduce the number of HIV transmissions in the absence of increased coverage and frequency of HIV testing [31]. There is some evidence that sexual risk behavior declines after an HIV Diagnosis, as it has been demonstrated that behavior is modified to prevent onward transmission [25,26]. However, this has not been explored in the context of TasP and little is known regarding changes in
sexual behavior during primary HIV infection (a period characterized by very high infectiousness) and on the variability in sexual risk behavior over time at an individual level (e.g., the duration of periods of very high risk). There are cohort studies of MSM that provide some information on these issues from Europe, the United States, and Australia [32-35]; however, there have been no follow-up studies among individuals at risk of HIV infection in the United Kingdom, which the AURAH2 study will seek to address. The role of TAP is also critical in HIV-negative MSM’s sexual decision making and risk reduction behaviors and, as yet, largely unexplored among UK HIV-negative MSM. Further investigation is needed, particularly in light of TAP, into the risk reduction strategies that HIV negative or undiagnosed MSM utilize at a community level [36], such as sero-sorting (choosing a partner of believed sero-concordant status), negotiated safety (condomless sex with a sero-concordant main partner), strategic positioning (choosing a different sexual position or practice depending on the sero-status of a partner), and withdrawal (in which the negative partner is receptive during intercourse but without ejaculation by his partner) [37]. To investigate the role of TAP in sexual decision making and risk reduction strategies, the AURAH2 study will collect data to inform on these themes, including information on knowledge of an HIV-positive partner’s viral load. Collection of longitudinal data will help describe the sexual behaviors and risk reduction strategies among HIV negative MSM and assess the extent to which patterns of sexual behavior and condomless sex change over time within individuals. This information will play a key role when developing effective targeted HIV prevention strategies.

A further significant development for HIV prevention strategies that the AURAH2 study will provide information on is pre-exposure prophylaxis (PrEP), which has been used as an HIV prevention tool for HIV-negative men in the United States since 2012 [38]. Although PrEP is not currently available on the UK National Health Service (NHS), generic formulations have been increasingly available via websites. In 2015, the results from the UK PROUD study [39] and the French PERGAY study [40] demonstrated that daily [39] and “on demand” [40] dosing of Truvada, the antiretroviral tablet used for PrEP, reduced the risk of HIV acquisition in HIV-negative men by 86%. There has been increasing community [41] and clinical [42] pressure to make PrEP available through the NHS. New PrEP websites that have been developed by activists [43,44] acknowledge the potential to access PrEP in a number of different ways that include ordering it online, which may challenge how the access and uptake of PrEP is monitored and may lead people to obtain PrEP without the appropriate counselling and follow-up [42]. Self-reported changes in attitudes, access to, and use of PrEP and factors associated with PrEP use by HIV negative men in the United Kingdom will be vital to inform policy and inform on acceptability and uptake of PrEP in sexually active HIV-negative gay men.

The landscape of HIV prevention is changing as concepts such as TAP and PrEP are introduced, and advances in HIV testing technologies potentially make testing for HIV more accessible. In conjunction with evolving HIV prevention strategies, emerging patterns in lifestyle choices that affect sexual behavior are important to consider if current and effective HIV prevention interventions are to be designed and implemented. The information provided by the AURAH2 study will contribute to the understanding of the social, psychological, and health-related factors that are linked to high-risk sexual behaviors that potentiate transmission of HIV. The study will provide data highly relevant to HIV prevention efforts among MSM and will help inform national policies aimed at reducing HIV incidence and increasing HIV testing in the United Kingdom.

Study Aims and Objectives

The aim of the AURAH2 study is to evaluate the incidence and predictors of new infections among HIV-negative MSM at risk of acquiring HIV and to assess changes over time in risk behavior and testing practices within individuals.

The detailed study objectives are to assess:

1. In MSM without diagnosed HIV:
   (i) the prevalence and correlates of specific sexual behaviors, including numbers of condomless sex partners, condomless sex with casual partners and partners of unknown HIV status, insertive/receptive condomless sex, and other specific higher-risk sexual activities such as group sex and chemsex
   (ii) the number of condomless sex partners before, during, and after the estimated period of primary HIV-infection and time of HIV diagnosis in men who were infected during the study period
   (iii) the frequency and type of HIV testing accessed over time (sexual health clinic, self-testing, general practitioner, surgery, hospital, other)

2. The extent to which baseline demographic, socioeconomic, and health and lifestyle factors (including recreational drug use and chemsex) are predictive of subsequent levels of condomless sex, incident HIV infection, and HIV-testing behaviors

3. The association of attitudes to HIV transmission, disclosure, treatment, and prognosis, with high-risk sexual behaviors, HIV-testing behaviors, and subsequent HIV acquisition

4. The associations of participant characteristics, sexual behavior, and attitudes with reported use of, and willingness to consider use of, post exposure prophylaxis (PEP) and PrEP

Methods and Design

Study Design

AURAH2 is a prospective cohort study of UK MSM not diagnosed with HIV. Baseline information is collected on each participant through the AURAH2 study paper questionnaire [9], which is completed during a sexual health clinic attendance. Follow-up questionnaires are made available online every 4 months through the study website and consist of two brief and one extensive questionnaire per year. Online follow-up will continue for up to 3 years from the time a participant joined the study during the recruitment period in 2015.
Population and Setting
HIV negative or undiagnosed MSM adults attending sexual health clinics at three sites in the United Kingdom for STI screening or testing are eligible to take part in the study. The three clinical sites are as follows: The Mortimer Market Centre, London; 56 Dean Street Clinic, London; and the Claude Nicol Centre, Brighton.

These three clinical sites were chosen based on their ability to provide access to large numbers of MSM attending sexual health services and previous successful collaboration with the researchers for the AURAH study [9]. During the AURAH study recruitment process, the three sites demonstrated their ability to provide a broad sample of homosexually active men, including gay, bisexual, and non-gay identified MSM.

The eligibility criteria to join the study is (1) self-reported HIV-negative, (2) self-defining as MSM, (3) being aged 18 years or over, (4) attending or having previously attended for routine STI or HIV testing in the study clinics, and (5) willing to be contacted for longitudinal follow-up for up to a 1-year period.

Sample Size
The sample size calculation was based on our objective to assess within-person changes in sexual behavior after receiving an HIV diagnosis. This outcome is more constrained by power than others because it relies on comparisons of participants within the group who are infected with HIV during follow-up. For sexual behavior classified as whether or not a man reports >3 condomless sex partners in the past 3 months, 85 new HIV diagnoses would be needed to detect, with 80% power and 5% significance level, the following changes: 17 (20%) men newly diagnosed switching from >3 to ≤3 condomless sex partners pre to post diagnosis, and 4 (5%) men newly diagnosed changing from ≤3 to >3 condomless sex partners pre to post diagnosis. With 1000 HIV-negative men initially enrolled in the study sample, assuming an annual HIV incidence of 4% for high-risk MSM and a dropout rate of 15% per year, 90 new HIV infections would be expected to accrue over a 3-year period. This sample size of 1000 should provide adequate power for the other objectives.

Recruitment
Participants are recruited to the AURAH2 study through two separate recruitment routes. The recruitment route 1 group consists of HIV negative or undiagnosed MSM who were (1) enrolled in the AURAH cross-sectional study [9] from the three clinics detailed above during targeted recruitment of MSM (until March 2015) and (2) who had indicated interest in future follow-up on the AURAH study consent form. An email invitation to participate in the AURAH2 study was sent to this group from the AURAH2 study website in March 2015. Participants who joined the AURAH2 study from AURAH were assigned the same study number in their online follow-up as their original AURAH study number so that online follow-up could be linked to responses in the original cross-sectional study.

The recruitment route 2 group consists of HIV-negative or undiagnosed MSM who are prospectively recruited in person through the three clinic sites from March 2015 until December 2016. This group is directly consented into the AURAH2 study in their sexual health clinic and completes the baseline AURAH paper questionnaire during their clinic attendance. Online registration with the study website using a personal smartphone or iPad is explained during the consent procedure, or participants are contacted within 2 weeks with an email invitation to register.

Consent
Consent for the study is gained through two mechanisms, according to the recruitment route. Participants from recruitment route 1 (contacted in March 2015) were required to complete an online consent form for the AURAH2 study. This was presented to them on the study website after they had read the online patient information sheet and prior to registration.

Consent for participants via recruitment route 2 is obtained at study enrolment in the clinic setting via a paper-based information sheet and consent form. Participants recruited through recruitment route 2 do not need to complete an additional online consent form as information on the AURAH2 study is provided in the Patient Information Sheet. In both consent processes, participants are (1) made aware of the study aims, (2) made aware that participation means they are expected to complete brief online questionnaires about sexual behavior and HIV testing on a regular basis over a 3-year period, (3) asked to provide their email address and mobile phone number and consent to receive reminders to complete the online questionnaires via email and/or text message, but are also told that there will be a maximum of two reminders by email followed by one text message if they do not respond, (4) asked to provide their full name and date of birth and made aware that this information will be used to link with matching data in UK national clinical databases including the national HIV/AIDS Reporting System (HARS) database (see clinical data), (5) made aware that results of any HIV test results from the day they joined the study, or that they self-report during the study period (up to 3 years), will be recorded and stored securely and separately from the study questionnaire, (6) made aware that they can withdraw from the study at any point and ask for their personal data to be deleted and that this will not affect their care at their GUM clinic, and (7) advised that should they wish to withdraw from the study they should send an email to a specified contact address to make this request.

Online Registration Procedure
Participants are sent a maximum of three “invitation to register” messages via the study website (see below). The first contact is an email containing an individualized link, which, when selected, allows the recipient to register an account with the study website. A second similar reminder email is sent a week later to participants who have not registered, and finally a text message is sent a week after the second email (if a mobile phone number was provided during the consent procedure). In each email, participants are provided with information on how to opt out of the study and any further contact. Participants who do not register within 1 week after the two reminder emails and a text message have been sent are removed from the study lists and not contacted further.
Website Design and Features
The AURAH2 website was designed to provide full information on the study to the general public and the study participants. The home page provides a login box that allows only registered participants to gain access to the study questionnaires by entering a username and password. Once a participant has registered and completed the first online questionnaire, automated reminder emails are sent every 4 months when follow-up questionnaires are due. Each reminder email informs the participant that a questionnaire is due for completion and contains a link to the study website homepage to login and access a questionnaire. The message also contains information on how to receive a username and password change prompt if login details have been forgotten. If a participant does not log in and complete a questionnaire, a second automated reminder email is sent 1 week after the initial email, and a final reminder is sent by text message a week later. If a participant does not log in and complete a questionnaire after the third reminder, no further contact is made until the next questionnaire is due, 4 months later.

The secure website provides facilities for content management including the ability to change information pages and add new items and details of study publications. The administration pages are accessible only to users accounts controlled by the study coordinator and data manager. From the administration pages of the website, the “invitation to register” and follow-up messages are managed and the status reports and questionnaire results data can be securely downloaded on a regular basis.

Study Questionnaires
Baseline Data
Extensive baseline data are collected through the pen-and-paper AURAH baseline questionnaire, details of which have been published elsewhere [9]. The questionnaire gathers detailed information on demographics, socioeconomic factors, physical and psychological health and well-being, knowledge and understanding of HIV and antiretroviral treatment. Lifestyle factors (smoking, alcohol, and recreational drug use), HIV testing, knowledge and use of PEP, and sexual behavior. Both recruitment routes use the baseline AURAH questionnaire for initial data collection, which takes approximately 20-25 minutes to complete.

Online Questionnaires
Online data collection every 4 months will be ongoing until 2018. It consists of a brief online questionnaire that assesses sexual risk behavior, HIV testing history, self-reported STIs, and use and frequency of chemsex drugs from the preceding 3 months. The basic 4-monthly online questionnaire takes approximately 5 minutes to complete. A more detailed questionnaire is undertaken on an annual basis that includes the information collected in the 4-month questionnaire and additional information on use of HIV testing preferences, PEP and PrEP, physical and psychological symptoms, and attitudes to HIV transmission. The annual online questionnaire takes approximately 20 minutes to complete.

Each online questionnaire commences with a question on the most recent date and result of a participant’s previous HIV test. If a participant consistently reports negative HIV test results or “not tested,” then the questionnaires remain specific to an HIV negative or unknown status. However, if a participant reports a positive HIV test result, the questionnaire is programmed to collect information on the number of partners, sexual behavior, and recreational drug use pre and post diagnosis. At each subsequent login, an HIV-positive participant will complete questionnaires that are similar to the HIV-negative participants, but tailored to reflect the HIV-positive semi-status of the participant. A flowchart illustrates recruitment from clinic to the online questionnaire sequence is shown in Figure 1.
Clinical Data

The result of any HIV test taken in clinic at the same time as the baseline questionnaire completion is stored as part of the study records. At each online follow-up questionnaire, participants are asked to self-report the result of their most recent HIV test and any diagnosed STIs. At the end of the study period, in collaboration with Public Health England, data will be checked against corresponding records and data in national clinical databases such as HARS, the Genitourinary Medicine clinical activity dataset (GUMCAD), and the Office for National Statistics. The linkage of the AURAH2 data to these databases will provide confirmation on the self-reported HIV status of participants as well as identify any new HIV diagnoses that have not been self-reported through the questionnaires.

Data Processing and Security

Baseline paper questionnaires completed in clinic are collected by the study nurses and transferred regularly to the study management center via registered post or collected in person from the clinic sites by the study researchers. At the study management center, the original paper questionnaires are stored securely in locked cabinets. Baseline questionnaires are identifiable only by an assigned study number to maintain confidentiality, and participant details linked with the study number are collected in a separate study log. The study log is maintained securely and updated daily at each clinical site. The study log contains study numbers, clinic identifiers, and details of consent status for all patients invited to participate in the study, whether or not HIV and other STI tests had been done, and the result of any HIV test. Contact details of participants are also entered in the log. A copy of the study log (with contact details removed for non-consenting participants) is transferred on a regular basis to the study management center using the NHS mail system, which is approved by the Department of Health for the purpose of sharing personal identifiable information and sensitive information.

Baseline questionnaires are digitized at the management center using the REDCap data capture system for secure double data entry. The study website is hosted in a secure data center and
network environment, and the online questionnaire response datasets are directly downloaded to encrypted data drives at the study management center on a monthly basis. Linkage to Public Health England’s datasets will be done at the end of the study using limited participant identifiers: surname, Surname, sex, and date of birth.

The final resulting study datasets, including scanned images of the questionnaires, are stored on the University College London Data Safe Haven, which is a secure technical solution for storing, handling, and analyzing identifiable data. This has been certified to the ISO27001 information security standard and conforms to the NHS Information Governance Toolkit.

The contact details of any participants who did not join the AURAH2 study after the email invitations from recruitment route 1 were removed from the study records 1 month after their final email reminder or the text message had been sent (if provided). All AURAH2 participants contact details will be erased from the study database 6 months after the completion of the study.

Ethics Approval

The research protocol and all versions of the study documents (information sheet, consent form, questionnaires, and versions of the online questionnaires) were approved by the designated research ethics committee (NRES committee London-Fallopian, ref. 14/LO/1881 in November 2014). Based on these documents, the study subsequently received permission for clinical research at the three participating National Health Service sites: Cheque and Westminster NHS Foundation Trust, Central and West London NHS Foundation Trust, and the Brighton and Sussex University Hospitals NHS Trust.

Results

Data collection commenced in March 2015 and is ongoing until March 2018. Initial results from analysis of the baseline questionnaires are expected in 2016, and results from longitudinal data are expected in 2018.

Discussion

Principal Considerations

The AURAH2 study will provide important longitudinal data on sexual risk behavior, HIV testing habits, and risk factors for ongoing transmission of HIV in UK MSM who were HIV negative at entry to the study but who are at risk of HIV infection. It uses a novel approach to data collection by combining paper-based questionnaires collected in the clinic setting and online follow-up questionnaires that participants access at their convenience. We applied a short recall period of 3 months in the questionnaire responses to maximize self-report accuracy and diminish recall bias [45] and to better capture within-person changes over time in sexual behavior. The request to complete questionnaires was sent on a 4-monthly basis to decrease the study burden for the participant and reduce attrition during the long follow-up period. The online recall period is reflective of the timeframes that are used in the paper-based questionnaires and is closely aligned to the frequency of survey completion in an attempt to capture ongoing and new behavioral information. The Internet has been increasingly used as a tool with which to collect survey data as it offers a low-cost, flexible, and fast way to collect data while reducing participant burden [46], and Internet surveys have been shown to be an acceptable method in researching MSM at risk of acquisition of HIV [47].

A similar study to AURAH2 is currently being conducted in the United States, using online follow-up over a 3-year period in a sample of 1000 gay and bisexual men who will complete self-administered HIV/STI tests and online surveys [48], which may offer comparisons of survey response rates and attrition over the 3 years. Despite some design differences, notably in recruitment routes (i.e., the One Thousand Strong study recruited in partnership with a marketing firm via email invitation as opposed to face to face in sexual health clinics) and methods (i.e., AURAH2 does not use biological methodologies for HIV/STI tests [48]), both studies will demonstrate the feasibility of using the Internet to engage MSM in online data collection and contribute substantial insight into sexual risk behavior and HIV testing. Longitudinal online follow-up in the HIV negative or undiagnosed population has not been widely explored among MSM in the United Kingdom but will be key to understanding how individual sexual behaviors change over time. The annual Gay Men’s Sex survey “Vital Statistics” has been successfully conducted among participants since 1993, although the survey is a one-off online survey [49], as opposed to the follow-up and retention of the same group of individuals over time. The AURAH2 study will provide valuable insight into the feasibility of recruiting and retaining MSM in a study that requires regular ongoing follow-up over a period of 3 years using the Internet as a tool for data collection.

Limitations

A recognized limitation of the study is the restricted recruitment of MSM from attendance at GUM clinics, which may not be reflective of the wider MSM population, and in particular from the two clinics (56 Dean Street and the Mortimer Market Clinic) that provide services for patients seeking support for drug use. However, recruitment is from the general clinic attendees, not from specific drug use services. Although the majority of MSM in London do appear to be engaged with GUM sexual health services [50], there is less information on engagement with these services in the rest of the United Kingdom, so recruiting from a site outside London will allow some comparison. Recruitment through GUM clinics was essential for this study so that the self-reported HIV test results of participants could be confirmed with UK national clinical HIV databases (in collaboration with Public Health England) and so that the study sampling frame was clearly based on MSM who had attended a sexual health clinic. Recruitment online or through other settings could have potentially provided larger numbers of anonymous participants but would have been limited by the inability to confirm HIV status during or at the end of the study period due to participant anonymity.

We identify a further limitation of the study in the lack of recruitment from clinical sites outside two major cities that have large gay communities. It is recognized that this will limit the study’s generalizability given the potential differences in
lifestyle, HIV testing opportunities, and access to sexual health services between urban and rural settings. Future studies might address this issue using the Internet or other digital platforms to enroll participants so that a broader sample of MSM from across the United Kingdom could be included.

Conclusion
Evidence that HIV incidence is increasing among MSM in the United Kingdom[1] indicates a clear need for ongoing research in this group. The AURAH2 study will provide detailed longitudinal data on the incidence and predictors of new infections among HIV-negative MSM at particular risk of HIV infection and will further provide some of the first data on emerging behaviours such as chemsex that have raised concern for sexual health and well-being among MSM, as well as interest and uptake of PrEP and expanded HIV testing options for this group. The study completed recruitment of participants in March 2016, and it is hoped that the wide range of topics explored by the AURAH2 study renders results that will help improve a variety of targeted health promotion strategies that are specific to the men that need them. The study will be highly relevant to HIV prevention efforts among MSM, and it is planned for the data to feed into a mathematical model that simulates different scenarios to inform prevention strategies[4,5,12]. The results of the study will also inform national policies aimed at reducing HIV incidence and increase HIV testing in the United Kingdom in this population.

Acknowledgments
This paper summarizes independent research funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research Programme (Grant Reference Number RP-PG-1212-30006). The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, or the Department of Health.

We would like to thank all the study participants for their time and effort. We gratefully acknowledge the three participating sites and the contributions and efforts of the following at each site:
1. The Mortimer Market Centre, London: Ana Milinkovic, Fabienne Styles, Rosanna Laverack, Marzena Orzol, Emma O'Seam
2. 56 Dean Street Clinic, London: Ali Ogilvy
3. The Claude Nicol Centre, Brighton: Celia Richardson, Elayne Youssef, Sarah Kirk, Marion Campbell, Lisa Barbour

Conflicts of Interest
None declared.

References
null


44. I want PrEP now. 2015. URL: http://www.iwantprepm.co.uk [accessed 2016-06-08] [WebCite Cache ID 67bBRU]


Abbreviations
AIDS: acquired immune deficiency syndrome
Appendix XV. The AURAH study results paper “Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics.”

See overleaf.
Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics

Janey Sewell1, Ada Milzé, Fiona C. Lampe1, Valentina Cambiano1, Andrew Speakman1, Andrew N. Phillips1, David Stuart1, Richard Gilson1, David Asboe2, Nneka Nwokolo3, Amanda Clarke4, Simon Collins5, Graham Hart5, Jonathan Elford5, Alison J. Rodger5,6, for the Attitudes to and Understanding of Risk of Acquisition of HIV (AURAH) Study Group

1Research Department of Infection and Population Health, University College London, London, United Kingdom
2Chelsea and Westminster Hospital NHS Foundation Trust, London, United Kingdom
3Brighton and Sussex University Hospitals NHS Trust, Brighton, United Kingdom
4NHS-eMac, London, United Kingdom
5City, University of London, London, United Kingdom

Article Info
Article history:
Received 8 August 2016
Received in revised form 30 November 2016
Accepted 3 January 2017

Keywords:
Recreational drug use
Chemsex
Sexual behaviour
HIV-negative
Men who have sex with men
Sexual health
HIV prevention

Abstract
Background: Recreational drug use and associated harms continue to be of significant concern in men who have sex with men (MSM) particularly in the context of HIV and STI transmission.

Methods: Data from 1464 HIV-negative or undiagnosed MSM included in the AURAH study, a cross-sectional, self-completed questionnaire study of 2830 individuals from 20 sexual health clinics in the United Kingdom in 2013–2014, was analysed. Two measures of recreational drug use in the previous three months were defined: (i) polydrug use (use of 3 or more recreational drugs) and (ii) chemsex drug use (use of mephedrone, crystal methamphetamine or GHB/CrH). Associations of socio-demographic, health and lifestyle factors with drug use, and associations of drug use with sexual behaviour, were investigated.

Results: Of the 1464 MSM, 330 (22.8%) reported polydrug use and 324 (21.8%) reported chemsex drug use in the past three months. Overall 852 (57.5%) men reported condomless sex in the past three months: 430 (29.0%) had CLS with 1–2 partners, 424 (30.0%) had CLS with unknown HIV+ partner(s); 187 (12.0%) had receptive CLS with an unknown status partner. For polydrug use, prevalence ratios (95% confidence interval) for association with CLS measures, adjusted for socio-demographic factors were: 1.38 (1.20, 1.59) for CLS, 2.31 (1.90, 2.87) for CLS with 1–2 partners, 1.69 (1.05, 2.69) for CLS with unknown HIV+ partner(s); 1.54 (1.00, 2.36) for receptive CLS with an unknown status partner. Corresponding adjusted prevalence ratios for chemsex drug use were: 1.16 (1.26, 1.52) 2.07 (1.78, 2.41) 1.88 (1.62, 2.19) 1.49 (1.10, 2.02). Polydrug and chemsex drug use were also strongly associated with previous STI, PEP use, group sex and high number of new sexual partners. Associations remained with little attenuation after further adjustment for depressive symptoms and alcohol intake.

Conclusion: There was a high prevalence of polydrug use and chemsex drug use among HIV negative MSM attending UK sexual health clinics. Drug use was strongly associated with sexual behaviours linked to risk of acquisition of STIs and HIV.

© 2017 Elsevier B.V. All rights reserved.

http://dx.doi.org/10.1016/j.drugpo.2016.12.001
0165-3347/© 2017 Elsevier B.V. All rights reserved.
Appendix XVI. A comparison of the AURAH study and the AURAH2 study results paper “Changes in recreational drug use, drug use associated with chemsex, and HIV-related behaviours, among HIV-negative men who have sex with men in London and Brighton, 2013–2016”

See overleaf.
Changes in recreational drug use, drug use associated with chemsex, and HIV-related behaviours, among HIV-negative men who have sex with men in London and Brighton, 2013–2016

Janey Sewell,1 Valentina Cambiano,1 Ada Miltz,1 Andrew Speakman,1 Fiona C Lampe,1 Andrew Phillips,2 David Stuart,3 Richard Gibson,3 David Asboe,3 Neneka Nwokoro,1 Amanda Clarke,1 Graham Hart,1 Alison Rodger1

ABSTRACT

Objectives The objective of this study was to compare the prevalence of polydrug use, use of drugs associated with chemsex, specific drug use, and HIV-related behaviours between two time periods, using two groups of HIV-negative men who have sex with men (MSM) attending the same sexual health clinics in London and Brighton, in two consecutive periods of time from 2013 to 2016.

Methods Data from MSM in the cross-sectional Attitudes to and Understanding Risk of Acquisition of HIV (AURAH) study (June 2013 to September 2014) were compared with baseline data from different MSM in the prospective cohort study Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2) (November 2014 to April 2016). Prevalence of polydrug use, drug use associated with chemsex and specific drug use, and 10 measures of HIV-related behaviours including condomless sex, post-exposure prophylaxis (PEP) use, post-exposure prophylaxis (PEP) use, and HIV testing, were compared. Prevalence ratios (PRs) for the association of the study (time period) with drug use and HIV-related behaviour measures were estimated using modified Poisson regression analysis, unadjusted and adjusted for sociodemographic factors.

Results In total, 901 MSM were included from AURAH and 1031 MSM from AURAH2. After adjustment for sociodemographic factors, use of drugs associated with chemsex had increased (adjusted PR 1.10, 95% CI 1.01 to 1.20) and there were prominent increases in specific drug use; in particular, methamphetamine (PR 1.33, 95% CI 1.06 to 1.67), γ-hydroxybutyryl-γ-butyrolactone (PR 1.47, 95% CI 1.15 to 1.87) and metamphetamine (PR 1.42, 95% CI 1.01 to 1.91). Use of ketamine had decreased (PR 0.54, 95% CI 0.38 to 0.78). Certain measures of HIV-related behaviours had also increased, most notably PEP use (PR 1.56, 95% CI 1.21 to 1.98) and number of self-reported bacterial STI diagnoses (PR 1.24, 95% CI 1.08 to 1.45).

Conclusions There have been significant increases in drug use associated with chemsex and some measures of HIV-related behaviours among HIV-negative MSM in the last few years. Changing patterns of drug use and associated behaviours should be monitored to enable sexual health services to plan for the increasingly complex needs of some clients.

INTRODUCTION

The use of recreational drugs by gay and bisexual men who have sex with men (MSM) in the UK is significantly higher than in the male population in general. Along with alcohol and tobacco use, recreational drug use and its complex relationship with sexual risk behaviour12 and the potential to facilitate HIV transmission13 may have a broader impact on the health and wellbeing of gay men.14 The emerging phenomenon of chemsex (defined in the UK as the use of 'nosedrops, crystal methamphetamine and γ-hydroxybutyryl-γ-butyrolactone (GHB/CBL) to enable, enhance and prolong sexual interactions')15 is described predominantly within the MSM community, and, although chemsex drug use is not always problematic,16 issues relating to it have received increasing academic17 and clinical18,19.20 attention. The interest is mainly driven by the strong associations with high-risk sexual behaviour21 and other potential harms such as overdose and death.22 Data from some sexual health clinics suggest there has been a rapid rise in chemsex drug use by MSM attending STI clinics within the last few years,23 both in and out of major conurbations24 and chemsex has become a considerable public health concern. Public Health England’s 2013/2016 action plan to promote the health and well-being of MSM in the UK government 2017 Drug Strategy25 both targets chemsex and aims to reduce it; however, current evidence on prevalence of chemsex drug use is limited, as is the impact chemsex drug use may have on sexual behaviour.

In this paper, we use cross-sectional questionnaire data from two studies that recruited HIV-negative or HIV-undiagnosed MSM from sexual health clinics in England, the Attitudes to and Understanding Risk of Acquisition of HIV (AURAH) study (June 2013 to September 2014),26 and the AURAH2 (Attitudes to and Understanding Risk of Acquisition of HIV over Time) study (November 2014 to April 2016).27 We assess the prevalence and use of polydrug use, drugs associated with chemsex and specific drug use, and HIV-related behaviours, among the AURAH study participants and compare it with a different set of participants from the AURAH2 study at a different time period.
METHODS

The AURAH study is a cross-sectional, clinic-based study that recruited HIV-negative or undiagnosed participants from sexual health clinics across England between June 2013 and September 2014. Participants completed a self-administered confidential paper questionnaire on demographics (gender, sexual identity, age, ethnicity, UK birth, English fluency), socioeconomic factors (education, employment, housing, money for basic needs), health and lifestyle factors (alcohol use, smoking, symptoms of depression, treatment for depression and other mental illness), as well as recent sexual behaviour (past 3 months), and recent recreational drug use (past 3 months), while waiting for their clinic appointment (participants were offered a private room if preferred).

The AURAH2 study is a prospective cohort study that recruited HIV-negative or undiagnosed MSM from three of the same sexual health clinics (two in London, one in Brighton) that participated in the AURAH study. The AURAH2 study used the same paper questionnaire as the AURAH study to collect baseline data, in clinic, during the recruitment period from November 2014 to April 2016. Participants then completed subsequent 4-monthly and annual online questionnaires on HIV status, health and lifestyle factors (including recreational drug use and chemsex) and recent sexual behaviour. Online follow-up of participants continued for 5 years until March 2019 and did not necessitate a clinic visit. Methodological details for both studies, including response rates, have been published elsewhere.22 23

This paper uses data collected from the AURAH study and the baseline questionnaire of the AURAH2 study, from MSM aged over 18 and HIV negative (or undiagnosed at recruitment) who attended the three sexual health clinics in England that participated in both the AURAH and the AURAH2 studies: 36 Dean Street, London; Montague Market Clinic, London; Claude Nicol Centre, Brighton. Individuals who participated in both studies were only included in the AURAH study analysis for this paper.

Ascertainment of recreational drug use

All participants were asked to self-report whether they had used recreational drugs in the last 3 months and, if so, to select which drug or drugs from the following list: acid/LSD, magic mushrooms, anabolic steroids, cannabis (marijuana, grass), cocaine (coca), crack, codeine, crystal meth (methaemphetamine), ecstasy (E), GHB/GBL (liquid ecstasy), heroin, ketamine (K), khat (khat), methadone, morphine, opium, poppers (amyl nitrate), speed (speed), Viagra and Others. If a participant selected ‘Others’, there was space for free text and a request to specify the name(s) of the drug(s).

Recreational drug use definition

Two measures of recreational drug use were defined: (1) polydrug use, use of three or more recreational drugs at any time in the past 3 months; (2) drugs associated with chemsex, use of one or more of methadone, crystal meth or GHB/GBL in the past 3 months. It should be noted that the questionnaire did not ask about drug use during sex specifically.

HIV-related behaviours

Ten measures of HIV-related behaviours and related activities were derived from the questionnaire. Four measures of condomless sex (CLS) in the past 3 months were defined as (1) CLS with one or more partners, (2) CLS with two or more partners, (3) CLS with partners of unknown or HIV-negative partners (excluding long-term HIV-positive partners with whom they thought the risks of catching HIV were low because their partner was on antiretroviral therapy) and (4) receipt of CLS with an HIV unknown status partner. Six additional measures related to sexual behaviour: (5) diagnosis with a bacterial STI in the past year (gonorrhoea, chlamydia, syphilis and/or lymphogranuloma venereum), (6) more than 11 sexual partners per year, (7) group sex in the past 3 months, (8) post-exposure prophylaxis (PEP) use (past year), (9) pre-exposure prophylaxis (PrEP) use (past year) and (10) recent HIV test (past 6 months). CLS refers to anal sex and, for MSM who self-reported their sexuality as bisexual, vaginal sex.

Statistical analysis

Prevalence of polydrug use, drug use associated with chemsex and specific drug use between the AURAH and AURAH2 study were assessed, with and without adjustment for sociodemographic factors, and results are shown as unadjusted and adjusted prevalence ratios (aPRs). Prevalence of HIV-related behaviours between the two studies (time periods) was then compared with and without adjustment for the same factors. All the multi-variable models were adjusted for sociodemographic factors: age (as a continuous variable), ethnicity (born/not born in the UK and white/non-white ethnicity), education (university level or not), sexual identity (gay or bisexual/hetero) and relationship status (ongoing relationship or not), to produce aPRs using modified Poisson regression analysis.24 All analysis was conducted in Stata statistical software V13.21 These models were applied to subjects with no missing values for all the variables included in the model. In sensitivity analyses, we treated missing values as separate categories and applied the models to all subjects in the study.

An additional analysis was undertaken to assess the association of drug use measures with HIV-related behaviours among a restricted sample of AURAH2 MSM that reported anal (or vaginal) sex in the past 3 months to specifically compare those having condom protected sex with those having CLS and the associations with polydrug use and drugs associated with chemsex. The multivariable models were adjusted for (1) the sociodemographic factors outlined above and (2) sociodemographic factors plus higher risk drinking (WHO AUDIT-C. Alcohol Use Disorders Identification test-C) score ≥26 and depressive symptoms PHQ-9 (Patient Health Questionnaire-9) total score ≥10.

RESULTS

Participant characteristics

In 2013/2014, 1484 MSM participated in the AURAH study. The response rate was 60.0%. Of these, 991 MSM attended the same three clinics that took part in the AURAH2 study. There were 1031 individuals who participated in the AURAH2 study with a response rate of 51.2%. In total, 136 individuals participated in both the AURAH and AURAH2 studies and were excluded from the AURAH2 sample for this analysis. Table 1 compares the characteristics of the 991 MSM in the AURAH study with the 1031 MSM who participated in the AURAH2 study. The participant characteristics in both studies were similar: the large majority were white (AURAH 81.0%, AURAH2 86.5%), self-identified as gay (AURAH 89.9%, AURAH2 92.7%), financially stable (always having money to cover basic needs, AURAH 74.4%, AURAH2 76.6%), educated to university degree level (AURAH 71.3%, AURAH2 74.6%) and employed (AURAH 80.2%, AURAH2 82.6%) (table 1). The main significant difference between the two studies was the higher proportion of younger MSM (≤25 years) in the AURAH2 study (AURAH 14.8%, AURAH2 24.3%).

---

[Further content and analysis not shown due to reaching the end of the snippet]
Changes over time in recreational drug use

Overall, a greater proportion of MSM in the AURAH2 study reported the use of one or more recreational drugs in the past 3 months (AURAH1: 57.4%, AURAH2: 60.4%). Figure 1 shows the proportion of MSM reporting polydrug use, the use of drugs associated with chemsex, and specific substances used in the AURAH and AURAH2 study. There was an increase in polydrug use from the AURAH to AURAH2 study (PR 1.19, 95% CI 1.04 to 1.37, P = 0.013); however, after adjustment for sociodemographic factors, the increase did not persist (aPR 1.16, 95% CI 0.99 to 1.37, P = 0.07). The use of drugs associated with chemsex had significantly increased by about a third from AURAH to AURAH2, and this increase remained significant after adjustment for sociodemographic factors (aPR 1.30, 95% CI 1.11 to 1.53, P<0.002; see figure 1).

Across both studies, the most commonly used drug was nitrites (AURAH 35.2%, AURAH2 36.3% (figure 1). The prevalence of cocaine use (AURAH 21.5%, AURAH2 23.0%) was similar between the two studies (figure 1).
The most prominent increases in the use of specific drugs were seen in drugs associated with chemsex: methamphetamine use had increased by about a third (aPR 1.32, 95% CI 1.10 to 1.57), GHB/GBL by nearly half (aPR 1.47, 95% CI 1.11 to 1.87) and methamphetamine use had increased by nearly half (aPR 1.42, 95% CI 1.01 to 2.01). In fact, use of nearly all types of specific drugs had increased in the AURAH2 study with the exception of ketamine, which had decreased (aPR 0.64, 95% CI 0.28 to 1.47), while cannabis and ‘other drugs’ (barren, crack cocaine, opium, morphine, lsd, cocaine, acid) remained at roughly the same prevalence. The proportion of MSM who reported use of drugs associated with chemsex, while still a minority, had increased from the AURAH to AURAH2 study for all three drugs commonly associated with chemsex: methamphetamine from 28.8% to 28.8%, GHB/GBL from 13.1% to 19.8% and methamphetamine 6.6% to 9.8% (see figure 1).

Changes over time in HIV-related behaviours

Some measures of HIV-related behaviours had increased to various extents in the AURAH2 study compared with the AURAH study (CLS, CLS 2+ partners, STI, PER, PreP, HIV testing), and most of these remained statistically significant after adjusting for sociodemographic factors (table 2).

The results were very similar when missing values for all the variables included in the model were treated as separate categories and applied (see online supplementary table 1).

The largest differences among the measures of HIV-related behaviours between the AURAH and AURAH2 study was in PER use (past year), which had increased by over 40% (aPR 1.50, 95% CI 1.21 to 1.88), and the number of self-reported baccareal STI diagnoses (past year), which had increased by a quarter (aPR 1.24, 95% CI 1.08 to 1.43). There was also an increase in the proportion of men who had recently tested for HIV in the AURAH2 study, which remained significant after adjustment for study and sociodemographic factors (aPR 1.14, 95% CI 1.07 to 1.21).

Figure 1 Prevalence of polydrug use, drug use associated with chemsex and individual drug use in MSM participants in the Atitudes to and Understanding Risk of Acquisition of HIV (AURAH), 2013-14; and Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2, 2014-16) studies.

Relationship between recreational drug use and HIV-related behaviours

Table 3 shows the associations of polydrug use and drug use associated with chemsex, with HIV-related behaviour measures among the subgroup of MSM who reported and (or vaginal) sex within the past 3 months (n=949) in the AURAH2 study. Similar to the AURAH study results, in AURAH2, polydrug and drug use associated with chemsex use remained strongly associated with all measures of HIV-related behaviours, with the exception of receptive anal sex with an unknown status partner, in (1) unadjusted, (2) adjusted for study, age, ethnicity, sexual identity, university education and ongoing relationship status, and (3) adjusted for study, sociodemographic factors plus additional, higher-risk drinking and depressive symptoms.

DISCUSSION

We observed substantial increases over the 3-year period from the AURAH to AURAH2 study in the use of drugs associated with chemsex and specific drug use, as well as increases in some measures of HIV-related behaviours, including condomless sex, PER - and HIV testing. The most notable increase was the prevalence of drugs associated with chemsex (AURAH: 24.2% vs AURAH2: 32.3%), driven by the considerable individual increase in methamphetamine, methamphetamine and GHB/GBL. Certain measures of HIV-related behaviours had also increased, including CLS with one or more partners, which may partly explain the increase in self-reported bacterial STI diagnoses from the AURAH to AURAH2 study (50.3% vs 50.3%). Encouragingly, there was also an increase in the number of MSM who reported an HIV test in the past 6 months (63.4% vs 73.4%), in line with increasing ever and repeat HIV testing in MSM in the UK over the same time period.

To our knowledge, the AURAH and AURAH2 studies are the largest studies within the UK to have investigated prevalence of recreational drug use and HIV-related behaviours among HIV-negative MSM attending sexual health clinics. The prevalence of recreational and specific drug use in our results from

the AURAH study is similar to that reported by other high-income countries from the same calendar years.22,23 However, the AURAH2 study results provide a more recent estimate. In Australia, baseline analysis on the first entirely online cohort study of MSM (Following Lives Undergoing Change [FLux] study) (n=2,231) recruited in 2014-2015, found that over half (56.5%) had reported use of any illicit drug in the previous 6 months, and over a quarter (28%) had used party drugs (E, speed, cocaine, crystal methamphetamine, GHB, ketamine, LSD) in the previous 6 months. Trends in drug use among Australian gay men are also monitored in routinely conducted behavioural surveillance surveys, 'the Guy Community Periodic Surveys', which suggest little change in recent years. A similar prevalence (53.7%) was reported among HIV-negative MSM in the USA by the National HIV Behavioural Surveillance survey conducted in the same year as the AURAH and FLux studies (2014) and this has steadily increased among MSM (regardless of HIV status) from 47% in 2004-200524 to 49% in 2011,25 to 55.7%26 in 2014. As demonstrated by the changes in prevalence and patterns of drug use and associated behaviours over time in our results, the monitoring of recreational drug use in MSM is crucial if service providers, including sexual health, HIV and drug use services, are to anticipate and plan for the needs of their clients, whilst a better understanding of factors that may facilitate the use of drugs within a sexual setting, such as geographical networking apps, is needed. Furthermore, longitudinal monitoring would help identify trends that may be hidden when examining prevalences in cross-sectional surveys.

A recent steep decrease in HIV diagnoses has been reported in two of the London clinics from which the AURAH and AURAH2 studies recruited,27 despite an increase in HIV testing. The decline in HIV incidence has been attributed to a combination of prevention interventions, particularly testing followed by rapid initiation of HIV treatment, and the use of PrEP (despite not being freely available).28 Self-reported PrEP use was relatively low as in both AURAH1 (3.8%) and AURAH2 (5.0%), although it is likely to have increased since the collection of the AURAH2 baseline. In the USA, where PrEP has been available since 2012, HIV-negative MSM substance users were identified as a high-risk trajectory group that would benefit from access to PrEP.29 and our results indicate that this is similar in the UK. While the effect of wider access to PrEP on sexual behaviour and recreational drug use is yet unknown, our results show an increasing trend in certain measures of HIV-related behaviours and polydrug and recreational drug use in a context where PrEP is not freely available.

MMS who use recreational drugs, particularly in the context of chemsex, may not see themselves as ‘typical’ drug users or consider the use of chemsex drugs to be problematic and are therefore unlikely to access traditional drug services.30 Equally, these services may not be trained to deal with the specific needs of this population.31 The large numbers of MSM reporting polydrug use and drugs associated with chemsex in the AURAH and AURAH2 studies, along with the high proportions of PrEP use, STI infection and clinically significant depression and anxiety symptoms, highlight the complex needs of this population and support the view that sexual health services need to provide holistic clinical assessment and care, including drug services, to improve health and well-being in an acceptable environment for MSM.32,33

---

**Table 2**: Prevalence of HIV-related behaviours among men who have sex with men in the Attitudes to and Understanding Risk of Acquisition of HIV (AURAH) (n=991) and Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2) (n=1021) studies and association of these measures with study.

<table>
<thead>
<tr>
<th>Measures of sexual behaviour</th>
<th>Study</th>
<th>Prevalence n (%) (95% CI)</th>
<th>Unadjusted OR (95% CI)</th>
<th>P value</th>
<th>Adjusted OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSL with one or more partners (past 3 months)</td>
<td>AURAH</td>
<td>238 (28.3%) (25.1% to 31.5%)</td>
<td>1.14 (1.05 to 1.23)</td>
<td>0.001</td>
<td>1.14 (1.05 to 1.24)</td>
<td>0.001</td>
</tr>
<tr>
<td>CSL with one or more partners (post 3 months)</td>
<td>AURAH2</td>
<td>268 (44.4%) (41.5% to 47.4%)</td>
<td>1.22 (1.18 to 1.26)</td>
<td>0.002</td>
<td>1.22 (1.18 to 1.26)</td>
<td>0.002</td>
</tr>
<tr>
<td>CSL with two or more partners (past 3 months)</td>
<td>AURAH</td>
<td>286 (35.8%) (32.1% to 39.5%)</td>
<td>1.00 (0.98 to 1.01)</td>
<td>0.944</td>
<td>0.99 (0.98 to 1.00)</td>
<td>0.899</td>
</tr>
<tr>
<td>CSL with two or more partners (post 3 months)</td>
<td>AURAH2</td>
<td>304 (41.4%) (37.9% to 44.9%)</td>
<td>1.10 (1.06 to 1.15)</td>
<td>0.004</td>
<td>1.10 (1.06 to 1.14)</td>
<td>0.004</td>
</tr>
<tr>
<td>CSL with unknown status partner (past 3 months)</td>
<td>AURAH</td>
<td>315 (38.1%) (34.8% to 41.4%)</td>
<td>1.10 (1.05 to 1.14)</td>
<td>0.005</td>
<td>1.10 (1.05 to 1.14)</td>
<td>0.005</td>
</tr>
<tr>
<td>CSL with unknown status partner (post 3 months)</td>
<td>AURAH2</td>
<td>324 (41.4%) (37.9% to 44.9%)</td>
<td>1.10 (1.06 to 1.15)</td>
<td>0.004</td>
<td>1.10 (1.06 to 1.14)</td>
<td>0.004</td>
</tr>
<tr>
<td>PEP use (past year)</td>
<td>AURAH</td>
<td>118 (14.1%) (11.4% to 16.8%)</td>
<td>1.07 (1.04 to 1.11)</td>
<td>0.003</td>
<td>1.07 (1.04 to 1.10)</td>
<td>0.003</td>
</tr>
<tr>
<td>PEP use (post year)</td>
<td>AURAH2</td>
<td>128 (22.4%) (19.5% to 25.4%)</td>
<td>1.07 (1.04 to 1.10)</td>
<td>0.003</td>
<td>1.07 (1.04 to 1.10)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

* AURAH is the reference group.
** P values by fisher test.
---

*Adjusted for: age, gender (continuous variable), ethnicity, sexual identity, university education, ongoing relationship status (Poisson model on subject with no missing values for all the variables included in the model).

AURAH, Attitudes to and Understanding Risk of Acquisition of HIV; AURAH2, Attitudes to and Understanding Risk of Acquisition of HIV over Time; CSL, condomless sex; PrEP, pre-exposure prophylaxis; OR, prevalence ratio; PrEP, pre-exposure prophylaxis.

---

---
Table 3  Associations of polydrug use and drug use associated with chemsex, with measures of HIV-related behaviours, among 949 MSM in the AURAH2 study who reported anal or vaginal sex in the past 2 months

<table>
<thead>
<tr>
<th>HIV-related behaviour</th>
<th>Poly drug use (past 3 months)</th>
<th>Chemsex drug use (past 3 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted PR (95% CI)</td>
<td>Adjusted (a) PR (95% CI)</td>
</tr>
<tr>
<td></td>
<td>P value*</td>
<td>P value*</td>
</tr>
<tr>
<td><strong>CLS with one or more partners (past 3 months)</strong></td>
<td>1.30 (1.20 to 1.40)</td>
<td>1.31 (1.21 to 1.42)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>CLS with two or more partners (past 3 months)</strong></td>
<td>1.01 (0.44 to 2.24)</td>
<td>1.03 (0.89 to 2.25)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>CLS with unknown/unknown-positive partner (past 3 months)</strong></td>
<td>1.71 (1.40 to 2.05)</td>
<td>1.69 (1.40 to 2.02)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Receptor: CLS with unknown status partner (past 3 months)</strong></td>
<td>1.37 (0.98 to 1.93)</td>
<td>1.34 (0.97 to 1.87)</td>
</tr>
<tr>
<td></td>
<td>0.027</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Bacterial STI diagnosis (past year)</strong></td>
<td>1.05 (0.53 to 1.73)</td>
<td>1.06 (0.54 to 1.93)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Other or new sexual partner (past year)</strong></td>
<td>1.04 (0.41 to 2.59)</td>
<td>1.02 (0.41 to 2.15)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Group sex (past 3 months)</strong></td>
<td>2.41 (0.12 to 4.57)</td>
<td>2.38 (0.28 to 2.72)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>PEP use (past year)</strong></td>
<td>2.10 (0.72 to 5.77)</td>
<td>2.10 (0.71 to 5.71)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>PrEP use (past year)</strong></td>
<td>2.49 (0.14 to 4.41)</td>
<td>2.34 (0.24 to 4.35)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Recent HIV test (within past 6 months)</strong></td>
<td>1.10 (0.80 to 1.50)</td>
<td>1.10 (0.59 to 1.26)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Adjusted model (a) age (continuous variable), ethnicity, sexual identity, university education, gender identity status. Adjusted model (b) age (continuous variable), ethnicity, sexual identity, university education, gender identity status, higher-risk drinking, depressive symptoms (PHQ-9 > 10) (missing values included in variables for adjusted model).

*P value by Wald test.

AURAH/MSM: Attitudes to and Understanding of Risk of Acute HIV/STI/MSS, men who have sex with men PEP post-exposure prophylaxis, PrEP pre-exposure prophylaxis.

Limitations
We recognize the different proportions in non-response between the AURAH and AURAH2 study could bias the comparison, and unfortunately data were not collected on the characteristics of non-responders to limit this. We also acknowledge a certain degree of selection bias may have occurred during recruitment to both studies. We further recognise that in our results, the reporting of drugs associated with chemsex does not necessarily equate to use of drugs during sex; however, previous data have shown that 75% of mephedrone and 85% of GHB/GLB users said they used the drugs solely to facilitate sex, although the use of drugs outside of a sexual setting, such as in a social or clubbing environment, is also important to consider. Additionally, the results from the AURAH and AURAH2 studies may not be directly generalizable to the broader MSM population due to the sample of men being solely from sexual health clinics in London and Brighton, which have large gay communities, and may not reflect behaviour and lifestyle choices of clinic attendes in the wider community. In contrast to non-clinic attendees, and given the strong associations between sexual behaviour and recreational drug use, MSM who voluntarily attend sexual health clinics may have self-identified a need for sexual health screening, which could explain the associated higher prevalence of recreational drug use in this group. Furthermore, two of the clinics that participated in the AURAH and AURAH2 studies, Dean Street and Mortimer Market Clinic, are specialist centres of chemsex support where chemsex awareness is robust and specific psychosocial interventions are offered frequently to high-risk MSM. The increased awareness and community engagement around chemsex within these two clinics may have resulted in a larger proportion of those engaging in chemsex opting to attend them, which may also account for an overestimation. However, it is also possible that some MSM not engaged with clinics may not use for HIV and STIs through perceived stigma or fear related to higher-risk sexual behaviours and or recreational drug use, and therefore our results could potentially underestimate the true prevalence of both.

CONCLUSIONS
There have been significant changes in use of drugs associated with chemsex and specific drug use, as well as increases across measures of HIV-related behaviour among HIV-negative MSM in the AURAH and AURAH2 study. Despite the decline in HIV

Key messages
- Use of drugs associated with chemsex has substantially increased among HIV-negative men who have sex with men attending sexual health clinics from 2013 to 2016.
- Some measures of HIV-related behaviours including condomless sex, post-exposure prophylaxis, and HIV testing have also increased between 2013 and 2016.
- There is a need for improved monitoring to assess changing patterns of recreational drug use and associated behaviours so that sexual health services are able to anticipate and provide holistic care for their clients.
394


Appendix XVII. The AURAH2 study longitudinal results paper “Changes in chemsex and sexual behaviour over time, among a cohort of MSM in London and Brighton: Findings from the AURAH2 study.”

See overleaf.
Changes in chemsex and sexual behaviour over time, among a cohort of MSM in London and Brighton: Findings from the AURAH2 study


* UCL Institute for Global Health, UCL, London, United Kingdom
** Centre forWaich and Wellcome Trust/EPSRC Centre for Health Data Science, University of Oxford, Oxford, United Kingdom
*** Brighton and Sussex University Hospitals NHS Trust, Brighton, United Kingdom

INTRODUCTION

Recent evidence has suggested that chemsex (the use of methylphenidate, crystal methamphetamine and 3,4-methylenedioxymethamphetamine, 3,4-methyleneoxybutyrophenone) to enable, enhance and prolong sexual interactions has increased among men having sex with men (MSM) attending sexual health clinics in large UK cities. To date, there has been no data from the UK or Europe that describes changes in chemsex over time within a cohort of MSM.

METHODS: The prospective cohort study, Attitudes to and Understanding Risk of Acquisition of HIV over Time (AURAH2), collected online questionnaire data from HIV-negative or undiagnosed MSM at enrolment (2015–2016) and at follow-up (2017–2018). To investigate changes in chemsex, three individual drugs associated with chemsex were included in the questionnaire: frequency of chemsex sessions and measures of sexual behaviour, among the cohort of MSM over the study’s 3-year follow-up period.

RESULTS: In total, 622 MSM completed at least one questionnaire over the last six months of follow-up. Prevalence of chemsex significantly declined during the follow-up (41.3% to 31.4% at the first online questionnaire, to 11.1% [95% CI, 8.4% to 13.9%] at the 2017 questionnaire). This decline was reflected in the proportion of MSM reporting use of two or three of the three chemsex drugs: 12.2% to 3.8% at the first questionnaire and to 5.7% [95% CI, 2.9% to 9.0%] at the second. The proportion reporting exclusive use of chemsex drugs significantly declined (from 10.1% to 5.0% at the first questionnaire and to 2.3% [95% CI, 0.9% to 4.1%] at the second). While crystal methamphetamine use declined, but not significantly, (11.1% [95% CI, 4.9% to 17.3%]), most measures of sexual activity (number of sex acts, group sex, recent HIV testing and bacterial STI) also declined over the period of follow-up, with the exception of condyloma acuminatum among one and more than two partners.

CONCLUSIONS: Chemsex and use of two chemsex drugs (methylphenidate and GHB/GRL) significantly declined over time among individuals in the study, alongside must measures of sexual behaviour with the exception of those related to GAI. Focusing health promotion and HIV prevention, such as awareness of post-exposure prophylaxis (PEP) and access to pre-exposure prophylaxis (PrEP), on MSM who report chemsex, and in particular problematic chemsex, would be highly beneficial, potentially only necessary for a relatively short period of time for individuals, and could have long-term benefits for HIV and STI prevention.
the quality of sex and increasing the ability to engage in type of sex that is desired (Wassertheil, Nickos, Reid, Torres-Rueda, & Borne, 2017). However, research has also highlighted issues around sexual consent in the context of drugs, as well as difficulties in negotiating sex, particularly in group sex environments (Roume et al., 2012). Whilst not all chemsex is problematic in nature, recent evidence has demonstrated that MSM attending sexual health clinics who disclosed chemsex participants had a five-fold increase in the odds of being newly diagnosed with HIV-infection (Rakshit et al., 2014). For this reason, chemsex is currently a key area of focus for Public Health England (PHE) with the aim of improving the health and wellbeing of MSM (PHE action plan, 2015-16: Promoting the health and wellbeing of gay, bisexual and other men who have sex with men, 2015), as well as to develop best practice in terms of specialist support services. Although, there is some evidence that drug use and chemsex is more common among HIV-positive MSM (Rakshit et al., 2013), cross-sectional data (e.g. 2015/16) indicated an increase in the proportion of HIV negative or undiagnosed MSM attending large, urban, sexual health services reporting use of drugs typically associated with chemsex (Sellwell et al., 2018), and recent research has shown that chemsex is widespread across the UK (Wiggins et al., 2018), and not confined to urban areas, where the majority of data have been collected (Edmundson et al., 2018). Most previous cross-sectional studies from the UK have collected information on use of chemsex drugs among MSM, but not context of use (whether these drugs were used just prior to or during sexual activity) (Edmundson et al., 2018), despite evidence that drugs associated with chemsex, in particular mephedrone and GHB/UH, are used in a range of other settings outside of a sexual context (Farrington, Flowers, McDiarmid, & Roume, 2014; Melander, Turner et al., 2013). Pantheoretically, as yet, there have been no longitudinal studies from the UK or Europe. Able to detect changes in frequency of chemsex at an individual level over time, which would help contextualise cross-sectional prevalence data. Although strong associations between chemsex and measures of sexual risk behaviour have been reported (Sellwell et al., 2017), there is a lack of data that placebo chemsex patterns in the context of other sexual behaviour patterns within the same period of time. In this paper we present data from the prospective cohort study, attitudes to and understanding of risk of Acquisition of HIV over time (AURAE2), which recruited HIV-negative or undiagnosed MSM from sexual health clinics in London and Brighton ( Sellwell et al., 2018). We report changes in chemsex, and use of individual chemsex drugs, in the cohort over the time of the study, and describe changes in sexual behaviour over the same time period. We further investigate factors associated with chemsex and the individual chemsex drugs, among AURAE2 participants.

Methods

The AURAE2 study was a prospective cohort study that recruited HIV-negative or undiagnosed MSM from sexual health clinics in London and Brighton (56 Jean Street clinic, London, Montrose Market centre, London and Claude Nicol clinic, Brighton) from November 2014 to April 2016. Participants completed a baseline paper questionnaire in clinic and, subsequent to four monthly (from online registration) online questionnaires, available from March 2015, for up to three years until March 2018. The four monthly questionnaires captured information on HIV status, HIV testing history, recent sexual behaviour (number of condomless sex partners, group sex, status of partners and whether on anti-retroviral therapy (ART) (if partners) were HIV+), health and lifestyle factors including recreational drug use and chemsex, and STI diagnoses (all with a 3 month recall period). Participants were also invited to complete a longer, online, annual questionnaire that collected the same information as the four monthly questionnaires plus additional information on post exposure prophylaxis (PEP) and pre-exposure prophylaxis (PrEP) use (in the past year), relationship status, mental health (using the Patient Health Questionnaire-9 (PHQ-9) ( Kroenke, Spitzer, & Williams, 2003) and Generalised Anxiety Disorder 7 (GAD-7) (Spitzer, Kroenke, Williams, & Lowe, 2006)) and alcohol consumptions (World Health Organisation alcohol screening tool audit (AUDIT-C score) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001)). Methodological details for the AURAE2 study have been published elsewhere ( Sellwell et al., 2016).

Ascertainment of chemsex drug use

At each four monthly online questionnaire, participants were asked to self-report whether they had used drugs before or during sex (chemsex) with a recall period of last three months, and if so, to select which chemsex drugs from the following list: mephedrone, GHB/UH, crystal methamphetamine, other (with space for free text). Participants were then asked 'approximately how often did you have chemsex in the last 2 months?' with the answer options of; 'once', 'monthly' or 'weekly'.

Sexual risk behaviours, STI diagnoses and HIV testing

Seven measures of sexual risk behaviour and related activities were derived from the four monthly online questionnaires. Sexual risk for anal sex with men throughout the questionnaires. The first measure was (i) any anal sex within the past three months, subsequent measures of condomless anal intercourse (CIAI) in the past three months were defined as: (ii) CIAI with one or more partners, (iii) CIAI with two or more partners, (iv) CIAI with partners of unknown HIV status. Three additional measures related to sexual behaviour (in the past three months) were defined as: (v) diagnosis with a bacterial STI (Chlamydia, E. coli, Syphilis, and/or Lymphogranuloma Venereum (LGV), (vi) group sex, and (vii) recent HIV test.

Online questionnaire completion

Two reminder emails were spaced over a two week period were sent to participants when they were due to complete a questionnaire, followed by a text message a week after the second email (if the participant had provided a phone number at enrolment). If a participant missed a questionnaire at any time during follow-up they were still invited to complete subsequent questionnaires and were only withdrawn from the study if they specifically emailed the study manager stating their decision to withdraw. Participants who completed a first online follow-up questionnaire in March 2015 had the option of completing up to 9 online questionnaires, whereas participants who joined the study afterwards only had the option of completing fewer, as the online follow-up finished in March 2018.

Statistical analysis plan

Analyses were based on all MSM that completed an online questionnaire (n = 532), using pooled data from all the online follow-up questionnaires; therefore, multiple responses from individuals were included. Firstly, we examined the association of sociodemographic, health, lifestyle characteristics and PEP, PrEP, HIV status and calendar year and time in the study with chemsex (binary dependent variable) using univariate generalized estimating equations (GEE) Poisson model with robust variance estimation, with an exchangeable covariance matrix to produce prevalence ratios (PR). In these and subsequent analyses, baseline values of sociodemographic variables were used throughout follow-up, as these were not collected subsequently. For all other variables, information from the relevant follow-up questionnaire was used. Then, in multivariable analysis, using pooled data from the online follow-up questionnaires, we assessed the association between chemsex (binary, dependent variable) and time in the study, adjusting for socio-demographic factors, that could not be influenced by chemsex: age group (< 25, 25-29, 30-34, 35-39, 40-44, > 45 years), country of...
birth and ethnicity (white UK born, non-white UK born, non-white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual, other), university education (yes or no, missing) and study site (The Mortimer Market Centre, London; 36 Dean Street Clinic, London; The Claude Nicolle Centre, Brighton).

To examine changes over time in the study in chemsex and individual chemsex drugs, we considered the proportion of those who reported chemsex at each 4 monthly online questionnaire, using the total number who responded to that questionnaire as the denominator. Univariate generalized estimating equations (GEE) Poisson models with robust variance estimation was used to see if the changes in chemsex and individual chemsex drugs over the follow-up period were significant. This method was also used to investigate changes in the seven measures of sexual behaviour over time.

Three sensitivity analyses were conducted to better understand whether results were affected by lost to follow-up over time. The first analysis included only MSM who completed a questionnaire within the final six months of the study follow-up period compared to the main results. The second sensitivity analysis investigated whether chemsex predicted being lost to follow-up. Two variables were created, ‘lost to follow-up’ (stopped completing online questionnaires and did not resume) and ‘missed the next questionnaire’ (missed the next questionnaire). The GEE Poisson model used in the main analysis was utilized to explore whether chemsex predicted being ‘lost to follow-up’ or ‘missed the next questionnaire’. For the third sensitivity analysis, the last observation for the chemsex variable was carried forward where online questionnaires were missing and the same adjustment and Poisson model was used as in the main analysis. All analysis was conducted in stata statistical software V.12.

Results

Characteristics of online participants

Of the 1,167 MSM who consented to and completed the AURAVEI 2 study baseline questionnaire in clinic, 622 (53.2%) went on to complete at least one online follow-up questionnaire. Of these, 64.3% (406/622) remained engaged with the study throughout (completed a questionnaire within the last 6 months of the study follow-up period). In total, all participants that completed at least one online questionnaire contributed a total of 1,424 person-years of follow-up. Table 1 shows sociodemographic, health and lifestyle characteristics, sexual behaviour, FEP, PEP and HIV testing in the AURAVEI 2 study.

Socio-demographic, health and lifestyle characteristics, sexual behaviour, FEP, PEP and HIV testing, among participants in the AURAVEI 2 study, and those that reported chemsex at first online questionnaire of online (n = 622).

The median age among participants who completed at least one online questionnaire (n = 622) was 34 (standard deviation [SD]: 11.3) years. 57.0% (354/622) identified as gay and 34.8% (215/622) identified as bi, sexual or other. Most (51.1%, 32/8) were of white ethnicity and over three quarters (72.7% 472/622) were educated to university level (see Table 1). The prevalence of chemsex associated drug use at baseline among MSM who did not complete any online questionnaires (n = 570) was comparable (29.9%) to that among MSM that completed at least one online questionnaire (32.3%); as was the prevalence of individual chemsex drugs that were reported among MSM who did not complete an online questionnaire compared to those that did, methedrene (20.8% vs 20.3%), GHB/GBL (17.7% vs 20.3%) and crystal methamphetamine (9.4% vs 10.0%) (see supplementary material 1, Table 2).

Poisson men self-reported a raw HIV diagnosis during the 3-year online follow-up period.

When examining associations with chemsex using pooled data from all the follow-up questionnaires, a number of factors were found to be

---

Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>123 (21.8%)</td>
<td></td>
</tr>
<tr>
<td>25-34</td>
<td>253 (41.5%)</td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>121 (18.5%)</td>
<td></td>
</tr>
<tr>
<td>45-54</td>
<td>60 (9.8%)</td>
<td></td>
</tr>
<tr>
<td>55-64</td>
<td>40 (6.4%)</td>
<td></td>
</tr>
<tr>
<td>65+</td>
<td>113 (18.5%)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Yes, white</td>
<td>227 (37.2%)</td>
<td></td>
</tr>
<tr>
<td>Yes, non-white</td>
<td>198 (32.5%)</td>
<td></td>
</tr>
<tr>
<td>No, white</td>
<td>70 (11.5%)</td>
<td></td>
</tr>
<tr>
<td>No, non-white</td>
<td>209 (34.2%)</td>
<td></td>
</tr>
<tr>
<td>Mobility at the time</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>81 (13.3%)</td>
<td></td>
</tr>
<tr>
<td>Sometimes, too</td>
<td>25 (4.1%)</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>472 (77.6%)</td>
<td></td>
</tr>
<tr>
<td>University education</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>143 (23.2%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>577 (93.9%)</td>
<td></td>
</tr>
<tr>
<td>Housing status</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Own home</td>
<td>250 (40.7%)</td>
<td></td>
</tr>
<tr>
<td>Renting</td>
<td>328 (53.1%)</td>
<td></td>
</tr>
<tr>
<td>Unemployed/other</td>
<td>78 (12.9%)</td>
<td></td>
</tr>
<tr>
<td>Gay</td>
<td>577 (94.5%)</td>
<td></td>
</tr>
<tr>
<td>Bisexual/other</td>
<td>25 (4.1%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>358 (58.2%)</td>
<td></td>
</tr>
<tr>
<td>Higher risk alcohol consumption (BAC)</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>AUDIT-C ≤ 6</td>
<td>572 (93.8%)</td>
<td></td>
</tr>
<tr>
<td>≥ 7</td>
<td>54 (9.0%)</td>
<td></td>
</tr>
<tr>
<td>Clinically significant depressive symptoms (PHQ-9 score ≥ 13)</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70 (11.5%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>542 (87.7%)</td>
<td></td>
</tr>
<tr>
<td>Clinical anxiety symptoms (GAD-7 score ≥ 11)</td>
<td>[n = 610]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>542 (87.7%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>70 (11.5%)</td>
<td></td>
</tr>
<tr>
<td>Drug use</td>
<td>[missing n = 41]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>562 (90.1%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>50 (8.0%)</td>
<td></td>
</tr>
<tr>
<td>CLAI with 1 or more partner(s)</td>
<td>[missing n = 41]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>562 (90.1%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>50 (8.0%)</td>
<td></td>
</tr>
<tr>
<td>CLAI with 2 or more partner(s)</td>
<td>[missing n = 41]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>249 (39.5%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>373 (59.9%)</td>
<td></td>
</tr>
<tr>
<td>CLAI with partner(s)</td>
<td>of unknown status</td>
<td>[missing n = 41]</td>
</tr>
<tr>
<td>Yes</td>
<td>213 (33.8%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>420 (66.2%)</td>
<td></td>
</tr>
<tr>
<td>Chemsex (missing n = 41)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>198 (32.5%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>420 (66.2%)</td>
<td></td>
</tr>
<tr>
<td>Stigmated with bacterial STI</td>
<td>[missing n = 41]</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>164 (26.4%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>456 (74.6%)</td>
<td></td>
</tr>
<tr>
<td>Group use (missing n = 41)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>203 (32.5%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>467 (74.6%)</td>
<td></td>
</tr>
</tbody>
</table>

---

1 From baseline questionnaire data; from first 4 monthly questionnaire data.
2 CLAI: Condensates and associate.
3 DRUGS: the use of drugs of the 3,4-methylenedioxyamphetamine (MDMA) type.
4 Associated with chemsex. In unadjusted analysis (Table 2). There was a tendency for prevalence of chemsex to be higher among participants not born in the US and among those born in an ongoing relationship. Clinically significant symptoms of depression (PHQ-15 ≥ 15) and anxiety (SPY-4 ≥ 15) were both associated with chemsex, as was the use of MDMA (PHQ-15 ≥ 15) and anxiety (SPY-4 ≥ 15). Age and markers of socioeconomic status were not associated with chemsex. The prevalence of chemsex significantly decreased over time in the study increased and as calendar year increased (see Table 2).

Associations of chemsex and individual chemsex drugs with time (calendar year) over the AURAVEI 2 follow-up period

In unadjusted analysis we found a strong negative association.
Table 2
Unadjusted associations of sociodemographic and lifestyle characteristics, PEP, PTF, HIV status, calendar year and time in the study, with chemsex during follow-up in the AURORA study. Analysis using pooled data from all available follow-up questionnaires.

<table>
<thead>
<tr>
<th>Factor (number of observations)</th>
<th>Prevalence Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (observations 3259)</td>
<td>1</td>
</tr>
<tr>
<td>&lt;25</td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>2.05 (0.45, 1.09)</td>
</tr>
<tr>
<td>30-34</td>
<td>0.99 (0.73, 1.36)</td>
</tr>
<tr>
<td>35-39</td>
<td>1.03 (0.79, 1.34)</td>
</tr>
<tr>
<td>40-44</td>
<td>1.00 (0.79, 1.26)</td>
</tr>
<tr>
<td>&gt;45</td>
<td>0.76 (0.61, 1.00)</td>
</tr>
<tr>
<td>p = 0.296</td>
<td>p = 0.572</td>
</tr>
</tbody>
</table>

| Born in the UK and white ethnicity* (observations 3259) | Yes, white |
|                                                       | p = 0.006** |
|                                                       | 0.09 (0.56, 1.24)         |
| Yes, non-white                                      | 1.25 (0.97, 1.61)         |
| Yes, non-white                                      | 1.46 (1.04, 2.00)         |

| Money to cover basic needs* (observations 3257) | 1.05 (0.77, 1.45)         |
|                                                       | 1.06 (0.61, 1.77)         |
|                                                       | p = 0.921                |

| University education (observations 2257) | Yes |
|                                         | p = 0.712** |
|                                         | 0.56 (0.74, 1.23)         |

| Employment (observations 3257) | Yes |
|                                | p = 0.564 |
|                                | 1.12 (0.77, 1.63)         |

| Housing status* (observations 3257) | Renting |
|                                     | p = 0.314 |
|                                     | 0.36 (0.79, 1.58)         |
|                                     | Unavailable, other         | 1.02 (0.72, 1.44)         |
|                                     | p = 0.052                |
|                                     | p = 0.825**               |

| Sexual identity* (observations 3547) | Male/other |
|                                      | 1.13 (0.63, 1.94)         |
|                                      | p = 0.621                |

| Engaging in sex with a person with HIV* (observations 897) | No missing |
|                                                           | p = 0.138 |
|                                                           | 0.79 (0.54, 1.14)         |

| Clinical significantly depressed symptoms* (PHQ-9 score > 10) (observations 842) | No missing |
|                                                                               | p = 0.7665 |
|                                                                               | 1.09 (0.78, 1.54)         |

| Clinical significant anxiety symptoms* (GAD-7 score > 10) (observations 842) | No missing |
|                                                                                 | p = 0.0011 |
|                                                                                 | 1.47 (1.03, 2.06)         |

| PEP use* (observations 942) | No missing |
|                            | p = 0.805 |
|                            | 1.43 (1.01, 1.98)         |

| PTF use* (observations 942) | No missing |
|                            | p = 0.0009 |
|                            | 1.63 (1.24, 2.16)         |

| HIV status (observations 3277) | Positive |
|                                | 0.87 (0.53, 1.38)         |
|                                | p = 0.0001*               |
|                                | 0.87 (0.53, 1.38)         |

| Year (observations 2621) | 2015 |
|                         | p = 0.8353               |
|                         | 0.93 (0.57, 1.49)         |
|                         | 0.77 (0.52, 0.86)         |
|                         | 0.73 (0.62, 0.87)         |
|                         | 0.74 (1.01, 1.15)         |

| Time in the study (since 1st online questionnaire) (observations 3277) | 0 months |
|                                                                      | 0.09 (0.81, 1.00)         |
|                                                                      | 0.79 (0.63, 0.99)         |
|                                                                      | 0.88 (0.79, 0.96)         |
|                                                                      | 0.71 (0.61, 0.81)         |
|                                                                      | 0.78 (0.68, 0.88)         |
|                                                                      | 0.77 (0.67, 0.88)         |
|                                                                      | 0.68 (0.55, 0.84)         |
|                                                                      | 0.34 (0.46, 0.70)         |

1: from baseline questionnaire; 2: from annual questionnaire; 3: p value from Poisson GEE model; 4: p value from Poisson GEE model including the predictors as continuous variable.

Table 3
Associations of time since first online questionnaire with chemsex, and individual chemsex drugs during follow-up in the AURORA study. Analysis using pooled data from all available follow-up questionnaires.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Unadjusted OR for p value (95% CI)</th>
<th>Adjusted OR for p value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemsex</td>
<td>0.05 (0.01, 0.27)</td>
<td>0.001</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>0.09 (0.06, 0.10)</td>
<td>0.001</td>
</tr>
<tr>
<td>GHB/GBL</td>
<td>0.06 (0.03, 0.09)</td>
<td>0.003</td>
</tr>
<tr>
<td>Crystal Meth</td>
<td>1.02 (0.06, 1.05)</td>
<td>0.269</td>
</tr>
</tbody>
</table>

CI confidence interval; OR: prevalence ratio.

*Observations in each model: Unadjusted = 3277, Adjusted = 3229.
**Methamphetamine No missing data for question on chemsex at any online questionnaire.
***Chemsex Chemsex Yes missing data for question on chemsex at any online questionnaire.

Adjusted sociodemographic characteristics that could not be influenced by chemsex time-updated age (15, 25-29, 30-34, 35-39, 40-44, 45 years), county of birth and ethnicity (white UK born, non-white UK born, white non-UK born, non-white non-UK born), self-reported sexual identity (gay or bisexual/other), university education (yes or no), missing and study site (The Mixter/Merker Centre, London, 56 Queen Street, Glasgow, London, The Price Nicol Centre, Brighton).

between time spent in the study and chemsex, and use of methamphetamine and GHB/GBL, but not crystal methamphetamine (see Table 3). After adjusting for age, country of birth and ethnicity, sexual identity, university education and study site, we found the strength of this association remained for chemsex, and the individual drugs methamphetamine and GHB/GBL, with crystal methamphetamine use remaining not significantly associated.

Changes in prevalence of chemsex over time in the study

Overall, chemsex and the use of two (methamphetamine and GHB/GBL) of the three individual chemsex drugs significantly declined over the follow-up period of the study (see Fig. 1). The prevalence of chemsex at the first online questionnaire was 31.8% (196/622), which steadily and significantly declined over time to 11.3% (86/762; p < 0.001) among MSM who completed the 9th questionnaire of follow-up. This decline was reflected in the proportion of MSM reporting use of two individual chemsex drugs: methamphetamine use significantly declined from 35.3% to 9.7% (p < 0.001), whereas GHB/GBL also significantly declined from 15.9% to 8.3% (p < 0.001). However, crystal methamphetamine use marginally decreased, but not significantly, 11.1% at the first online questionnaire and 9.5% at the 9th online questionnaire (p = 0.2895).

These results remained similar in the first sensitivity analysis that only included MSM who had completed a questionnaire within the final six months of the study follow-up period (supplementary material 2, Figure 4).

In the second sensitivity analysis, we explored whether there was a selective loss to follow-up among MSM engaging in chemsex. There was no association of chemsex with loss to follow-up (stopped and did not resume online questionnaires) (PR 1.04 (95% CI: 0.89, 1.24) or with missing the next online questionnaire (PR 1.03 (95% CI: 0.90, 1.16)) (supplementary material 3, Table 6). In the third sensitivity analysis, in which the last observation for the chemsex variable was carried forward
Fig. 1. Prevalence of chemsex, and individual chemsex drug over time in the study, among MSM in the AUDIT32 study (n = 3277 questionnaires). No missing data for question on chemsex at any online questionnaire among respondents except decreasing.

Within-person changes in frequency of chemsex over time in the study

Fig. 2 shows the frequency of chemsex reported over the follow-up period according to frequency of chemsex reported at the first online questionnaire. There was some variation in levels of chemsex use within individuals over time in the study, and a general tendency for use to decline over time. At the first online questionnaire, around two thirds of MSM (68.3%, 423 of 622) reported no chemsex, in the past 3 months, 7.0 out of 0.33 (11.9%) reported chemsex ‘once’, 30 (13.3%) reported chemsex ‘Monthly’ and 32 (13.1%) reported chemsex ‘Weekly’. As each questionnaire (time point) over 65% had reported no chemsex at first online questionnaire and continued to report no chemsex. In total, of the 72 MSM who replied to the 9th questionnaire 90.3% (65 of 72) reported ‘no chemsex’ at the 9th questionnaire, 1 (1.4%) reported it ‘once’ and 6 (8.5%) reported it ‘Monthly’, none reported it ‘Weekly’ at the 9th questionnaire covering the most recent 3 month period (Fig. 2).

Changes in sexual risk behaviours, STI diagnosis and HIV testing, over time

Overall the measures of sexual behaviour and associated behaviour, tended to decline over time among the cohort (see Fig. 3), with only those related to GLAM slightly increasing (GLAM with 1 or more partner and GLAM with more than one partner) and any anal sex declined from 90.9% at the 1st questionnaire to 88.9% at the 9th questionnaire, while GLAM with one or more partners increased from 66.6% to 70.4% at the 9th.

Fig. 2. Within-person changes in frequency of chemsex over time in the study among MSM in the AUDIT32 study (n = 3277 questionnaires).

58
questionnaire and group sex decreased from 32.6%–25.5%. Reporting a bacterial STI had significantly decreased from 26.4%–9.7% over the follow up period (p < 0.001). Reporting a recent HIV test (within the past 3 months) had also significantly declined, although the high prevalence of HIV testing at the first online questionnaire (70.3%) could be a reflection of the study process whereby participants were invited (via email) to complete their first online questionnaire within 3 months of recruitment to the study in clinic, where it is likely they were offered an HIV test.

Discussion

This paper provides the first longitudinal analysis of chemsex among a cohort of MSM in Europe and is provided in the context of changes in sexual behaviour over the same time period. Our results suggest a decline in prevalence of chemsex, and chemsex specific drugs such as mephedrone and GBL/CBN, over time among MSM in the study; even when we restrict to those who remained engaged with the study over the 3-year follow up period. Despite some selective drop out of MSM who reported chemsex in the study, we found no association between chemsex and being lost to follow up or missing the next study questionnaire. This decline is reflected in the patterns of reported frequency of chemsex at each online follow up (No chemsex, ‘Once’, ‘Monthly’, ‘Weekly’ [past 3 months]) over the same period which showed an increase in MSM reporting ‘No chemsex’ from the first online questionnaire to the last. Although it is difficult to attribute a direct cause for this decline, one explanation could be found in the clinics that AURAH2 recruited from, which are specialist centres for chemsex support where interventions are specifically tailored to MSM reporting chemsex (Sewell et al., 2018). As such survey results may be a reflection on the effectiveness of these services at providing valuable support and interventions to reduce chemsex among a specific group of MSM. Furthermore, engagement with questionnaires that encourage reflection on behaviour may play a factor in study participants becoming more conscious of the consequences of their choices, which could have led to behaviour change (McCann & Kyle, 2013); and may partly explain the decrease in chemsex and individual chemsex drug use witnessed in this cohort. Another potential explanation for the decline in chemsex in the cohort over time in the study is regression to the mean. In other words, men may have been recruited to the study at a time of particularly high risk behaviour, which would then tend to decline with time. It appears that men were more likely to have chemsex with more than one and more than two partners as the study progressed, but it became less likely that this sex involved a partner of unknown HIV status, group sex and chemsex drugs.

The number of self-reported new HIV diagnoses (15 semi-conversions) among our cohort over the three-year follow up period is low, even when considered in the context of the steep fall in HIV diagnoses reported by both 30 Dean Street and Mertoner market clinic (Brown et al., 2017) during the same time period as the study follow up. Differently from (Palkanathan et al., 2018), we did not find an association between reporting chemsex and becoming newly diagnosed with HIV in an unadjusted analysis, despite a strong association with FEP and FEPF use. Similarly to what we reported for the AURAH study (cross-sectional) on use of chemsex drugs (Sewell et al., 2017), we found here a significant association between depression and anxiety and chemsex. It has been suggested that use of recreational drugs among MSM could be a part of a behaviour to cope with a feeling of being part of a minority and other stressors (Meyer, 1995; Wollschl, Nall, & Valderrain, 2009).

The estimated prevalence of chemsex at the start of online follow up in the AURAH2 study (32.0%) is similar to that estimated in the cross-sectional analysis of the larger sample (n = 1011) of MSM who completed a baseline paper questionnaire in clinic in 2013/2014 during recruitment to the study (32.3%) (Sewell et al., 2018), and is substantially higher than the prevalence of chemsex drug use observed in the cross-sectional AURAH study conducted in 2011/2013 (prevalence among MSM attending 29 sexual health clinics across England: 21.8%, prevalence among MSM attending the same three sexual health clinics included in the AURAH2 study: 24.2%) (Sewell et al., 2017, 2015). Compared to other clinic based studies, the prevalence of chemsex at the start of online follow up in the AURAH2 study is higher than that reported by a recent retrospective case note review from 2014/2015 among MSM (n = 1794) attending sexual health services in a different area of London (18.5%) (Palkanathan et al., 2018), and similar to that reported among HIV positive MSM in-patients admitted to an HIV unit in 2014 (31%, n = 42) also in London (Elliot, Singh, Teyebly, Godin, & Nelson, 2017). This high prevalence of chemsex at the start of online follow up in the AURAH2 study could also be related to the location of the clinics (London and Brighton), that the study population were recruited from. Both cities were in the top three among 48 cases in Europe where use of t-cams was reported highest among MSM in the 2010 European MSM Internet survey, 2010 (Schmitt et al., 2010). Furthermore, two of the clinics from which participants were recruited from (56 Dean Street and Mertoner Market) are renowned for their chemsex support services in London, which may have resulted in a larger number of MSM who engage in chemsex, opting to attend them. However, the declining trend is chemsex in this longitudinal analysis, from 31.3%–11.1%, over the 3-year follow up period of the AURAH2.
study, indicates that MSM attending sexual health clinics who report chemsex would appear to do so for specific, relatively short periods of time, during which regular attendance at sexual health clinics for STI monitoring, HIV testing and access to PrEP and PTPP would be likely beneficial due to the high risk sexual behaviours (negasi et al., 2017; nowell et al., 2017). Due to the relatively short follow-up period of the online study (3 years) and the loss to follow-up, it is not known whether MSM who stopped reporting chemsex during the course of the AURAE2 online follow-up period have remained abstinent from chemsex or have since reinitiated. Further longitudinal studies with extended follow-up periods would help elucidate this information and qualitative data on stopping and re-initiating chemsex would be beneficial to contextualise our results.

There is limited longitudinal data on chemsex patterns and trajectories among MSM at national or international level with which to compare our results to. The Australian, following zero change (Flux) Study, is an online prospective cohort study (n=1770) that commenced in 2014/2015 and collects biannual data on lijst and illicit drug use among Australian MSM recruited online through social media, gay community websites and gay sexual networking websites (hammond et al., 2017). Recent results from the Flux study described an increase over calendar time in concurrent use of methamphetamines, 'Vagra' and other erectile dysfunction medications, and Truvada® as PrEP (hammond et al., 2018), however no results on chemsex have yet been published. Furthermore, the major difference in study samples (Flux used an online convenience sample while AURAE2 recruited from clinics) and the drugs included in each analysis (Flux: methamphetamine, Vagra® and Truvada®, AURAE2: methadone, crystal methamphetamine and CIBR/GBL) makes it difficult to draw comparisons. A major strength of this study is the large sample size and regular recall period that was used to capture event-level data on chemsex. This allowed us to investigate trends in patterns and frequency of chemsex and individual chemsex drugs. The online retention of participants that registered and completed an online questionnaire was not optimal, however 64.3% of participants completed an online questionnaire within the last six months of the study follow-up period, and there were no significant differences in the main analyses when restricting to people who had completed a questionnaire in the last 6 months of follow-up. Additionally, collecting sensitive and personal information on drug use and sexual behaviour online may have reduced potential social desirability bias (dietlmann, von der heide & rieger, 2015).

As with any study collecting self-reported data, results may be influenced by recall bias, despite the time frame for chemsex and the sexual behaviour measures being within the past 3 months, the maximum period of recall recommended to obtain accurate self-reports (nipper, fisker, reynolds, & johnson, 2010). Potentially both a strength and limitation of the study was the recruitment of participants attending sexual health clinics renowned for their focus on integrating substance use services with sexual health services, and the location of these clinics being in large, urban centres, noted for their gay communities, London and Brighton. Whilst understanding trends in chemsex and sexual behaviour among clinic attendees in these clinics may elucidate patterns in similar high-density areas populated by MSM, it limits the generalisability of our results to include smaller towns and cities and rural areas where service provision is required but often not supplied in the same capacity (wiggins et al., 2018). Additionally, our highly educated, economically stable cohort may not be representative of the wider MSM community, thus limiting the generalisability of our results further. Furthermore, we recognise that our results may not reflect trends in chemsex trajectories and patterns among MSM who are not engaged with sexual health services, where potential for problematic harm associated with chemsex may be greater, despite the risk group being the potential smaller (matroquez, torres et al., 2018).

Conclusions and implications

This is the first study from the UK and Europe to describe changes in patterns of chemsex, frequency of chemsex and sexual behaviour over time among MSM. Chemsex and use of two individual chemsex drugs (mephedrone and CIBR/GBL) significantly declined over time among individuals in the study, as did most of the measures of sexual behaviour except for CCAI with one or more and two or more partners. Whilst the majority of MSM in the study did not report chemsex, there is a clear need for integrated drug and sexual health services, with a focus on health promotion and HIV prevention, such as PrEP and PrEP access, aimed at MSM who report chemsex, and in particular problematic chemsex. Such targeted interventions would be highly beneficial, potentially only necessary for relatively short periods of time for individuals, and could have long term benefits as well as wider HIV and STI prevention.

Author contributions

Design and data collection: JS, AS, AP, FL, D6, BG, DA, NN, AC, JR. Analysis and interpretation: JS, VC, AR. Drafting the manuscript: JS, VC, AS, AP, AR.

Funding

The AURAE2 study was funded by the NIH under its Programme Grants for Applied Research Programme (RP-12112.00000). The AURAE2 Study Group acknowledges the support of the NIH, through the Comprehensive Clinical Research Network. The views expressed in this paper are those of the authors and not necessarily those of the NIH, the NHS, or the Department of Health.

Ethics approval and participant consent

The AURAE2 study was approved by the designated research ethics committee, NRES committee London-East, ref: 14/LO/1881 in November 2014. Based on these documents, the study subsequently received permission for clinical research at the three participating National Health Service sites: Chelsea and Westminster NHS Foundation Trust, Central and North West London NHS Foundation Trust and the Brighton and Sussex University Hospitals NHS Trust. All participants provided written, informed consent before taking part.

Declarations of interest

None.

Study sponsor

The AURAE2 study was sponsored by the Joint Research Office, UCL. The sponsor and funder were not involved in the study design, collection, analysis, and interpretation of data or in the writing of the report; or the decision to submit the article for publication.

Acknowledgements

We would like to thank all the study participants for their time and effort. We particularly acknowledge the 3 participating sites and the contributions and efforts of the following at each site: The Mortimer Market Centre, London: Anna Milinkovic, Fabienne Styles, Roxanne Lawrie, Marissa Corder, Renu Sampat. The Claude Nicol Centre, Brighton: Celia Richardson, Elaney Yeusef, Sashi Kiri, Marion Campbell, Lisa Barbour.
Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:10.1016/j.iirmp.2019.03.021.

References


Appendix XVIII. Poster presentation from the 2nd European Chemsex Forum, Berlin 2018.

Changes in recreational drug use, drug use associated with chemsex, and HIV related behaviours, among HIV negative MSM; in London and Brighton, 2013-2016

Background and Objective

Q There is a great deal of interest in the emerging phenomenon of chemsex (defined in the UK as use of mephedrone, crystal methamphetamine and/or GH/GBL, to enhance, enhance and prolong sexual interactions) which is described almost exclusively within the men who have sex with men (MSM) community.

Q Data from some sexual health clinics suggest there has been a rapid rise in chemsex drug use by MSM within the last few years (1,2), but there is limited data on the prevalence and extent of chemsex drug use.

Q The objective is to compare prevalence of poly drug use, use of drugs associated with chemsex, specific drug use, and HIV related behaviours between two time periods (2013-2014 and 2014-2016), using data from two studies (AURAH and AURAH2) of HIV negative MSM attending the same sexual health clinics in London and Brighton.

Methods

Q AURAH is a cross-sectional, clinic-based study that recruited HIV negative or undiagnosed participants, >18 years, from sexual health clinics across England between June 2013 and September 2014.

Q AURAH2 is a prospective cohort study that recruited HIV negative or undiagnosed, >18 years, MSM from three of the same sexual health clinics (56 Dean Street, London, Morton Market Clinic, London, Clapham North Centre, Brighton) as the AURAH study. Participants were recruited from November 2014 to April 2016. Online follow-up of AURAH2 participants is on-going until March 2018.

Q Data collected from all baseline participants in AURAH2, in MSM are included in this poster.

Q ARI baseline participants in both studies completed the same confidential, self-administered paper questionnaire on demographics (gender, sexual identity, age, ethnicity, UK birth, socio-economic factors, education, employment, housing, money for basic needs), health and lifestyle factors (alcohol use, smoking, symptoms of depression, anxiety, and other mental illnesses), as well as recent sexual behaviours (past three months), and recent recreational drug use (past three months).

Q ARI participants were asked to self-report whether they had used recreational drugs in the last 3 months and, if so, to select which drug or drugs from the following list:

- acid/SDM/medical marijuana
- crystal meth (methamphetamine)*
- mephedrone
- anabolic steroids
- ecstasy (E)
- morphine
- cannabinoids (marijuana, hash)
- GHB/GBL (liquid ecstasy)
- opium
- cocaine (coke)
- heroin
- peppers (and nitrate)
- crack
- ketamine (K)
- speed (amphetamine)
- codeine
- xylazine
- Other (please specify)

Q Two additional measures of recreational drug use were defined (in past 3 months):

- (i) Poly drug use, use of three or more recreational drugs at any time
- (ii) Drug use associated with chemsex*, use of one or more of mephedrone, crystal meth or GHB/GBL.

*The questionnaire did not ask about drug use during sex specifically.

Q Measurements of HIV related behaviours and related activities were derived from the questionnaires. Four measures of condomless sex (CLS) in the past three months: (i) CLS with one or more partners; (ii) CLS with two or more partners; (iii) CLS with partners of unknown HIV status; (iv) CLS with partners of unknown HIV status, but whom they thought the risks of catching HIV were low because their partner was on ART.

Q Six additional measures related to sexual behaviour: (i) diagnosis with a bacterial STI in the past year (Gonorrhoea, Chlamydia, Syphilis, and/or Lymphogranuloma Venereum, LGV); (ii) more than eleven new sexual partners (past year); (iii) group sex (in the past three months); (iv) post-exposure prophylaxis (PEP) use (past year); (v) PEP use (past year) and (vi) recent rapid HIV test (past 6 months).

Statistical Analysis

Q Prevalence of poly drug use, drug use associated with chemsex and specific drug use and prevalence of HIV related behaviours were compared between AURAH and AURAH2, with and without adjustment for sociodemographic factors.

Q All the multivariate models were adjusted for sociodemographic factors: age (continuous variable), ethnicity (born/not born in the UK, White/other ethnicity), education (University level or mainstream), sexual identity (gay or biexual/other or unsure) and relationship status (living relationship or nonliving), to produce adjusted prevalence ratios (APR), using modified Poisson regression analysis.

Results

Q In 2013/14, 1484 MSM participated in AURAH; response rate 80.6%. Of these, 919 MSM attended the same 3 clinics that took part in AURAH2. 1013 individuals participated in AURAH2; response rate 81.2%. In total, 1361 individuals participated in both AURAH and AURAH2 and were excluded from the AURAH2 sample.

Q Participant characteristics in both studies were similar (Table 1). The main difference was the higher proportion of younger MSM (20-29 years) in AURAH2.

Q Changes over time in recreational drug use

Q ARI baseline participants in both studies were asked to select which drugs they had used in the past three months, (AURAH 57.4%, AURAH2 60.4%).

Q The use of drugs associated with chemsex increased significantly from AURAH to AURAH2 (APR 1.15; 95% CI 1.11 - 1.58; p=0.002) (Figure 1).

Q Changes over time in HIV related behaviours

Q Some measures of HIV related behaviours had also significantly increased in AURAH2 compared to AURAH1.

Q Among ARI participants, the proportion of HIV negative MSM attending an STI clinic was not significantly different (AURAH 40.8%, AURAH2 42.6%; APR 1.03; 95% CI 0.85 - 1.24; p=0.73).

Q Among ARI participants, the proportion of HIV negative MSM who self-reported recent sex with a new partner was not significantly different (AURAH 83.6%, AURAH2 85.0%; APR 1.01; 95% CI 0.85 - 1.20; p=0.98).

Q Among ARI participants, the proportion of HIV negative MSM with a known HIV positive partner was not significantly different (AURAH 7.1%, AURAH2 7.6%; APR 1.07; 95% CI 0.88 - 1.29; p=0.46).

Q Among ARI participants, the proportion of HIV negative MSM who reported condomless sex with one or more partners was not significantly different (AURAH 65.3%, AURAH2 67.2%; APR 1.04; 95% CI 0.88 - 1.22; p=0.68).

Q Among ARI participants, the proportion of HIV negative MSM who reported condomless sex with two or more partners was not significantly different (AURAH 26.5%, AURAH2 27.3%; APR 1.05; 95% CI 0.88 - 1.25; p=0.60).

Q Among ARI participants, the proportion of HIV negative MSM who reported condomless sex with a partner of unknown HIV status was not significantly different (AURAH 36.0%, AURAH2 37.3%; APR 1.03; 95% CI 0.86 - 1.24; p=0.81).

Q Among ARI participants, the proportion of HIV negative MSM who reported condomless sex with a partner of unknown HIV status but whom they thought the risks of catching HIV were low because their partner was on ART was not significantly different (AURAH 12.9%, AURAH2 13.2%; APR 1.01; 95% CI 0.84 - 1.22; p=0.93).

Q Among ARI participants, the proportion of HIV negative MSM who reported a diagnosis with a bacterial STI in the past year was not significantly different (AURAH 30.9%, AURAH2 32.7%; APR 1.06; 95% CI 0.89 - 1.26; p=0.46).

Q Among ARI participants, the proportion of HIV negative MSM who had more than eleven new sexual partners in the past year was not significantly different (AURAH 56.4%, AURAH2 60.4%; APR 1.09; 95% CI 0.97 - 1.23; p=0.15).

Q Among ARI participants, the proportion of HIV negative MSM who reported group sex in the past three months was not significantly different (AURAH 53.9%, AURAH2 55.0%; APR 1.02; 95% CI 0.90 - 1.15; p=0.82).

Q Among ARI participants, the proportion of HIV negative MSM who reported post-exposure prophylaxis use in the past year was not significantly different (AURAH 10.8%, AURAH2 11.7%; APR 1.06; 95% CI 0.89 - 1.27; p=0.46).

Q Among ARI participants, the proportion of HIV negative MSM who reported recent rapid HIV test use was not significantly different (AURAH 43.2%, AURAH2 45.3%; APR 1.05; 95% CI 0.88 - 1.26; p=0.55).

Limitations and Conclusions

Q Both 56 Dean Street and Mortimer Market clinic are specialist centres of chemsex support, thus increasing awareness and community engagement around chemsex within these two clinics may have resulted in a larger proportion of those engaging in chemsex opting to attend them, which may account for an overestimation.

Q There have been significant increases in use of drugs associated with chemsex, as well as some increases in condomless sex, among HIV negative MSM from AURAH (June 2013 - September 2014) and AURAH2 (November 2014 - April 2016).

Q Despite the decline in HIV diagnoses in some London clinics, our results demonstrate the increasingly complex needs of some MSM engaging in chemsex for their health, including physical and mental health.
Appendix XIX. Results from Literature review October 2014-October 2019

Results of the updated literature search (1st October 2014- 1st October 2019).

The results of the updated literature search identified 211 papers. From these, 168 were excluded as they did not present data on the UK. Full texts were then assessed (n=43), thirteen were excluded as they did not contain any prevalence data of recreational drug use and four were excluded as they reported duplicate data from studies, already included, and three were excluded as they were the published results of Chapters 6, 7 and 8, and are discussed in context with the literature review results.

Eligible publications identified in the literature search (n=20) were included alongside any found through reviewing citations (n=3, three conference presentations), and one report that was identified through the SIGMA research group website that was not published on Pubmed, into a final data synthesis of 24 eligible publications, summarised in Table 10-1.
<table>
<thead>
<tr>
<th>Author Year (ref)</th>
<th>Population and methods</th>
<th>HIV status</th>
<th>Location</th>
<th>Recall Period</th>
<th>Prevalence of drug use</th>
<th>Sexualised (recall period)</th>
<th>Chemsex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurka et al 2015 (318)</td>
<td>Survey of MSM in four clinical settings in Brighton, STI and HIV clinics, a local NGO (Terence Higgins Trust South) and a walk-in primary care clinic. January and March 2014 (n=246)</td>
<td>Both</td>
<td>England (Brighton)</td>
<td>Ever/rec current use</td>
<td>Club drug use</td>
<td>53.3% mephedrone 37.7%/19.3% GHB/GBL 24.2%/11.0% crystal meth 10.4%/2.8%</td>
<td></td>
</tr>
<tr>
<td>Nathan et al 2015 (314)</td>
<td>Self-completed survey in one sexual health clinic in London, MSM (n=150)</td>
<td>Both</td>
<td>England (London)</td>
<td>(i) any use (ii) last 6 months</td>
<td>(i) 60% (90/150) (ii) party drugs 21% (32/150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mohammed et al 2016 (317)</td>
<td>Pilot study in six sexual health clinics throughout England, August 2013 to April 2014 (n= 8741) (MSM n=519 (5.9%)).</td>
<td>Both</td>
<td>England</td>
<td>Last 3 months</td>
<td>cannabis 6.7% Overall-6.6% MSM-12.1%</td>
<td>mephedrone 10.4% GHB/GBL, 7.1% Injected: mephedrone - 7.4% (4/54), crystal meth 42.1% (8/19)</td>
<td></td>
</tr>
<tr>
<td>Thurtle et al 2016 (319)</td>
<td>Self-completed surveys given to attendees in two sexual health clinics in London, December 2013 to March 2014, (n=1472) (MSM n= 339 (43.6%))</td>
<td>Both</td>
<td>England (London)</td>
<td>(i)Last monthly use (ii) lifetime use</td>
<td>Lifetime use: cannabis 51.0% poppers 64.9% cocaine 42.5% MDMA (pills) 34.2% ketamine 27.2% amphetamine 19.3% LSD 10.6% GHB/GBL 18.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melendez-Torres et al 2016 (61)</td>
<td>Cross-sectional internet survey of MSM recruited from the community in 2011-212 (n=321)</td>
<td>Both UK</td>
<td>Event-level: last sexual encounter</td>
<td></td>
<td>crystal meth (15.2%) crack cocaine (4.0%) heroin (1.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay Men's sex survey^ 2016 (296)</td>
<td>Cross-sectional, self-completed online survey among MSM, July 2014 - October 2014, MSM (n=15,360)</td>
<td>Both UK</td>
<td>(i) last week (ii) last month (iii)last 6 months (iv) last year (v) ever</td>
<td></td>
<td>Injected drugs (2.9%) poppers (41.6%) EDD (22.7%) cannabis (25.9%) ecstasy (15.3%) Chemsex (14.2%) GHB/GBL (9.2%) crystal meth (8.0%) mephedrone (7.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schmidt et al 2016 (136)</td>
<td>Anonymous, self-administered online survey conducted simultaneously in 25 languages across 38 countries amongst MSM (UK n=8,291)</td>
<td>Both UK</td>
<td>Last month</td>
<td></td>
<td>4-chems (GHB/GBL, ketamine, crystal meth and/or mephedrone): UK-4.1% Brighton-16.3% Manchester-15.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
<td>Recreational (recall period)</td>
<td>Sexualised</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
<td>----------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Tomkins et al 2016</td>
<td>A retrospective case note review using a random, powered sample of MSM attending three sexual health clinics across Greater Manchester 2014</td>
<td>Both England (Manchester)</td>
<td>Not stated</td>
<td>18% - recreational drug use. cannabis (7%) cocaine (6%)</td>
<td>3.7% used one of three main drugs typically associated with chemsex.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowden-Jones et al 2017 (315)</td>
<td>Cross-sectional study in London club drug clinic, MSM who attended over a 45 month period 2011-2014 (n=407).</td>
<td>Both England (London)</td>
<td>(i)Last month (ii)ever</td>
<td>(i) injected drugs - 33% (ii) injected drugs-48.9%</td>
<td>73.3% used drugs to facilitate sex GHB/GBL-54.3% crystal meth-47.7% mephedrone-37.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ottaway et al 2017 (316)</td>
<td>Case control study: MSM with an STI attending Brighton sexual health service (n=130) Controls: MSM attending the STI service who did not have an STI (n=130) between 5 May 2015 and 2 November 2015.</td>
<td>Both England (Brighton)</td>
<td>Last 3 months</td>
<td>Cases: 38/122(31%) Controls: 20/125(16%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ottaway et al 2017 (6)</td>
<td>Case note review of MSM attending for PEP at the sexual health service in Brighton during two 4-month periods: November 2013 to February 2014</td>
<td>HIV-England (Brighton)</td>
<td>Reported drug use during PEP episode</td>
<td>9/51(18%) in the 2013-2014 period 41/101(41%) in the 2015 period GHB/GBL, mephedrone and crystal Meth most frequently reported (n not provided)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hegazi et al 2017 (5)~</td>
<td>Retrospective case notes review, all MSM attending two London sexual health clinics between 1 June 2014 and 31 January 2015. MSM (n=818), chemsex (yes/no) documented for 655.</td>
<td>Both</td>
<td>England (London)</td>
<td>Current use (i)&gt;once a month (ii)1-3 times in past 3 months (iii)less often</td>
<td>30% recreational drug use 13.5% (n=27) injecting drugs Poly drug use - 67.3%, 68/101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melendez-Torres et al 2017 (324)</td>
<td>Longitudinal online survey conducted in 2011–2012 in five waves among MSM (n=2142) (sexual encounters n=6742)</td>
<td>Both</td>
<td>UK</td>
<td>Event-level data-last sexual intercourse</td>
<td>Drug use: 42.9% (n=2881)</td>
<td>poppers-20.5% EDD-7.2% cannabis-3.9% MDM-1.7% ketamine – 1.8% cocaine-2.1% crystal meth-1.1% GHB/GBL-1.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and March 2015 to June 2015 (n=152)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>410</td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>-----------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elliot et al 2017 (299)</td>
<td>Prospective opt-out survey for all new HIV-positive admissions over a 10-week period (cases) (n=59) (42/49 (86%)) and all medical Acute Assessment Unit admissions over two 24-h periods (controls) (n=48) (1/17 (6%)) in a London hospital. Oct 2014-Jan 2015.</td>
<td>HIV+ Englan d (Londo n)</td>
<td>Current use</td>
<td>MSM- 45% (19/42) Poly drug use-53% (10/19) Injecting drug use-31% (13/42)</td>
<td>Chemsex-31% (13/42) crystal meth-21% (9/42) GHB/GBL-19% (8/42) mephedrone-17% (7/42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass et al* 2017(340)</td>
<td>Unlinked and Anonymous Monitoring survey of people who inject drugs conducted in general drug services (including needle and syringe programmes) across England, Wales and Northern Ireland, 2013-2015. MSM (n = 323) with the other men (n = 3497)</td>
<td>Both Englan d, Wales, N.Irelan d</td>
<td>‘recent initiative’</td>
<td>Stimulant injection increase: 57%–77% Recent injecting initiates: 13% (42/323) Injected mepedrone-12% Injected ketamine-9.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomkins et al 2018 (321)</td>
<td>Online survey available for ten weeks, promoted in Manchester, January 2016 - April 2016, MSM (n=52)</td>
<td>Both Englan d (Manchester)</td>
<td>Last year</td>
<td>Injecting drug use-37% (19/42)</td>
<td>mephedrone-81% (42/52) GHB/GBL-79% (41/52) crystal meth - 31% (16/42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>-----------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frankis et al 2018 (155)</td>
<td>Cross-sectional, online survey of MSM recruited in 2016 via gay sociosexual media in Scotland, Wales, Northern Ireland and the Republic of Ireland (n=2328)</td>
<td>Both</td>
<td>Scotland, Wales, N. Ireland &amp; Republic of Ireland</td>
<td>(i) ever (ii)last year (iii)last month</td>
<td>(i) 48.8% (ii)27.1% of men who used chemsex drugs reported no sexualised drug use, but 72.9% did</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pufall et al 2018 (311)</td>
<td>2014 survey of people attending HIV clinics in England and Wales were linked to clinical data from national HIV surveillance records and weighted to be nationally representative, May to November 2014, (392 sexually active MSM, 532 all MSM)</td>
<td>HIV +</td>
<td>UK</td>
<td>(i)last year (ii) last month</td>
<td>(i) 54.2% (275/532) (ii)42.5% (201 of 532)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melendez-Torres et al^ 2018 (335)</td>
<td>Latent class (five) analysis using data from 2014 Gay Men’s Sex Survey: open-access, internet-based</td>
<td>Both</td>
<td>UK</td>
<td>Last year</td>
<td>Class 1: minimal users-64.2% poppers-20.4% EDD-11.0% cannabis-10.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Chemsex drug use: (i) chemsex-29.5% (102/392) GHB/GBL - 71.6% (68 of 102) mephedrone-71.4% (76 of 102) (i)Slamsex-10.1% (34/392) crystal meth-69.2%; (24 /34) mephedrone-64.2% (22/34)
<table>
<thead>
<tr>
<th>Author Year (ref)</th>
<th>Population and methods</th>
<th>HIV status</th>
<th>Location</th>
<th>Recall Period</th>
<th>Prevalence of drug use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Heinsbroek et al* 2018 (338)</td>
<td>National, voluntary unlinked-anonymous survey of people who inject drugs in the UK attending services, 2013-2016, MSM n=299</td>
<td>Both</td>
<td>UK (excl Scotland)</td>
<td>Last month</td>
<td>Injecting drug use 82% (242) Sharing of needles and other paraphernalia-49% (114) heroin-85% (250) crack-51% (148)amphetamine (speed)-29% (85)</td>
</tr>
<tr>
<td>Author Year (ref)</td>
<td>Population and methods</td>
<td>HIV status</td>
<td>Location</td>
<td>Recall Period</td>
<td>Prevalence of drug use</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Hibbert et al 2019 (336)</td>
<td>Anonymous, cross-sectional online survey through Facebook advertising and community organisations' social media posts, April-June 2018. MSM n=1648</td>
<td>Both</td>
<td>UK</td>
<td>Last year</td>
<td>Recreational (recall period): 41% poppers-28% cannabis-13% EDD-12% cocaine-10% ecstasy-4%, ketamine-2% amphetamines-1%</td>
</tr>
</tbody>
</table>

Prevalence of drug use: Recreational (recall period)
- 41% poppers
- 28% cannabis
- 13% EDD
- 12% cocaine
- 10% ecstasy
- 4% ketamine
- 2% amphetamines

Abbreviations: MSM- men who have sex with men, STI sexually transmitted infection, NGO non-government organisation, EDD erectile dysfunction drugs, PEP post exposure prophylaxis *^~denotes same data
Appendix XX. AURAH study acknowledgements

The AURAH study group:

Alison J. Rodger, Andrew Speakman, Fiona C Lampe, Andrew N. Phillips, Janey Sewell,
Lorraine Sherr, Richard J. Gilson, David Asboe, Nneka C. Nwokolo, Amanda Clarke, Mark
M. Gompels, Sris Allan, Simon Collins, Christopher Scott, Sara Day, Martin Fisher, Jane
Anderson,
Rebecca O’Connell, Monica Lascar, Vanessa Apea, Maneh Farazmand, Susan Mann, Jyoti
Dhar, Daniel R. Ivens, Tariq Sadiq, Stephen Taylor, Michael Brady, Alan Tang, Rageshri
Dhairyawan, Graham J. Hart, Anne M. Johnson, Alec Miners, and Jonathan Elford.

AURAH clinic teams:

Rageshri Dhairyawan, Sharmin Obeyesekera (Barking), Vanessa Apea, John Saunders,
James
Hand, Nyasha Makoka (Barts and the London), Stephen Taylor, Gerry Gilleran, Cathy
Stretton
(Birmingham), Martin Fisher, Amanda Clarke, Nicky Perry, Elaney Youssef, Celia
Richardson,
Louise Kerr, Mark Roche, David Stacey, Sarah Kirk (Brighton), Mark Gompels, Louise
Jennings,
Caroline Holder, Katie Anne Baker (Bristol), Maneh Farazmand Matthew Robinson, Emma
Street (Calderdale & Huddersfield), Sris Allan, Abayomi Shomoye (Coventry), Nneka
Nwokolo,
Ali Ogilvy (Dean Street), Jane Anderson, Sfiso Mguni, Rebecca Clark, Cynthia Sajani,
Veronica
Espa (Homerton), David Asboe, Sara Day, Ali Ogilvy, Sarah Ladd (John Hunter), Susan
Mann,
Michael Brady, Jonathan Syred, Lisa Hamza, Lucy Campbell, Emily Wandolo, Janagan
Alagarajah (Kings), Linda Mashonganyika, Jyoti Dhar, Sally Batham (Leicester), Richard
Gilson,
Rita Trombin, Ana Milinkovic, Clare Oakland (Mortimer Market), Rebecca O’Connell, Nyasha
Makoka (Newham), Alan Tang, Ruth Wilson, Elizabeth Green, Sheila O’Connor, Sarah
Kempster, Katie Keating-Fedders (Reading), Daniel Ivens, Nicola Tyrrell, Jemima Rogers,
Silvia
Belmondo, Manjit Sohal (Royal Free), S Tariq Sadiq, Wendy Majewska, Anne Patterson, 
Olanike Okolo, David Cox, Mariam Tarik, Charlotte Jackson, Jeanette Honigsbaum, Clare 
Boggon, Simone Ghosh, Bernard Kelly, Renee Aroney (St George’s), Christopher Scott, Ali 
Ogilvy (West London Clinic for Sexual Health), and Monica Lascar, Nyasha Makoka, Elias 
Phiri, 
Zandile Maseko ( Whipps Cross).

AURAH (core) Study Group: Alison Rodger, Fiona Lampe, Andrew Phillips, Andrew 
Speakman.

AURAH data managers: Andrew Speakman, Ada Miltz and myself (Janey Sewell).

AURAH study nurse coordinator: Janey Sewell.

AURAH advisory board: Lorraine Sherr, Graham Hart, Simon Collins, Anne Johnson, Alec 
Miners, and Jonathan Elford.

CAPRA advisory board: Sir Nick Partridge, Kay Orton, Anthony Nardone, and Ann 
Sullivan.
Appendix XXI. AURAH2 study acknowledgements

The AURAH2 study group:

Dr Alison Rodger, Dr Fiona Lampe, Prof Andrew Phillips, Dr Andrew Speakman, Janey Sewell, Dr Richard Gilson, Dr David Asboe, Dr Nneka Nwokolo, Dr Amanda Clarke, Tony Nardone (Public Health England), Prof Lorraine Sherr (Department of Infection and Population Health, UCL, Royal Free Campus, Prof Graham Hart (Department of Infection and Population Health, UCL, Dr Valerie Delpech (Public Health England, Simon Collins (HIV i-Base), Prof Anne Johnson (Department of Infection and Population Health, UCL, Susan Michie (University College London), Prof Jonathan Elford (School of Health Sciences, City University London)

The AURAH2 study clinic teams:


56 Dean Street Clinic, London: Dr David Asboe, Dr Nneka Nwokolo, Ali Ogilvy.

The Claude Nicol Centre, Brighton: Dr Amanda Clarke, Celia Richardson, Elaney Youssef, Sarah Kirk, Marion Campbell, Lisa Barbour.


AURAH2 data managers: Andrew Speakman and myself (Janey Sewell).

AURAH2 study nurse coordinator: Janey Sewell.

AURAH2 advisory board: Tony Nardone, Prof Lorraine Sherr, Prof Graham Hart, Dr Valerie Delpech, Simon Collins, Prof Anne Johnson, Susan Michie, Prof Jonathan

PANTHEON advisory board.
References

41. Drumright LN, Patterson TL, Strathdee SA. Club drugs as causal risk factors for HIV acquisition among men who have sex with men: A review. Substance Use & Misuse. 2006;41(10-12):1551-601.


Vernazza P HB, Bernasconi E, Flepp M. Les personnes séropositives ne souffrant d’aucune autre MST et suivant un traitement antirétroviral efficace ne transmettent pas le VIH par voie sexuelle (HIV infected patients under HAART without any other sexually transmitted infection do not transmit HIV by sexual intercourse). 2008.


139. Stuart D. Chemsex: origins of the word, a history of the phenomenon and a respect to the culture Drugs and Alcohol Today. 2019 Vol. 19 (No. 1):3-10.
152. Public Health England Substance misuse services for men who have sex with men involved in chemsex. 2015.


Kurka T, Soni S, Richardson D. O10 Msm report high use of club drugs which is associated with high risk sexual behaviour. Sexually transmitted infections. 2015;91(Suppl 1):A4-A.


