METHOD ARTICLE

# Implementing remote data collection methods in an address-based probability sample for a population-based sexual health survey (Britain's fourth National Survey of Sexual Attitudes and Lifestyles, Natsal-4)

[version 1; peer review: awaiting peer review]

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## Abstract

### Background

The National Surveys of Sexual Attitudes and Lifestyles (Natsal) are decennial probability sample surveys, representative of the British population and have previously been conducted face-to-face. The fourth Natsal survey was under development when the COVID-19 pandemic began in early 2020. Pilot fieldwork was delayed while remote data collection options were considered.

### Methods

In 2020/21, we evaluated three potential remote data collection models by considering their ability to deliver Natsal's key survey design features: sample quality, selection of one participant per household, boost samples, a long interview (~60 minutes) with complex routing, a self-completion element, biological sampling, data linkage and time-series maintenance. Our chosen design prioritised in-person interviewing, with a remote option where necessary or preferred, rather than participant-led choice or experimental allocation, to minimise differences with previous Natsal surveys and maximise response to biological sampling and data linkage. Two pilot

studies were carried out (summer 2021 and spring 2022), incorporating the adapted study design and procedures.

**Results**

The requirements of the study at the time were best met by a model that used an interviewer-led doorstep contact approach, prioritised in-person interviewing and provided an option of remote data collection (by telephone or video). The implementation of a remote mode required significant adaptation to the existing study design. Remote interviews included interviewer-administered questions, an online self-completion questionnaire, biological sampling, and data linkage consent. Across the two pilot studies 30% (n=79/261) of interviews were conducted using remote methods. Response to biological sampling and data linkage consent were lower in remote interviews (34% and 61%, respectively) compared to face-to-face (56% and 80%, respectively).

Mainstage Natsal-4 address-based probability sample fieldwork retained a remote option, but emphasised in-home interviewing as the preferred mode.

**Conclusions**

We demonstrated the feasibility and acceptability of adapting a complex interviewer-administered bio-behavioural survey to enable remote data collection.

## Plain Language Summary

We are living in a time when many large surveys need to rethink how they collect data. This article shares what we learnt from Britain's fourth National Survey of Sexual Attitudes and Lifestyles (Natsal-4) about updating our approach for address-based probability sample data collection. Instead of only using face-to-face interviews, we added the option for people to take part remotely, i.e. by telephone or video call. We show that it is possible to a) run long and complex interviews where people answer some questions on their own and some that are asked by an interviewer, b) collect biological samples, and c) ask for permission to link survey answers to other data records, even when interviews take place remotely. However, compared to face-to-face interviews, fewer people agreed to provide a biological sample or consent to their data to be linked to other records. While making these changes required careful planning, it helped us give people more ways to take part in our survey. It also makes it easier for long-running surveys like ours to adapt if face-to-face interviewing becomes too difficult in the future.

## Keywords

Remote data collection; mode differences; biological sampling; data linkage; sexual health

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## Introduction

The National Surveys of Sexual Attitudes and Lifestyles (Natsal) are repeat cross-sectional probability sample surveys, representative of the British population. The series provides robust and detailed insight into the sexual health of the general population. The first three Natsal surveys (1990–91, 1999–2001, 2010–12) used address-based probability sampling and data collection was carried out in-person by trained non-clinical interviewers, typically in participants' homes. Natsal data have been used extensively to guide policy and practice, including to improve relationship and sex education, design and evaluate interventions (for example, chlamydia screening, teenage pregnancy strategy, HPV vaccination) and guide policy on the delivery of health services (Mercer *et al.*, 2019).

Following a detailed review of potential survey methodologies (Clifton *et al.*, 2019) a similar survey design was planned for Natsal-4. The decision to continue with in-person data collection for Natsal-4 was driven by a range of study design features, such as the questionnaire length and complexity, the use of both interviewer-administered and self-completion questions, the inclusion of biological sampling, a request for consent to data linkage, and maintenance of the time-series.

Preparation for Natsal-4 was well underway at the beginning of the COVID-19 pandemic. Numerous development activities had been undertaken including an online stakeholder consultation (Ridge *et al.*, 2020), questionnaire development (involving expert and lay reviews), cognitive question testing (Clifton *et al.*, 2019), programming and testing data collection instruments, development of fieldwork protocols and materials and securing ethical approval for piloting. Natsal-4 pilot fieldwork was due to commence in May 2020, however, in March 2020 in-home social research interviewing was suspended because of the UK's first national lockdown in response to the COVID-19 pandemic (Prime Minister's Office, 10 Downing Street, 2020). The decision was taken to delay pilot fieldwork and assess the feasibility of using a remote mode as an alternative to in-person data collection. At the time, the extent and length of lockdown restrictions were unknown, however we wanted to prepare for different scenarios: one where all types of face-to-face (in-person) interviewing activity was precluded; and others where some face-to-face interviewing would be possible but we would need to accommodate local or temporary lockdowns, ongoing shielding for specific at-risk groups and unwillingness from some participants to allow an interviewer into their home. Only methodological approaches that retained address-based probability sampling (PAF) methods were considered. Three models of remote PAF data collection were considered (Box 1).

**Box 1. Remote address-based probability sampling (PAF) data collection options**

**Model 1 - Remote self-administration**

In this model, participants self-administer data collection, removing the need for interviewers. A postal approach would be used to invite residents to complete the survey using an online or paper questionnaire. This method is often referred to as a **'push-to-web'** survey whereby online completion is encouraged (to minimise print and postage costs, and allow for complex questionnaire routing) but paper questionnaires are offered to non-responders to minimise coverage and non-response bias in the sample, in particular to enable inclusion of those who are unable or unwilling to complete an online survey (Cornick *et al.*, 2019; Ipsos MORI, 2017; Williams, 2017).

**Model 2 - Remote interviewer-administration**

This model involves remote data collection methods, eliminating the need for face-to-face contact, but still utilising professional survey interviewers. Invitation letters would be sent by post asking residents to participate in the study. Participants would be asked to provide their contact details and data collection would be conducted by telephone or video interview. We refer to this method as '**push-to-telephone/video**'.

**Model 3 - In-person interviewer-administration, with remote options**

The third model provides flexibility with a choice of face-to-face or remote participation. Initial contact with selected addresses and the random selection of one eligible participant would be carried out in-person by a trained interviewer on the doorstep. Participants may then be interviewed face-to-face, or remotely, depending on current pandemic restrictions and participant preference. Participant contact information required for remote interviewing would be collected on the doorstep. Protocols to mitigate infection risks for interviewers and participants would be employed on the doorstep and, where applicable, in people's homes.

This paper describes (i) the process of evaluating the suitability of the three models of remote PAF data collection, (ii) the adaptation of the Natsal-4 survey design to incorporate remote PAF data collection; and (iii) outcomes from field testing remote PAF data collection options in two pilot studies.

## Methods

### (i) Evaluation of remote PAF data collection models

Several features of the Natsal surveys ensure the collection of high-quality data that are widely used to inform policy and practice. Key survey features were initially considered, prior to the pandemic, when designing Natsal-4 (Clifton *et al.*, 2019) and revisited in 2020 in light of pandemic restrictions and the need for a remote data collection option. The key Natsal-4 survey design features were:

1. Sample quality & survey response

2. Random selection of one participant per household

3. Boost samples for specific population groups

4. Interview length

5. Self-completion questionnaire

6. Biological sampling

7. Consents to future research (follow-up studies / linkage to administrative datasets)

8. Time series maintenance

Details of these survey design features are set out in Box 2. The strengths and weaknesses of each of the three remote data collection models were assessed in relation to the survey design features and used to inform our decision about the preferred approach.

**Box 2. Natsal-4 key address-based probability ('PAF') survey design features**

**1. Sample quality & survey response**

Unlike most surveys of sexual and reproductive health, a key feature of Natsal is probability sampling of the general population and a high survey response rate. This provides a good level of confidence about sample quality and risks of sample bias.

**2. Random selection of one participant per household**

The Natsal survey series involve the random selection of one adult participant within each selected household. The very sensitive subject matter raises concerns regarding ethics and data quality with an approach that includes more than one participant within a household.

**3. Boost samples for specific population groups**

The Natsal-4 design intended to include young person and ethnic minority boost samples, to ensure the possibility of robust sub-group analyses in these groups that experience a disproportionate burden of adverse sexual and reproductive health outcomes.

**4. Interview length**

The Natsal-4 questionnaire covers a comprehensive range of topics relating to sexual health. It lasts an average of 60 minutes in total. Modularising the questionnaire content to reduce length is not feasible due to the complex routing between questionnaire modules and analytical requirements.

**5. Self-completion questionnaire**

The interview includes a relatively long self-completion module, about 30 minutes, covering the most sensitive questions. These questions are administered using Computer Assisted Self-Interviewing (CASI). Routing through the self-completion element is highly complex and unsuitable for paper administration.

**6. Biological sampling**

Natsal-4 participants are invited to provide a self-collected biological sample (either vaginal swab or urine) to enable estimates of the prevalence of Sexually Transmitted Infections (STIs), including asymptomatic and undiagnosed infections.

**7. Consents to future research (follow-up studies / linkage to administrative datasets)**

Natsal participants are asked for their permission to be re-contacted for future research and to link their survey data to administrative records. It is important to ensure consent to future research is informed and that agreement rates are maximised.

**8. Time series maintenance**

Results from Natsal-4 will be compared with previous surveys in the series. Consistent survey design methods and core question wording means that differences in survey estimates over time can be attributed to real change in the population rather than design differences.

### (ii) Implementation of remote PAF study design

To operationalise the preferred remote data collection model, substantial development work was undertaken to adapt the study design for remote settings. We implemented a range of modifications to the fieldwork procedures, questionnaire, fieldwork documents, consent processes and biological sampling protocol.

### (iii) Piloting PAF data collection

Two PAF pilot studies were undertaken using the adapted study design. The pilots aimed to test all fieldwork procedures and processes; the different mode administrations; response rates to the survey, biosamples and data linkage; the questionnaire (e.g. length, flow, routing, question wording); biological sampling protocol; and data linkage consent procedures.

The first pilot study took place June-July 2021. At this stage there had been a gradual easing of COVID-19 restrictions, from the third national lockdown in January 2021 to the removal of all legal limits on social contact by mid-July 2021 (Institute for Government, 2022). Survey interviews were carried out with 130 participants aged 16–59 in England and qualitative follow-up interviews were conducted with 20 survey participants. Recruitment of follow-up interview participants used quotas (gender, age, survey mode & biological sample consent) to ensure a range of views and experiences were captured.

The second pilot study took place February-March 2022, at which stage COVID-19 restrictions in response to the first Omicron wave had recently been lifted, including advice to work from home where possible, mandatory face-coverings and the use of COVID-passes in indoor settings (Prime Minister's Office, 2022). Survey interviews were carried out with 131 people aged 16 to 59 in England, Scotland and Wales. In the second pilot, each interviewer assignment comprised core (eligible age range: 16 to 59 years) and young person boost (eligible age range: 16 to 29 years) samples.

Pilot findings drew on a range of information sources including survey data, paradata, interviewer feedback (provided during debriefing sessions and on feedback forms) and participant feedback (from qualitative follow-up interviews).

Ethical approval for the pilot studies was provided by the East Midlands - Leicester South Research Ethics Committee (Reference no. 20/EM/0025, 24 February 2020 for Pilot 1 and 09 December 2021 for Pilot 2).

## Results

### (i) Evaluation of remote PAF data collection models

A detailed assessment of the strengths and weaknesses of each alternative data collection model (model 1 (remote self-administration), model 2 (remote interviewer-administration) and model 3 (in-person interviewer-administration, with remote options)) in relation to the eight key survey design features is set out in Box 3. To summarise the detailed

**Box 3. Strengths and weaknesses of remote PAF data collection models for Natsal-4**

| Remote data collection model | Survey design feature |
|---|---|
| | **Sample quality & survey response** |
| **Model 1: Remote self-administration** | A push-to-web approach would achieve a significantly lower response rate compared to previous Natsal surveys prompting concern about bias in the achieved sample. Evidence suggests people in lower income, ethnic minority groups, renters and with lower educational attainment are less likely to respond to push-to-web surveys, risking bias in key measures (Department for Culture, Media and Sport, 2015; Knudsen *et al.*, 2010; Office for National Statistics, 2020; Williams, 2017). |
| **Model 2: Remote interviewer-administration** | At the time of assessment, there was very limited evidence regarding response rates and bias in video and telephone surveys where participants were asked to actively provide their contact details. Early indications from surveys that had moved to this model suggested response rates would be well below those achieved using face-to-face methods (and indeed this was borne out on a number of large-scale national studies) (Christie *et al.*, 2022; NatCen Social Research and University College London, 2022). This was unsurprising given the opt-in nature of the design and pertinent for Natsal, where salience of the survey topic correlates with the likelihood of participation. For example, evidence shows higher reporting of same-sex behaviour and minority sexual identity in convenience sample surveys compared to high quality probability sample surveys (Legleye *et al.*, 2018; Geary *et al.*, 2019). |
| **Model 3: In-person interviewer-administration, with remote options** | An in-person interviewer-administered model would facilitate a sample design comparable to previous Natsal surveys. It aimed to maximise response and minimise bias by enabling those who were unable or unwilling to allow an interviewer into their home to take part by video or telephone. At the time of assessment, it was not known what face-to-face surveys response rates would look like either during or after the COVID-19 pandemic, but it was reasonable to assume that providing the option of remote data collection would achieve a higher response rate than a design that only permitted face-to-face data collection. |
| | **Random selection of a single participant per household** |
| **Model 1: Remote self-administration** | The random selection of a single adult in the household is difficult to achieve without facilitation by an interviewer. There is evidence from postal and push-to-web surveys that have attempted to select an individual participant that residents often make errors, or selection rules are ignored and the responding individual is not the target participant in about 20%–25% of cases (Department for Culture, Media and Sport, 2015; Olson *et al.*, 2014; Villar & Fitzgerald, 2017). For this reason, the preferred approach is usually to interview all adults in the household, up to an agreed maximum. For Natsal, however, this creates a range of ethical and data quality concerns, given the very sensitive content of the study. |
| **Model 2: Remote interviewer-administration** | Unlike the first model, the random selection of a single adult in the household would be carried out by the interviewer. After making contact with someone in the household, interviewers would be able to conduct the selection process over the phone and either proceed with the interview or make an appointment to speak to the selected individual. |
| **Model 3: In-person interviewer-administration, with remote options** | The selection of random adult in the household would be carried out by the interviewer, in-person on the doorstep, in the same way as previous Natsal surveys. |
| | **Boost samples for specific population groups** |
| **Model 1: Remote self-administration** | The requirement for boost samples presented a challenge for remote data collection methods. Address-based sample frames do not provide any information about the characteristics of individuals resident at each address. For some boost samples, area-level information from the census can be used to target areas that are known to contain a higher density of specific groups, but even using this technique, the vast majority of addresses will be ineligible to participate.<br>Theoretically, invitation mailings could be sent to a sample of addresses and a remote screening process attempted, in the invitation letter and/or using a question at the start of the questionnaire. However, the low eligibility and response rates anticipated using this method would require a huge issued sample and would be very cost inefficient. There would also be no way of verifying whether the screening process was successful; some ineligible recipients may be motivated to falsify data in order to receive the survey incentive. Given the relatively low eligibility rates for the planned Natsal-4 boost samples (i.e. young people and people from minority ethnic backgrounds), we decided not to attempt their inclusion using a push-to-web survey method.<br>An added complication for Natsal-4 is the fact that only those aged between 16 and 59 are eligible to participate. To our knowledge, no push-to-web surveys have attempted to screen for age eligibility therefore adherence to screening instructions in the absence of an interviewer is unknown. Limiting the sample to a specific age range may prove infeasible. |
| **Model 2: Remote interviewer-administration** | The requirement for boost samples posed similar problems for remote interviewer-administered designs as described above for push-to-web designs. We decided not to implement boost samples using a push-to-telephone/video method. |

| Remote data collection model | Survey design feature |
|---|---|
| **Model 3: In-person interviewer-administration, with remote options** | Initial doorstep contact enables the implementation of boost samples into this data collection model, mirroring the original Natsal-4 sample design. |
| | **Interview length** |
| **Model 1: Remote self-administration** | A significant drawback of the push-to-web design would be the limitation imposed on the questionnaire length. To encourage participation, it is recommended not to exceed 20–30 minutes in an online questionnaire, or around 12 pages of questions in a paper version. Evidence shows that longer paper questionnaires tend to get lower response rates (Edwards *et al.*, 2002; Nicolaas *et al.*, 2015). The Natsal-4 questionnaire content would need to be reduced to essential content only. Matrix sampling and questionnaire modularisation were ruled out due to the complex routing between questionnaire modules and analytical requirements of the study. |
| **Model 2: Remote interviewer-administration** | The implementation of remote interviewer-administered model would require a shorter interview than the traditional in-person mode. A common rule of thumb for the maximum acceptable telephone interview length is around 30 minutes and, given the lack of evidence relating to video interviewing, a similar limit seemed like a reasonable assumption. The planned Natsal-4 questionnaire content would need to be significantly reduced. |
| **Model 3: In-person interviewer-administration, with remote options** | The full Natsal-4 interview can be conducted in the face-to-face interviews. It was anticipated that the video and telephone interview options would need to be shorter than the in-person mode, although there was little or no evidence for this specific data collection model where an interviewer had made contact in-person and then collected data remotely. We speculated that interviewer interaction on the doorstep would enable a longer interview than might be anticipated from a typical telephone survey.<br>The full interview length for remote modes could be tested during piloting and if it proved infeasible then there would be a need to either reduce the interview length across all modes or to create a 'short interview' for those who take part remotely. |
| | **Self-completion questionnaire** |
| **Model 1: Remote self-administration** | By its nature, remote self-administration model utilises self-completion data collection. However, the desire to include a paper version of the questionnaire to reduce sample bias means that complex routing and the use of textfills will not be possible.<br>The self-completion element of Natsal-4 ensures privacy, however historically interviewers have often played an important role to ensure an inclusive and ethical approach in the collection of sensitive information.<br>They also ensure privacy and a lack of surveillance. They are able to show participants how to navigate the questionnaires and reassure participants who are reluctant to use the technology.<br>The interview can be distressing; interviewers ensure that the correct signposting and safeguarding procedures are followed. This may be more challenging remotely.<br>Alternative solutions to overcome these issues would need to be explored in the absence of an interviewer. |
| **Model 2: Remote interviewer-administration** | The administration of a self-completion questionnaire is not straightforward when using video or telephone interviewing. A potential solution is to send participants a web link to an online questionnaire; this would be limited to those who have internet access and a device on which to complete the questionnaire.<br>Given the restrictions on the length of video and telephone interviews, it was not recommended to include a substantial self-completion element for this model of data collection unless significant questionnaire cuts could be made elsewhere. The omission of a self-completion would, however, be a major limitation for Natsal-4 since many of the key survey estimates come from the self-completion element. |
| **Model 3: In-person interviewer-administration, with remote options** | The self-completion module of the Natsal-4 interview can be conducted using CASI in the face-to-face interview. As stated earlier, we speculated that participants may be willing to take part in a longer interview where they have had interaction with an interviewer on the doorstep, in which case an online self-completion within the remote telephone/video interview could be feasible. The self-completion could either be administered during or after the interview. Given the lack of evidence regarding response to a post-interview self-completion request, Natsal could pilot an approach where interviewers waited while participants complete the self-completion questionnaire mid-interview. This replicates the in-person approach, and piloting would establish whether it was acceptable to participants. |

| Remote data collection model | Survey design feature |
|---|---|
| | **Biological sampling** |
| **Model 1: Remote self-administration** | Although theoretically possible, we decided against asking participants to provide biological samples in the remote self-administered model. There was no evidence available regarding take-up of biological sampling samples among a cross-sectional survey sample, using a push-to-web method. There are some examples of longitudinal surveys where biological sampling collection has been administered remotely (Breakthrough Generations study, Understanding Society) (Al Baghal *et al.*, 2021; Generations, 2024) but they have relied on relatively motivated existing study participants.<br>Our previous experience conducting health and biomedical surveys suggested that fieldworkers play a pivotal role gaining high participation rates in biological sampling. Interviewers and nurses are able to explain the importance of these elements of the survey, address concerns and answer participants' questions. They also ensure that samples are dispatched to the laboratory after collection, which was another potential hurdle for a self-administration methods (Erens *et al.*, 2013). |
| **Model 2: Remote interviewer-administration** | As with Model 1, it would be theoretically possible to invite participants to provide a biological sample over video call or by telephone. We would anticipate a higher uptake with the interviewer-led method compared to online or paper questionnaire.<br>A remote biological sampling protocol could be trialled during piloting; those who agree to provide a biological sample could either be sent a self-collection kit by post or an interviewer could administer collection using a socially-distanced doorstep collection protocol. However, the decision to include biological sampling in the push-to-video/telephone mode would need to be carefully balanced against the other data collection priorities, given the restrictions on interview length and uncertainty about response rates to remote biological samples. |
| **Model 3: In-person interviewer-administration, with remote options** | In-person participants would be invited to provide a biological sample towards the end of the interview, once interviewers have established a rapport with participants.<br>As above, it would be possible to invite participants to provide a biological sample over video call or by telephone. It was recommended that piloting included an approach where video and telephone participants were invited to provide a biological sample, either by post or using a socially-distanced doorstep collection protocol. |
| | **Consents to future research (follow-up studies & linkage to administrative datasets)** |
| **Model 1: Remote self-administration** | Requesting participant consent to recontact them about future research and for data linkage in remote data collection methods is feasible. However, existing evidence suggests that lower consent rates would be obtained compared to interviewer-administered methods (Jäckle *et al.*, 2018; Sakshaug *et al.*, 2017). |
| **Model 2: Remote interviewer-administration** | The collection of consents to data linkage have been successfully implemented by telephone interviewing previously. We would expect higher rates of agreement compared to a push-to-web approach (due to the interviewer rapport), but lower than during a face-to-face approach (Thornby *et al.*, 2018). |
| **Model 3: In-person interviewer-administration, with remote options** | Obtaining consents to future research and data linkage should be possible in each of the data collection modes. Paper consent forms can be used to collect written consent face-to-face and can also be left with those who opt for a video or telephone call at the time of doorstep contact. Alternatively, electronic consent capture could be explored for all participants. |
| | **Time series maintenance** |
| **Model 1: Remote self-administration** | A departure from the previous methodological approach carries the risk of measurement differences that could lead to reduced comparability over time. Measurement differences tend to be minimised within self-completion administrations (for example, paper, web, CASI) and within interviewer-administered questions (for example, face-to-face, telephone, video) (Cernat *et al.*, 2016; Chang & Krosnick, 2010; Jäckle *et al.*, 2010). The sole use of self-administration would likely confound time-series analysis for some variables.<br>The inclusion of a paper questionnaire under this model would require substantial modification to the existing Natsal-4 questionnaire due to the extensive routing and use of textfills. It would also likely result in higher inconsistent data and item-non response for those completing the paper questionnaire (Johnson *et al.*, 2001). |
| **Model 2: Remote interviewer-administration** | The push-to-video/telephone approach (using the proposed 30 minute interview, with no self-completion) would result in measurement differences compared to previous Natsal surveys, leading to reduced comparability for the time series. Questions that have historically been asked by a field interviewer would not always be delivered in the same way (for instance, where questions require show cards or are relatively complex). But perhaps most significantly, questions previously delivered as part of a CASI section could not reliably be administered in this mode without a high risk of measurement differences. |
| **Model 3: In-person interviewer-administration, with remote options** | The requirement to maintain continuity in the time series would be best met by this model, which maintains a predominantly face-to-face approach, but augments that with an alternative remote mode for situations where in-person interviewing is not possible or desirable. The remote interview would include showcards and an online self-completion section, such that the data collection mode for each survey question would be maintained regardless of whether data collection is collected in-person or remotely. |

evaluation, each model was awarded a summary score, between 0 and 3 stars, for each of the survey design features (Figure 1).

The aim to maximise the survey **response rate and sample quality** was best achieved with model 3, where initial contact by interviewers on the doorstep was expected to achieve better results than either model 1 or 2 which both rely on sampled individuals' proactive participation. The **random selection of a single participant** at sampled household could only reliably be achieved in model 2 or 3, where interviewers would carry out the selection process. Alternative solutions, such as multiple participants per household, were not deemed appropriate for Natsal due to ethical concerns. The inclusion of **boost samples** was only deemed feasible in model 3, where interviewers could carry out eligibility screening on the doorstep.

The implementation of a relatively **long interview** (approx. 60 minutes) would be best achieved with model 3: we anticipated that model 2 would require some reduction in interview length and model 1 would need a substantial reduction. Although it was possible that the remote option in model 3 may require some reduction in interview length, we felt that initial piloting could include a full-length version to access acceptability.

The requirement for a **self-completion questionnaire** would be achievable with model 1, but the need for a paper version would require substantial changes from the planned computerised version. We speculated that the inclusion of an online self-completion within model 2 was possible but acknowledged the uncertainty about coverage bias (i.e. excluding the offline population entirely), self-completion length and competing interview content priorities. The third model offered the most satisfactory solution, where the CASI (computer assisted self-interview) self-completion would be retained in face-to-face interviews and the feasibility of an integrated online self-completion would be piloted.

The requirement to collect **biological samples** was theoretically possible with models 1 and 2 but we anticipated greater success with an approach that involved in-person administration by an interviewer and therefore favoured model 3, with a remote biological sampling protocol enabled for those who took part remotely. We anticipated that **consent rates to future research** (i.e. follow-up studies and data linkage requests) would be lowest in model 1, followed by model 2 and highest in model 3.

To reduce disruption to the **Natsal data time series**, a model that minimised measurement differences was preferred. Model 1

| | PAF Data Collection Model | | | |
|---|---|---|---|---|
| | **Original design** | **Model 1: Remote self-administration** | **Model 2: Remote interviewer-administration** | **Model 3: In-person interviewer-administration, with remote options** |
| **Design Feature** | **Face-to-face (CAPI+CASI)** | **Push-to-web (online / paper)** | **Push-to video or telephone (+ online)** | **Face-to-face / video / telephone (+ online)** |
| **Sample quality / survey response** | ★★☆ Anticipate lower than pre-pandemic | ★☆☆ | ★☆☆ | ★★★ Anticipate similar to pre-pandemic |
| **Random selection of individual** | ★★★ | ☆☆☆ c. 1 in 4 incorrect individual | ★★★ | ★★★ |
| **Boost samples** | ★★★ | ☆☆☆ | ☆☆☆ | ★★★ |
| **Interview length** | ★★★ | ☆☆☆ | ★☆☆ | ★★☆ Possibly reduce for remote options |
| **Self-completion** | ★★★ | ★★★ But simple routing necessary | ★☆☆ Not possible for offline population | ★★☆ Not possible if remote + offline |
| **Biological sampling** | ★★★ | ☆☆☆ | ★☆☆ | ★★☆ |
| **Consents to future research** | ★★★ | ★☆☆ Low take-up anticipated | ★★☆ Lower take-up anticipated | ★★★ |
| **Time-series maintenance: Interviewer data** | ★★★ | ☆☆☆ Risk of measurement differences | ★★☆ Some risk of measurement differences | ★★☆ Some risk of measurement differences |
| **Time-series maintenance: Self-completion data** | ★★★ | ☆☆☆ Risk of measurement differences | ★☆☆ Not possible for offline population or risk measurement differences | ★★☆ Not possible if remote + offline, or risk measurement differences |

**Figure 1. Strengths and weaknesses of alternative PAF data collection options for Natsal-4.** Legend: CAPI = computer-assisted personal interview; CASI = computer-assisted self-interview; ☆☆☆ to ★★★ = summary score of design feature, from 0 to 3 stars.

posed the greatest risk to the time series, followed by model 2 and then model 3 (in which the administration of questions either by interviewers or self-completion would be mirrored across modes).

The requirements of the Natsal study design were best met by model 3 (in-person interviewer-administration, with remote options) across nearly all of the survey design features, as indicated in by the number of stars awarded in Figure 1. Following discussions with the project delivery team and input from the study's External Advisory Group, we decided to implement and pilot this approach.

### (ii) Implementation of remote PAF study design

***a) Mode of administration.*** We decided to prioritise in-person interviewing, opposed to participant-led choice or experimental allocation, to minimise differences between previous Natsal surveys and maximise item response to biological sampling and data linkage. In practice, remote options were mentioned in advance participant materials, but interviewers were asked to prioritise face-to-face interviewing and to only offer alternative modes if participants displayed reluctance to the in-person interview. Additional interviewer training was required for remote interview administration, particularly setting up and conducting video interviews.

Each element of the study, and the order of administration, was replicated as closely as possible in the remote method. A summary of the revised Natsal-4 data collection processes is shown in Figure 2.

In response to the COVID-19 pandemic, organisational field interviewing protocols were implemented during fieldwork by the National Centre for Social Research, for use on the

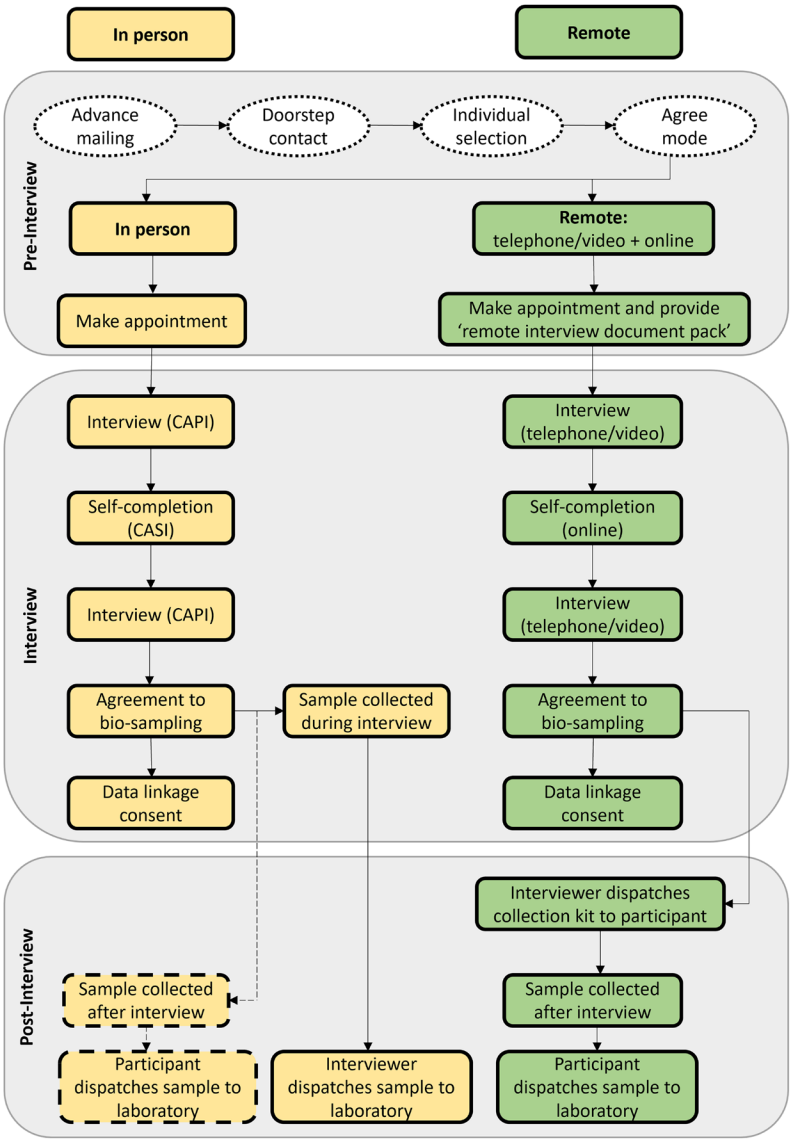


**Figure 2. Natsal-4 PAF data collection processes: in-person and remote modes.** Legend: CAPI = computer-assisted personal interview. CASI = computer-assisted self-interview.

doorstep and in people's home. These protocols were informed by risk assessments and focussed on mitigating risk to field-workers and research participants. Protocols for interviewers included personal health checks, regular lateral flow testing, adherence to national Test and Trace programmes (Comptroller and Auditor General, 2021), social distancing measures, good hand hygiene, face coverings, no 'walk-in' interviews, agile doorstep risk assessment before entering participants' homes, administration of participant health screening, the use of PPE where necessary (e.g. biological sampling), maintaining ventilation, wiping down devices between users, and single-use showcards.

***b) Questionnaire adaptations.*** Some changes to the pilot questionnaire content were made in response to the COVID-19 pandemic, regardless of mode. This included the addition of questions about Intimate Partner Violence, loneliness and non-suicidal self-harm.

The decision to use a consistent mode of administration for each question (either interviewer-administered or self-completion) regardless of whether the interview was remote or face-to-face meant that minimal adaptations to the Natsal-4 questionnaire were needed for the remote version. Some minor changes, such as to interviewer instructions, were required throughout.

The administration of the online self-completion questionnaire within remote interviews required careful consideration. Several options were reviewed: before, after or during the interview with varying levels of interviewer support. It was decided to retain the original placement of the self-completion, sandwiched in the middle of interviewer-administered sections, with the interviewer remaining on the call throughout. This model minimised question order effects between the face-to-face and remote modes and we anticipated it would maximise completion rates. Access to the self-completion questionnaire was via an email to the participant with unique URL; the email was automatically generated by the interview program and sent instantly. As a back-up, interviewers could read out a short URL and access code to participants.

***c) Ethical considerations.*** The introduction of remote data collection for very sensitive questionnaire content raised ethical considerations regarding participant well-being and safety. The Natsal-4 interview includes many sensitive topics (e.g. sexual practices, sexual violence, child sexual abuse, reproductive health, sexual health service use, sexual function, mental health) and we acknowledged that there is an inherent risk of causing distress to participants. The inclusion of remote data collection added further ethical concerns since interviewers would not be in a position to assess, manage and ensure privacy in the physical environment or to gauge participant distress during data collection. The risk of harm, for example being overseen by a violence perpetrator, may be greater in remote interview settings.

Risk mitigations included the use of explicit 'prefer not to answer' options at particularly sensitive questions, a mechanism for skipping very sensitive modules in their entirety, and a 'safety' button on screen that would take participants immediately to a neutral website if their privacy becomes compromised. At the end of the interview, participants were provided with a leaflet containing the contact details for a range of support services. After the second pilot we also added a question at the beginning of the self-completion module to check with the participant that it was private enough to continue with the interview, and to instruct them to let the interviewer know if at any point their setting was no longer private. A further consideration was whether the self-completion element should ever be administered *by interviewers reading out the questions* in remote settings, an option available for face-to-face interviews at the request of the participants (for example, due to a dislike for computers, poor literacy, visual impairment, etc.). Given the sensitive nature of the self-completion questions, and the reduced ability of interviewers to assess risks to privacy in remote interviews, we decided that no attempts would be made to administer the self-completion by interviewers in remote settings.

We considered excluding particularly sensitive modules in remote interviews but decided that the value in collecting these data, and the potential bias that would be introduced by excluding them from the remote interview, outweighed the risks. A further review of their inclusion was undertaken after piloting and these questions were retained.

***d) Fieldwork documents.*** In light of the remote data collection modes, a review and update of all participant-facing and interviewer documents was undertaken. It was important that participant documents were provided directly to the selected individual (not to the whole household) given the potentially sensitive content of some documents. Therefore interviewers were asked to provide a 'remote participant document pack' to participants on the doorstep. Copies of all participant facing documents were also made available online. We decided to retain the use of interview showcards for remote interviews, rather than replacing with an approach where interviewers read out each answer category given the increased privacy of the showcard approach (participants simply need to read out a letter or number, rather than give a full response) and the long list of response options at some questions.

Careful consideration was given regarding the inclusion of biological sampling and data linkage leaflets in the document pack. In a face-to-face setting, these documents would be provided towards the end of the interview once a rapport had been established between the interviewer and participant (although both these elements of the study are briefly mentioned in the survey leaflet provided at the outset). We speculated that providing the detailed documents ahead of the interview could dissuade participation in the study altogether. The alternative option was to provide these documents after the interview, in which case informed consent to these elements could only be obtained at a later date, potentially reducing consent rates. We decided to pilot the inclusion of biological sampling and data linkage leaflets in the remote documents pack. Biological sampling kits, collection instructions, dispatch notes and packaging were not included in the remote documents pack, given the potential waste.

***e) Record of consents.*** Informed consent is sought and documented for all aspects of the Natsal survey, with all consent procedures having been approved by the Research Ethics Committee. In line with standard practice for UK surveys, and in response to evidence suggesting that signing a consent form might lead to a greater sense of obligation to complete the interview, we obtained verbal rather than written consent to participate in Natsal-4 (Lewis & Graham, 2007). We ensured verbal informed consent via our interviewer training and protocols: interviewers were trained to make sure that participants had read the study leaflet and had the opportunity to discuss the study fully before the interview began; and at the beginning of each interview, interviewers were prompted (on screen) to remind participants that they could choose not to answer any question and interviewers had to confirm that respondents had read the information leaflet in the computer programme before commencing the interview.

In the original study design, we planned to obtain written consent to biological sampling and data linkage later in the interview (recorded on paper consent forms). The inclusion of remote data collection required adaptation of the consent process. The administration of paper consent forms remotely would involve asking participants to provide a signed copy of the completed form after the interview and could lead to significant reconciliation problems. Instead, we investigated and implemented electronic consent (eConsent) for biological sampling and data linkage across all data collection modes.

Procedures for obtaining eConsent involved a combination of interviewer-administered and self-completion questions in the computer programme. The interviewers referred participants to the relevant information leaflets and provided an opportunity for questions before participants were asked to provide their consent directly into the self-completion questionnaire (whether CASI or online).

Although relatively uncommon in survey research, the Health Research Authority (HRA) and Medicines and Healthcare products Regulatory Agency (MHRA) (Medicines and Healthcare Products Regulatory Agency *et al.*, 2018) advise that "electronic methods may be used for seeking, confirming and documenting informed consent in research studies".

***f) Biological sampling protocol.*** In the original face-to-face study design, interviewers would introduce the biological sampling element of the study; provide an information leaflet; obtain consent; record tube label barcode numbers; provide collection instructions, equipment and packaging to the participant; and complete the dispatch note. The standard dispatch protocol was for interviewers to post samples to the laboratory immediately after the visit, although there was already a process for participants to complete the biological sampling after the interview and dispatch their sample to the laboratory themselves. This method still relied on interviewers recording barcode numbers and completing the dispatch note during the face-to-face visit.

The inclusion of biological sampling using remote methods required significant adaptation to the protocol. Two broad approaches were initially considered:

1. **Provision of self-collection kits by post with participant dispatch.** This method had been successful in the French population health sex survey, Contexte de la Sexualité en France (CSF) and, with a series of reminders (letters and phone calls), the response rate to biological sampling was 52% (Goulet *et al.*, 2010).

2. **An interviewer-administered socially-distanced doorstep collection approach**. At the time, this approach was being used on the ONS COVID-19 Infection Survey (University of Oxford and Office for National Statistics, 2020).

We also considered a hybrid approach where interviewers sent self-collection kits to participants in the post and then made an in-person visit to collect and dispatch samples. However, if interviewers were making an additional visit to the household, we hypothesised that a doorstep collection approach was likely to yield a higher response and less waste. The hybrid approach was, therefore, discounted.

We decided to pilot the first approach. Remote participants were asked if they were willing to provide a sample towards the end of the interview, following a similar process to the in-person protocol. Participants were asked to read the biological sample information leaflet which had been included in the 'remote participant document pack' and complete the eConsent module in the self-completion questionnaire.

Interviewers prepared the relevant documents and collection kit and posted them to the participant. This was favoured over a centralised office-administration since interviewers already held a stock of sampling kits for face-to-face interviews. Participants were asked to post their samples to the laboratory via Royal Mail, with interviewers informing participants of the location of their nearest priority post box. Interviewers also arranged to phone participants approximately two days after sending the collection kit to check it had arrived and whether they had any questions. If interviewers were able to return to the address (for example, while working in the area) then they could collect and dispatch the samples themselves. Following these pilot studies, a reminder SMS was introduced for the main survey, sent six days after the interview asking participants to return their biological samples.

### (iii) Piloting PAF data collection

The survey response rates were 32% in the first pilot (June–July 2021) 25% in the second pilot (February–March 2022), calculated according to the AAPOR standard definitions 'response rate 4' (American Association for Public Opinion Research, 2016).

***a) Mode of administration.*** Table 1 shows the number of interviews achieved by mode of administration during the two

**Table 1. Productive PAF pilot interviews by mode.**

| Mode | Pilot 1 (Jun–Jul 2021) | | Pilot 2 (Feb–Mar 2022) | | Pilot 1 + Pilot 2 | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Face-to-face | 76 | 58 | 106 | 81 | 182 | 70 |
| Remote: Telephone | 47 | 36 | 25 | 19 | 72 | 28 |
| Remote: Video | 7 | 5 | n/a | n/a | 7 | 3 |
| **Total** | **130** | **100** | **131** | **100** | **261** | **100** |

*n = number of productive interviews; % = percentage of interviews by mode. Data are from two pilot studies conducted in 2021 and 2022*

pilot studies. There was very low take up of video interviews during the first pilot (n=7), so the option was discontinued in the second pilot.

Across the two pilot studies 30% of productive interviews were conducted using remote methods (either telephone or video), although the proportion was higher in the first pilot (42%) compared to the second (19%).

Across the modes, average interview length was approximately 60–70 minutes. There was no clear pattern of one mode being longer than another: in the first pilot, remote interviews took less time to administer than face-to-face interviews (mean=63mins/median=62mins vs. mean=68mins/median=67mins, respectively), whereas in the second pilot, remote interviews took more time to administer than face-to-face (mean=71mins median=71mins vs. mean=61mins median=58mins, respectively). These data should be interpreted with caution given the relatively small number of remote interviews.

Interviewers were generally positive about the remote interviews, saying they were easy to manage and worked well. They appreciated having flexibility with regard to administration mode and being able to offer alternatives, either for their own or participants' preference. Interviewers had been briefed that the face-to-face mode should be prioritised, and remote modes should only be used where preferred by the participant, or where in-person interviewing was not possible. However, we found that some interviewers carried out all their interviews using the remote mode, indicating that the mode was sometimes selected based on interviewer preference. Following the pilot studies, the rationale for prioritising in-person interviews was emphasised in the interviewer briefings for the main survey.

In the qualitative follow-up interviews, participants who opted for the remote modes reported doing so for a variety of reasons, including convenience, being able to book evening interviews, being parents who could take part during childcare commitments and to facilitate taking part while working from home. Participants also mentioned that the remote options offered them more privacy and they therefore felt less embarrassed to answer the survey questions. Some preferred remote modes because they did not want anyone in their house for COVID-19 related reasons. Those who had a face-to-face interview also gave a range of reasons, such as the ease of seeing visual cues and body language, that it felt more personal and less intimidating and it being easier to ask questions. Others reported that they were *not* nervous about having people inside their home and did not like that the pandemic had meant they spent a lot of time doing things remotely. Participants also expressed that the face-to-face mode was easier to organise and that it made biological sampling more straightforward.

Table 2 shows the consent and sample receipt rates for biological sampling in the two pilot studies by mode. Across the two pilots, agreement to provide a biological sample was higher in face-to-face (64%) than remote (57%) modes of data collection. The receipt of samples at the laboratory was higher in face-to-face (56% of productive interviews) than remote modes (34% of productive interviews).

Table 3 shows the consent rate to data linkage in the two pilot studies by mode. In the first pilot participants were asked to consent to linkage of their survey data to health records and/or education records. In the second pilot they were asked for consent to linkage to health records and/or education records and/or economic records. The request to link to economic records was dropped following the second pilot due to a lower consent rate (60%, vs 67% for education and 68% for health). Consent to data linkage was higher in face-to-face interviews (80% across the two pilots) compared to remote modes (61% across the two pilots).

***b) Questionnaire adaptations.*** The completion rate for the self-completion questionnaire in remote interviews was high (90%, n=71/79 across the two pilots), suggesting that the placement during the middle of the interview was a successful strategy

**Table 2.** **Biological sample consent and receipt by mode.**

| | Face-to-face | | Remote[a] | | All | |
|---|---|---|---|---|---|---|
| **Pilot 1 (Jun–Jul 2021)** | **n** | **%** | **n** | **%** | **n** | **%** |
| Consent to biological sampling | 47 | 63 | 34 | 63 | **81** | **63** |
| Sample received by laboratory | 38 | 51 | 21 | 39 | **59** | **46** |
| **Pilot 2 (Feb–Mar 2022)** | | | | | | |
| Consent to biological sampling | 69 | 65 | 11 | 44 | **80** | **61** |
| Sample received by laboratory | 64 | 60 | 6 | 24 | **70** | **53** |
| **Pilot 1 + Pilot 2** | | | | | | |
| Consent to biological sampling | 116 | 64 | 45 | 57 | **161** | **62** |
| Sample received by laboratory | 102 | 56 | 27 | 34 | **129** | **50** |
| *Denominator (productive interviews) Pilot 1*[b] | *75* | | *54* | | *129* | |
| *Denominator (productive interviews) Pilot 2* | *106* | | *25* | | *131* | |
| *Denominator (productive interviews) All* | *181* | | *79* | | *260* | |

*n = number of participants who consented to or submitted a biological sample; % = percentage of productive interviews resulting in biological sample consent or sample received*

[a]Telephone and video modes combined for pilot 1

[b]Excludes one partially productive case that did not start the biological sampling module

**Table 3.** **Data linkage consent by mode.**

| | Face-to-face | | Telephone | | Video | | Total | |
|---|---|---|---|---|---|---|---|---|
| **Pilot 1** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| At least one data linkage consent | 66 | 88 | 32 | 68 | 4 | 57 | **120** | **79** |
| **Pilot 2** | | | | | | | | |
| At least one data linkage consent | 78 | 74 | 12 | 48 | n/a | n/a | **90** | **69** |
| **Pilot 1 + Pilot 2** | | | | | | | | |
| At least one data linkage consent | 144 | 80 | 44 | 61 | 4 | 57 | **192** | **74** |
| *Denominator (productive interviews) Pilot 1*[a] | *75* | | *47* | | *7* | | *129* | |
| *Denominator (productive interviews) Pilot 2* | *106* | | *25* | | | | *131* | |
| *Denominator (productive interviews) All* | *181* | | *72* | | *7* | | *260* | |

*n = number of participants who consented to at least one form of data linkage;*

*% = percentage of productive interviews resulting in at least one data linkage consent*

[a]Excludes one partially productive case that did not start the data linkage module

to avoid missing data. Those who didn't complete the self-completion comprised a mixture of individuals who were unable to access the online questionnaire entirely and those who started but did not finish it. Interviewers stayed on the line and completed other tasks while the participant completed the questionnaire. Interviewers found that the majority of remote interviews went well and flowed successfully, with participants able to follow the instructions and not having to ask for much, or any, help.

Some minor problems were observed with the remote self-completion. There were a handful of cases where provision

of the self-completion URL to remote participants was unsuccessful (with automated emails not received or taking a long time). However, the back-up option of interviewers reading out the URL to participants worked well.

During qualitative follow-up interviews, participants generally reported finding the self-completion questionnaire simple to complete, using their personal computers or smartphones. Most participants said that the instructions were clear, concise and easy to follow.

***c) Ethical considerations.*** Despite the concerns about questionnaire sensitivity, the content of the questionnaire was generally well-received during piloting. While it was recognised that much of the content was extremely sensitive, interviewers and participants recognised that the topics covered were important and necessary. There were no reported problems with privacy for remote interviews; some participants used headsets during video interviews to increase privacy.

***d) Fieldwork documents.*** Some pilot interviewers reported that providing the 'remote participant document pack' ahead of the interview was off-putting to some participants. Interviewers speculated that cancelled appointments were a result of providing so much detailed information up-front. They wondered whether there was some way that participants could be given the links to online documents during the interview or asked not to look at the documents until they need to. In qualitative follow-up interviews with people who took part, some participants reported reading the content of documents before the interview and felt particularly well-informed prior to participation. Others said that they didn't look at the pack before their interview appointment.

Following the first pilot, we considered whether it would be preferable to only provide online versions of documents for remote interviews, but practical (e.g. showcard administration) and ethical (e.g. ensuring participants could access documents outside of the interview setting, given their lack of existing relationship with the study or survey organisation) considerations led to the decision to retain hard copies of the 'remote participant document pack'. Biological sampling and data linkage leaflets were also retained in documents packs following piloting.

***e) Record of consents.*** The pilot consent rates for data linkage and biological sampling by mode are described earlier (see Table 2 and Table 3). In general, the collection of consents to biological sampling and data linkage using an eConsent process worked well both in face-to-face and remote interview. In the first pilot a few interviewers mentioned that the process of switching between interviewer-administered and self-completion questions could be 'clunky' in remote interviews. It was hard to keep track of progress during the eConsent process, both in terms of *what* the participant had consented to (which determined whether they needed to send a biological sampling kit) and *where* the participant was in the questionnaire. In some cases, the participant had progressed from the self-completion questionnaire to the eConsent module before biological sampling had been explained and so they refused to provide a sample. Following piloting, adjustments were made to overcome these difficulties with instructions for participants to stop and notify the interviewer of their position and (for the main stage) a mechanism where participants were unable to start the online eConsent module without a password provided by the interviewer. Interviewers reported a much smoother process following these adaptations.

In the qualitative follow-up interviews, participants explained that they understood the process of providing consent in the self-completion. They reported the importance of being able to provide separate consents to the different elements of biological sampling and data linkages.

***f) Biological sampling protocol.*** The pilot outcomes for biological sampling by mode are described earlier (see Table 2). Pilot interviewers and participants were generally positive about the procedure around biological sampling for remote interviews. Interviewers felt that the questionnaire guided them through the processes well and appreciated the checklist of steps involved in preparing kits for dispatch. Some suggested improvements including the addition of a cover letter to send with the kit and the use of first class postage. Interviewers felt that the follow-up phone call worked well, although there was no reminder to do this, so it could be difficult to remember if they had multiple participants requiring a telephone call. After the first pilot a standard script for the reminder phone call was implemented and well-received by interviewers during the second pilot.

## Discussion

Our work demonstrates the feasibility of adapting a PAF face-to-face population-based sexual health survey to enable remote data collection while maintaining key elements of the study. To achieve this, we developed a model that utilised an interviewer-led doorstep contact approach, prioritised in-person interviewing and provided an option of remote data collection. After piloting this model, the Natsal-4 mainstage PAF fieldwork retained a remote option.

Although a range of remote survey methods are available to researchers, identifying an optimal approach for a specific study requires consideration of the survey's design features. A systematic assessment of different data collection models in relation to Natsal-4's key requirements (Box 3) facilitated evidence-based decision-making before adaptations were made to the study design.

The retention of initial doorstep contact was a favourable approach for several features of Natsal-4 PAF fieldwork, including maximising sample quality, the random selection of one participant per household and the inclusion of boost samples for specific populations. Alternative designs, where participants proactively respond to a survey invitation, were not well-placed to meet these requirements (Villar & Fitzgerald, 2017; Williams, 2017). Entirely remote approaches would

have required more compromises in terms of the questionnaire length and therefore time-series maintenance, than this hybrid face-to-face and remote approach (Erens *et al.*, 2013; Thornby *et al.*, 2018). We chose to develop a model that prioritised face-to-face interviewing but offered remote data collection where in-home interviews were impossible or undesirable. Attempts to minimise measurement differences by mode & time-series disruption were made through the maintenance of question administration method (interviewer or self-completion) across the face-to-face and remote modes. It is worth noting that different surveys may draw different conclusions about the 'optimal' design, depending on their priorities. For example, cost-saving was not our primary consideration, given that funding for the face-to-face survey was already in place.

Across the two Natsal pilots, 30% (n=79/261) of productive interviews were carried out remotely, although the proportion was higher during the first pilot (42%) than the second (19%). The lower rate at the second pilot is likely to reflect the easing of pandemic related restrictions and attitudes over time, despite the first pilot being conducted in summer (June–July 2021) and the second in winter (February–March 2022). The first pilot included remote options of telephone or video interviews, however video interviewing was very low and was dropped after the first pilot.

We demonstrated that remote administration of biological sampling (vaginal swabs or urine samples) was feasible, but that lower consent and sample receipt rates were achieved in remote PAF interviews (consent rate 57% and receipt rate 34%) compared to face-to-face (64% and 56%, respectively). These findings suggest that fieldworkers play an important role encouraging participant co-operation and ensuring the successful dispatch of biological samples in population health surveys. We also found that obtaining consent to data linkage was feasible in PAF remote interviews but, in line with existing evidence (Jäckle *et al.*, 2022; Thornby *et al.*, 2018), resulted in lower consent rates (61% across both pilots) than the face-to-face interviews (80% across both pilots). We successfully implemented an eConsent process for consents that would traditionally be collected on paper consent forms, i.e. biological sampling and data linkage.

This development study has some limitations: the decision to implement a 'face-to-face first' model (i.e. encourage face-to-face as the primary mode of data collection) was necessary, given the context of adapting a survey reactively due to the pandemic, and the need to maintain consistency with the time series. However, the lack of experimental design limits our ability to draw conclusions. For example, consent to biosampling and data linkage were lower among those taking part remotely, but our data alone do not allow us to conclude that this is due to the mode of data collection, or due to differences in the type of people who choose to take part in face-to-face vs remote interviews. However, we can draw on the literature from other studies to conclude that it is at least in part likely due to the mode of data collection (Jäckle *et al.*, 2022; Thornby *et al.*, 2018). Due to the relatively small sample sizes of pilot studies, it is not possible to assess the extent of mode effects on survey data and any resulting impacts on estimates, which may affect interpretation of change over time.

We found that it was feasible and acceptable to adapt a complex face-to-face PAF survey with biosamples and data linkage to remote modes of data collection. Prioritising face-to-face data collection but enabling remote options appears to be a pragmatic solution for a survey that is part of an existing time series, in an era where some survey participants may be reluctant or unable to participate in person. In addition, the adaptation of surveys to allow multiple modes of data collection gives increased flexibility to adapt to any future challenges to face-to-face data collection (Blows *et al.*, 2020; Charman *et al.*, 2024; Office for National Statistics, 2022), enabling surveys to pivot to different data collection methods as needed. However, this adaptation requires considerable investment of time and resource, and the addition of new modes will present additional challenges for interpreting change over time data.

## Data availability statement

As in previous Natsal surveys, the pilots are small (<150 participants in each) and when analysing by subgroup could lead to deductive disclosure. This is particularly the case for a survey that covers sensitive topics. Furthermore, the pilots were intended to test fieldwork procedures and the questionnaire program, but not to provide data in a repository for wider analysis. As such, the data have not been collected and curated in such a way as to make them meaningful and useable to an external user. However, interested researchers may contact the Natsal team (natsal@ucl.ac.uk) to request an extract of the pilot data (allowing for appropriate considerations about confidentiality and data protection) and/or pilot study documentation.

Mainstage study documents will be published alongside the mainstage study findings, which we will add reference to here when made publicly available. The mainstage Natsal-4 data will be deposited with the UK Data Archive in 2026.

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