bump2bump: Designing and Evaluating Technology to Promote Maternal Wellbeing in the Transition to Motherhood

By Nikki Newhouse

Thesis submitted for the Degree of Doctor of Philosophy

University College London

Department of Computer Science

July 2019
Declaration

I, Nikki Newhouse, 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.

The following work was carried out at University College London, under the supervision of Professor Ann Blandford (Department of Computer Science) and Professor Elizabeth Murray (Department of Primary Care Health Sciences).

This thesis has not been submitted, in whole or in part, for any other degree, diploma or qualification at any other University. My work was funded by a studentship from the Medical Research Council.

This thesis does not exceed the limit of 100,000 words specified by the Degree Committee.

Correspondence concerning this thesis should be addressed to Nikki Newhouse,
nikki@thenewhouses.co.uk.

Signed, 29th July 2019
Acknowledgments

They say that it takes a village to raise a child. Well, it also takes one to produce a thesis. So many people helped me along the way and taught me above all never to underestimate the value of a quick chat in the corridor.

First and foremost, I would like to express my gratitude to my supervisors Professor Ann Blandford and Professor Elizabeth Murray for your encouragement, patience and unwavering support over the course of this PhD. Your curiosity, commitment and integrity are inspiring, and I consider it an honour to have had the opportunity to work with you. You are two of the best women I have ever met and you both changed my personal and professional life in ways I can’t even begin to thank you for.

This PhD was funded by a Medical Research Council studentship and the contribution was very gratefully received. Thanks also goes to Anna Spathis, Amanda Wood, Nick Chater, Joanne Webster, Mandy Sadan, Madeline Balaam, John Powell, Maria Breen and Louise Locock, for their generous mentoring and support. Special thanks to Sarah Boyd, Will Knight, Jo Cox, Jake Chancellor, Adam Barnett, Kevin Doherty and Chris Williamson - your patience, generosity and perseverance made all the difference. I would like to thank my wonderful colleagues and friends at UCL, the University of Oxford and beyond, particularly Olga Perski, Veronika Williams, Trude Nergård Nilsson, Aneesha Singh, Marta Cecchinato, Aisling O’Kane, Emma Dunphy, Giulia Barbareschi, Kathy Stawarz, Paulina Bondaronek, Shoba Pudoval, Anne-Marie Boylan, Helen Atherton, Abi McNiven, Annu Sible Prabhakar, Emma Davies and Sarah Hennelly. What an amazing bunch you are - I appreciate and admire you all so very much.
Enormous thanks to the families who took part in this research. I am amazed and eternally grateful that strangers gave up their precious time to help me and that they did so with such grace and enthusiasm at such a significant time in their lives.

Special thanks to The Athlete Centre in Oxford, who looked after my body when my mind had most definitely had enough.

Finally, thank you, thank you, thank you to my wonderful husband, my three girls and my mama. You’ve walked this PhD journey with me every step of the way, sharing in the highs and lows, always interested, always supportive. To the three self-possessed, vibrant young women I am honoured to call my daughters: you’re amazing. Your curiosity, resilience and unrelenting sense of adventure (and sarcasm) give me hope in these crazy times. Thank you for keeping me on my toes. Thank you to my little family for cheering me on and always believing in me. I could not have done this without you and I love you all more than you can imagine.

We did it!
Abstract

The notion of wellbeing is synonymous with feeling competent, supported and satisfied with one’s life. Understanding how to sustain one’s own wellbeing is important at times of significant life change. The transition to motherhood is characterised by major emotional and physiological changes, which can impact on maternal subjective wellbeing and affect pregnancy outcomes. While Human Computer Interaction (HCI) has begun to address some of the challenges in the prevention and treatment of affective disorders in vulnerable perinatal groups, approaches that promote holistic maternal wellbeing in the low-risk majority have received less attention.

This thesis draws on the multidisciplinary legacy of digital intervention development, utilising best practice from eHealth and HCI. Six studies using quantitative and qualitative methods were conducted. Study 1 was a systematic, interdisciplinary literature review, which proposed an integrated framework of factors involved in the successful development and evaluation of digital perinatal wellbeing resources. Study 2 used qualitative methods to explore the contextualised usage of digital resources by perinatal women. Studies 3, 4 and 5 involved the iterative development and formative evaluation of a prototype (bump2bump). Study 6 used mixed methods to explore the longitudinal, in-the-wild usage of bump2bump by a group of women as they became mothers.

This thesis contributes to current discourse in HCI on how technology might be used positively and presents recommendations regarding the development and use of digital resources in first time pregnancy. Digital resources are increasingly relied upon when community services are lacking, and usage of such resources is particularly
nuanced at the transition to motherhood. Design features that support users’ trust in content, facilitate face-to-face interaction with local similar others, and provide brief, practical information were found to be most important in meeting user needs. These findings can be used to inform the development and evaluation of digital perinatal wellbeing resources.
Impact statement

My key contribution to knowledge is an interdisciplinary set of recommendations intended to support the development and evaluation of digital health interventions. This can inform understanding of what works, how and for whom in the context of digital perinatal wellbeing and support efficient, effective development and evaluation of such resources.

The work presented in this thesis has gained attention from researchers working across the fields of behavioural science and human-computer interaction and has generated invitations to talk at the Maternal Mental Health Alliance, the University of Oxford and UCL’s Institute for Digital Heath. This work has led to collaborations with researchers at UCL, Bristol University, the University of Texas at Austin, Indiana University and the University of Oxford.

Aspects of this thesis have been published and presented at workshops and conferences:


Newhouse, N., & Blandford, A. (2016). ‘My Facebook is a bit of a multiple personality at the minute’: Social Media and the Transition to New Motherhood. NordiCHI ’16, Gothenburg, Sweden. (Workshop)


**Newhouse**, N. & Blandford, A. (2019). “Having come through the other side, I’m not sure anything would have prepared me for what’s happened”: the role of technology in supporting the perinatal journey. CHI’19, Glasgow, Scotland, UK. (Workshop)


A version of the recommendations presented in Chapter 11 are under review by The Royal College of General Practitioners, for inclusion in their perinatal mental health toolkit.

Together with collaborators from the University of Oxford’s Department of Geography, I won funding to apply the conceptual framework of bump2bump to the development
and evaluation of a novel digital resource targeting underserved new parents in and around Oxford. The resource is under development and due for launch in late 2019.
<table>
<thead>
<tr>
<th>Table of contents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaration</td>
<td>2</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>3</td>
</tr>
<tr>
<td>Abstract</td>
<td>5</td>
</tr>
<tr>
<td>Impact statement</td>
<td>7</td>
</tr>
<tr>
<td>Table of contents</td>
<td>10</td>
</tr>
<tr>
<td>List of tables</td>
<td>14</td>
</tr>
<tr>
<td>List of figures</td>
<td>16</td>
</tr>
<tr>
<td>List of abbreviations</td>
<td>21</td>
</tr>
<tr>
<td>Chapter 1 Introduction</td>
<td>23</td>
</tr>
<tr>
<td>1.1 Chapter overview</td>
<td>23</td>
</tr>
<tr>
<td>1.2 Wellbeing in routine first-time pregnancy</td>
<td>24</td>
</tr>
<tr>
<td>1.3 Women's use of technology in the perinatal period</td>
<td>26</td>
</tr>
<tr>
<td>1.4 Thesis aims and objectives</td>
<td>28</td>
</tr>
<tr>
<td>1.5 Thesis structure</td>
<td>30</td>
</tr>
<tr>
<td>Chapter 2 Background to the thesis</td>
<td>37</td>
</tr>
<tr>
<td>2.1 Chapter overview</td>
<td>37</td>
</tr>
<tr>
<td>2.2 Motivation for the thesis</td>
<td>37</td>
</tr>
<tr>
<td>2.3 Exploring wellbeing as a topic of interest</td>
<td>40</td>
</tr>
<tr>
<td>2.4 Exploring perinatal wellbeing as a topic of interest</td>
<td>49</td>
</tr>
<tr>
<td>2.5 An overview of the ideology of motherhood</td>
<td>56</td>
</tr>
<tr>
<td>2.6 Redefining motherhood: the role of perinatal technologies</td>
<td>62</td>
</tr>
<tr>
<td>2.7 Perinatal technologies in the context of austerity</td>
<td>66</td>
</tr>
<tr>
<td>2.8 What are DHIs?</td>
<td>70</td>
</tr>
<tr>
<td>2.9 Developing DHIs</td>
<td>73</td>
</tr>
<tr>
<td>2.10 Summary</td>
<td>87</td>
</tr>
<tr>
<td>Chapter 3 Background to the methodological approach</td>
<td>89</td>
</tr>
<tr>
<td>Chapter 10 In the wild evaluation of the bump2bump prototype</td>
<td>395</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>10.1 Chapter overview</td>
<td>395</td>
</tr>
<tr>
<td>10.2 Introduction</td>
<td>396</td>
</tr>
<tr>
<td>10.3 Study aims and objectives</td>
<td>408</td>
</tr>
<tr>
<td>10.4 Methods</td>
<td>408</td>
</tr>
<tr>
<td>10.5 Results</td>
<td>417</td>
</tr>
<tr>
<td>10.6 Discussion</td>
<td>467</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 11 General Discussion</th>
<th>477</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.1 Summary and interpretation of key findings</td>
<td>478</td>
</tr>
<tr>
<td>11.2 Strengths</td>
<td>485</td>
</tr>
<tr>
<td>11.3 Limitations</td>
<td>486</td>
</tr>
<tr>
<td>11.4 Implications for research, policy and practice</td>
<td>487</td>
</tr>
<tr>
<td>11.5 Unanswered questions and opportunities for future research</td>
<td>493</td>
</tr>
<tr>
<td>11.6 Conclusions</td>
<td>495</td>
</tr>
</tbody>
</table>

| References | 497 |

<table>
<thead>
<tr>
<th>Appendix 1 Chapter 4</th>
<th>550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix 2 Chapter 5</td>
<td>561</td>
</tr>
<tr>
<td>Appendix 3 Chapter 6</td>
<td>569</td>
</tr>
<tr>
<td>Appendix 4 Chapter 8</td>
<td>572</td>
</tr>
<tr>
<td>Appendix 5 Chapter 9</td>
<td>579</td>
</tr>
<tr>
<td>Appendix 6 Chapter 10</td>
<td>585</td>
</tr>
</tbody>
</table>
List of tables

Table 1.1 Thesis aims, objectives and methods................................................................. 29

Table 3.1 Examples of the ways in which the development process might be addressed by eHealth and HCI approaches ................................................................. 92

Table 4.1 Integrated framework of key factors for exploration in subsequent research .......................................................................................................................... 136

Table 5.1 Participant characteristics.................................................................................. 159

Table 5.2 Digital resources used by participants............................................................... 161

Table 5.3 Inductive themes and subthemes.................................................................... 163

Table 5.4 Themes and subthemes from the perinatal women dataset relating to user needs and requirements.......................................................... 193

Table 5.5 Themes and subthemes from the perinatal women dataset relating to the operationalisation of self-determination theory constructs............................... 199

Table 7.1 Example of concept card content................................................................. 255

Table 7.2 Workshop participant characteristics............................................................ 260

Table 8.1 Cooperative evaluation participant characteristics......................................... 303

Table 8.2 Immediate impressions and suggestions for improvement ......................... 305

Table 9.1 Black Hat session participant identifiers........................................................ 349

Table 9.2 Immediate impressions, critical usability issues and suggestions for improvement from the Black Hat session................................................................. 350

Table 9.3 Lay expert evaluation participant identifiers.................................................... 377

Table 9.4 Immediate impressions from lay expert evaluation......................................... 378
Table 10.1 Measures used in the final study to assess wellbeing, parenting competency and resource acceptability. ................................................................. 414

Table 10.2 In the wild study participant characteristics. ........................................... 418

Table 10.3 Aggregated usage data by all participants and information relating to ecological momentary assessment notification and responses received............. 420

Table 10.4 Most viewed pages and search terms..................................................... 421

Table 10.5 Individual pre-post scores on measures of flourishing, self-efficacy and resource acceptability ................................................................. 422

Table 11.1 Recommendations for research............................................................. 489

Table 11.2 Recommendations for policy................................................................. 491

Table 11.3 Recommendations for practice ............................................................. 493
List of figures

Figure 2.1 Csikszentmihalyi’s ‘flow’ model (1975) .......................................................... 46

Figure 2.2 Dodge et al.’s (2012) definition of wellbeing .............................................. 47

Figure 2.3 Keyes’ mental health spectrum (Huppert, 2009; Keyes, 2002) .............. 48

Figure 2.4 The effect of shifting the mean of the mental health spectrum (Huppert, 2009) .......................................................................................................................................................................................... 49

Figure 2.5 National austerity policies and their Oxfordshire equivalents. Reproduced with permission from Samani & Middleton (forthcoming) ............................................. 70

Figure 2.6 Original Medical Research Council framework for the development of complex interventions; Campbell et al., (2000) .................................................................... 75

Figure 2.7 Revised Medical Research Council framework for the development of complex interventions; Craig, Dieppe, Macintyre et al., (2008) ................. 76

Figure 2.8 ISO 9241-210:2010, Human centred design for interactive systems ..... 82

Figure 2.9 The design process (Sanders & Stappers, 2008) ....................................... 85

Figure 3.1 Model of the development and evaluation process .................................. 107

Figure 4.1 Position of the study within the overall thesis (highlighted) ............... 110

Figure 4.2 PRISMA flow diagram of the study selection process ......................... 118

Figure 5.1 Position of the qualitative study within the overall thesis (highlighted). 146

Figure 6.1 Position of the synthesis within the overall thesis (highlighted) .......... 216

Figure 6.2 Simple articulation of ‘problem-and-outcome’, showing the relationship between digital resource and maternal wellbeing ........................................... 230

Figure 6.3 Full logic model of the bump2bump digital resource ............................ 231
Figure 6.4 Proposed design hypotheses of the first iteration of the bump2bump prototype. ................................................................. 234

Figure 7.1 Position of the codesign workshop within the overall thesis (highlighted). .................................................................................................................. 240

Figure 7.2 Exemplar IDEO cards illustrating examples of methods intended to Ask and Learn. ................................................................. 242

Figure 7.3 Examples of the drawing exercise and visual prompts used as icebreakers. .................................................................................................................. 249

Figure 7.4 Example of a persona developed by one of the workshop groups. ......251

Figure 7.5 Sample ‘Day in the Life’ tool. ................................................................. 253

Figure 7.6 The concept cards. ............................................................................. 255

Figure 7.7 Completed example of the storyboard template................................. 257

Figure 7.8 Participants critically evaluating the parenting information topics......258

Figure 7.9 Revised logic model. ............................................................................ 269

Figure 7.10 Revised design hypotheses.............................................................. 272

Figure 7.11 Conceptual model (Cooper et al., 2014). ......................................... 274

Figure 7.12 Definition of the bump2bump interaction framework. .................... 277

Figure 7.13 Initial sketches of the bump2bump prototype................................. 279

Figure 7.14 Screenshots of the homepage from Powerpoint to WordPress test page. ......................................................................................... 280

Figure 7.15 Screenshots of the information sections on the homepage.............. 281

Figure 7.16 Screenshots of the registration/login from Powerpoint to WordPress test page. ......................................................................................... 281
Figure 7.17 Screenshots of the login landing page from Powerpoint to WordPress test page. ................................................................. 282

Figure 7.18 Screenshots of the parenting information landing page from Powerpoint to WordPress test page. ........................................................................................................ 283

Figure 7.19 Screenshots of a parenting topic page from Powerpoint to WordPress test page........................................................................................................ 283

Figure 7.20 Screenshot of the My Favourites WordPress test page................. 284

Figure 7.21 Screenshots of the provisional wellbeing toolkit WordPress test pages. ........................................................................................................ 285

Figure 7.22 Screenshots of the local resource Powerpoint and Wordpress test pages. ........................................................................................................ 286

Figure 7.23 Screenshot of the local meetups WordPress test pages. .............. 287

Figure 8.1 Position of the study within the overall thesis (highlighted).......... 293

Figure 8.2 Revised design hypotheses.............................................................. 317

Figure 8.3 Revised home page........................................................................ 319

Figure 8.4 About bump2bump page............................................................... 320

Figure 8.5 Meet the team page....................................................................... 320

Figure 8.6 Registration page........................................................................... 321

Figure 8.7 My Home page............................................................................. 322

Figure 8.8 Parenting information main page. ............................................... 324

Figure 8.9 Parenting information – experiential content.............................. 325

Figure 8.10 Parenting information – transcript shown below the video image. ..... 325

Figure 9.1 Position of the study within the overall thesis (highlighted)......... 340
Figure 9.2 Black Hat’ design critique session with HCI professionals. ..................346

Figure 9.3 Examples of screenshots used in the Black Hat session. ..................347

Figure 9.4 Usability problem decision tree from userfocus.co.uk ..............................356

Figure 9.5 Alternative homepage layouts suggested during Black hat session. ....357

Figure 9.6 Pop-out light box providing information on the home page. ...........359

Figure 9.7 (a) Pre- evaluation Homepage and (b) post-evaluation Homepage. ....359

Figure 9.8 Pre- evaluation My Home and (b) post-evaluation Registration page. .360

Figure 9.9 Pre- evaluation My Home and (b) post-evaluation My Home. .............362

Figure 9.10 Pre- evaluation Suggest a Listing and (b) post-evaluation Suggest a Listing.................................................................363

Figure 9.11 Pre- evaluation Local Resources page and (b) post-evaluation Local Resources page, showing more than one review. ......................................................364

Figure 9.12 Keywords were added to the Parenting Information content. ...........365

Figure 9.13 Example of the search results returned for ‘sleep’. .........................366

Figure 9.14 Pre-evaluation About and Who We Are pages and (b) Post-evaluation About and Who We Are pages. .................................................................367

Figure 9.15 Pre-evaluation Parenting Information and (b) Post-evaluation Parenting Information. .................................................................369

Figure 9.16 Experiential videos and accompanying straplines. ..........................370

Figure 9.17 Professional videos and accompanying straplines. ..........................370

Figure 9.18 Pre-evaluation video labels and (b) Post-evaluation video labels.......372

Figure 10.1 Position of the study within overall thesis (highlighted). .................395
Figure 10.2 User engagement (October 2017-May 2018) with bump2bump (number of pages viewed) around the points of registration, birth and exit interview.

Figure 11.1 Proposed update to the balance model of subjective wellbeing.
List of abbreviations

App - Application
AQoL-8D - Assessment of Quality of Life 8 Dimensions
BCT - Behaviour change technique
CASP - Critical Appraisal Skills Programme
CES-D - Center for Epidemiologic Studies Depression Scale
DHI - Digital health intervention
EMA - Ecological momentary assessment
HCI - Human computer interaction
IM - Intervention mapping
METUX - Motivation, Engagement and Thriving in User Experience
NCT - National Childbirth Trust
NICE - The National Institute of Health and Clinical Excellence
PBA - Person Based Approach
PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCGP - Royal College of General Practitioners
RCT - Randomised controlled trial
SDT - Self-determination theory
WHO - World Health Organisation
UCD - User centred design
UCL - University College London
Chapter 1 Introduction

1.1 Chapter overview

This thesis focuses on the importance of supporting holistic maternal wellbeing in the transition to first-time motherhood and explores the opportunity afforded by digital resources to meet this challenge. The ways in which we might harness the ubiquitous use of digital resources by women for information and support during pregnancy and the early weeks of motherhood are not fully understood; existing resources typically conflate positive wellbeing with absence of affective disorder; they are not developed with input from target users; they often digitally mirror the physical experience of pregnancy. The aim of this thesis is to take an interdisciplinary approach to the development and evaluation of a digital resource to support maternal wellbeing in the transition to first-time motherhood.

This chapter provides a background to the wider context of the thesis. It outlines women in routine first-time pregnancy as a population of interest and summarises what is known regarding women’s current use of technology to support their own perinatal wellbeing. The overall aim was to develop a prototype digital resource by examining and synthesising existing evidence and working with target users to develop a digital tool that would then be formatively evaluated in the wild. I addressed these objectives through a series of related studies; the aims and objectives are described below, followed by an outline of the thesis structure, which describes each chapter and its content.
1.2 Wellbeing in routine first-time pregnancy

The concept of wellbeing is notoriously difficult to define. It is a term which is used in everyday life and across disciplines and yet it remains conceptually ambiguous: ‘a complex, multi-faceted construct that has continued to elude researchers’ attempts to define and measure’ (Pollard & Lee, 2003). The term ‘perinatal wellbeing’ is similarly conceptually ambiguous. It has been defined as ‘a complex concept which involves self-evaluation of various inter-relating life dimensions during the perinatal period’ (Allan, Carrick-Sen, & Martin, 2013). The clear conceptualisation of perinatal wellbeing has been stifled by limited consensus on what perinatal wellbeing is or how best to measure it (Alderdice et al., 2013; Allan et al., 2013). This has led to methodological and theoretical inconsistency and the persistent medicalisation and association of maternal wellbeing with the absence of clinically significant physical and psychological disease. However, significant improvements in individual care and public health practice have resulted in a shift away from the focus on reducing maternal mortality towards improving overall maternal wellbeing. Nonetheless, defining perinatal wellbeing remains an important challenge for those looking to develop interventions which aim to improve it. This is discussed further in Chapter 2.

Although the transition to motherhood is a universal biological event, a woman’s experience of the transition is culturally, socially and politically relative and therefore consistently subjective and context-dependent (Gow, Lydecker, Lamanna, & Mazzeo, 2012; Lazarus & Rossouw, 2015; Luce et al., 2016). Acknowledgement of this complexity and subjectivity is not reflected in current assessment methods or by routine practice in statutory perinatal care, which prioritises the provision of information relating to maternal physical health and the process of giving birth (Alderdice et al., 2013; Jomeen, Glover, Jones, Garg, & Marshall, 2013; Rollans,
Schmied, Kemp, & Meade, (2013). In addition, widespread funding cuts across the UK have resulted in the reduction or removal of crucial services, such as parenting classes, breastfeeding support and activities specifically designed to facilitate face to face peer support (Toombs, Morrissey, Gray, Simpson & Balaam, 2018). The impact of such cuts on maternal wellbeing in the transition to parenthood is beginning to be explored.

The antenatal period can be a time of intense physiological and psychosocial adjustment, which may cause maternal stress. Pregnancy-related stress is different from general stress in that it is specifically related to events experienced during pregnancy (Lynn, Alderdice, Crealey, & McElnay, 2011). Antenatal stress is robustly associated with a broad range of negative emotional, physical, behavioural and cognitive outcomes (Glover, 2014; Glover & O’Connor, 2002; Pearson et al., 2013). A number of studies have provided consistent evidence that pregnancy-related stress is a better indicator of adverse maternal and neonatal outcomes than measures of anxiety, irrespective of maternal risk status (Coussons-Read et al., 2012; Stojanow, Rauchfuss, Bergner, & Maier, 2017). However, maternal antenatal stress may not be clinically significant. Research on the association between the timing and degree of stress and negative outcome is inconsistent; what is established, however, is that subclinical stress also exerts harm and that stress is a subjective experience (DiPietro, Novak, Costigan, Atella, & Reusing, 2006). Levels of pregnancy-specific worry and stress are higher in first-time mothers (Latendresse, 2009; Lynn et al., 2011) who consistently report feeling over-informed yet under-prepared, citing a perceived lack of emotional and social support and limited self-efficacy in meeting the demands of new motherhood (Newham, Roberts, Aquino, & Olander, 2016).
Lumley, Austin, & Mitchell (2004) describe three potential intervention populations: indicated (women currently experiencing mental health problems), selected (women who are at risk of developing mental health problems) and universal (all pregnant women). The majority of existing perinatal wellbeing research focuses on indicated populations. However, the growing evidence of the impact of “daily hassles” (Glover, O’Connor, & O’Donnell, 2010; Gutteling, De Weerth, & Buitelaar, 2004) and pregnancy-specific stress - particularly in first-time pregnancy - suggests that intervention development which takes a universal, positive and preventative approach has substantial potential benefits for population health (Rowe & Fisher, 2015).

1.3 Women’s use of technology in the perinatal period

Internet and smartphone access and usage is near-ubiquitous amongst perinatal women, providing both opportunities and challenges. A substantial body of literature confirms that a significant number of women routinely and repeatedly source information and support via the Internet and digital applications during pregnancy, particularly when they deem their antenatal care to be insufficient (Gibson & Hanson, 2013; Huberty, Dinkel, Beets, & Coleman, 2013; Lagan, Sinclair, & Kernohan, 2010; Lagan, Sinclair, & Kernohan, 2006; Lupton, Pedersen, & Thomas, 2016; Madge & O’Connor, 2006; Plantin & Daneback, 2009a; Prescott & Mackie, 2017; Sayakhot & Carolan-Olah, 2016). Women want to be able to access online interventions and they want health professionals involved in their care to recommend suitable and evidence-based alternatives to existing generic digital resources (Cumberlege, Chantler, & Baum, 2016; Seefat-van Teeffelen, Nieuwenhuijze, & Korstjens, 2011). However, existing research is largely descriptive, retrospective and methodologically inconsistent, shows high attrition and includes limited detail regarding theoretical underpinning or user involvement in determining content and acceptability. In
addition, there is limited understanding of whether and how women's use of digital resources during the perinatal period evolves in response to changing user needs and requirements. Where digital interventions have been found to support maternal wellbeing in routine first-time pregnancy, it is not yet clear how they do this and for whom. Nonetheless, there is substantive evidence to suggest that online interventions to support perinatal maternal wellbeing are worthy of further exploration. See Chapter 2 for a more extensive description of the evidence for digital health interventions (DHIs) for perinatal maternal wellbeing. This PhD explores the potential of digital resources to support maternal wellbeing in the context of routine, first-time pregnancy and outlines the development and evaluation of such a resource.
1.4 Thesis aims and objectives

**Aim:** To develop and evaluate a novel digital resource to support maternal wellbeing in routine, first-time pregnancy.

**Objectives:** The thesis objectives are outlined below. The objectives were met by conducting six iterative studies, outlined in Table 1.1. The rationale for the choice of methods is presented in Chapter 3.

1. Identify and synthesise evidence regarding digital wellbeing interventions for women in routine first-time pregnancy from the literature and through consultation with target users.

2. Use a theoretical paradigm to underpin the co-design of a digital prototype, based on the data collected in objective 1.

3. Formatively evaluate the prototype in the wild.

<table>
<thead>
<tr>
<th>PART 1 - UNDERSTANDING THE PROBLEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aim</strong></td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
</tr>
<tr>
<td><strong>Methods</strong></td>
</tr>
</tbody>
</table>
PART 2 - DEVELOPMENT WORK

Aim
To develop a digital prototype resource which is acceptable to the target population, is likely to have good uptake and use, and which contains active ingredients and theoretical underpinning that are likely to effectively address the tractable problems identified above.

Objectives
To synthesise data from the literature review and qualitative study; to develop a wireframe outline which addresses user requirements; to refine the wireframe into a clickable prototype; to refine the clickable prototype such that it can be tested in the wild by representatives of the intended user population.

Methods
Codesign with members of the target population and usability experts to refine the design and acceptability of a novel digital resource.

PART 3 - EVALUATION

Aim
To explore the usability, uptake, acceptability and perceived impact of the prototype in the target population in a real-life context.

Objectives
To describe the use made of the prototype; to explore user perceptions of the acceptability, pros, cons and impact of the prototype.

Methods
Mixed-methods, in-the-wild study with members of the target population.

PART 4 - SYNTHESIS

Synthesis of insights, reflections on learnings and implications for future research.

Table 1.1 Thesis aims, objectives and methods
1.5 Thesis structure

The thesis has 11 chapters including this introduction chapter. The remaining 10 chapters are outlined here.

Chapter 2 is the background to the thesis. It begins with an overview of the rationale for the thesis. This is followed by an overview of dominant perspectives and sociocultural constructions of wellbeing, pregnancy and motherhood and how these inform our contemporary understanding of wellbeing in relation to new mothers. Having outlined the problem, the chapter then moves on to an examination of what is known regarding perinatal women’s use of technology. The chapter then describes what interactive digital interventions are and summarises current usage, advantages, disadvantages and potential in relation to supporting perinatal wellbeing. The thesis takes an interdisciplinary approach to the development and evaluation of novel technologies for health: established approaches are described and critically evaluated.

Chapter 3 is the background to the methodological approach taken in the thesis. It begins by reiterating the aims and objectives of the thesis. The thesis takes a mixed-methods approach to addressing the objectives, and the background to this choice is presented, along with the background to the choice of methods used (systematic narrative review, semi-structured interviews, a process of codesign and a mixed-methods, in-the-wild study). Finally, the decision to use theory in the two-part analysis of the qualitative data is explained, and the rationale for choosing the theory, self-determination theory (SDT), is presented.
The following three chapters form Part I of the thesis: *Understanding the Problem*

**Chapter 4** describes a systematic review guided by the principles of narrative synthesis. This begins with a statement of the review's specific aims and objectives. The methods used to achieve the objectives are then described, including the rationale for conducting this form of review and the epistemological position taken to the selection and interpretation of studies. The review results are then reported before moving on to a discussion of the findings. This is followed by a consideration of the review's strengths and limitations and pragmatic implications of the review for future research.

**Chapter 5** describes the interview study. The chapter begins with a reminder of the study objective that the interview study is designed to address, and an outline of the research design and the interview process, both content and practicalities. The two-stage approach taken to the analysis of the data is described, and the interpretation of key themes and sub-themes is subsequently reported. This is followed by discussion and reflection on reflexivity, methodological strengths and weaknesses and the implications of the study results.

**Chapter 6** describes how the evidence gathered in Chapters 4 and 5 was documented and synthesised in order to support development of a novel digital resource. The chapter begins with a reminder of the key evidence drawn from the review in Chapter 4 and qualitative interview study in Chapter 5. The chapter then outlines the way in which this evidence was used to inform the development of evidence statements and design hypotheses and how these in turn informed the development of a preliminary logic model of the digital prototype's proposed
mechanisms of action. The chapter then provides an illustrative diagram of the process subsequently used to scaffold the development of the novel digital resource.

The following three chapters form Part 2 of the thesis: Development Work

**Chapter 7** describes the first codesign exercise. It begins by reiterating the study objective and provides an outline of the research design. The chapter is formed of two parts: Part 1 outlines the rationale, practicalities and results of a *codesign workshop* held with new mothers and Part 2 describes the subsequent design response and operationalisation of the data into formal design requirements.

**Chapter 8** describes the second codesign exercise. It begins by reiterating the study objective and provides an outline of the research design. The chapter is formed of two parts: Part 1 outlines the rationale, practicalities and results of a *cooperative evaluation* of the clickable prototype and Part 2 describes the subsequent design response and refinement of the prototype.

**Chapter 9** describes the third codesign exercise. It begins by reiterating the study objective and provides an outline of the research design. This chapter is formed of two parts: Part 1 outlines the rationale, practicalities and results of an *expert evaluation* of the prototype and Part 2 describes the subsequent design response and final refinements made prior to in-the-wild piloting.
The following chapter forms Part 3 of the thesis: **Evaluation**

**Chapter 10** describes the mixed methods, longitudinal, in-the-wild evaluation of the prototype. The chapter begins with a reminder of the study objective and is followed by an overview of the study’s guiding principles, namely the contextualised use of a technology probe, experience sampling methods, interaction logging and how measures of wellbeing were determined. The chapter then describes the methods used to address the study objectives and the approach to data analysis. The study results are then reported and are followed by a discussion and reflections on methodological strengths and weaknesses. The chapter concludes with a discussion of the implications of the study findings.

The following chapter forms Part IV of the thesis: **Synthesis**

**Chapter 11** is the overall discussion and conclusions chapter for the thesis. This chapter brings together the findings of the thesis and presents an integrative framework of recommendations for the development and evaluation of digital resources to support the transition to motherhood. The chapter then considers the methodological strengths and weaknesses of the thesis, and the implications of the findings for those working within and across the disciplines of human computer interaction, public health promotion and for future research. The chapter ends with the thesis conclusions.
Part 1: Understanding the problem
Chapter 2 Background to the thesis

2.1 Chapter overview

This chapter presents the rationale for developing a novel interactive digital resource to support maternal wellbeing in low risk first time pregnancy. It begins with the motivation for the thesis and its positioning between the disciplines of human-computer interaction (HCI) and eHealth. This is followed by an overview of dominant perspectives and sociocultural constructions of wellbeing, perinatal wellbeing, pregnancy and motherhood. Having described the problem, the chapter then moves on to a review of perinatal women’s use of technology to support wellbeing and considers the importance of acknowledging sociocultural context. The chapter then describes what digital health interventions are and why this term has been selected, and summarises advantages, disadvantages and their potential in relation to supporting maternal perinatal wellbeing. The interdisciplinary approach to the thesis is then described, with critical evaluation of established eHealth and HCI practices. The chapter content is then summarised before the next chapter introduces the methodological approach chosen.

2.2 Motivation for the thesis

The perinatal period is characterised by significant emotional and physiological changes, which can impact on maternal subjective wellbeing and affect pregnancy outcomes (Glover, 2014; Glover & O’Connor, 2002) particularly in the first time mother (Guardino & Dunkel Schetter, 2014). Evidence consistently suggests that over 20% of women experience clinical levels of anxiety or depression during the perinatal period (Dennis, Falah-Hassani, & Shiri, 2017) and most pregnant women and new
mothers experience some degree of distress (Fontein-Kuipers et al., 2015; Lynn et al., 2011), particularly in the context of first time motherhood. Subclinical perinatal distress may also impact on pregnancy outcomes (Glover, 2014; Pearson et al., 2013) and is frequently linked to a perceived lack of support (Meadows, 2011) and readiness for parenting (Darvill, Skirton, & Farrand, 2010; Dunkel Schetter & Tanner, 2012).

Maternity services in England prioritise maternal physical health and adequate perinatal screening and psychological/wellbeing support services are scarce (Hogg, 2013). As a result, there is a distinct need for the development of preventative tools which could promote and maintain holistic perinatal wellbeing. Many mothers prefer psychosocial interventions and approaches during the perinatal period (Stanley, Borthwick, & Macleod, 2006) and there is growing evidence that such interventions do not always require face-to-face involvement from healthcare professionals (Johnson, 2015). Women’s use of digital resources for information and advice is ubiquitous across the perinatal period (Huberty et al., 2013) and lay peer support found online is a particularly valued tool (Madge & O’Connor, 2006), especially in the so-called ‘fourth trimester’ (first three months after giving birth). Digital interventions have shown some promise in addressing postpartum affective disorders (Haga, Drozd, Brendryen, & Slinning, 2013) but online programmes targeting promotion of maternal perinatal wellbeing are in their infancy (Hamilton et al., 2016). In addition, little is known about how women’s use of digital perinatal resources evolves over the transition from pregnancy to early motherhood and how this might be harnessed.

There exists an opportunity to develop evidence-based, theoretically informed, person-centred, preventative digital tools which promote maternal wellbeing across
the perinatal period. This thesis seeks to explore the potential for novel digital resources to support maternal wellbeing in low risk first time pregnancy by identifying best evidence on existing digital perinatal wellbeing resources; by adding new evidence on how women use digital perinatal wellbeing resources; and by synthesising these data to determine design recommendations to inform the subsequent development and evaluation of a novel digital resource.

2.2.1 Interdisciplinary considerations

This thesis is informed by the methods, values and assumptions of HCI and eHealth research. HCI has been defined as ‘a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them’ (Hewett et al., 1992). Broadly, the field of HCI is focused on usability and the user experience, on determining whether or not technologies ‘engage, and satisfy people and extend their capabilities, or frustrate, thwart, and confound them’ (Churchill, Bowser, & Preece, 2013).

eHealth is ‘the use of information and communication technologies (ICT) for health’ (World Health Organisation, https://www.who.int/ehealth/en/). A review by Oh, Rizo, Enkin & Jadad (2005) identified 51 unique definitions of the term, many of which stem from Eysenbach’s seminal definition (2001) (see section 2.9.1) which underlines the necessity of eHealth practice to address the concerns of efficiency, education, ethics and evidence, amongst others.

The disciplines appear to sit at opposing ends of the spectrum in terms of one’s focus on usability and user experience (HCI) and the other’s commitment to risk mitigation and efficacy (eHealth). Conducting research which aims to improve subjective
wellbeing in a defined population by utilising established approaches from both disciplines poses particular challenges relating to methodology, terminology, values and assumptions regarding evidence, priorities and style (Blandford et al., 2018). I reflect upon this challenge throughout the thesis and the impact of this interdisciplinary approach on the selection of methods is expanded upon in Chapter 3.

2.3 Exploring wellbeing as a topic of interest

In order to explore wellbeing as a topic of interest, perspectives, characteristics and definitions of wellbeing were considered.

2.3.1 What is wellbeing?

Interest in and the study of wellbeing has grown exponentially in recent decades (Dodge, Daly, Huyton, & Sanders, 2012; Linton, Dieppe, & Medina-Lara, 2016). Governments are keen to find ways to measure wellbeing and this has become a key objective for healthcare professionals, policy makers and academics, leading to heightened public interest and emerging interdisciplinary work (Blanchflower & Oswald, 2011). However, the question of how the complex concept of wellbeing should be defined and measured still remains largely unresolved, often resulting in blurred and broad definitions (Allan et al., 2013; Linton et al., 2016). Definitions of wellbeing vary by discipline and are frequently conflated with the notions of happiness, health and quality of life. In addition, the multiplicity of theoretical perspectives makes definition and measurement problematic: theoretical approaches may conceptualise wellbeing as an absence of mental illness, a subjective assessment of an individual’s capabilities, or as the fulfilment of basic human needs. Although a range of dimensions of wellbeing (psychological, social, economic,
biological and spiritual) have been acknowledged in the literature, the way in which they are operationalised as measures of wellbeing is inconsistent and, as such, concepts and measurement tools remain “scattered across disciplines” (Linton et al., 2016a), with new tools continuing to be developed in response to evolving perspectives and to meet government objectives (Bann et al., 2012). The following section considers perspectives of wellbeing.

Historically, definitions of wellbeing have been based on two dominant approaches: (a) the hedonic perspective, which considers wellbeing in terms of affective balance or the extent to which the level of positive affect outweighs the level of negative affect in someone’s life, and (b) the eudaimonic perspective, which considers wellbeing in terms of a person’s judgments about their life satisfaction.

2.3.1.1 Hedonia: feeling good

The hedonic tradition suggests that all human beings should strive for maximum happiness whilst avoiding pain (Kahneman, Diener, & Schwarz, 1999) and that happiness will result from an accumulation of hedonic moments. Pleasure may be related to the body (e.g. food, sex, physical prowess) and to the mind (e.g. fulfilled self-interests). The related concept of affective balance corresponds to the notion of happiness. In essence, a person is doing well (is happy) when they experience (subjectively appraise) more positive than negative feelings in their life. These subjective, internal evaluations of one’s life distinguish subjective wellbeing from externally assessed, objective measures such as a person’s wealth or education level (Keyes & Annas, 2009).
2.3.1.2 Eudaimonia: functioning well

The eudaimonic tradition argues that happiness *per se* is not a principal criterion of wellbeing and instead highlights the importance of positive psychological functioning and human development (Rogers, 1961; Ryff & Singer, 2008). Rather than seeking out the simple goal of pleasure, wellbeing can be achieved by living a life of meaning and realising one’s potential (Ryff & Keyes, 1995) which may in itself be challenging and uncomfortable. In addition, seeking out pleasures for their own sake (such as wealth or approval) may lead to increased frustration (Kahneman et al., 1999) and is therefore not a guarantee of wellbeing. According to Waterman (1993), if people’s lives are congruent with their values and beliefs and lived in accordance with their *daimon*, or true self, then eudaimonia occurs as a feeling of intense authenticity and personal expression.

2.3.2 Extending the concept of wellbeing

Much of the research exploring optimal psychological functioning and experience has been dominated by the avoidance of psychopathology. However, the 1960s saw the beginning of a series of shifts towards a more preventative approach, focused on personal growth, positive psychology and the realisation of human potential. Ryan & Deci (2001) note that this post-war era was marked by periods of relative affluence (for White, Western populations at least) and that such bursts of interest in wellbeing “may have been prompted by a culture of surplus” in which people recognised that the hedonic achievement of financial security and material accumulation did not necessarily equate to happiness and fulfilment. The turn towards optimism led primarily to the inclusion of a person’s social, cultural and health context in assessment of wellbeing. Approaches which combined hedonic and eudaimonic
traditions are described below, as are those which conceptualised wellbeing as the attainment of flourishing or balance.

2.3.2.1 The importance of context

Ryff & Singer (1996) extended the dichotomised concept of wellbeing beyond that of pleasure versus functioning. They proposed that subjective, hedonic models of wellbeing were limited and, echoing the notion of the “fully functioning person” (Rogers, 1961), they developed an alternative, holistic approach termed psychological wellbeing. By synthesising existing humanistic and clinical psychology literature on positive human functioning by Erikson (1959) and Rogers (1961), and the personality theories of Maslow (1943) and Allport (1955) they constructed a measure of wellbeing around six core dimensions: self-acceptance, purpose in life, environmental mastery, positive relationships, personal growth, and autonomy.

This extension of the concept of wellbeing firmly situated the individual within a subjectively experienced context and inferred that agency and interaction with others are an integral part of co-constructing wellbeing. Indeed, social interaction and social support - the perception that one is cared for, valued and has access to help if required – is now recognised as one of the most influential determinants of wellbeing and physical health, transcending cultural and domain-specific boundaries. More recent evidence has identified the powerful role of providing support to others, with research demonstrating that giving support in the form of volunteering may be associated with higher levels of psychological well-being (Greenfield & Marks, 2004; McLeish & Redshaw, 2015, 2017).
2.3.2.2 The demedicalisation of wellbeing

If the work of Ryff & Singer (1996) invited wellbeing research to consider a more holistic model of wellbeing, the next shift in the field demonstrated a conscious move away from the medicalised, “clinical gaze” of pathology (Conrad, 2007) towards the active promotion of positive functioning.

According to Keyes (2007), “the success of the current approach to mental health hinges on the hypothesis that measures of mental illness and measures of mental health belong to a single, bipolar latent continuum”. This approach has been consistently challenged in recent years and it is now acknowledged (Keyes, 2007, 2010) that positive psychological wellbeing is not the same as the absence of mental illness; rather, psychological wellbeing requires both the reduction of mental illness (pathogenic focus) and the presence of mental wellbeing (salutogenic focus) (Keyes, 2002).

Flourishing refers to the experience of life going well, the opposite of ‘languishing’ (Huppert & So, 2013; Keyes, 2002) and the term has become synonymous with the positive psychology movement: Seligman recognised that “it wasn’t enough for us to nullify disabling conditions and get to zero. We needed to ask, what are the enabling conditions that make human beings flourish?” (Seligman, 1998, cited in Wallis, 2005, online). However, flourishing is not the same as being happy all the time: pathogenic and salutogenic balance is an integral part of the human experience and stress and loss are inevitable. As Huppert (2009) points out: “sustainable wellbeing does not require individuals to feel good all the time: the experience of painful emotions is a normal part of life and being able to manage these negative or painful emotions is essential for long-term wellbeing.” This more holistic view is enshrined in the World
Health Organisation (WHO, 2004) definition of mental health, which describes mental health not in terms of absence of illness but as a state “which allows individuals to realise their abilities, cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their community” (p.12). Bolier et al. (2013) extend this: ‘people can be free of mental illness and at the same time be unhappy and exhibit a high level of dysfunction in daily life. Likewise, people with mental disorders, can be happy by coping well with their illness and enjoy a satisfactory quality of life’.

Increasingly, contemporary ideas about wellbeing prioritise a tripartite approach which explicitly assesses emotional, psychological and social wellbeing and examines the ways in which individuals describe feeling good about a life in which one is functioning well (Keyes, 2010). For example, in Seligman’s PERMA model (2011), the five essential elements of wellbeing (positive emotion, engagement, relationships, meaning, accomplishment), “comprise what free people will choose for their own sake” (2011, p. 16), and together define ‘wellbeing’.

Ryan and Deci’s (1985;2001) self-determination theory (SDT) also extends the original concept of wellbeing by way of proposing that all individuals have a natural tendency to be curious, committed and agentic. However, individuals can also be “apathetic, alienated and irresponsible” (Ryan & Deci, 2000) and the expression of personal growth can be supported or constrained by social or environmental factors. SDT is a theory of motivation in which subjective wellbeing relies on the fulfilment of three psychological needs, drawn from previous tripartite theories: autonomy (the agency to initiate one’s own behaviour); competence (perceiving one’s own actions as effective); and relatedness (feeling connected to others and feeling cared for). The balanced fulfilment of these three needs is considered to lead to a subjective
perception of positive personal wellbeing, where an individual feels intrinsically motivated and capable of fulfilling their potential and managing challenges. SDT is returned to in Chapter 5 where it informs the second stage of the analysis of the qualitative data collected during interviews with new mothers and pregnant women.

### 2.3.2.3 Wellbeing as balance

Contemporary wellbeing theory acknowledges that subjective wellbeing is a fluctuating state rather than a stable trait. This core idea of the dynamic ebb and flow of life proposes that events vary in the degree of challenge they present and that, as a consequence, people develop skills and resources in order to manage and thrive. The balance between skill and challenge is central to Csikszentmihalyi’s (1997;2014) concept of ‘flow’, in which a person becomes entirely absorbed in an activity and experiences happiness (Figure 2.1).

![Figure 2.1 Csikszentmihalyi’s ‘flow’ model (1975)](image)

Dodge et al., (2012) drew on this work in order to offer a new, synthesised definition of wellbeing as a see-saw (Figure 2.2), which focuses explicitly on the ideas that (i) individuals seek to maintain equilibrium and (ii) that resources and challenges can impact on that equilibrium. Stable wellbeing is achieved when individuals have the psychological, social and physical resources they need to meet corresponding
challenges. A lack of resource causes the see-saw to dip, as does a lack of challenge. The authors argue that this synthesised definition offers a simple and precise model, which is accessible to the lay person; the definition is universal in its application and emphasises the positive pursuit of agency and self-management. This definition of wellbeing is used in this thesis to explore and further the understanding of perinatal wellbeing and the potential supporting role of digital resources in the transition to motherhood.

![Diagram](image)

*Figure 2.2 Dodge et al.'s (2012) definition of wellbeing*

2.3.3 Wellbeing and public health

Poor psychological wellbeing is a significant public health issue. Until relatively recently, the standard approach to addressing the problem of poor wellbeing has been a combined approach of treating mental health problems and targeted initiatives aimed at mitigating risk in vulnerable populations (including pregnant women). However, it is recognised that this approach has not been sufficient to reduce the prevalence, burden, or onset of mental disorder (Keyes, 2010) and that the focus should now be on developing and promoting positive mental health. Huppert (2013) proposes that “by increasing flourishing in the population, we might do more to reduce common mental and behavioural problems than by focusing exclusively on the treatment and prevention of disorder”. Efforts focused on making small improvements in wellbeing could significantly reduce the incidence of mental health disorders in the general population. Keyes (2002) represents mental health on a continuum from full
mental health disorder to flourishing (see Figure 2.3). In a given population, the majority of people are languishing or moderately mentally healthy, and only a minority have a clinically diagnosable mental illness or can be said to be flourishing.

Evidence suggests (Huppert, 2009; Rowe & Fisher, 2015) that if the priority is to reduce the number of individuals with clinically significant disorders, it may be more effective to target the larger proportion of the population with sub-threshold symptoms or those who are not flourishing, rather than focusing on treatment. Overall levels of mental health disorder may be reduced by achieving a small positive shift in population wellbeing (Figure 2.4), reducing the number of people who are languishing and increasing the proportion of the population who are moderately mentally healthy and therefore less likely to develop mental health problems.
However, this approach may involve targeting a large and heterogeneous group and Huppert (2013) cautions against the use of broad-spectrum wellbeing approaches which fail to consider context and domain specificity. This has been echoed in the perinatal wellbeing literature (Alderdice et al., 2013) which underlines the importance of understanding what ‘wellbeing’ means in the perinatal context and identifying which aspects may be tractable.

2.4 Exploring perinatal wellbeing as a topic of interest

In order to explore perinatal wellbeing as a topic of interest, perspectives, characteristics and definitions of perinatal wellbeing were considered.

2.4.1 What is perinatal wellbeing?

Huppert (2009) advises that the measurement (and therefore promotion) of wellbeing becomes far more complex when we take a domain-specific approach, using refined measures rather than a global single-item measure. For example, large surveys using

Figure 2.4 The effect of shifting the mean of the mental health spectrum (Huppert, 2009)
single-item measures of wellbeing (e.g. overall rating of life satisfaction) usually find a U-shaped relationship with age (e.g. Blanchflower & Oswald, 2008), whereas wellbeing assessed according to context can show a decline (Steptoe, Deaton, & Stone, 2015). Domain satisfaction reflects the extent to which outcomes in that domain match a person’s goals or needs in that area. While domain satisfaction and life satisfaction are generally highly correlated, measurement of domain satisfaction allows the examination of variations in wellbeing related to specific circumstances. For example, pregnancy-specific anxiety measures show more predictive value than non-pregnancy-specific measures (e.g. Green, Kafetsios, Statham, & Snowdon, 2003); a similar rationale can be used for pregnancy-specific wellbeing.

However, the importance of taking a granular approach to the assessment and promotion of maternal wellbeing has not been reflected in perinatal wellbeing research. This is surprising as it is acknowledged that the primary aim of antenatal care is to assess, monitor and improve maternal and foetal health, to enrich women’s experience of pregnancy and birth and to prepare women for motherhood. A conceptual analysis and review of the literature pertaining to perinatal wellbeing (Allan, 2014) failed to determine a satisfactory definition of the term, concluding that “perinatal well-being is a complex concept which involves self-evaluation of various inter-relating life dimensions during the perinatal period”, deserving of further qualitative investigation.

Examination of perinatal wellbeing has been stifled by a combination of conceptual and historical challenges, including limited consensus on what perinatal wellbeing is (Alderdice et al., 2013; Allan et al., 2013; Bayrampour et al., 2016). This has led to the persistent medicalisation and association of perinatal wellbeing with optimal physical health and the absence of clinically significant affective disorders. As a
consequence, much of the research into assessing and promoting perinatal maternal wellbeing focuses on the quantification and treatment of clinically significant maternal psychological distress. The importance of examining the nature of holistic perinatal wellbeing has also been overshadowed by (i) lingering anecdotal perception that pregnancy confers a protective health status on the mother beyond that with clinical evidence (Grof et al., 2000; Russo, Moral, Balogh, Mailo, & Russo, 2005) and (ii) a bias towards the treatment of postnatal affective disorders. However, a shift in policy, economic and research priorities suggests increased recognition of the value of taking an alternative approach (Bauer et al., 2014; Hogg, 2013; Stanley, Borthwick, & Macleod, 2006) which accounts for the holistic perinatal experience and attempts to prevent postnatal affective disorders from occurring in the first place.

The definition of perinatal wellbeing remains elusive. Nonetheless, defining perinatal wellbeing remains an important challenge for those looking to develop interventions which aim to improve it. This challenge is being addressed largely by those interested in measuring perinatal wellbeing who argue that the measurement (and therefore definition) of perinatal wellbeing is yet to catch up with contemporary approaches to wellbeing as being composed of both negative and positive constructs. Morell et al.’s (2013) review of instruments to measure wellbeing among pregnant women found that most are primarily designed for use with a generic population to quantify the presence and magnitude of problems. This was echoed by Alderdice, McNeill, Gargan, & Perra (2017) in the formative development of the Wellbeing in Pregnancy tool: intervention studies aimed at promoting health and wellbeing during pregnancy and childbirth have tended to use measures of stress, anxiety, self-esteem or self-efficacy (Alderdice, Lynn, & Lobel, 2012), despite evidence of the beneficial effect of positive emotions on physical health and wellbeing (e.g Pressman & Cohen, 2005). Jomeen (2004) calls for the multidimensional evaluation of perinatal wellbeing beyond
that of psychological distress; Alderdice et al. (2013) propose a multidisciplinary, biopsychosocial approach to the definition and measurement of maternal perinatal wellbeing, incorporating the constructs of wellbeing, quality of life, salutogenesis and resilience. For the purpose of this thesis, I refer to Dodge et al. (2012) and define perinatal wellbeing as a woman’s subjective appraisal of the balance between her psychological, social and emotional challenges and resources during pregnancy and the first year following birth.

2.4.2 Why does perinatal wellbeing matter?

Many pregnant women experience enhanced self-esteem and a sense of optimism and report motherhood as a positive experience (Dipietro, Ghera, Costigan, & Hawkins, 2004; Downe, Finlayson, Tunçalp, & Metin Gülmezoglu, 2016). However, the existence and potential consequences of compromised perinatal maternal wellbeing are well established in the perinatal research literature. Stress can be defined as demands appraised as taxing or exceeding the resources of the individual (Lazarus & Folkman, 1984). Perinatal stress is robustly associated with a broad range of negative outcomes for mother and baby and can also have an adverse impact on wider family and social functioning (Beijers et al., 2014; Glover, 2002; Glover, 2014; Talge, Neal, & Glover, 2007; Pearson et al., 2013). Poor maternal mood is also related to poor self-care. Multiple studies examining children from birth to adulthood have demonstrated associations between increased perinatal stress and a range of emotional, physical, behavioural and cognitive outcomes including congenital malformation, reduced birth weight, spontaneous early birth, sleep difficulties, reduced cognitive performance, emotional problems such as depression, anxiety, attention deficit hyperactivity disorder and conduct disorder, increased risk of cardiovascular disease and asthma (Barker, 1993; Khashan, 2012; Klienhaus et al., 2013; Laplante et al., 2008; O’Connor et al., 2002). Estimates of the prevalence of
perinatal psychological distress display considerable variation. Rates in industrialised countries are between 8% and 24% of women during pregnancy (Rubertsson et al., 2003; van Bussell, Spitz, & Demyttenaere, 2006); an analysis of prevalence studies concluded that 7.1% of women experience a major depressive episode in the first 12 weeks during the postpartum period; including minor depression, the 12-week period prevalence rate increases to 19.2% (Gavin et al., 2005). Another systematic review and meta-analysis examining prevalence of antenatal and postnatal anxiety concluded that perinatal anxiety is highly prevalent and merits clinical attention: rising from 18.2% in the first trimester to 19.1% in the second trimester and 24.6% in the third trimester, with 15% women experiencing anxiety symptoms at 1–24 weeks postpartum (Dennis et al., 2017).

Research on the association between the timing and degree of stress and negative outcome is inconsistent; what is established, however, is that subclinical stress also exerts harm on the individual and that stress is a subjective experience (DiPietro et al., 2006). A number of studies have provided consistent evidence that pregnancy-related stress is a better indicator of adverse maternal and neonatal outcomes than generic measures of anxiety, irrespective of maternal risk status (Buss, Davis, Hobel, & Sandman, 2011; Lynn et al., 2011; Fontein-Kuipers et al., 2015). Nonetheless, interventions aimed at promoting perinatal wellbeing typically prioritise the identification of those considered to be at high risk of developing clinically significant affective disorders.

In the UK, approximately 80% of pregnancies are considered to be ‘low risk’ (McKenna et al., 2003); therefore, the majority of women are provided with routine wellbeing care as recommended by The National Institute of Health and Clinical Excellence (NICE) (Howard, Megnin-Viggars, Symington, & Pilling, 2014). Routine
perinatal care does not include the assessment of any form of maternal stress level and therefore it is unlikely that women experiencing mild to moderate levels of perinatal stress will be identified by current practices. Critically, the threshold at which poor perinatal wellbeing exerts negative effects is unknown and is likely to be person-specific (Glover, 2014); the physiological mechanisms by which negative affect is ‘transmitted’ indicates that worry and stress may exert as much of an effect as a clinically significant mood disorder (Furber, Garrod, Maloney, Lovell, & McGowan, 2009; Glover, 2014; Glover et al., 2010; Jomeen et al., 2013).

2.4.3 What matters to perinatal women?

Antenatal care in the United Kingdom for low-risk pregnancy typically consists of approximately 10 individual visits. Following an in depth ‘booking appointment’, subsequent visits include measurement of blood pressure and weight, abdominal examination to assess foetal growth and position, and documentation of foetal heart rate. Although appointments are intended to offer health education and general support, they are typically short in duration and therefore clinicians may need to focus primarily on biomedical priorities. Women are supposed to be referred to antenatal classes and signposted to other appropriate services in their area. These services may not be available locally or may not be free of charge, and therefore, women with financial or transportation difficulties may not receive them. Resources such as www.nhs.uk offer a detailed breakdown of what women can expect from their care during the antenatal period but information regarding postnatal care and support is less clear. Postnatal care is less structured: women are told to expect a visit from a health visitor at home, ‘usually’ around 10 days after their baby is born. Until then, women are ‘under the care of their local midwives’.
The World Health Organisation (WHO) recommendations (WHO, 2002) for antenatal care provision promote a package of focused antenatal care, comprising at least four visits with evidence-based interventions through goal-oriented clinic visits (ANC 4+). The proportion of pregnant women receiving four or more antenatal care visits is considered a global benchmark indicator, standing in as a proxy for adequacy of antenatal care. Along with skilled birth attendance, ANC 4+ has been the most frequently used summary measure of maternal health program performance. This has had the unfortunate consequence of drawing the attention of program managers away from the content of care and toward mere contact (Hodgins & D’Agostino, 2014).

Although this global recommendation is arguably most pertinent in countries with underdeveloped maternity services, all healthcare programmes are more likely to result in health improvement if they are designed on the basis of delivering outcomes that matter to users, in a way that can be considered acceptable and accessible. The notion that the primary objective of antenatal care is the identification and prevention of pathology persists, as does the simplistic quantification of women’s ‘satisfaction’ with their antenatal care (Cumberlege et al., 2016). However, studies suggest that other, more complex, outcomes might also be important to pregnant women and new mothers in England (Downe et al., 2016). According to the National Maternity Review (Cumberlege et al., 2016) women want greater choice in their care and often feel pressurised by midwives and clinicians to make choices that fit existing services; women wanted consistent care from one midwife who communicated with them clearly, consistently and with compassion; conflicting advice was problematic and was often not locally relevant; postnatal care was deemed to be largely inadequate, especially in relation to breastfeeding support. Critically, women’s expectations for digital communication during pregnancy were not met. The vast majority of those included in the National Maternity Review self-reported as confident users of online
information who expected digital tools to support their decision-making. Trusting digital information was as important to women’s care experience as trusting the healthcare professional delivering the information.

These UK findings echo wider exploration of what women value during the perinatal period. In a qualitative evidence synthesis (Downe et al., 2016) which aimed to describe what women in high-, medium- and low-income countries want and expect from antenatal care, based on their own accounts of their beliefs, views, expectations and experiences of pregnancy, one overriding theme was identified: *women want and need a positive pregnancy experience*. In addition, women want to maintain physical and sociocultural normality; to maintain a healthy pregnancy for mother and baby; a positive labour and birth; positive motherhood (including maternal self-esteem, competence and autonomy); relevant and timely information; and psychosocial and emotional support.

### 2.5 An overview of the ideology of motherhood

The concept of a good mother ‘*casts a long shadow over other women’s lives*’ (Ruddick, 1989) and every society holds implicit beliefs regarding ‘good’ motherhood. The dominant Western ideology of white, heterosexual, economically independent, intensive mothering is a powerful cultural image of what a mother should be and how she should perform her role. *“Mere mothering is out”* (Hardyment, 2007, p.283): a mother should spend significant time, energy, and financial resources on her child and must recognise, respond to and support her child’s emotional, physical and intellectual developmental needs. Although women respond to social norms in varying ways, the cultural expectations around Western motherhood are institutionalised in social practices and are also frequently contradictory and shifting,
according to fashion and context (Porter & Kelso, 2008). Contemporary discourse values the ‘slummy mummy’ as much as the ‘earth mother’, just one example of a contradiction described as contributing to increased perinatal anxiety (Rowe & Fisher, 2015). Becoming a mother for the first time makes a woman particularly susceptible to these multiple ideologies. Navigating perinatal care, experiencing birth and postnatal recovery, understanding the demands of a newborn, and managing cultural expectations and identity disruption, are emotionally and physically demanding (Rowe & Fisher, 2015). In addition, contemporary discourses are influenced by the increased medicalisation of motherhood, which in turn has led to preoccupation with surveillance and the management of image and role expectations.

2.5.1 The medicalisation of motherhood

Pregnancy and childbirth have become increasingly medicalised over the past 40 years during which the discourse around safety and risk has served to shape expectations of the experience of the transition to motherhood (Luce et al., 2016). Improvements in medical expertise have led to increased medical surveillance in the care of the “precious cargo” (Lupton, 2012) which has in turn altered the experience of pregnancy (Cummins, 2014). In addition, contemporary pregnancy care has relocated from home to hospital, leading to fundamental changes in women’s personal control over their own bodies. Recognition of this perceived and actual lack of control has resulted in efforts to transform hospital spaces into more homely settings, and to improve antenatal services to provide a personalised, individual experience (Cumberlege, 2016).

Women’s perinatal experiences, including a growing number of accounts of perinatal worry and anxiety, have been used to critically interrogate this turn towards risk...
management (Rowe & Fisher, 2015; Thomas & Lupton, 2016). Women widely perceive that the dominant social and cultural discourses around pregnancy and motherhood frequently over-simplify health messages and over-emphasise perceptions of personal risk and individual responsibility for consequences. As a result, contemporary cultural discourse leads to intolerance of uncertainty and imperfection; leads to over-sensitivity to the opinions of others; encourages a tendency towards critical self-evaluation; encourages ‘worry behaviours’, including attempts to generate reassurance; and fosters information-processing biases which suggest that ambiguous situations are threatening perceptions and that negative outcomes are likely (Rowe & Fisher, 2015).

Biomedical discourse also dominates self-help literature on pregnancy and childbirth with evidence-based diet and lifestyle advice and information serving to ‘manage’ women’s behaviour, expectations and attitudes towards their bodies, both during and after pregnancy (Cummins, 2014; Hardyment, 2007). Indeed, women have never been so informed about the physical facts and processes of pregnancy and birth (Cumberlege et al., 2016) but the emphasis on the importance of evidence to underpin action is at odds with a prevailing discourse that mothering behaviours are instinctive. In this view, maternal behaviours ‘appear’ as a result of giving birth, rather than being based on rational thought and learned skills.

2.5.2 The impact of increased perinatal surveillance

The theme of perinatal image management and its alignment with the social construction of motherhood is well documented (Barclay, Everitt, Rogan, Schmied, & Wyllie, 1997; Collett, 2005; Spiteri, Borg Xuereb, Carrick-Sen, Kaner, & Martin, 2014). Pregnancy and the postpartum period in high-income countries is
characterised by increasingly close personal, medical and public scrutiny and women's pregnant and postnatal bodies and behaviours are more visible now than ever before (Cummins, 2014; Lupton, 2012). Modern perinatal care is characterised by frequent medical testing and monitoring of diet, exercise and health risk, shaping acceptable behaviours that are reinforced by the media. This culture of surveillance simultaneously engenders in women a process of self-surveillance and preoccupation with their personal appearance and behaviour (Nicolson, Fox, & Heffernan, 2010), complicated by the inherently contradictory nature of motherhood messages. Women are told to ‘eat for two’ but not to get fat, to be a selfless mother but ensure they look appealing while doing so, to instinctively combine ‘good’ mothering with being a ‘yummy mummy’. Women’s responses to these messages are closely monitored, leading to the navigation of “a whiplash of messages that conflate self-acceptance with self-loathing” (Fahs, 2014).

2.5.3 Identity, performance and biographical disruption

Motherhood is both a personal and a social identity (Collett, 2005; Djafarova & Trofimenko, 2017; Tiidenberg & Baym, 2017). The shift in personal identity is signaled by the growing belly and the physical act of giving birth, but the social identity is heavily influenced by ever-accessible, stylised media representations of motherhood. A pervasive culture of celebrity mothering affirms beauty and motherhood as central features of femininity (O’Brien Hallstein, 2011). Engaging with social media can help women reduce isolation and has been associated with improved maternal wellbeing (McDaniel, Coyne, & Holmes, 2012). However, evidence also suggests that excessive consumption of such images can promote an idealised picture of family life and engender anxiety about failure to live up to the image (Choi, Henshaw, Baker, & Tree, 2007).
Work on the concept of biographical disruption has highlighted the effects of chronic illness on identity, notably, the “crumbling self-image” (Charmaz, 1990). Pregnancy and motherhood may not be chronic health conditions but the notion of biographical disruption and Charmaz’ crumbling self-image are nevertheless highly salient. A woman’s biographical self-knowledge is fundamentally challenged by entering into the cultural discourse of contemporary motherhood and the subsequent identity resolution that occurs involves work to reconcile conflicting identities and to match them to particular ideologies. Indeed, contemporary Western mothers are increasingly separated from cultural displays of parenting until they become parents themselves, and are then only given a limited number of guiding “cues, hints, and stage directions” (Goffman, 1995, p.72).

The effort of addressing biographical disruption is arguably a luxury afforded to middle-class Western women. Nonetheless quantifiable pressure exists on women to enact the social role of motherhood by playing a socially-defined, publicly visible role and by “looking and acting the part” (Collett, 2005). “A ‘natural’ mother is a person without further identity, one who can find her chief gratification in being all day with small children…that maternal love is, and should be, quite literally selfless…” (Rich, 1986, p.22). Simultaneously, a good woman is someone who is more than ‘just’ a mother, ambitious to achieve self-serving professional and personal goals. Messages within books like Yummy Mummy Survival Guide: How to Put the Mmmmm back into Motherhood with chapters like Hospital Bag (got lipstick? good to go, then) (Fraser, 2006), or Why Mummy Drinks (Simms, 2018) offer vastly contrasting messages on what kind of mothering identities are socially ‘acceptable’. However, selective self-presentation, or impression management, also means “accentuating certain facts and concealing others” (Goffman, 1959,p.65). Not only do women (re)create an identity following the intense biographical disruption of entering into motherhood but are also
compelled to decide which aspects of this fragile self-concept to display, how and to whom.

2.5.4 Managing expectations and recreating ‘normal’

The extent of the work involved in managing biographical disruption and identity management is singularly influenced by the expectations that women have of the reality of motherhood. Studies have shown that prenatal expectations play an important role in the transition to becoming a mother (Barclay et al., 1997; Read, Crockett, & Mason, 2012; Rowe & Fisher, 2015; Spiteri et al., 2014) and disconfirmed expectations are associated with a difficult adjustment to parenthood and negative impact on maternal wellbeing (Read et al., 2012). Cultural representations of women effortlessly transitioning to motherhood serve to reinforce the dominant myth that ‘real’ mothers possess an innate ability to immediately bond with their baby and quickly become a selfless and caring nurturer (Buultjens & Liampittong, 2007; Choi et al., 2007; Luce et al., 2016; Read et al., 2012). The surprising reality for many women is that the day-to-day work of parenting is still uniquely gendered (Miller, 2017) and exhausting (Stadlen, 2005), and despite more realistic depictions of motherhood in popular literature, women nonetheless go to great lengths to protect the cultural ideal of motherhood by hiding their vulnerabilities and difficulties. Staneva and Wittkowski (2013) describe participants’ perception that mothers had “kept secret” the reality of motherhood: “I wish friends had warned me. It seems like there is this thing that women feel uncomfortable discussing that a child could be burdensome” (p. 263). Similarly, Choi et al. (2005) found that women who perceived themselves as failing to meet such ideological criteria chose to work harder at appearing to be the ideal mother rather than share their worries or concerns. The strong taboo against maternal struggle and the lack of an alternative mother discourse leads women to feign the appearance of strength and coping rather than acknowledge that “maternal emotions
Such biographical disruptions frequently prompt a process of meaning-making and creation of a new version of ‘normal’ life (Genuis & Bronstein, 2017). The concept of normality is commonly understood as a lack of pathology, a desirable state. However, as described above in section 2.2, the concept of normality in relation to health and wellbeing is less clear and is arguably even less so in the context of perinatal wellbeing, although this has not been explored explicitly. The goal of ‘normality’ has been documented across a range of health conditions and life transitions; the processes involved in recreating a sense of normality centre around information seeking, information exchange and sense- and meaning-making (Burgess, Reddy, Davenport, Laboi, & Blandford, 2019; Faisal, Blandford, & Potts, 2013), often through bridging gaps in understanding (Savolainen, 2006). Crucially, sense and meaning making in the context of creating a “new normal” is an interactive social process that is highly influenced by the presence and input of other people (Genuis & Bronstein, 2017).

2.6 Redefining motherhood: the role of perinatal technologies

Increasingly separated from traditional and consistent support structures, childbirth and early motherhood now lack cultural elaboration (Evagorou, Arvaniti, & Samakouri, 2016). As such, the creation of a new mother’s sense of ‘normality’ involves the individualised redefinition of motherhood. Online resources have played an important role in this process of redefinition, with women collectively challenging, subverting and recreating the notion of the good mother via digital communication (Mackenzie, 2017). The internet offers the opportunity for freedom and support for mothers to voice their ‘deviant’ experiences (Madge & O’Connor, 2006) and online spaces are used to challenge dominant constructions and representations of
femininity and motherhood (Johnson, 2014; Orton-Johnson, 2017) as much as they are used to seek out factual information (Prescott et al., 2017; Sayakhot & Carolan-Olah, 2016).

A significant and multidisciplinary body of research has examined how women use parenting websites, discussion forums, blogs, digital applications and social media in order to self-support during the transition to motherhood (Holtz, Smock, & Reyes-Gastelum, 2015; Lupton, 2016; Niela-Vilén, Axelin, Salanterä, & Melender, 2014; Plantin & Daneback, 2009a; Slomian, Bruyère, & Reginster, 2017). Women’s use of digital resources during the perinatal period is ubiquitous although there is some disagreement regarding the relative importance of digital information: whilst the majority of research reports it as a critical component of a successful transition to motherhood (Madge & O’Connor, 2006), some regard it as having nominal value, with Grimes, Forster & Newton (2014) reporting that fewer than half of the 350 women involved in their study used the internet to access pregnancy-related information. Nonetheless, for the majority of Western women, contemporary motherhood has become an exercise in data mining and data management and this can be burdensome: evidence suggests that increased, unsupported access to information presented in graphic and excessive detail may lead to a new fear of the known and cyberchondria (Fergus & Dolan, 2014; Fleming, Vandermause, & Shaw, 2014).

In general, women are prolific users of digital resources throughout the perinatal period: apps and websites enable women to access and track information such as fetal growth, heart rate and movement, to shop for baby products, to monitor infant feeding and sleeping patterns, to record breastfeeding duration. More popular than fitness apps in terms of downloads (Tripp et al., 2014), several studies have reported women’s general satisfaction with perinatal apps as a source of information, valued
largely for their convenience (Lupton et al., 2016) and functionality in filling in gaps in perinatal knowledge (Peyton, Poole, Reddy, Kraschnewski, & Chuang, 2014). Digital applications are a familiar form of information resource for the reasonably digitally literate perinatal woman: they offer convenient access to information which is increasingly offered in digestible ‘tidbits’ (Johnson, 2014). First-time mothers use apps significantly more often than women pregnant for the second time and most frequently accessed information concerning signs of risk and disease during pregnancy (Larsson, 2009; Lee, Denison, Hor, & Reynolds, 2016). However, some research (Peyton et al., 2014; Thomas & Lupton, 2016) questions the manner in which many digital resources serve only to confirm heavily gendered and heteronormative assumptions about pregnancy through their use of ‘feminine’ colours and imagery. In addition, concerns have been raised regarding overall quality of content, functionality and security of perinatal digital resources (Scott, Gomez, Richards, & Caldwell, 2015).

The role of online information production as well as information consumption has also been explored. Frequently confessional and humorous, parenting blogs are typically written - and read - by white, middle class, educated, digitally literate women (Orton-Johnson, 2017; Pedersen & Smithson, 2013). Both the acts of writing and reading blogs have been associated with improved wellbeing in new mothers and improved perceptions of social support (McDaniel et al., 2012). Exploration of how women use social media in the context of pregnancy is an emerging field of study (Archer, 2018; Bartholomew, Schoppe-Sullivan, Glassman, Kamp Dush, & Sullivan, 2012; Djafarova & Trofimenko, 2017; Harpel, 2018; Holtz et al., 2015; Morris, 2014). Gibson and Hanson’s (2013) ethnographic study of technology use by UK mothers found that they particularly valued the social connectivity and opportunity to ask questions afforded by Facebook, a finding extended by Newhouse & Blandford (2016) to illustrate how
women use social media not just to search for information but also to maintain multiple subjective identities. Morris (2014) offers a similarly nuanced view, challenging the hegemonic narrative of the ‘wired parent’: in this study, new mothers posted less frequently postpartum, with a consistent decrease in posts referencing their child as the child grew older.

It is largely agreed that many women use information websites and forums as an adjunct to statutory support and information and that the opportunity for anonymity allows free expression and the exploration and testing of new identities (Johnson, 2015; O’Higgins, Murphy, & Egan, 2014; Plantin & Daneback, 2009). Women have long sought support from other new mothers with similar backgrounds (Barclay et al., 1997) and this translates into digital support-seeking (Dennis, 2013; McLeish & Redshaw, 2015; Niela-Vilén et al., 2014; Sarkadi & Bremberg, 2005). There is general consensus that use of online resources including experiential information or opportunities for interaction with similar others echoes the support traditionally found in neighbourhood communities (Brady & Guerin, 2010) and contributes to increased confidence and perception of social support (Sarkadi & Bremberg, 2005), both of which are associated with better maternal health, relationship satisfaction, child outcomes and coping (Cutrona, 1990). Lagan et al. (2010) reported a statistically significant increase in women’s confidence levels with respect to making decisions about their pregnancy after Internet usage.

In our digitised world, the transition to first-time motherhood is now “an embodied project which encompasses digital health, responsible biocitizenship, accessing the internet as a source for support and advice and the use of a range of new devices, changing the way pregnancy and mothering are understood and practiced” (Johnson, 2014). As such, the HCI and eHealth communities are increasingly interested in the
intersection of motherhood and technology (Balaam et al., 2013; Gibson & Hanson, 2013; Newhouse & Blandford, 2017; Peyton et al., 2014; Wang, O’Kane, Newhouse, Sethu-Jones, & de Barbaro, 2017). Nonetheless, women frequently describe feeling unprepared for the realities of life with a new baby, despite unparalleled access to information. The overarching message from research exploring women’s use of perinatal digital resources is that usage is prolific and somewhat chaotic. Use of such resources may impact positively on subjective wellbeing and perceived self-efficacy but there is limited understanding of which resources are most valued and why. There exists an opportunity to harness women’s existing digital behaviours in the design and development of digital resources to support maternal wellbeing in the transition to motherhood. Emerging research points to the importance of understanding how women’s use of technology changes and evolves over the perinatal period (Barkhuus, Bales, & Cowan 2017), with Gibson & Hanson (2013) suggesting that a deeper understanding of the women’s motivation for using the wide variety of perinatal resources will yield far better design solutions than simply developing resources that simply digitally mirror the process of pregnancy and motherhood.

2.7 Perinatal technologies in the context of austerity

The impact of the UK government’s programme of austerity became an unexpectedly important theme over the course of this thesis. All participants described how their experience of care and support in the perinatal period had been affected by the withdrawal of services. An overview of the context is briefly provided below, with a focus on how austerity measures impacted on service provision in the City of Oxford, where the thesis research was conducted.
The challenges of the transition to parenthood described in this chapter have arguably been exacerbated in recent times by a widespread and dramatic reduction in the funding of public and voluntary services. The UK government’s programme of “fiscal discipline” (Jensen & Tyler, 2012) has led to significant strain being placed on services, not just in rural communities, which have found themselves cut off from existing limited provision of healthcare and adjunct support but also in urban areas which cater to a large and varied population (Toombs et al., 2018). Many services have been dramatically reduced or removed completely. As a result, services (if present at all) are increasingly only available to those who meet a certain level of clinical or socioeconomic need. New parents as a collective group are not traditionally considered to be amongst society’s most ‘vulnerable’. Pregnant women are able to access statutory healthcare and there is an expectation that those who can will supplement their care by accessing community or paid-for services. At-risk women are able to access relevant services (if they exist in their locality) and healthcare providers act as gatekeepers, ensuring that scarce resources are only accessed by those with true need (Cumberlege et al., 2016).

The UK’s economic climate of austerity has major implications for how care is delivered and received. Whilst austerity measures impact many social groups, they have profound repercussions for cities due to the number of people reliant on public services. In particular, there is evidence that the cuts have disproportionately affected low income, single parent families, and those with disabilities. However, far less attention has been paid to first-time parents, who are often heavily dependent on services such as community groups for face to face peer and practical support. As noted by Toombs et al. (2018) and Jensen & Tyler (2012), the reduction in state budgets, with its ideology of increased efficiency and elimination of waste has prompted the need for certain types of care – particularly interpersonal care – to be
initiated and facilitated by networks of volunteers and motivated community members. This shift in the delivery of care has largely been driven by the cuts to child services in general, and to children's centres in particular, which were considered the cornerstone of community parenting support. Since 2010, funding for children's centres in England has been halved from £1.2bn to £0.6bn and The Local Government Association expects £2bn more of council cuts to children's services in general by 2020.

This project focused on the experiences of new mothers in the City of Oxford, an ethnically diverse city in the South East region of England with an estimated population of 170,000. In 2016, there were 1811 live births in Oxford (ONS, 2016). Widely considered to be an affluent city because of its connection to the University of Oxford, 10 of Oxford's 83 neighbourhood areas are among the 20% most deprived areas in England (according to the 2015 Index of Multiple Deprivation). Figure 2.5 provides an overview of how national austerity policies have been implemented in Oxfordshire. In particular, Oxford Council has focused on providing support only in areas where there is most significant socioeconomic need: in 2016, Oxfordshire county's 44 children's centres were replaced by 8 Early Intervention centres, three of which are based in Oxford, in the areas of deprivation described above. Whilst prioritising those in most immediate need is unarguably correct, the effective removal of early years support and services designed specifically to support new parents and facilitate supportive face to face contact from the remaining 80 neighbourhood areas of Oxford is undeniably controversial.

Care and caring practices are fundamental to the cohesion of communities. The fragmentation of services for the majority has led to volunteers, community and faith groups picking up the burden of care: 'stay and play' sessions for new parents are
increasingly facilitated by churches, and healthcare professionals feel compelled to establish (and maintain) community support groups. In 2018, Oxford County Council commissioned a review of early years provision, with a view to using the findings to apply for significant funding. The review is being conducted using a ‘social lab’ approach, which includes input and codesign from a wide range of stakeholders. Whilst this initiative is a positive step towards targeted and joined up perinatal and early years’ service provision, it is not able to alleviate the current burden for new parents.

As the current research progressed, questions emerged around what services new mothers felt unable to access and how this impacted on their experience of new motherhood. In particular, this related to how new mothers accessed breastfeeding support, how they connected with and supported each other, and the role of new technologies in this context. Commercial applications such as Mush (letsmush.com) and Peanut (peanut-app.io) exist to facilitate social connection between new mothers and excellent work is ongoing which explores how technologies can support new parents’ social lives (Toombs et al., 2018) and help them to feel like “more than just a mother” (Gibson & Hanson, 2013). This project examined the holistic needs and requirements of new mothers with a view to determining how new mothers currently meet their needs and the contextual considerations of any novel digital resource. As will be demonstrated by the analysis of the primary data, social connection was important but there also emerged an important role for technology in signposting to fragmented services and subsequently supporting new mothers’ wellbeing.
2.8 What are DHIs?

2.8.1 The promise of DHIs

Increased financial burden has led to growing demand for United Kingdom (UK) health care services to deliver more cost-effective, efficient preventative and treatment programmes. As such, ‘digital medicines’ in the form of websites, mobile phones, smartphone applications (apps) or wearable devices have come to be regarded as a viable evidence-based intervention option (Topol, 2019; Wachter, 2016). The potential for the internet to deliver credible and effective health-related information and support is significant. DHIs have the potential to provide private, convenient and timely support and information, which can be tailored to meet individual users’ evolving needs (Michie, Yardley, West, Patrick, & Greaves, 2017; Yardley et al., 2016). In addition, enabling access to information and services that were previously only provided by healthcare professionals may reduce health
inequalities (Topol, 2019). Web-based interventions are also appealing for healthcare providers, policy makers and researchers because of their potential to transcend geographical boundaries, be scaled up with little cost per additional user, be integrated into users’ existing digital ecologies and facilitate data collection in real-time (Schueller, Muñoz, & Mohr, 2013).

DHIs are not without potential disadvantages. There are concerns that provision of online health information and support may in fact reduce equity by furthering the so-called ‘digital divide’ (Cotten & Jelenewicz, 2006) as only those with adequate access to the internet are able to benefit from online information, support and services. In addition, internet access is insufficient to guarantee effective use of such resources: accurate evaluation of online resources requires sufficient digital and health literacy (Coughlin, Stewart, Young, Heboyan, & Leo, 2018) and exposure to credible online information is not synonymous with acting upon it (Carlbring & Andersson, 2006) or engagement with it (Perski, Blandford, West, & Michie, 2017). Outside of the controlled research environment, interaction with digital resources may not be a suitable approach for all conditions. The development of DHIs is a highly dynamic practice often conducted across disciplinary boundaries. As such, differences in disciplinary priorities and practices have led to methodological inconsistency in development and evaluation approaches (Michie et al., 2017).

Since the introduction of DHIs (Della Mea, 2001), a number of randomised controlled trials (RCTs) have established that internet-based interventions are effective in helping people address a range of behaviours including physical activity, tobacco use and healthy eating (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012; Riper et al., 2014; Taylor et al., 2017), although effect sizes have been mixed. A recent meta-analysis (Karyotaki et al., 2017) has demonstrated how the delivery of a
guided self-help cognitive behavioural intervention to people with subthreshold depression can prevent escalation in symptoms. The positive effect of DHIs shown across a wide variety of health conditions is promising for their application to the maternal wellbeing context. The evidence and potential for health-related DHIs is developed further in Chapter 4.

2.8.2 DHIs for perinatal wellbeing

A substantial amount of research has established the widespread use and acceptability of both interactive and static digital resources within the context of pregnancy and parenting for information and support (Gibson & Hanson, 2013; Hamilton et al., 2016; Madge & O’Connor, 2006; Niela-Vilén et al., 2014; Peragallo Urrutia et al., 2015; Plantin & Daneback, 2009a; Slomian et al., 2017). In addition, a number of studies have been conducted to evaluate the effectiveness of online interventions to support perinatal psychological wellbeing. Studies have shown positive effects on major depression in pregnancy (Heller, van Straten, de Groot, & Honig, 2014; Kim, Hantsoo, Thase, Sammel, & Epperson, 2014) and postnatal depression (Ashford, Olander, & Ayers, 2016; Buultjens, Robinson, & Milgrom, 2012; Kelman et al., 2016; Milgrom, Schembri, Ericksen, Ross, & Gemmill, 2011; O’Mahen et al., 2013; Sockol, 2015). A growing number of studies are exploring the potential of digital interventions to promote holistic wellbeing, parenting satisfaction and self-efficacy in pregnant women and new parents (Haga et al., 2013; Hamilton et al., 2016; Hearn, Miller, & Lester, 2014; Salonen et al., 2011). Meta-analysis (Nieuwboer, Fukkink, & Hermanns, 2013) has demonstrated that web-based parenting programs offer opportunities for sharing social support, consulting professionals and training parental competencies. However, these studies are methodologically inconsistent, show high attrition and, critically, include limited detail regarding theoretical underpinning or user involvement in determining content and acceptability.
Nonetheless, there is sufficient evidence to suggest that online interventions to support perinatal maternal wellbeing are worthy of further exploration.

2.9 Developing DHIs

Development of DHIs has historically involved two primary disciplines: Human Computer Interaction (including software engineering) and the broad discipline of eHealth (including psychology, health informatics and the biomedical sciences). The two approaches frequently start at the same place of seeking to establish the state of the art or understand what is currently known about a health condition or context; they frequently conclude in the same outcome of a set of user needs and requirements which are translated through the development of a novel digital resource. However, the underlying values, motivation and methods employed are often in sharp contrast and grounded in disciplinary differences in values, terminology and methodologies. The work of the thesis was conducted under the supervision of experts from each field. This necessitated ongoing consideration of how to combine best practice in a meaningful way that combined rigour with insight, acceptability with efficacy and acknowledged the expertise of researcher and target user in the development of a resource that was fit for purpose.

2.9.1 The eHealth approach

According to Eysenbach (2001), “e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information
and communication technology”. The term has been used to describe a wide range of digital health interventions developed across a broad range of settings for a variety of purposes (Pagliari et al., 2005) and a systematic review identified over 50 unique definitions of the term eHealth (Oh, Rizo, Enkin, & Jadad, 2005). However, Eysenbach’s definition remains the most widely accepted. The definition is global and yet tacit assumptions and understanding of the approach’s aims, objectives and methods are firmly grounded in a biomedical approach which has “largely privileged a medical perspective” (Nunes et al., 2014) and which prioritises the degree to which digital tools can mitigate risk and demonstrate clinical efficacy or efficiency.

As such, eHealth approaches to the development and evaluation of digital health tools typically conceptualise DHIs as ‘complex interventions’ (Campbell et al., 2000) focused on changing target behaviours; ‘interventions’ are proposed to contain several interacting components which may act alone or in conjunction with each other, with varying complexity. Other factors which contribute to the complexity of the intervention include:

- The degree of flexibility or tailoring allowed by the intervention
- The number of groups targeted by the intervention
- The number and types of behaviours targeted by the intervention
- The number of outcomes associated with use of the intervention

The development and evaluation of complex interventions has historically been guided by the Medical Research Council framework (Campbell et al., 2000; Craig et al., 2008). The framework was originally conceived as a sequential process of evidence synthesis for the development and evaluation of medications, culminating in a randomised controlled trial (RCT) of a fixed, static product, in order to determine efficacy (Figure 2.6). A subsequent version of the framework (Figure 2.7) went some
way towards acknowledging the ‘messiness’ inherent in the development and evaluation of digital tools (Craig et al., 2008), questioning the RCT evaluation model and proposing a more iterative, context-sensitive approach. However, the fundamental premise (and methodologies) of adhering to the ‘hierarchy of evidence’ (Murad, Asi, Alsawas, & Alahdab, 2016) remain.

The MRC guidelines were not intended to prescribe an exact procedure for designers of digital health interventions to follow but to highlight critical considerations in the process. As such, the guidance has been criticised for being open to interpretation. For example, Hardeman et al. (2005) suggested that the process for evaluating appropriate theory was unclear and that insecurity at this critical early stage compromised the theoretical fidelity of any subsequent development work. Hardeman et al. (2005) proposed that causal modelling extended the MRC framework by offering more detailed guidance about intervention points, choice of techniques and assessment of intervention fidelity.

Figure 2.6 Original Medical Research Council framework for the development of complex interventions; Campbell et al., (2000)
Other developmental frameworks, such as Intervention Mapping (IM) (Bartholomew, Parcel, & Kok, 1998) or the general guidelines developed by the National Institute for Health and Clinical Excellence (2007) also critically evaluate the MRC framework by focusing on the planning, delivery and evaluation of a complex intervention as well as how best to report the outcomes of intervention trials to enable meaningful contributions to be made to the evidence base. IM focuses on behaviour change from a psychological perspective in contrast with the clinical trials-based MRC framework. However, like the revised MRC framework, IM envisages development as an iterative and cumulative process and acknowledges the contribution that both quantitative and qualitative methods. Indeed, IM’s six-stage framework appears to offer a coherent and pragmatic alternative to the MRC framework, taking into account three core processes of literature searching, using theory and collecting new data. However, IM has also been found to be difficult to apply in practice, with the process reported to be time consuming and resulting in the generation of excessive amounts of information. The retrospective application of the framework is reported by Haga et al. (2015) in the development of Mamma Mia, an internet-based intervention for the prevention of perinatal depression (see Chapter 4). The authors hint at the absence of systematic and comprehensive description of digital perinatal intervention development in their description of the study as one which ‘unravels the logic of the
development of the current intervention by linking objectives, theories, and actual program materials and activities, and provides a blueprint of the intervention.’ The retrospective application of the IM framework to the development process allowed the authors to identify gaps in the development process and reflect on how these might be addressed in future work; however, the framework itself is not critically evaluated and the degree to which the full framework was applied – and how - is unclear.

This lack of clarity around exactly how best to apply the various intervention development frameworks is a recurring theme in eHealth research. In addition, intervention developers are faced with the messy reality of user variability: behaviour can only be changed for some of the people for some of the time (Morrison, Moss-Morris, Michie, & Yardley, 2014). Consequently, eHealth approaches have sought to systematise techniques used to change behaviour and to identify the most effective behaviour change techniques (BCTs) so that intervention effectiveness may be maximised for more people and studies more effectively replicated through the RCT paradigm. The movement towards such systematisation of behaviour change techniques has been enormously influential. However, there is a pushback by those who claim that imposing order on the way we code behaviour change does not necessarily translate into improved intervention development let alone adherence and efficacy. Authors such as Ogden (2016) argue that the push towards systematisation of behaviour fundamentally neglects to acknowledge the very real gaps that exist between belief and behaviour. The behavioural ‘taxonomies’ code for what should happen when certain techniques are applied but does not consider the reality of what a person actually does and why.

Novel frameworks such as the Person Based Approach (PBA) (Yardley, Morrison, Bradbury, & Muller, 2015) aim to address this variability by describing an approach
which aims to “build a deep understanding of the psychosocial context of users and their views of the behavioural elements of the intervention”. The authors underline the imperative to improve low uptake and adherence to digital health interventions and state that this can be achieved largely by including the user perspective at all stages of development. The PBA claims to go beyond the identification and systematisation of behaviour by addressing the user experience of applying behaviour change techniques. The approach is firmly grounded in health psychology and has been applied to the development of digital and analogue interventions targeting a range of public health and illness self-management issues such as back pain, hypertension, lifestyle habits and diabetes (Band et al., 2017; Bishop et al., 2019; Howarth, Quesada, Donnelly, & Mills, 2019; Rowsell et al., 2015). The PBA claims to go beyond using the user voice simply to assess usability and acceptability of digital tools and resources; in addition, the approach explicitly acknowledges the interdisciplinary complexity of developing digital health interventions. However, the approach also routinely culminates in research outcomes being translated into a standardised interface (LifeGuide), itself developed by the PBA team. In addition, the PBA has so far only been reported as an overwhelming success story by those who have developed it and, to date, there is limited critical reflection of its utility by objective others. The approach simultaneously acknowledges and takes advantage of the disciplinary gap between eHealth and HCI: for example, the meaningful incorporation of the user perspective may be limited in traditional eHealth development frameworks but is standard practice in HCI approaches. Although the PBA (and other eHealth development frameworks) acknowledge that the success of complex interventions is highly dependent on human behaviour, the role that users play in the development and evaluation process is less clear. This will be focused upon in the following section.
2.9.2 The HCI approach

The previous section sought to describe the main eHealth developmental frameworks and to highlight how they prioritise rigour through transparency and efficacy by way of adherence to a ‘hierarchy of evidence’. Risk mitigation and efficacy are critical considerations as are scalability and cost effectiveness. In contrast, contemporary HCI approaches can be perceived to prioritise meaning and acceptability over efficacy in the way in which they fundamentally reimagine the role of the user-as-expert, and therefore may be seen as a somewhat ‘scruffy’ alternative to the eHealth paradigm (Blandford et al., 2018). HCI approaches to product development are fundamentally problem-driven and involve studying, planning and designing interactions between people and computers and developing the software that mediates those interactions.

HCI sits at the intersection of computer and behavioural science and emerged as an area of research and practice in the early 1980s. Until this time, human-computer interaction was limited to dedicated hobbyists and those who worked in information technology; with the advent of personal computing, everyone in the world was now a potential user. Early HCI was therefore primarily concerned with quantifying, operationalising and achieving usability objectives, that is, ensuring that digital tools were easy to learn and effective and enjoyable to use. Grounded in cognitive science, early HCI benefitted from parallel developments in human factors and software engineering which began to promote iterative prototyping and empirical testing. The emergence of computer graphics and information retrieval in the 1970s led to a prioritisation of interactive systems which supported personal productivity and the growth of a discipline which was “concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (Hewett et al., 1992, p.5). The focus on ease and enjoyment of product usage led to a natural partnering with industry and the economic imperative to produce resources that met key functionality and user-
experience criteria and client-defined requirements within rapid, commercially viable time frames using small convenience samples of users (Pagliari, 2007). This commercial focus on rapid iteration and the willingness to ‘fail quickly’ is in stark contrast to the linear, lengthy processes of eHealth academic research, focused on the sequential consolidation of (largely quantitative) evidence.

A number of early models described the process by which novel digital products should be designed and evaluated. The MRC framework described above (Figure 2.7) is a lifecycle approach to digital intervention development, beginning with development work and piloting of ideas, through to the evaluation and ultimate implementation of a finished digital product. Comparable early software engineering models include the Waterfall (Royce, 1970), Spiral (Boehm, 1988) and Star (Hartson & Hix, 1989) models, named after the sequence and pattern of development stages. Such software engineering models have varying levels of sophistication and complexity. The sequential Waterfall model offers a certain linear comfort in its supposition that user needs can be determined from the outset and a product designed in response. However, the later Spiral and Star models reflect a different philosophy of software development more akin to the contemporary notion of HCI development processes, in their advocacy of iterative design and inclusion of the user voice throughout the development process.

HCI practices have always prioritised pragmatism and real-world application but the operationalization of these principles has not always been clear. In 1985, Gould & Lewis (1985) stated three principles they believed would lead to a ‘useful and easy to use computer system’:
1. Early focus on users and tasks
2. Empirical measurement
3. Iterative design

These principles are now accepted as the basis of user-centred design but were considered unremarkable at the time that they were published because they seemed to be so obvious. It was widely assumed that these were already routine practices but scrutiny (Gould & Lewis, 1985) confirmed that operationalisation of these principles was difficult. In response, contemporary HCI practices have become increasingly concerned with the ‘messiness’ of understanding, designing for and evaluating a wider range of user experiences (Rogers, Sharp, & Preece, 2011) and addressing more complex user experience goals rather than simply prioritising usability. The repositioning of HCI away from its rationalist origins towards an understanding of technology as experience (McCarthy & Wright, 2014) is achieved by fundamentally reimagining the role of the user as the expert in the process in order to address user needs in a meaningful way.

Central to the concept of the user as expert is acknowledgment of the dynamic co-evolution of personal experience and the digital artefacts that mediate those experiences. Having developed and evaluated a digital tool in response to contextualised user needs and requirements, a user’s skills, needs and contextualised goals will change, and so should the artefact. Carroll and Rosson (1992) describe this inherent codependence of tool, expertise and goal as the ‘task-artefact cycle’, recognising that usage of such tools will change, and often in ways that are not anticipated. Responsiveness to changing user-driven goals therefore necessitates the parallel application of development and evaluation processes which understand this inherent co-evolution. An example of such a process is the
International Organisation for Standardisation (ISO) model of user-centred design (Figure 2.8). The ISO model is increasingly adopted when designing interactive digital health (LeRouge & Wickramasinghe, 2013; O’Brien et al., 2016) and emphasises the identification of the need for human-centred design from the outset, understanding the context in which the system will be used and taking an inductive approach to development rather than adhering to fixed development models or commercial briefs.

The continual feedback loop of the ISO model fundamentally acknowledges that, in HCI, the resource under development is never ‘finished’. Rather, needs and requirements continue to change and therefore so should the system. It is important to note the critical differences between this model and that of the MRC framework above (Figure 2.7b): the entire ISO model fits neatly within just the first, ‘Development’ stage of the MRC framework, which places much more focus on the testing and roll out of an effective intervention.

![Figure 2.8 ISO 9241-210:2010, Human centred design for interactive systems](image-url)
2.9.3 User-centred design

The repositioning of the user-as-expert in contemporary HCI practice has led to much critical discourse around the exact nature and purpose of user involvement (Vines, Clarke, & Wright, 2013). Early practices included the user only in terms of ‘user-as-subject’; over time, this hierarchical approach has been heavily influenced by the Northern European view of ‘user-as-partner’ (Bødker, 2015; Bødker, Dindler, Halskov, & Iversen, 2016; Sanders & Stappers, 2008) and the terms co-design or co-creation are often used synonymously as umbrella terms to encompass any design activity involving some form of direct user input. Although the underlying principle is that any user participation is a form of democratisation and that more meaningful and relevant technology will be created when end users have more influence over the making of it (Vines et al., 2013), in reality, the degree to which users participate in the design and development process occurs somewhere along a spectrum.

User-centred design is a contemporary HCI design philosophy in which the goal is to fully comprehend users’ mental models and situated contexts of use before specifying or finalising design. The researcher serves as the interface between the user and the designer, collecting and interpreting primary data through scenarios or sketches. The roles of the designer, researcher and user are distinct but interdependent and the researcher and user may or may not continue to be a part of the development process through subsequent usability testing (Sanders, 2002). At the other end of the spectrum, participatory design, originating from the political struggles of Scandinavian labour movements (Bødker, Ehn, Kammersgaard, Kyng, & Sundblad, 1987), is based on the fundamental principles of ownership, control and agency. Participatory design originally involved very little design: the cooperative work was premised around providing skills and information to workers whose jobs appeared to be threatened by the introduction of computerised systems (Nygaard, 1979). To this end, participatory
design can be said to seek to balance the reflection of current practice and how this might influence subsequent change (Ehn, 1989). The view of participatory design as empowerment is highlighted by Bødker’s statement (2015) that, as an advocate for participatory design, her intention has been to invite participants to acknowledge that there are alternatives available to them and that they can direct the form that these take. Activities along the participation spectrum can be seen as looking to achieve balance between pragmatism and idealism. Nonetheless, Caroll & Rosson’s (2007) moral argument sits at the centre of all design processes which acknowledge and include users directly: “that the people whose activity and experiences will ultimately be affected most directly by a design outcome ought to have a substantive say in what that outcome is”.

In parallel with the critical discourse exploring the function of user involvement, the ways in which users are included has been re-imagined and adapted for different contexts. In particular, there has been marked effort to ‘tidy up’ user involvement. HCI processes may be considered to be inherently ‘messy’ (Blandford et al., 2018; Frauenberger, Good, Fitzpatrick, & Iversen, 2015) and this can be difficult to reconcile with more ‘scientific’ paradigms such as eHealth, which typically value generalisability. Figure 2.9 illustrates how Sanders and Stappers (2008) underline the inherent complexity of working with people. They state that the ambiguous “fuzzy front end” of the process characterizes explorations conducted in order to “determine what is to be designed and sometimes what should not be designed and manufactured”. This chaotic process subsides as the more traditional processes of design and refinement are subsequently employed.
However, Frauenberger et al. (2015) argue firmly against the instinct to “scientise” participatory design in particular. Rather than attempting to impose a positivist perspective on an inherently reflective and co-constructed process, they argue that participatory design (and, by extension, any codesign process) should honour its dialogic and phenomenological roots by focusing on ways to highlight the “cornerstones” of accountability and rigour, but by using a language that reflects its belief system. This effort to provide some form of guiding structure to process of involving users has also been seen in the eHealth literature, with the emergence of work which attempts to combine established practices of eHealth and HCI, where user involvement in the development process has been prioritised. O’Brien et al. (2016) describe their attempt to “describe and appraise a systematic, sequential approach to integrate scientific evidence, expert knowledge and experience, and stakeholder involvement in the co-design and development of a complex health intervention”. Using the development of a web-based lifestyle intervention for people in retirement as an example, they developed a structured process in which outputs from each stage of the research were explicitly used as inputs to the next. Evidence from three systematic reviews, qualitative research findings, and expert knowledge was compiled to produce evidence statements, which were then assessed by key stakeholders (ie target users) in a codesign workshop. The resulting intervention principles were assessed again and translated into prototypes which guided the

Figure 2.9 The design process (Sanders & Stappers, 2008)
building of a functioning prototype. Arguably, the intention was to “scientise” user involvement and, to a lesser extent, open the ‘black box’ of design (Danaher et al., 2015). Nonetheless, this work illustrates the way in which the user voice is being actively valued in eHealth; in addition, its documentation of the inclusion of the user voice addresses concerns raised by Frauenberger et al. (2015) around promoting the value of the user voice and avoiding the re-invention of wheels through lost insight. User involvement in this thesis is described as ‘user-centred design’ to distinguish the approach taken in the project to that of participatory codesign. The approach is described further in Chapter 3.

2.9.4 Design for wellbeing

Technology can both support and thwart user wellbeing. User-centred or person-based approaches seek to fully comprehend situated contexts of use in order to understand how and why people use digital resources and to optimise user experience. There has been a shift in the conceptualisation of user experience away from productivity, convenience or task efficiency towards the hedonic pleasure of using an aesthetically pleasing interface (Hassenzahl, 2010; Norman, 2004). Secondary to this has been a move towards design for eudaimonic wellbeing, that is, developing resources that explicitly acknowledge and support values and personal flourishing (Ferrario et al., 2017) rather than the immediate hedonic experience and how this might be harnessed to support positive, rather than addictive, engagement. Outside of the field of HCI, the complementary concept of ‘affective atmospheres’ has recently emerged in cultural geography to refer to feelings generated by the interaction of people and nonhuman agents in specific spaces and places. This multisensory, dynamic idea of how people encounter and engage with digital resources has been applied to the area of digital health (Lupton, 2017) where it has been used to reflect on the question of how does digital health feel?
Examples of contributions to the area include Experience Design (Hassenzahl, 2010), Positive Technologies (Riva, Baños, Botella, Wiederhold, & Gaggiolo, 2012), Positive Design (Desmet & Pohlmeyer, 2013) and Positive Computing (Calvo & Peters, 2013, 2014; Peters, Calvo, & Ryan, 2018; Sander, 2011). These approaches suggest pathways towards design based on psychological factors shown to contribute to subjective wellbeing but acknowledge that ‘operationalising’ wellbeing through the application of a coherent set of actionable design features is supremely challenging. Acknowledgement that design for eudaimonic and hedonic wellbeing might be significant has recently emerged as a concern in the perinatal literature (Carissoli, Villani, & Riva, 2016) but has received limited attention.

2.10 Summary

The first stage in addressing the thesis aim included providing working definitions of wellbeing and digital health interventions. In this thesis, perinatal wellbeing is a woman's subjective appraisal of the balance between her psychological, social and emotional challenges and resources during the transition to motherhood. A digital health intervention is a resource that uses computer technology to deliver information and support.

The population of interest is women who are giving birth for the first time and whose pregnancy is considered low risk. Psychological wellbeing is a public health concern and standard approaches to addressing the problem of poor wellbeing in the perinatal and general populations has been a combined approach of treating mental health problems and targeted initiatives aimed at mitigating risk. However, it is recognised that this approach has not been sufficient to reduce the prevalence, burden, or onset of mental disorder and that the focus should now be on developing and promoting
positive mental health. Suboptimal perinatal wellbeing can have serious, long term impact and experiencing subclinical maternal stress and pregnancy-specific worry may result in consequences as severe as clinically significant affective disorders.

Women who are pregnant for the first time desire, above all, a positive perinatal experience. However, dominant social ideologies around contemporary motherhood and femininity, together with medicalised and reduced perinatal services leave women feeling conflicted and that their holistic needs have not been met. Therefore, women turn to alternative, digital sources of information and support in order to manage the transition to first time motherhood. The use of technologies to access information and support during the perinatal period is ubiquitous amongst this population but there are concerns around how women evaluate perinatal digital resources and the motivations, content and security of such resources.

Overall, an opportunity exists to explore how we can best harness women’s existing online behaviours in the development of digital resources to support maternal wellbeing in low risk first time pregnancy. The research conducted in this thesis takes an interdisciplinary approach, seeking to utilise established methods from the paradigms of eHealth and HCI. A user-centred approach is taken in order to determine how best a novel digital resource can address the unmet information and wellbeing needs and requirements of women as they transition to first time motherhood.
Chapter 3 Background to the methodological approach

3.1 Chapter overview

This chapter outlines the background to the methodological approach used in the thesis. It begins by reiterating the overall thesis aims and objectives. This is followed by a consideration of how the interdisciplinary legacy of contrasting approaches to DHI development was integral in guiding how the thesis objectives might best be structured and addressed. A description of the fundamental challenges involved in gathering evidence, developing and evaluating DHIs is followed by more detail regarding selection of the research methods. These sections address the decision to take an approach which sought to balance rigour with meaning by integrating eHealth and HCI approaches to digital intervention design. The methods themselves are described in subsequent chapters.

3.2 Aim and objectives

As outlined in Chapter 1, the overall aim and objectives of the study were:

Aim

To develop and evaluate a novel DHI to support maternal wellbeing in routine, first-time pregnancy.

Objectives

1. Identify and synthesise evidence regarding digital wellbeing interventions for women in routine first-time pregnancy from the literature and through consultation with target users.
2. Use a theoretical paradigm to underpin the co-design of a digital prototype, based on the data collected in objective 1.

3. Formatively evaluate the prototype in the wild.

### 3.3 Developing objectives for the thesis

As described in the previous chapter (section 2.9), development of DHIs has historically involved two primary disciplines: HCI (including software engineering) and the broad discipline of eHealth (including psychology, health informatics and the biomedical sciences). Whilst the two approaches share similarities in terms of iterative development and evaluation processes, there are arguably epistemological differences between the approaches, namely: differences in language; agreement of what constitutes evidence; the role of the expert; and what the DHI is for. Although the approaches have thus far been presented in this thesis as poles, development of DHIs in reality is far more nuanced and occurs somewhere along the continuum between them. Determining a pragmatic, interdisciplinary approach which combined rigour and understanding and made best use of the strengths of both approaches is the focus of the following section.

#### 3.3.1 Taking an interdisciplinary approach

Information technologies have been increasingly integrated into processes of health and social care in parallel with unprecedented lay access to information via the Internet and online health and lifestyle resources (Pagliari, 2007). This integration has had a transformative impact on service delivery and the potential for self-care and patient activation and has also reconfigured the relationship between patient and healthcare provider (Ziebland et al., 2016). Health services are increasingly
harnessing patient-facing digital tools to support remote monitoring and self-management of long-term conditions, to capture data on symptoms and health behaviour and to encourage information and support seeking. However, the research evidence of the effectiveness, impact or risk of such interventions remains extremely mixed and user ‘involvement’ is frequently reduced to qualitative data gathered as part of process evaluation conducted alongside an RCT, during which participants may not have used an intervention as they would in ‘real life’. In addition, interventions developed using rigorous methods are likely to be a part of academic research, with minimal translational impact once the study (and its funding) ends.

Interdisciplinarity is now on the agenda of all UK research councils (Spiller et al., 2015), as part of a shift from ‘pure’ to applied research. This is particularly true in the case of innovation intended to address so-called ‘grand challenges’ (Rose, 2013). Goulden et al. (2016) describe this ‘wild interdisciplinarity’ as a conscious reconnection of academia with the ‘real world’. There are examples of systems and resources that have failed due to unforeseen real-world human, technical or organisational issues and as such, there is an imperative to explore ways in which the best of eHealth and HCI approaches can be incorporated. As Pagliari (2007) says: ‘By sharing information about our research approaches and seeking to actively collaborate in the process of design and evaluation, the aim of achieving technologies that are truly user-informed, fit for context, high quality, and of demonstrated value is more likely to be realized.’

3.3.2 Developing a guiding framework

The previous section outlined the need for meaningful collaboration between the disciplines of eHealth and HCI. Such collaboration is undeniably challenging. A non-
An exhaustive example of the differing ways in which the questions might be addressed by the two approaches is outlined in Table 3.1.

<table>
<thead>
<tr>
<th>Focus</th>
<th>eHealth approach</th>
<th>HCI approach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rigour; health outcomes; adherence; effectiveness; sequential gathering of evidence, pre-implementation</td>
<td>Meaning; acceptability; usability; contextual use; rapid iteration, refining and testing, pre-deployment</td>
</tr>
<tr>
<td>Gathering evidence</td>
<td>Systematic review of existing academic evidence; focus groups; questionnaires; interviews</td>
<td>Opportunistic requirements gathering: user interviews, content analysis; ethnography; review</td>
</tr>
<tr>
<td>Next steps</td>
<td>Development work: systematic operationalisation of theoretical constructs; logic model; mechanisms of action</td>
<td>Implementation work: conceptual models; metaphors; personas; wireframes; prototypes; rapid iteration and ‘failing quickly’</td>
</tr>
<tr>
<td>Evaluating the work</td>
<td>(Summative) Delphi study; experimental and quasi-experimental designs, e.g. RCT; usage tracking; parallel qualitative assessment; focused on efficacy. Leads to implementation</td>
<td>(Formative) In the wild study; task analysis; heuristic evaluation; cooperative evaluation; think aloud; gaze tracking; self-report; usage tracking; focused on process. Leads to deployment</td>
</tr>
</tbody>
</table>

Table 3.1 Examples of the ways in which the development process might be addressed by eHealth and HCI approaches

However, rather than focusing on the epistemological differences between the approaches, I took the view of exploring the ways in which the approaches complemented each other and examined how their compatibility could be harnessed. At the most basic level, both approaches acknowledge the importance of a staged approach to DHI development: the need for the resource is identified before moving on to development and assessment phases. Indeed, as Preece et al. (2002) point out, there is a logical set of guiding questions that unites all development processes:
1. What do we know?

2. What do we need to do?

3. How will we know we have done it?

The fundamental simplicity of these guiding questions is acknowledged in a growing number of academic studies which explicitly try to bridge the epistemological and methodological gaps between eHealth and HCI approaches to DHI development. The approach taken by O’Brien et al. (2016) was introduced in the previous chapter (section 2.7.3): the authors describe the systematic integration of evidence from systematic reviews with qualitative data from key stakeholders in order to develop LEAP, a web-based intervention for people transitioning into retirement from full-time work. The authors describe a process which incorporated sequential validation of evidence, prototyping, testing and optimisation in which each stage of the process was systematically recorded and led to outputs which then informed the next stage of the research. Whilst the sequential approach addresses an important gap in the methodological literature regarding the integration of academic and stakeholder evidence, the objectivity of the process by which evidence was documented and ‘translated’ into design is not entirely clear. Indeed, O’Brien et al. acknowledge that “pragmatic compromises were made” at each stage. In addition, the authors note that the process is time and labour intensive and requires the input of a large interdisciplinary team with expertise in a range of research methodologies.

This is echoed in work by Curtis, Lahiri & Brown (2015) in their aim to systematically design and develop a theory and evidence-driven, user-centered healthy eating app targeting parents for childhood weight management. They acknowledge that “precisely how to develop theory-informed mHealth interventions that engage users remains a challenge and is rarely well documented in the literature” and go on to...
describe a three-stage process by which input from multiple stakeholders was systematically integrated with a comprehensive theoretical framework. A key strength of the study is the explicit documentation of how decisions were made regarding the inclusion of user preferences. Suggestions gathered from interview data with key stakeholders was evaluated with regard to the extent they met the following criteria: aligned with target behaviour; supported by literature; already exists; outside scope of project; aligned with recommended usability guidelines. This objective translation of ideas into features opens the ‘black box’ (Danaher et al., 2015) of intervention design and promotes a systematic development process, grounded in user needs. Again, however, the expertise of a large, interdisciplinary team is underlined as a critical strength, the collaboration with the commercial app design team being particularly valued.

As outlined in Chapter 2 and highlighted by O’Brien et al. (2016) and Curtis et al., (2015), existing frameworks do not offer a suitable integration of meaning and rigour. Indeed, developmental frameworks as abstractions do not offer a tidy prescription of what actions are required at each stage, let alone how to perform each action, prompting exploratory work which seeks to find ways to combine rigour and meaning in a systematic, replicable way. Therefore, an approach of ‘fitness for purpose’ was taken in the current project, in which the guiding principles of the various frameworks were examined and methods selected that would most appropriately address the study aim and objectives.

Acknowledging the unifying logical process offered by Preece et al. (2010), and taking influence from successful studies which have described the integration of multiple forms of evidence, the following guiding framework was proposed (see section 1.4):
Phase 1: Understanding the problem

Phase 2: Development work

Phase 3: Evaluation

Phase 4: Synthesis

3.3.3 Developing objectives within the framework

Objectives were developed to address the thesis aim (section 3.2). Objective 1 relates to the first phase of the framework, *Understanding the problem*, and was addressed using a systematic narrative review and semi-structured interviews, with self-determination theory used to interpret the data arising from the interview study. Objective 2 relates to the second phase of the framework, *Development Work*; Objective 3 relates to the third phase, *Evaluation* and was addressed using a mixed-methods in the wild evaluation study. More detail on the background to the choice of methods for addressing the objectives, including background to the decision to use both quantitative and qualitative methods, is outlined in the following section.

3.4 Selecting the research method

3.4.1 Reviewing the literature

Knowledge synthesis is vital to advancing understanding of what is known about a specific topic or research question. Engaging with the literature is an integral part of being able to provide a rationale for our own research and to demonstrate how our findings add to the body of knowledge. However, the appropriate and useful synthesis of evidence from large, heterogeneous bodies of literature can be challenging. In addition, the methods selected for searching, assessing, synthesising and reporting
existing academic evidence are determined by both the research question and disciplinary norms.

The methodology of conducting reviews of the health literature has typically focused on rigour, transparency and elimination of bias in an effort to synthesise findings from primary data and increase the generalisability of knowledge about a phenomenon outside of the research setting (Greenhalgh, Thorne, & Malterud, 2018b). Such reviews are systematic, reproducible and based upon the production of a protocol before the review commences. The review addresses a clearly defined question using standardised methods for selecting articles and critically appraising and synthesising relevant studies. Results are quantitatively summarised where appropriate. Within the biomedical research paradigm, systematic reviews with meta-analyses are considered to sit at the top of the hierarchy of evidence, a tool which supports the assessment of a particular study based upon its design. Such reviews are used to summarise evidence from RCTs, and are thus grounded in the pharmacological paradigm, therefore working well for studies which focus on effectiveness of interventions of a similar type on similar populations, using similar methods. The review remit has been extended, particularly where the literature is methodologically heterogeneous, and novel review methodologies such as meta-narrative (Greenhalgh, Potts, Wong, Bark, & Swinglehurst, 2009), critical interpretive synthesis (Dixon-Woods et al., 2006), narrative review (Popay et al., 2004) and realist review (Pawson, Greenhalgh, Harvey, & Walshe, 2004) are now routinely recognised methodologies.

Conversely, Blandford et al. (2018) describe the HCI literature review as “an interesting meander through relevant and insightful literature that builds a case for a particular perspective”. Computer science journals are typically not included in formal
curations of academic content (e.g. Medline) and so the search of an HCI literature review necessarily takes a highly iterative approach. Indeed, this iterative approach is highly valued as a process of conscious sense making. In direct opposition to the stance taken when embarking upon a systematic review, the HCI review begins with the position that all knowledge of a topic cannot be known or fully defined at the start and therefore the process is one of developing insight and knowledge construction rather than just knowledge synthesis. A range of resources is consulted through opportunistic search and *ad hoc* citation chaining to find relevant resources, which are combined by the researcher in order to construct a compelling narrative about the topic in question.

However, as interdisciplinary work becomes increasingly commonplace, a degree of academic ‘borrowing and boundary-crossing’ (Krishnan, 2009) becomes necessary in order to produce a review which achieves a balance between rigour and insight. If a review is to be useful to the research community, the methods must demonstrate an auditable approach to assure that the synthesised findings accurately represent the aggregation or synthesis of individual studies (Whittemore, Chao, Jang, Minges, & Park, 2014). Integration of evidence and knowledge synthesis in the context of digital health is varied. For example, O’ Brien et al., (2016) conducted three systematic reviews in order to identify the effectiveness and cost effectiveness of existing interventions and features and combined these with primary qualitative data in order to develop an understanding of how their proposed intervention might be used by the target population; Perski et al. (2017) conducted a critical interpretive synthesis to examine multidisciplinary concepts of engagement with digital behaviour change interventions; Nunes et al., (2015) used grounded theory to identify research opportunities in the field of technologies for self-care.
In this study, a systematic review using principles from narrative synthesis was used to partially address the first objective: *Identify and synthesise evidence regarding digital wellbeing interventions for women in routine first-time pregnancy from the literature and through consultation with target users*. Narrative synthesis is a form of storytelling which uses words to summarise and explain the synthesis of multiple studies (Barnett-Page & Thomas, 2009; Popay et al., 2004). The approach uses ‘traditional’ systematic review methods (a clearly defined research question, a specified and documented search strategy, quality appraisal, appropriate analysis of the data) but aims to provide a useful, text-based analysis of the relevant evidence drawn from a heterogeneous range of sources.

Integrative reviews using a narrative approach are not uncommon in the perinatal literature. For example, Poh, Koh & He (2014) conducted an integrative review to explore fathers’ experiences during pregnancy and childbirth and Novick (2009) used the methodology to examine women’s experiences of prenatal care. In the context of perinatal digital health, Niela-Vilén, Axelin, Salanterä & Melender (2014) conducted a systematic integrative review in order to explore Internet-based peer support interventions and their outcomes for parents.

### 3.4.2 Use of theory

Theories provide ‘lenses’ through which to critically evaluate and explain complicated problems and social issues and provide a framework within which to conduct qualitative analysis (Reeves, Albert, Kuper, & Hodges, 2008). There is widespread recognition by both the eHealth and HCI communities that the development and evaluation of health technologies is greatly enhanced by the application of theory (Hekler et al., 2016; Murray et al., 2016; Prestwich, Webb, & Conner, 2015). Theory
provides a framework to guide the selection of digital intervention components from a huge array of what might ‘work’ or produce a desired effect and helps select appropriate outcomes for measuring any impact or effects. The application of theory in tandem with qualitative data supports the development and evaluation process by exploring theoretical fidelity within user testing: proximal outcomes can be identified during the development lifecycle rather than having to rely on the movement of distal endpoints (Gustafson et al., 2002; Hekler, Klasnja, Froehlich, & Buman, 2013; Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005).

Some have argued that the judicious application of theory might be the bridge to link the traditionally siloed disciplines of eHealth and HCI (Hekler et al., 2013), calling for the development of a “shared understanding about what theory is, discuss ways in which behavioural theory can be used to inform research on behaviour change technologies, identify shortcomings in current behavioural theories, and outline ways in which HCI researchers can not only interpret and utilize behavioural science theories but also contribute to improving them”. However, the application of behavioural theory is challenging, is often poorly conducted and poorly described. In addition, some argue that there is disproportionate focus on the systematisation of behaviour and subsequent dominance of behavioural theory in the context of digital health (Ogden, 2016). Ogden (2016) argues that theory variability is “necessary for the health and well-being of a discipline” and that practice variability is central to the professional status of our practitioners in order to prevent us from becoming mere ‘technicians’ in our production of digital health resources. This is especially pertinent in relation to our efforts to design for wellbeing: the primary outcome may not necessarily focus on the quantifiable outcome of a change in a discrete behaviour. Rather, the focus may be on helping to support existing behaviour or to create the conditions by which a person simply ‘feels better’.
3.4.2.1 Choice of theory and rationale

Self-determination theory (SDT) was used to guide the interpretation of the qualitative data collected in the first study (Chapter 5). This addressed objective 2: *Use a theoretical paradigm to underpin the co-design of a digital prototype, based on the data collected in objective 1.*

SDT is a macrotheory of motivation rather than behaviour change (Deci & Ryan, 2008; Ryan & Deci, 2000; Ryan & Deci, 1985) which states that a person’s subjective wellbeing is largely determined by the extent to which the three key needs of autonomy, relatedness and competence are perceived to be met. Autonomy is the sense that one’s actions are volitional rather than controlled by strong external forces; competence is a perception of self-efficacy while relatedness is the need to experience connection with other people. Following preliminary inductive analysis of the exploratory qualitative data, SDT was selected for its overall fitness for purpose. The relative value of autonomy, competence and relatedness may vary from person to person and the life experience of the transition to motherhood may impact on people in different ways. However, it is likely that first time motherhood may compromise the satisfaction of all three needs: ‘I feel out of control’ (autonomy), ‘I don’t know what I’m doing’ (competence) and ‘I feel lonely’ (relatedness) are common messages in the perinatal literature (Gibson & Hanson, 2013). A range of empirical studies support the positive impact on subjective wellbeing of addressing the balance of the three needs (Calvo & Peters, 2014; Gustafson et al., 2002; Patrick & Williams, 2012; Ryan, Patrick, Deci, & Williams, 2008) as well as the notion of pregnancy as a ‘teachable moment’ in which users might be best motivated to address imbalance (Atkinson, Shaw, & French, 2016; Olander, Darwin, Atkinson, Smith, & Gardner, 2016).
3.4.3 Using qualitative methods

Qualitative research takes an inductive approach, aiming to describe a participant’s perception and experience of the world. The approach assumes that there are multiple versions of reality or knowledge and aims to answer ‘why’ and ‘how’ questions about behaviour, motives, attitudes and beliefs. Crucially, qualitative research acknowledges that such research cannot be entirely objective as the researcher necessarily brings their own subjectivity into the research process (Attia & Edge, 2017; Robson, 2011). Results are not generalisable but may be transferable.

Empathy is a strong resource for design and evaluation in HCI (Segal & Suri, 1997) in its efforts to ‘know the user’ (McCarthy & Wright, 2014) and can be derived through talking with users and observing them, using methods such as contextual enquiry, ethnography, cultural probes (Gaver, Dunne, & Pacenti, 1999), personas, scenarios, and design workshops. The qualitative methods used in this thesis supported the investigation of all study objectives: semi-structured interviews and contextual enquiry were used to explore the lived experience of using/not using digital resources in routine first-time pregnancy (objective 1); a design workshop, persona development, think-aloud methods and cooperative evaluation methods were used in the co-design of a digital prototype (objective 2); semi-structured interviews were used in the mixed-methods, in-the-wild evaluation study (objective 3).

3.4.3.1 Semi-structured interviews

Semi-structured interviews allow the researcher to engage with the participant on a topic of interest by exploring context and meaning. The process of interviewing complements the sometimes abstracted ‘what’ of an academic literature review by providing the ‘why’. This is particularly valuable if the literature review highlights issues worthy of further exploration with the target population. A topic guide is
produced to structure the interview and contains open-ended questions so that the interview is directed by the participant's responses. These responses can then be explored in more detail (Braun & Clarke, 2013; Britten, 2006) in order to gauge a better understanding of context.

The semi-structured interview was selected as the best qualitative method to meet the study aims, largely for pragmatic reasons. Alternative methods, particularly focus groups, were considered. Focus groups capitalise on communication between a group of participants to generate data. While the group moderator steers discussion on a given topic, the group is encouraged to speak to one another and engage in ‘normal’ conversation (Braun, Clarke, & Gray, 2017; Krueger & Casey, 2008). This affords participants the opportunity to reflect upon and clarify their views and provides data in the form of anecdote and interaction that may go beyond the considered responses of the one-to-one interview. However, focus groups require a certain degree of participant homogeneity in order to prevent people feeling inhibited about talking about their views and experiences (Britten, 2011). The primary focus of the study was to explore the contextual nuances of usage and non-usage of digital resources; a focus group may not have allowed the adequate exploration of these differences. The ‘show and tell’ approach of such contextual enquiry would also not have been possible. In addition, the practicality of gathering a group of pregnant women and new mothers together at a mutually convenient time and place was an important consideration.

In addition, focus groups can be difficult when discussing sensitive topics and probing of individual statements can be inappropriate. Although the focus of the qualitative work was on the contextualised use of digital resources by first time mothers and women who are pregnant for the first time, the context itself was unknown. In asking
about usage of digital resources, it was anticipated that women would want to talk about their pregnancy or experiences of birth and that this could act as an emotional trigger for others if conducted in a group context.

### 3.4.3.2 User-centred design and evaluation methods

As outlined in Chapter 2, user-centred design (UCD) is an approach to interactive system design and development that prioritises the usability of a digital system or resource and places the user at the center of the design process (Vredenburg, Mao, Smith, & Carey, 2002; ISO, 2019). Preece, Rogers & Sharp (2011) explain UCD as an approach in which users and their goals, not just technology, drive product development.

Contemporary iterative design methods focus on the actual context of use (Wania, Atwood, & McCain, 2006) and considerable attention has been paid to developing methods for parallel development-evaluation by which meaningful information may be elicited. Selecting methods by which to access people’s experiences is challenging (Vines et al., 2013), and the required creativity and ‘making’ can be intimidating for the interdisciplinary researcher. Vines (2013) describes the way in which the ‘omnipresent’ design workshop has evolved to better provoke exploration of participants’ existing practices and concerns through the use of boundary objects such as cardboard boxes or inspiration cards (Ehn & Kyng, 1991; Halskov & Hansen, 2015).

Design and evaluation are typically separated in communities of practice; however, Wania et al. (2006) argue for their inherent interrelatedness within the iterative design life cycle and how this impacts on the way in which users are involved in the
development cycle as a whole. Gathering information which is to be translated into design necessitates continued interaction with target users in order to confirm and refine translation of ideas; this ‘checking’ is realised as processes of formative evaluation and narrows from a broad evaluation of overall usability to one that examines contextual use of a high functioning prototype by a sample of a specified participant population. Indeed, Vines outlines (personal communication, 2014) this ‘funneling down’ process of user-centred design as consisting of four stages: Presuming, Structuring, Provoking and Generating, Refining and Partnering, echoing the optimal overarching design process described by Preece et al. (2010) (section 3.3.2). There is a huge variety of methods applicable to the practice of undertaking parallel user-centred design and evaluation, determined by both the study objective and the researcher’s familiarity and comfort with using user-centred methods. Indeed, a growing number of toolkits have been developed that detail a large number of specific methods and techniques for engaging in user-centred activities (e.g. IDEO, (ideo.com); Frog Design, (frogdesign.com)).

The overarching aim of the study was to develop and evaluate a novel digital resource to support maternal wellbeing in the context of routine, first time pregnancy and to do so using methods which achieved a balance between rigour and insight. It was an early priority to ensure that the development process was systematic yet driven by user needs and requirements and which also acknowledged the practical limitations of working with a perinatal population. As such, rich contextual data was gathered through semi-structured face-to-face interviews. Personas (Cooper, 1999; LeRouge, Ma, Sneha, & Tolle, 2013; Neate, Stumpf, & Wilson, 2019; Pruitt & Grudin, 2003), paper prototypes and provocative ideation cards (Vines et al., 2012) were then used in a design workshop in order to refine and generate concrete design hypotheses and inform the development of a clickable prototype. The usability of the clickable
prototype was then evaluated by a mixed group of naïve and experienced participants through a process of cooperative evaluation (Monk, Davenport, Haber, & Wright, 1993). Following the subsequent refinement, an expert review was conducted (Buley, 2013; DeBono, 1985) in which lay, usability and design experts were invited to critically evaluate the overall acceptability of the high functioning prototype prior to a mixed methods, longitudinal, in-the-wild evaluation by naïve users (Rogers & Marshall, 2017).

3.4.4 Using mixed methods

Quantitative research takes a deductive approach, testing pre-existing ideas, using methods characterised by quantification and measurement using standardised tools. The validity and reliability of the measurement is important, and the method often involves statistical analysis of the gathered data. While qualitative data aims to be transferable, quantitative data seeks to be generalisable: the population sample from which the data is collected are expected to be representative of a wider group so that the results are relevant and useful outside the research setting (Robson, 2011).

Both quantitative and qualitative methods were used to address the research aim. The combination of complementary methods is regarded as adding value to research and has become relatively unremarkable (Bryman, 2006; Creswell & Clark, 2017), despite their fundamentally differing epistemologies. There are a variety of ways of combining research methods. For example, a qualitative interview study might be used in order to explore salient topics to be used in the subsequent development of a questionnaire. Methods may also be combined using a ‘multiple methods’ approach, where two methods are used to answer different aspects of a research question. This acknowledges the integrity of each approach and affords the complementary
examination of a topic from different angles (Bryman, 2006; Pope & Mays, 1995). A multiple methods approach was chosen to address the aim of the project. Although a largely qualitative, user-centred approach is taken throughout the thesis, standardised quantitative measures of usage data and subjective wellbeing were used to complement the semi-structured interviews conducted in the final evaluation study (Chapter 10), addressing objective 3: *Formatively evaluate the prototype in the wild*.

### 3.4.5 Going into the wild

As described in Chapter 2, eHealth typically takes a summative approach to intervention evaluation, with static products empirically tested using an RCT design or similar. The move towards interdisciplinary team working has led to authors increasingly arguing for a more nuanced approach to intervention evaluation (Murray et al., 2016), which acknowledges the need for efficient generation of cumulative knowledge around identifying important components of digital interventions and knowing how to test them in order to improve efficacy and research efficiency. This granular measurement of efficacy is somewhat in contrast to the pragmatism of HCI development and evaluation practices which are increasingly conducted ‘in the wild’. ‘In the wild’ research is typically agnostic about the methods it uses (Rogers & Marshall, 2017) and some have argued that this active ‘bricolage’ approach to methodology (Kincheloe, 2005) may compromise the ecological validity sought by moving the evaluation process outside of a controlled setting (Raptis, Kjeldskov, Skov, & Paay, 2014). The intention of the final study was to determine how hypothesised use of a novel digital resource was realised in a group of women as they transitioned from late pregnancy into early motherhood; therefore, an in the wild approach was considered to be most appropriate to meet objective 3.
3.5 Development model

A model was developed to illustrate the stages of the research and to highlight the systematic integration of HCI and eHealth approaches. The model shows how the findings from each stage were used to inform the next and how this resulted in cumulative knowledge, whereby early outputs were sequentially tested, optimised and evaluated.

![Model of the development and evaluation process.](image-url)
3.6 Summary

This chapter has outlined how an interdisciplinary approach was taken to address the thesis aim. A framework for the development and evaluation of a novel digital resource was developed and is reflected in the thesis objectives. In addressing these objectives, the thesis takes a ‘multiple methods’ approach which combines best practice from the disciplines of eHealth and HCI with the aim of systematically balancing rigour with ecological validity. The approach is outlined in a model outlining the stages of the project. An inclusive approach was taken to identifying and synthesising the interdisciplinary evidence base in the form of a systematic narrative review. Qualitative methods were used to explore the contextualised use of digital resources by pregnant women and first-time mothers and inform the development and iteration of a clickable prototype. Additionally, self-determination theory was chosen to support the analysis of the first interview study and aid the development of the prototype. A mixed methods approach was taken to the formative evaluation of a high functioning prototype ‘in the wild’, whereby data gathered by semi-structured interviews was supported by quantitative data in the form of usage data and responses to validated wellbeing measures.
Chapter 4 The development and evaluation of digital health technologies to support the transition to motherhood – a systematic review using principles from textual narrative synthesis

4.1 Chapter overview

Digital resources may have the potential to support and promote maternal psychological wellbeing in the transition to motherhood by enhancing the perinatal experience. Understanding how maternal wellbeing is conceptualised and addressed by existing digital resources and how such resources are developed and for whom is critical to inform development of future DHIs that go beyond simplistic digital mirroring of the process of becoming a mother. At the time of writing (2016), synthesis of the evidence relating to perinatal digital wellbeing resources supporting the transition to motherhood was limited. I begin the chapter by providing the background to the review and outlining the aims and objectives. The methods used to address these are then described. The review results are then reported before moving on to a discussion of the findings. This is followed by a consideration of the review’s strengths and limitations and pragmatic implications of the review for future research. The position of the review in the overall project is illustrated in Figure 4.1.
4.2 Background

As outlined in Chapter 2, DHIs have the potential to provide cost-effective, timely support and information to women in late pregnancy and early motherhood. DHIs may be able to address unmet needs and fill gaps in statutory care and Chapter 2 provided an overview of the rationale for developing resources that go beyond the digital mirroring of the pregnancy experience, aimed at the low-risk majority and which re-imagine the concept of maternal wellbeing beyond that of treating physical illness or psychological distress. However, before development and evaluation recommendations can be made, it is important to know what already exists and what evidence there is for its usability, acceptability and likely effectiveness. Syntheses of
Digital perinatal interventions have focused on the efficacy of web-based resources to treat or prevent perinatal physical complications from excessive weight gain, (O'Brien, McCarthy, Gibney, & McAuliffe, 2014); on the treatment and prevention of mental health disorders (Ashford et al., 2016; Lee, Denison, Hor, & Reynolds, 2016a); the improvement of parenting skills (Nieuwboer et al., 2013); and the impact of peer and professional parenting support (Niela-Vilén et al., 2014).

In addition to knowing what already exists, it is important to know how such resources have been developed and why. Approaches to DHI development are heterogeneous and DHIs may vary on multiple dimensions, such as: the degree of interactivity, theoretical basis, and use of face-to-face or alternative forms of support. Numerous commercial applications exist which claim to support women in the transition to parenthood but the academic evidence regarding the range and types of DHIs which claim to enhance the perinatal experience for the low-risk majority is sparse (O’Brien et al., 2014). Disciplines accrue knowledge and develop paradigm-specific concepts and approaches which accord with their epistemological and methodological norms (Kuhn, 1962). However, development and evaluation of DCBIs has been informed by multidisciplinary approaches, including biomedical, behavioural, and computer sciences, and human-computer interaction. Therefore, an interdisciplinary approach which synthesises knowledge from across the disciplines is required in order to identify replication or knowledge gaps, and to harness best practice from across traditionally siloed disciplines so as to best understand what works, how, for whom and why.
The aims of this review were twofold, the second building upon output from the first.

1. To synthesise and critically evaluate past work on perinatal DHIs to address the following research questions:
   
a) Who have perinatal DHIs actually been developed for?

b) How have perinatal DHIs been developed?

c) How has wellbeing been defined in the selected literatures?

d) How has wellbeing been measured in the selected literatures?

e) Which theories have been used to underpin interventions?

f) What factors are proposed to support successful outcomes?

2. To develop an integrated framework of recommendations that could be used to support the design and development of future digital resources to support the transition to motherhood in low-risk pregnancy.

4.3 Methods

The Cochrane Handbook of Systematic Reviews of Interventions (Higgins & Green, 2011) was used to inform the development of the search strategy, identify inclusion criteria and select studies. Principles from narrative synthesis (Lucas, Baird, Arai, Law, & Roberts, 2007; Popay et al., 2004; Ryan, 2013) were used to inform data extraction and synthesis.
4.3.1 Criteria for considering studies for this review

The acronym PICOS (Population, Intervention, Comparator, Outcome and Study type) was used to determine the inclusion and exclusion criteria. Studies with adult pregnant participants were included, where pregnancy was low risk and conception was spontaneous (i.e. not through assisted reproductive technologies). Studies were included which described the development, evaluation or usage of any digital resource or intervention (including text messaging, wearables) designed to promote holistic wellbeing in pregnancy or support the pregnancy experience. Articles were excluded if they described online information seeking or described resources which were designed primarily for use in the postnatal period, which did not incorporate any digital component as part of the resource itself (i.e. face-to-face delivery only) or if the technology was used solely as a way to deliver measurement tools. Interventions or resources with the main aim of ‘treatment’ of or ‘therapy’ for pre-existing conditions (e.g. moderate/severe affective disorders) or gestational physical conditions (e.g. hypertension, obesity or diabetes) were excluded, as were those intended to support women with complicated pregnancy (foetal abnormality, miscarriage) or termination of pregnancy. Resources designed to support healthcare professionals in the care of pregnant women were also excluded. The outcomes of interest included the definition or conceptualisation of maternal wellbeing, measures of wellbeing, descriptions of theoretical underpinning and key intervention components and intervention efficacy expressed either implicitly or explicitly. All types of study designs were included except position papers and all information sources included other than those which were not peer-reviewed or available in English.
4.3.2 Search methods

4.3.2.1 Electronic searches

A structured search of the following electronic databases was conducted in May 2016: OVID Medline (1946-May 2016), PsycINFO (1806-May 2016), MIDIRS (1971-May 2016); ISI Web of Knowledge (1900-May 2016) and ScienceDirect (1900-May 2016). An academic librarian was consulted and provided support in finalising the search terms with the aim of achieving a pragmatic balance between sensitivity and specificity (Higgins & Green, 2011). Terms were searched for in titles and abstracts as free text terms or as indexed terms (e.g. Medical Subject Headings, MeSH) to identify studies related to wellbeing and pregnancy and online: ‘wellbeing’, ‘well-being’, ‘quality of life’, ‘worry’, ‘pregnancy’, ‘maternal’, ‘antenatal’, ‘online’, ‘web’, ‘digital’, ‘internet’. The full search strategy used is provided in Appendix 1.

Literature from adjacent disciplines such as HCI is not commonly indexed on academic databases. Therefore, a semi-structured search was also conducted using the Association for Computing Machinery Digital Library (a repository for conference proceedings) and the HCI Bibliography search engine. Relevant journals (e.g. Journal of Medical Internet Research, Journal of the American Medical Informatics Association, Telemedicine and e-Health) were hand searched, and reference chaining was employed to identify additional articles of interest (Higgins & Green, 2011).
4.3.2.2 Data collection and analysis

4.3.2.2.1 Selection of studies

Articles identified through the electronic and hand searches were merged using the bibliographic software Mendeley and duplicates removed. Two reviewers independently screened titles and abstracts of the identified articles against the inclusion and exclusion criteria (Higgins & Green, 2011). Any disagreements were resolved through discussion. Following screening of titles and abstracts, additional inclusion and exclusion criteria were added such that the sample of articles might be refined in order to better answer the research questions. For example, articles describing user needs and requirements in the context of digital interventions addressing healthy eating and general lifestyle changes were included as they included general measures of wellbeing and provided valuable qualitative evidence regarding women’s views of the development and evaluation of digital resources within the broader ‘pregnancy ecology’ (Peyton et al., 2014).

4.3.2.2.2 Data extraction and management

A data extraction form was developed in order to extract information about the participant characteristics, study design and key findings relevant to the research questions (Lucas et al., 2007; Popay et al., 2004). The pro-forma was piloted on a sample of included articles to ensure that relevant information was captured. No changes were made.
4.3.2.3 Quality appraisal

Narrative syntheses take an approach akin to that of other pragmatic aggregative review methods such as critical interpretive synthesis in advocating the prioritisation of relevant articles rather than favouring particular study methodologies (Dixon-Woods et al., 2006). Therefore, studies were included which were considered to be relevant to the research questions rather than if they met certain methodological standards. However, a ‘best practice’ approach was taken to the evaluation of quality and was guided by use of the appropriate CASP (Critical Appraisal Skills Programme, 2018) checklist: clear formulation of the research question; appropriate methodology; clear rationale and description of data analysis; appropriate description of the results; discussion of limitations and transferability or generalisability; discussion of researchers’ position (where appropriate). No articles were excluded from the synthesis on the basis of quality. Instead, quality assessments were incorporated into the data synthesis (Popay et al., 2004).

4.3.2.4 Data synthesis

Based on the principles described by Popay et al. (2004) and Lucas et al. (2007), the analysis comprised of the following steps which facilitated the logical reduction, comparison and interpretation of the data:

1. **Textual description**: a descriptive paragraph was produced for each included study.

2. **Grouping**: included studies were organised into groups to support the iterative exploration of patterns within and across these groups.

3. **Sub-group synthesis**: a synthesis of each sub-group was produced.

4. **Thematic synthesis**: the scope, differences and similarities among studies were used to draw conclusions across the studies relating to the research questions.
4.3.2.5 Epistemological position

Literature reviews rarely include consideration of the reviewer’s epistemological position. Conventional systematic review methodologies are positioned to be ‘objective’ in this respect: the technical skills of searching, sorting and checking data allegedly ‘protect’ against potential researcher bias, although this absence of bias is contested (Greenhalgh et al., 2018a). This review took a constructivist perspective, both in terms of the iterative approach taken to the interpretation of the data and of the data included, which prioritised studies describing the contextual evaluation of existing technology. In addition, this review takes a position akin to that described by Nunes et al., (2015) in their review of self-care technologies in HCI: I did not conduct this review as a neutral researcher. Professional and personal experiences, together with a belief that technology has an important role to play in supporting health and wellbeing, sensitised me to important problems and influenced my interpretation of those issues.

4.4 Results

4.4.1 Summary of search results

Figure 4.2 shows a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the study selection process (Moher, Liberati, Tetzlaff, & Altman, 2009). The electronic database search yielded 561 published articles. After removing duplicates, 396 articles remained for screening. Of the 24 full texts screened, 15 met the inclusion criteria and were included in the review. Nine further texts were found through hand searching. Three reviews, 7 quantitative studies, 1 qualitative study and 9 mixed methods studies were included. In addition, 2 protocols, 1 article describing a retrospective mapping exercise, and 1 article
describing development of an intervention were included. Sixteen interventions from 10 countries were described across the articles. Characteristics and textual descriptions of the included studies are described in Appendix 1.

Figure 4.2 PRISMA flow diagram of the study selection process.
4.4.1.1 Grouping and sub-group synthesis

Each included article was numbered and described in a commentary (Appendix 1), reporting on study characteristics, context, quality and findings. Factors identified from the wider literature as likely to be helpful in synthesising the evidence regarding the development and evaluation of health technologies to support the transition to motherhood were used to define a number of sub-groups. These were:

1. Definition of perinatal wellbeing / target behaviours
2. Target users
3. Theoretical underpinning
4. Involvement of target users in the development process
5. Measures of wellbeing used
6. Evaluation methods

A synthesis was then produced for each sub-group (see Appendix 1 for an example). Finally, the key differences and similarities among articles were used to draw conclusions across the studies relating to the research questions. Drawing conclusions across the studies was not always possible due to study heterogeneity and missing data. In the synthesis, articles are referred to by number corresponding to that provided in the table of characteristics (Appendix 1).
4.4.2 Who have digital perinatal resources actually been developed for?

4.4.2.1 First time mothers

Four [9,11,12,24] out of the 16 DHIs explicitly targeted women who were pregnant for the first time. They were heterogenous in rationale and technology described. Two [9,11] used a website, one [12] used a computer-based programme, and the fourth [24] described the development of a smartphone application. The rationale for targeting first time pregnant women was also varied: a programme designed to enhance the strengths and well-being of parents [9]; provision of culturally congruent information [11]; provision of factual, newborn care information to support maternal confidence [12]; provision of tailored information and self-tracking features, to mitigate women’s “insufficient experience in handling pregnancy and high insecurity” [23]. All four positioned themselves as holistic, low-threshold preventative tools.

4.4.2.2 Pregnant women and/or their partners

Four DHIs [7,8,9,19] targeted pregnant women and/or their (heterosexual) partners. These resources were also heterogenous in rationale and technology described. Three described websites [8,9,19] and one [7] describes the development and formative evaluation of a wearable paired with a smartphone application for the purpose of interpreting somatic sensations and communicating them to the partner. Provision of information and support for partners (fathers) varied: to improve the pregnancy experience for the couple [7]; to target relationship satisfaction by enhancing communication between partners and facilitating healthy conflict resolution [8]; to support parental self-efficacy and self-confidence and address the unmet need for father-focused information in the perinatal period [9,19].
4.4.2.3 User subgroups

There is evidence of development of DHIs targeting the wellbeing needs of specific subgroups of pregnant women [1,6,11,14,17,18]. DHIs have been developed for complicated grief during pregnancy, pregnancy following miscarriage, and anxiety in context of diagnosis of pre-term labour [1]; to meet the needs of underserved pregnant women [6,14]; to meet the needs of underserved African American women [11 17]; to meet culturally specific needs of pregnant Pakistani women [18]. The technologies employed vary: web-based programmes [1,11,14], text messages [6], generic mHealth opportunities [17] and a smartphone application [18]. The development and evaluation were reported in some instances through a particular lens of cultural specificity and provided nuanced contextual feedback regarding user needs and requirements [11,18].

4.4.2.4 Postnatal women

Although post-natal interventions were not the specific focus of this synthesis, findings from existing syntheses of the behavioural science literature provided valuable insight. Previous syntheses have sought to provide an overview of computer- or web-based interventions for the prevention or treatment of women's perinatal mental health issues by systematically identifying and reviewing their characteristics and efficacy [1,13]. The majority of interventions were developed for use in the postnatal period and there was some evidence of the efficacy of treating postnatal affective disorders through engagement with digital resources. However, findings were largely limited by study heterogeneity and quality. The evidence suggested that there was an opportunity to explore the viability of antenatal resources which take a more preventative approach.
4.4.2.5 Pregnant women as a homogenous group

Six of the sixteen DHIs were aimed at pregnant women and new mothers as a relatively homogenous group [2,6,15,21,22,33], conceptualising pregnancy and the transition to motherhood as a culturally and subjectively universal experience. There was evidence of some overlap: some resources were targeted at particular subgroups (e.g. underserved women facing health disparities) but could be used by anyone interested.

4.4.3 How have digital perinatal resources been developed and evaluated?

The majority of studies received average to high scores on the quality appraisal tool and all were included in the synthesis. However, descriptions of intervention development and evaluation varied widely in detail and scope and most studies were found to have limitations relating to sampling strategy and potential bias, sample size, missing demographic information, unclear population description, poor or missing intervention description, poor reporting of methods or results, or appropriateness of methods. In addition, there was evidence of a tension between paradigms and the quality appraisal tool itself: for example, articles from the HCI literature did not always meet the requirements of the critical appraisal tool but nonetheless provided rich, contextual, useful data.

4.4.3.1 Development

It is important that intervention content and development processes are described for other researchers to build on, so that science is cumulative. However, full descriptions were absent or partial in the majority of articles. Four studies provide evidence and explanation of their development processes, most notably in one case [5] through the
retrospective application of the Intervention Mapping framework (Bartholomew et al., 1998). Similar depth was noted in [9,10, 19,23] although the approaches were less formalised. Examples from the HCI literature outlining the iterative development and formative evaluation of prototypes also provided evidence of the development process, albeit on a small scale.

One article [2] described the digitisation of an existing face to face perinatal resource; one article [15] described the repurposing of an existing digital resource for a novel population; in one case [3] it was unclear whether it was a description of an existing tool being evaluated in a new population or a novel tool. The remaining articles described the development of a novel web- or computer-based programme [1,2,3,4,9,10,11,12,14,15,20,21], email programme [21], text messaging service [6], wearable [7], or smartphone application [7,10,18,22,24].

A number of papers described the involvement of healthcare professionals in the development of the content and/or intervention [7,9,10,11,12,14,16,18,19,21,22,23,24], although contribution varied widely, ranging from limited involvement in sensitising interviews to their exclusive development of the intervention. Similarly, inclusion of the target user in the development process varied: where it is reported, inclusion ranged from pre-evaluation usability only [2,9] to target users providing some sort of sensitising information or feedback throughout the development process [7,10,18,22,23,24]. However, evidence was lacking as to how this feedback was translated into design solutions.
Several papers explicitly refer to the involvement of large, multidisciplinary teams of subject experts in the development, evaluation and implementation of the resource [5,9,10,19,21,23].

4.4.3.2 Evaluation

Seven papers describe evaluation in the form of a full or pilot RCT [1,2,6,8,9,12,15,20]. Some studies report a statistically significant intervention effect: a reduction in smoking in the last 30 days [6]; improved attitudes towards alcohol consumption [6]; users felt significantly more prepared to be a new mother [6]; users were significantly more confident in their knowledge of new baby care [12]; users with the highest prenatal anxiety levels experienced the biggest reduction [3]; increase in maternal parenting satisfaction and parenting self-efficacy [20]. Interventions were also evaluated formatively using a combination of interviews, questionnaires and the extrapolation of usage data [7,10,11,14,18,21,22,24]. High levels of attrition and lack of user engagement were reported [2,11,15,20,21] by a number of studies but was largely unexplained.

Notably, the literatures demonstrated evidence of a paradigm-based split in terms of those articles which describe studies taking a more ‘eHealth’ approach to development and evaluation and those which could be considered to take an HCI approach. ‘HCI articles’ [7,17,18,22,24] provided detailed description of an integrated design and evaluation process. They reported the iterative development of high functioning prototypes, based on interviews with the target population and the subsequent development of personas, wireframes and operational prototypes tested with a small group of target users. Meeting user needs and requirements gathered through contextualised methods was prioritised; however, all studies described
formative evaluation of prototypes undertaken in laboratory conditions, using conventional usability and acceptability testing methods such as task completion [18,24] and think aloud paradigms [22,24]. The eHealth papers showed evidence of iterative development, but this was not well described.

4.4.4 How has perinatal wellbeing been defined in the selected literatures?

All the papers included in the review described the development and/or usage of a digital tool designed with the aim of ‘supporting’, ‘improving’ or ‘enhancing’ the maternal pregnancy experience or preventing negative clinical outcomes. However, few provided an explicit definition of perinatal wellbeing as a way of anchoring the objectives of the resource or determining how such support or improvement might be operationalised. Although all the papers recognise pregnancy and birth as a unique life event, there is limited evidence of acknowledgement of the context-specificity of perinatal wellbeing and how this might impact on the development and evaluation of a novel digital tool. No article refers to established wellbeing frameworks (Chapter 2).

4.4.4.1 Wellbeing as subjective experience

Maternal perinatal wellbeing has been defined in the literature (often implicitly) as a subjective experience in which the user feels ‘happier’ or more in control. Where a definition of maternal wellbeing was provided or implied, it was synonymous with self-confidence [9,12,19], self-efficacy [3,9,12,19], feeling relaxed [3,4], relationship satisfaction [5,9], satisfaction with social support [5], an ‘enhanced pregnancy experience’ [7], relatedness [11], and psychological flexibility [15]. One article acknowledged subjective, context specificity [9] and noted that maternal perinatal
wellbeing is a “complicated construct determined by an individual’s perception and evaluation of their life during the perinatal period”.

The subgroup of papers classified as taking more of an HCI approach do not explicitly refer to a guiding concept of maternal wellbeing. Rather, wellbeing was implicitly recognised as the holistic subjective experience of the user while engaging with the digital resource and it is this user experience that the resource targeted rather than a clearly defined clinical outcome or proxy score on a wellbeing measure. Therefore, any underlying concept of maternal wellbeing was directly associated with the contextualised use, design and affordances of the tool itself. The target experience and behaviours were often described in quite simple language, such as the mother feeling “more in control” [18]. Improved maternal wellbeing was overwhelmingly associated with self-management through a process of tracking and sharing information with a partner or healthcare professional. This empowerment through self-awareness was largely operationalised as the user’s active engagement with their data. Data collection was presumed to be consistent, correct and the user was expected to be motivated and able to interpret their data and respond accordingly by accessing appropriate resources.

4.4.4.2 Wellbeing as falling within clinical and cultural norms

The previous section outlined how maternal perinatal wellbeing has been defined in the literature (often implicitly) as a subjective experience in which the user feels ‘happier’ or more in control. However, this was contrasted by the number of resources which, instead, defined wellbeing as complying with cultural or behavioural norms and ‘fitting’ within clinical ranges on psychiatric and somatic measures [2,7,10,11,14,15,18,21,22,24]. Such studies conceptualised perinatal wellbeing in
behavioural or attitudinal terms, associating wellbeing with wide-ranging behavioural change and the absence of postnatal affective symptoms or quantifiable changes in physical health behaviours and beliefs. This was also the case even for studies which positioned themselves as being holistic in aim and scope [3,4,9]. There was also evidence of resources being developed which inadvertently negated the user’s subjective experience [18,22], using social comparison tools to direct the user towards behaviour change resources if self-report information fell outside established norms.

In addition, all studies framed the pregnancy experience as uniquely heteronormative: women were consistently assumed to be one of a heterosexual pair and the woman was often positioned in a passive role of needing to be cared for, where she could actively avoid engaging with her physiological data by muting notifications and passing them on to her (male) partner [7] or communicating more efficiently with her partner or healthcare team [18,22,24]. This was particularly true of articles representing HCI approaches.

4.4.5 How has wellbeing been measured in the selected literatures?

4.4.5.1 Subjective measures

Self-report questionnaires have frequently been used to measure perinatal wellbeing [1,2,3,4,6,8,9,12,14, 20]. A wide number of validated measures have been used: CES-D (Center for Epidemiologic Studies Depression Scale) [2], Edinburgh Postnatal Depression Scale [2,3,4,9,20], Major Depressive Episode Screener - Current/lifetime version [2], Perceived Stress Scale [3], Coping Self-Efficacy Scale [3], Mindful Attention Awareness Scale [3], anxiety subscale of Edinburgh Postnatal Depression Scale [4], Subscale of What Being the Parent of a New Baby is Like-Revised [20],
AQol-8D (Assessment of Quality of Life 8 Dimensions Multi Attribute Utility Instrument) [9], Couples Satisfaction Index [9], Social Support Survey [9], Newborn-Care Knowledge Tool [12], Neonatal Perception Inventory-II [12], Interpersonal Support Evaluation List [12], Maternal Confidence Questionnaire [12], Satisfaction with Life Scale [4], subscale of Family Functioning, Health and Social Support instrument [20], Parental Stress Scale [4], Relationship Satisfaction Scale [4], Breastfeeding Self-Efficacy Scale [4], Prenatal Attachment Inventory [4], Oslo 3-Item Social Support Scale [4], Postpartum Attachment / Parenting Stress Index [4], Efficacy Subscale of the Parenting Sense of Competence Scale [4], emotional reactivity assessed using Infant Characteristic Questionnaire [4], Ages and stages questionnaire-Communication subscale [4].

There was also evidence of measures being developed specifically for use within individual studies, for the evaluation of parenting self-efficacy [20,9], resource acceptability [14,9], child’s sleeping pattern [4], attitudes and behaviours concerning nutrition, smoking and health information-seeking [6], computer use and skills [20].

Qualitative approaches, such as interviews or think-aloud methodology, have also been used to gain understanding of the users’ experiences of engaging with digital perinatal resources and perceived impact on wellbeing [3,6,7,15,17,18,22,24].

4.4.5.2 Objective measures

Automatic tracking of resource usage, including the number of logins, time spent on the resource, the amount and type of content viewed has also been used as a proxy measure for reach and acceptability and, by implication, impact on user wellbeing [2,10,11,15,21].
4.4.5.3 Timing of measures

The timing of measures is notable. Many of the DHIs were evaluated during pregnancy after reasonably limited exposure [6, 7, 8, 11,14,15,22,24]. Of those that were evaluated across the third-fourth trimester transition period, [2,4,9,12,20] postnatal evaluation was largely limited to online self-report of objective measures, or analysis of postnatal usage logs and was often compromised by missing data.

4.4.6 4 Which theories have been used to underpin interventions?

4.4.6.1 Theoretical underpinning

Theoretical underpinning was poorly described across all papers. Theory was either not reported at all or, where it was, its operationalisation was unclear, and it was not used to guide interpretation of results. Theories referred to include: social learning theory [2], reality management training [2], attachment theory [2], Transtheoretical Model [5,6,14], elaboration likelihood model [5], Social Cognitive Theory [5,6], self-regulation theory [5], normative social influence theory [5], Health Belief Model [6], ‘medical theories’ [7], social support theory [11,19], self-efficacy theory [12,19]. Some of the articles refer to ‘guiding principles’ or logic models which have guided the development of the resource but did not necessarily explain how these constructs had been operationalised or why they had been selected to work in combination [6,10]. None of the studies describing HCI approaches referred to the use of any behavioural or motivational theory to guide development or evaluation of the resources. However, it is important to note that there was clear evidence of behaviour change techniques and motivational theory being operationalised in practice if not in name. For example, feedback and monitoring [7,18,24], goal setting [18,24], and nudge theory [7].
4.4.6.2 Therapeutic approaches

Some DHIs framed their content as being delivered through the frame of a variety of therapeutic approaches, including relaxation and mindfulness principles [3,11], metacognitive therapy [5], positive psychology [5], or Acceptance and Commitment Therapy [15]. In a number of cases, the therapeutic approach was implied rather than being explicitly stated [e.g., 9]. Some DHIs included contact with a healthcare professional: users could use an ‘ask-the-nurse’ email feature [11], contact a healthcare professional by email for up to 2 weeks postpartum [19], or send their tracking information directly to their healthcare provider [24].

4.4.7 What factors and features have been found or hypothesised to be important to user engagement with a digital perinatal resource?

4.4.7.1 Mechanisms of action

Mechanisms of action proposed to impact on the efficacy of the intervention included increased knowledge [2,3,5,6,7,10,11,12,18,21,23,24], affect management [3,5,11], expectation management [2,6], cognitive restructuring [5], skill building [5,11,12,22], practice of programme content [2,3,24], increased self-efficacy [5,6,9,14,19], problem solving [9], goal setting [7,9,10,22], self-monitoring [10,18,22,24], and social comparison [18,22,24]. Some DHIs which included a focus on behaviour change posited a distinction between passive receipt of information content and the ‘activation’ of skills proposed by the intervention [9,14], such as help seeking [5,23], improved communication [5,7,22,23], and positive lifestyle choices [2,6]. It has also been hypothesised that mechanisms of action such as relatedness to peers might lead to positive outcomes [11,12,18,22].
4.4.7.2 Demographic characteristics

Age [8,9], gender [8,20] internet use [10,20] and education [6,8,11,18, 20,21] were hypothesised and found to be associated with usage and behavioural activation as a result of engaging with DHIs. There were patterns towards a positive relationship between higher age, being a woman (when using a resource targeting couples), higher baseline levels of internet use and higher levels of education. However, the pattern was more mixed for age, with some studies reporting increased use by younger participants [11,20].

4.4.7.3 Physical characteristics

Being in first time pregnancy was hypothesised and found to be positively associated with interest in and usage of DHIs [2,8,9,11,12,17,20].

4.4.7.4 Psychological characteristics

Although treatment of existing perinatal affective disorders was not the focus of this review, there was evidence [1,2,3,13] that DHIs can be effective in treating pre-existing affective disorders, particularly in the postnatal period. Conversely, the user’s belief that they did not need to address wellbeing or already possessed the information being presented was negatively associated with use of DHIs [3,8].

4.4.7.5 Intervention features and content

4.4.7.5.1 Relevance

Resources which provide multiple ‘hooks’ and included content perceived as being relevant to the user in a subjectively meaningful way were associated with increased
use [2,6,10,11,12,14,17,18,21,22,24]. The perception that content was not relevant was found to impact on engagement, especially if it was not congruent with the user's gestation [8], or if an existing resource was being repurposed for use in a different population with no adjustment made [15].

4.4.7.5.2 Cultural congruence

Resources featuring culturally congruent content, imagery and focus were hypothesised and found to associated with increased usage and acceptability [2,3,11,12,14,17,18].

4.4.7.5.3 Personalisation

The personalisation or tailoring of content was found to be important [7,10,17,18,22,24] and qualitative data showed that users may actively disengage with a resource if the content cannot be adjusted to meet their needs [8]. Interactivity, that is, a two-way flow of information between the user and the DHI is hypothesised [7,8,9,10,11,14,18,21,22,24] to influence user engagement. However, the way in which studies define interactivity was broad and could refer to features enabling self-monitoring and tracking, completion of worksheets, inputting preferences in order to receive tailored feedback, the autonomous selection of content, or the completion of a worksheet in response to a prompt.

4.4.7.5.4 Social support

Social support features which provide users with the opportunity to interact with peers or healthcare professionals or view experiential information were associated with increased engagement and user satisfaction [11,12,17,18,22,24]. However, there
was also evidence [24] that healthcare professionals had concerns about the potential additional burden this could place on their workload and how they would manage user expectations around contact and accountability.

4.4.7.6 Delivery

4.4.7.6.1 Mode of delivery

A wide variety of modes of delivery have been hypothesised to be appropriate for the delivery of perinatal wellbeing information and support, including computer- or web-based programmes [1,2,3,5,9,10,11,12,14,16,19,21], text messages [6], email [21], wearable [7], and smartphone application [7,15,17,18,22,24]. In addition, the mode of delivery was hypothesised to impact on engagement with DHLs. Platform incompatibility [8] or the inability to access the resource on the user’s own device [11,15] was associated with user disengagement. Structured content, such as tunnelled interventions which lead the user along a predetermined set of steps according to a schedule [2,3,4,5,6,21] were hypothesised to be important for engaging users and ensuring they receive the ‘right content at the right time’. It was acknowledged in one study [8] that this was not always seen as efficient by the user but was still proposed to have a positive effect on intervention adherence. Conversely, other studies proposed self-paced, unlimited use [7,9,10,11,17,18,22,24] as being more appropriate.

4.4.7.6.2 Prompts

There was evidence of studies using prompts to remind users to enrol in the study or complete study measures, but only limited evidence [9] of studies using prompts to
remind users to engage with the resource under evaluation. Repeated telephone calls to users to encourage them to use the resource were shown to be ineffective [11].

### 4.4.7.6.3 Tone

The tone, terminology and wording used to communicate content were hypothesised and found to be important factors in engaging users [8,9,10,11,17], as was the presence of a narrative or personification [5]. Features that were suggestive of credibility and trust in the content and its provenance were hypothesised and found to be important [2,8,10,12,24]. Furthermore, ease of use was important in maintaining user involvement [8,11,14,23,24].

### 4.4.7.7 Timing and ‘dosage’

The point of pregnancy at which the resource is intended to be used varied widely across all studies and there was limited reflection on the impact that this may have had on the study outcomes [15]. Some studies indicated when the resource should be introduced [4,9,11,12,15,20,21], and this ranged from around 10 weeks’ gestation to around 34 weeks’ gestation. Two studies [2,10] were effectively open access resources available to any individual who had access to the internet and gestational time at recruitment was not reported.

The prescribed or intended dose of the intervention was similarly broad, and findings are synthesised with caution, due to the fact that some studies report an abbreviated, formative evaluation of the resource. Therefore, use as described in the studies may not reflect intended dosage. Nonetheless, studies which ‘prescribe’ use in some way ‘prescribe’ the sequential unlocking of 8, 15 or 44 sessions [2,3,4] and the receipt of
up to 3 text message per week [6]. Notably, one study reported that there was no impact of duration of usage on self-reported levels of the primary outcome [20].

**4.4.8 Development of an integrated framework**

Torraco (2005) recommends the inclusion of a pragmatic research agenda that flows logically from the critical analysis of the literature, to posing questions that direct future research. An integrated framework was therefore produced, using key factors arising from the synthesis which could be explored in subsequent research (see Table 4.1), and is summarised below.

Development of an integrated framework was limited by the heterogeneity of studies and limited qualitative feedback reported. However, the synthesis suggested that the aims and objectives of the resource should be clearly defined and linked to an appropriate theory, with constructs clearly operationalised. The resource components identified as being of most value may include synthesised, practical content, perceived by the user to be relevant to the stage of pregnancy, delivered to a clearly defined population. The resource should cross the transition from late pregnancy to early motherhood and should be evaluated in a meaningful way, in the wild, at this point in the perinatal journey. The resource should be delivered via a simple multiplatform resource which the user is able to access via their own digital devices. The resource should be developed together with target users and subject experts and should not necessarily be the digitisation of an existing face to face resource and should not be the implementation of an existing wellbeing tool in a new context.
<table>
<thead>
<tr>
<th>Who might the resource be for?</th>
<th>Women who are pregnant for the first time [2,8,9,11,12,17,20]</th>
</tr>
</thead>
<tbody>
<tr>
<td>When might the resource be introduced to the user?</td>
<td>Antenatal use in mid-late pregnancy, for use over the transition into the fourth trimester [4,6,9,10,12,17,19]</td>
</tr>
</tbody>
</table>
| What may be important factors to include in the resource? | Information perceived to be credible and relevant to stage of pregnancy [2,6,8,10,11,12,14,17,18,21,22,24]  
Synthesised, specific and practical parenting information (care for a newborn, breastfeeding etc) [5,8,9,10,12,17,18,20,21,24]  
Culturally congruent information [2,3,11,12,14,17,18]  
Direct /indirect access to healthcare professionals via (a)synchronous communication platform or FAQs [11,12,17,18,22,24]  
Multiple ‘hooks’, including general lifestyle advice and support (diet, emotional wellbeing, physical activity; intimate relationships) [5,6,7,9,10,12,17,18,20,22,24]  
Experiential information or access to other mothers in form of blog or discussion board [11,12,17,18,22,24]  
Tracking or self-monitoring facility [7,10,18,22,24]  
Positive and encouraging tone [5,8,9,10,11,17] |
| How might we develop the resource? | Clarity and operationalisation of theoretical underpinning; grounded in user needs and requirements; iterative development with target users; inclusion of subject experts. |
| How might we evaluate the resource? | Longitudinal evaluation in the wild, across the transition to the fourth trimester; use of meaningful measures and qualitative approaches in the first month of new motherhood. |
| What do we still not know? | User goals; aesthetic preferences; structural preferences; dosage; how a resource would ‘fit’ into existing pregnancy information and support ecologies; how perinatal women conceptualise their wellbeing and how this might impact on resource content and evaluation measures; how many intervention components are sufficient. |

*Table 4.1* Integrated framework of key factors for exploration in subsequent research
4.5 Discussion

This synthesis has integrated the HCI and biomedical science literatures on the topic of perinatal wellbeing for the first time and has highlighted the diverse ways in which different disciplines are engaging with the theme of perinatal wellbeing. The review explored who DHIs have actually been developed for and how they have been developed and evaluated. It also examined how perinatal wellbeing has been defined and measured and which factors have been proposed as being important in terms of mechanisms of action, user characteristics, and intervention features, content and delivery. The review found that a reasonable number of resources have been developed across the disciplines of behavioural science and HCI. However, resources were methodologically heterogeneous and critical evaluation was limited by studies’ lack of theoretical positioning, the density of intervention components and evaluation measures used and a lack of meaningful evaluation. This synthesis led to the development of an integrated framework intended to guide the evidence-based development and evaluation of digital perinatal wellbeing resources targeting first time mothers and their preparation for early parenthood.

This synthesis confirms and extends what is known about the development and evaluation of digital perinatal wellbeing resources. Previous research has shown that perinatal women are ubiquitous users of a wide variety of online resources (Plantin & Daneback, 2009a) and that pregnancy may be a teachable moment in which women may be particularly motivated to engage with health and wellbeing information (Olander et al., 2016). However, this review illustrates that, in the development of DHIs, pregnant women are persistently defined as a homogenous group with similarly homogenous information and support needs, regardless of being in early or late pregnancy. Nuances of digital behaviours across the perinatal period are largely unexplored and resources are largely developed for women rather than by or with
them. This lack of user involvement in resource development and/or evaluation has led to the development of DHIs which replicate each other and do not address user needs.

Indeed, determining what works, why and for whom in the context of digital resources is critically important: there is an acute moral imperative to use public funding wisely in the development of patient-facing digital tools. As such, the development of complex digital interventions arguably requires the clear formulation of questions that the intervention is attempting to address and the steps taken to achieve this (Craig et al., 2008; Murray et al., 2016), including clarity and appropriateness of intended population and outcome, coherence of theoretical basis and description of intervention components. Although there was evidence of this [5,9,10], this process was largely absent from the studies included in this review. Where theory was described, there is evidence of what Hekler, Klasnja, Froehlich, & Buman (2013) have argued is the ‘cherry picking’ of theoretical constructs from a wide range of theories with limited rationale for doing so. This lack of systematic, clear description of development was often coupled with limited depth of evaluation. The synthesis underlines a marked preference for the administration of quantitative measures, often in larger numbers, with a focus on efficacy of a DHI rather than acceptability. Crucially, most of the resources evaluated hypothetical efficacy and engagement, either by only providing a resource intended for long-term use for an abbreviated period of time, or by developing paper prototypes or resources which were only for use during pregnancy. Meaningful qualitative exploration of use was largely absent, limited to content analysis of within-study discussion boards or responses to open ended survey questions.
The process of data reduction also highlighted a distinction between studies perceived to be taking an ‘eHealth’ approach and those taking more of an ‘HCI’ approach. The distinction was evident from titles and terminology to the underlying principles guiding the study aims and design and positioning of key findings. eHealth papers might be characterised by their descriptions of evaluation of a static digital resource, using what would be considered ‘gold standard’ study designs; the majority of these studies described ambitious programmes, developed by large teams, intended to reach large, heterogeneous audiences and to have quantifiable efficacy. Some kind of theoretical underpinning was more likely to be described by these papers and maternal wellbeing more likely to be defined (albeit implicitly) and measured using quantitative tools. Conversely, the papers demonstrating an HCI approach describe exploratory, iterative design cycles incorporating small-scale evaluations of acceptability and functionality with limited samples. These studies articulated the contextualised development and (very) formative evaluation of the user experience of engaging with these digital tools. Papers presented within the HCI paradigm focused on acceptability rather than efficacy; theoretical underpinning or causal pathways were not described and conceptualisation of user wellbeing was largely absent.

These two subgroups of included studies take different epistemological positions and therefore tell different kinds of ‘stories’. The eHealth papers largely took the form of large-scale, rigorous studies which were published in reasonably high impact journals, followed certain disciplinary methodological and publishing conventions and reported their results in terms of efficacy (even if efficacy is sometimes simply conflated with usage). However, nuance was hidden and results were described in overwhelmingly positive terms, masking the realities of low uptake, attrition and limited evaluation. Few of the eHealth papers included in the study demonstrated
intended efficacy and most struggled either with recruitment, dropout or both, a noted feature of eHealth interventions and trials (Murray et al., 2013). Conversely, HCI studies included student design and works in progress and focused perhaps disproportionately on design and usability. Evaluation was limited and constrained to laboratory settings and the studies fell short when evaluated using formal quality appraisal tools. Nonetheless, the resources developed were pragmatic and original, and arguably more likely to be perceived as useful and engaging and downloaded onto a user’s smartphone for everyday use. Furthermore, the HCI approaches included in this review also provided evidence of an interesting disciplinary tension: pregnancy was perceived as a heteronormative, medicalised experience in which a woman tracks her behaviour and fits within clinical norms - this focus on the self-monitoring of ‘good behaviour’ contrasted with evidence of deep exploration of women’s goals and the creation of an optimal user experience.

However, the distinction between eHealth studies and those taking an HCI approach is not mutually exclusive. eHealth studies were generally large and highly ambitious complex interventions, yet suffered from poor uptake, high attrition and lack of clarity around determining which parts of the intervention were of value and which were not, and why. Conversely, the HCI studies were small and focused extensively on meeting user needs through an intense and iterative process of requirements gathering, prototype refinement and limited evaluation. The studies that were most useful were those which appeared to sit somewhere between the two approaches, namely [11,12,18], which described the development and use of relatively simple, culturally-congruent resources. The studies were comparatively small in scale but this was advantageous in that they were helpful in terms of understanding the relationships between targeted users, engagement and potential impact. For example, the women recruited to use the Healthy Baby website [11] engaged with it in unanticipated ways
but the site’s limited components allowed for a clear understanding of what aspects of the site were valued and which might benefit from better signposting.

A pragmatic, interdisciplinary approach is critical to be able to produce a credible, documented account of how to develop and evaluate a targeted digital resource. Multiple resources exist that simply replicate the pregnancy experience in digital form (O’Donnell, Lewkowitz, Vargas, & Zlatnik, 2016); these are insufficient in meeting the wellbeing needs of pregnant women and therefore alternative resources that address user needs are required. Pregnancy does not exist in a cultural or social vacuum; rather, the ‘pregnancy ecology’ [17] necessitates the development of congruent health and wellness management tools which are useful and ‘fit’ within a user’s existing digital lifestyle. This requires interdisciplinary crosspollination whereby best practice from eHealth and HCI approaches are combined (Murray et al., 2013).

Through the application of a systematic, interdisciplinary approach, the proposed integrated framework offers an overview of factors that may be important to consider in the development and evaluation of digital perinatal wellbeing resources for use in first time pregnancy and is a starting point for a clearer articulation of what works, how and for whom.

4.5.1 Strengths and limitations

The synthesis benefited from a process of systematic searching, the use of transparent and replicable inclusion and exclusion criteria and double screening. Data was extracted systematically and synthesised using a formal process. The synthesis of the literature was guided by a predefined set of research questions. This may have limited the interpretation of data but reflected the key questions of interest as set out
in the rationale for the review. Another limitation is that the quality assessment of the included articles was incorporated into the synthesis rather than being reported formally and separately. However, this was in line with the chosen method, which suggests that the articles should be judged on the basis of their relevance to the research question rather than their methodological rigour. A further limitation is that the data extraction and literature synthesis were conducted by a single reviewer, potentially introducing bias. Finally, the end date for the literature search (i.e. May 2016) constitutes a limitation; with the pace of technological advances and the proliferation of digital health research, relevant literature has since been published.

4.5.2 Conclusions

This review of the multidisciplinary literatures has identified, described, synthesised and critically evaluated the evidence regarding digital wellbeing interventions for women in low risk pregnancy. Due to the heterogeneity of resources and limitations in development and evaluation approaches, it is difficult to draw definite conclusions about their potential impact and acceptability. However, the findings are encouraging and suggest that women are willing to engage with such digital resources and that small-scale projects which target first time mothers in mid-to-late pregnancy, which are grounded in theory and user needs and formed of relatively few interacting components, may be acceptable and valued by the target population.

4.5.3 Implications for the thesis

In order to evaluate and refine the integrated framework, the next steps of the thesis were to explore how target users of a new DHI developed to support maternal wellbeing over the transition to first time motherhood conceptualise their own wellbeing and gain a deeper understanding of how women use digital resources in
general in mid-to-late pregnancy. These insights could then be used to guide the
development and evaluation of a new DHI. A qualitative exploration of perinatal
women’s contextualised use of digital resources and their views and beliefs about
wellbeing in pregnancy and motherhood was conducted and is reported in the
following chapter.
Chapter 5 Establishing user needs and requirements: a qualitative interview study with perinatal women

5.1 Chapter overview

Critical evaluation of the relevant literature in Chapter 2 established that many perinatal women are willing and able to engage with digital tools to support and improve their experience of becoming a mother. The narrative synthesis in Chapter 4 suggested that non-commercial digital tools developed for use by women in the perinatal period are heterogeneous in design and aim, often treat pregnant women as a homogenous group, conflate perinatal wellbeing with an absence of affective disorder, and focus on meeting clinical norms rather than interrogating and meeting user need. In parallel, there was evidence of smaller-scale studies, grounded in user needs and requirements, but lacking in rigour, theoretical underpinning or formalised evaluation. The review identified an opportunity to support maternal wellbeing in the transition from the third to the fourth trimester through the systematic co-design, development and evaluation of a novel digital tool. The next step, and the focus of this chapter, was to obtain a more nuanced understanding of perinatal women’s digital behaviour by exploring their contextualised usage of digital resources during the transition from the third to the fourth trimester (see Figure 5.1). In addition, it was important to ask perinatal women about their perception of their own wellbeing needs and the feasibility of addressing these through usage of a digital tool. I begin the chapter by providing a background to the study and outlining the aims and objectives. The study was an in-depth qualitative interview study that explored the thoughts, beliefs, experiences and emotions of perinatal women that might influence how and why they engage with digital tools. The exploratory study was conducted with women who were in late, first-time pregnancy, and with women who had delivered their first
child within the previous year. Inductive thematic analysis of the data was followed by a mapping exercise in which the data was reanalysed using principles of self-determination theory in order to operationalise and inform the structured development of a digital prototype. The study demonstrates that a novel DHI for perinatal wellbeing was highly acceptable to participants and women described their wants and needs with regards to features, design, usability, user experience and perceived outcomes. Together with the evidence from the narrative synthesis, the findings from the exploratory study informed the subsequent codesign of a clickable prototype.

Figure 5.1 Position of the qualitative study within the overall thesis (highlighted).
5.2 Introduction

Acceptability is a critical factor in the development and evaluation of new digital tools. The extent to which a target user finds the tool acceptable may determine the degree to which they engage with and benefit from the resource. Digital tools can be complex and comprised of multiple components; developing a resource that meets broad and evolving user needs is challenging. Assessing acceptability through user involvement in the design process is a cornerstone of iterative HCI development and evaluation practice and is emerging as a priority in the context of eHealth. Reference to acceptability within the MRC framework for the development of complex interventions has increased with each guidance publication (Campbell et al., 2000; Craig et al., 2008; Moore et al., 2015) reflecting the growing importance of this construct. However, acceptability is poorly defined, particularly in the healthcare literature (Sekhon, Cartwright, & Francis, 2017) and is often over-simplified and conflated with user satisfaction. Sekhon et al. (2017) argue that acceptability and satisfaction are distinctly different. They propose that acceptability is a multi-faceted construct comprised of a user’s feelings, beliefs and attitudes about a resource and the extent to which it meets one’s needs and values. In addition to being conceptually richer than ‘satisfaction’, acceptability can also be based on a person’s anticipated versus experiential response to an intervention and proposes that development practice would be improved through recognition of the potential tension between the two. This echoes the iterative approach of HCI development practice, where a user’s perception of a digital tool is acknowledged as being fluid and therefore expected to change over time and use. The development and evaluation of credible digital tools therefore requires an understanding of the views and experiences of potential users that captures the complexity of acceptability. Users will have a wide variety of needs and motivations for making use of digital resources and consequently will have different expectations of what such a resource should look like, what it should provide and how
it should ‘fit’ within their wider digital ecology. If we are to be able to maximise uptake and engagement, we must understand the in situ needs and requirements of perinatal women when developing such resources and how these needs and requirements change over time.

However, as described in Chapters 2 and 4, current work on perinatal digital behaviour is often descriptive rather than explanatory. Substantial research from a number of disciplines including eHealth, sociology and cultural geography has examined and described relationships between motherhood and technology, particularly around information seeking (Barkhuus, Bales, & Cowan, 2017; Plantin & Daneback, 2009a; Prescott & Mackie, 2017) and the use of specific forms of digital resources, such as social networking sites and pregnancy-specific applications (Morris, 2014; Thomas & Lupton, 2016). In parallel, an emerging body of feminist HCI takes a more applied approach in its exploration of technology in relation to the perinatal experience and women’s health in general. For example, the development of prototype tools to encourage healthy behaviours in pregnant women (Peyton et al., 2014), tools to support vulnerable women (Thomas, Rankin, Tuta, & Mibuari, 2011) and exploration of how the experience of pregnancy might be documented, shared or managed (Gao, Li, Lin, Liu, & Pang, 2014; Hui, Ly, & Neustaedter, 2012; Sajjad & Shahid, 2016; Wierckx, Shahid, & Al Mahmud, 2014). However, even this work does not always systematically identify, articulate and operationalise women’s evolving needs and requirements and translate them into design solutions. Nor does it use the voice of the target user in a meaningful way: it is often descriptive in nature and rarely situates itself within the “dirty work” of women’s health (Balaam et al., 2017). Rather, it focuses on the margins: describing usage, promoting pleasure, providing information on how to support healthy behaviours, change ‘bad’ ones or better document or manage interaction with healthcare providers. Notable exceptions

The narrative synthesis (Chapter 4) indicated that there is still work to be done in determining what features of a digital intervention are considered important by the user in supporting maternal wellbeing during the transition to first-time parenthood. Studies involving the evaluation of multi-component interventions by large, heterogenous populations of perinatal women are unhelpful in determining what was acceptable to whom and why, especially when robust qualitative exploration of users’ perceptions of acceptability are frequently lacking. Although such quantitative studies can tell us a certain amount about perceived acceptability in terms of user uptake and drop-out rates, they are limited in being able to tell us about the nuances of why people use a resource, why they might not engage and what they value. High usage rates do not necessarily indicate engagement or efficacy (Salonen et al., 2011; Ziebland et al., 2016). Rather, contextual factors combine with intervention design to influence key outcomes. A recent study by Barassi (2017) on the rapid proliferation of self-tracking pregnancy apps frames such resources as “complex ethnographic environments” where acceptability is uniquely tied to user’s culturally-specific beliefs and values. Qualitative research is concerned with the ways that people interpret the world around them, interactions and social processes (Britten, 2011), and as such, is best placed to ask ‘what’, ‘how’ and ‘why’ questions. As Sekhon et al. (2017) remind us, understanding the acceptability of a resource ought to be an ongoing consideration and this is particularly relevant in the context of designing a resource for use at a time of significant life transition (Massimi, Bender, Witteman, & Ahmed, 2014).
To better guide the development of a prototype, it was prudent to explore how usage and acceptability of perinatal digital resources might change across the transition from the third to fourth trimesters. In particular, what design features of a digital resource are considered important, how do perinatal women describe their wellbeing and what values, beliefs and attitudes impact on this. The present study therefore aimed to address the following 3 research questions through the use of qualitative methods:

1. How do perinatal women talk about their wellbeing?
2. How do perinatal women describe their information and support needs in the transition between the third and fourth trimesters?
3. What design features are judged to be important for supporting the transition to the fourth trimester?

5.3 Methods

5.3.1 Design and setting

This was an exploratory qualitative study in which 11 in-depth, semi-structured qualitative interviews were conducted in the general community with 4 pregnant women and 7 postnatal women.

5.3.2 Ethics and research governance approval

UCLIC’s Departmental Research Ethics Committee granted ethical permission (UCLIC/1213/015). Participation was voluntary, and participants were recruited in the same way as any other healthy adult able to give informed consent. Personal
identifiers were removed from the data and the data were stored securely, according to the principles of research governance (Northway, 2017).

5.3.3 Theoretical framework

A critical realist perspective was taken in order to explore participant’s experiences. Critical realist positions acknowledge the way that the broader socio-cultural contexts act as ‘lenses’ through which we interpret and describe experience (Madill, Jordan, & Shirley, 2000). A critical realist approach acknowledges that participants’ accounts are co-constructed through interaction with and subsequent interpretation by the researcher (Tebes, 2005).

5.3.4 Participants

This exploratory study sought the views of pregnant and postnatal women. Women were eligible to take part if they i) were aged ≥ 18 years, ii) were currently in the third trimester of (clinically healthy) pregnancy with their first child or had one child under the age of 1 year, iii) had experience of using digital perinatal resources, iv) lived in or near Oxford. Women who were actively using or who had used digital perinatal resources were recruited in order to gather more valid data. It was supposed that these women would be more able to reflect on design considerations than women who were not interested in engaging with digital resources.

Initially, postnatal participants were required to have one child under the age of one year, but this was revised as data collection proceeded. Qualitative research is by its nature highly iterative and adjustment of the eligibility criteria ensures that the research agenda is defined by the participants rather than the researcher (Braun & Clarke, 2014). Although the intention was to take an inductive approach to the first stage of data analysis, initial data gathering indicated that it was necessary to adjust
the eligibility criteria so as to explore in more depth the experiences of recently postnatal women. Simply, women with older babies found it more difficult to recall the nuances of what digital resources they had found useful and why. The eligibility criteria were therefore amended to include women who had given birth within the previous five months.

5.3.5 Sampling

Determination of sample size often depends on the resources available and the depth of analysis desired (Sandelowski, 1995). A pragmatic balance is often sought between gathering a rich and deep data set and practical management of the data itself (Braun & Clarke, 2013). Indeed, Blandford, Furniss and Makri (2016) propose that the answer to the question of how many participants to include in a qualitative study will be driven either by theory or pragmatism: a theoretical approach will require data collection to continue until theoretical saturation is achieved (where gathering and analysing data on a chosen theme does not yield further insight), whereas a pragmatic approach sees the researcher gathering as much data as it is possible to gather and analyse well in the time available. Saturation is a widely used rationale for sample size in qualitative research but invokes a particular, more positivist model, in which data are collected to provide a complete picture of the object of interest. This study was intended to be a first stage of qualitative data collection in which a relatively large amount of rich data on a reasonably narrow topic was collected in order to ensure that I had enough data to tell an informed story but not so much that it precluded deep engagement with the data in the time available (Onwuegbuzie & Leech, 2005).

As described in Chapter 4, many studies exploring the acceptability and use of digital resources for health and wellbeing support in pregnancy draw somewhat
decontextualised conclusions from quantitative surveys or interview small subsamples selected from within a primarily quantitative study. Examples of studies which do include qualitative methods report sample sizes ranging from 4 to 196 participants (e.g. Haga et al., 2013; Hearn et al., 2014;) and use a range of methods to select their participants, gather and analyse data. Regardless of the approach taken and number of people interviewed or observed, Baker, Edwards, & Doidge (2012) urge transparency regarding the research questions guiding data collection and how the process is managed. The 11 interviews in the current study took the form of ‘sensitising’ interviews (Balaam et al., 2015). They were conducted with the intention of sensitising the researcher to the context as described by members of the population of interest and orienting the subsequent development work.

5.3.5.1 Recruitment

Participants were recruited through approaches to perinatal charities, healthcare and support services in the local community. In addition, local groups affiliated with the National Childbirth Trust (NCT) were approached. However, regulations around how research is ‘managed’ within the larger organisation structure meant that I was not able to approach attendees of local branches directly without approval from Head Office. This process of gaining approval was lengthy and frustrating and was only given following conclusion of the current study. However, the approval was project-rather than study-specific and was invaluable for recruitment to the final, in-the-wild study described in Chapter 10. Participants were also recruited through social media and a free, online community noticeboard.
5.3.6 Data collection

5.3.6.1 Practicalities

The interview location varied according to where was convenient for the participant. Eight interviews were conducted in the participant’s home. One participant was interviewed at her place of work and a further two were interviewed in local cafés. Only the researcher and participant were present. All postnatal women were interviewed with their babies. Interviews ranged from 50 to 102 minutes. The average interview length was 81 minutes. Participants received a £20 gift voucher as compensation for their time.

5.3.6.2 Pilot interviews

Three pilot interviews were conducted, one with a pregnant woman and two with mothers of young toddlers. This was a convenience sample of acquaintances of the researcher and it is acknowledged that some of the questions may not have been of direct relevance to the participants. However, the interviews allowed content and delivery of the interview guide to be checked and revised. The interview guide was not perceived to be ‘fixed’ at the start of data collection: the guide comprised a series of open-ended questions, which served as prompts during the interviews rather than a strict guide. However, piloting improved the dynamic of the interview and encouraged increased focus on contextualised use of digital resources. In addition, minor adjustments were made to the information sheet, including the addition of a colourful logo and a reduction in text.
5.3.7 Procedure

Participants were invited to re-read the information sheet; they then provided informed consent and demographic information, which included a question regarding their perception of their own digital literacy (Appendix 2). The face to face interview began with an open-ended, narrative question, inviting participants to talk generally about their pregnancy or life as a new mother. The open-ended question was intended largely to encourage the participant to become comfortable with the interview process but also acted as a springboard for the researcher to start the interview by probing key points raised. The open-ended narrative question worked well as an ice-breaker but frequently generated a large amount of superfluous data. However, the intimacy of the setting and interview content necessitated an informal, semi-conversational style of interview. During the interviews, I was often holding the baby or making the participant a cup of tea while she fed the baby; we might be looking at content on each other’s mobile phones or talking about intimate aspects of the transition to motherhood. Probes associated with subsequent questions were used to explore and clarify participant responses further. Not all probes were used, and the order of questions and direction of the interview was directed by the participant.

Interviews were scaffolded by the use of digital and paper-based probes to prompt participants to think about different types of digital perinatal information that they may have engaged with. Women were invited to open applications or websites on their own devices and ‘walk through’ their typical usage of them. The interviews included ‘critical incident’ questions in which women were invited to talk about instances when perinatal digital resources had not met their needs or had surprised or disappointed them. The interviews also included questions which took the form of appreciative enquiry (Cooperrider & Srivastva, 2013), based on positive, constructionist principles, in which women were asked to reflect on what they liked and found useful about digital
resources. The interviews concluded with a ‘clean-up’ question which allowed the participant to raise anything important to them that had not been covered.

5.3.8 Data analysis

Interviews were audio-recorded, transcribed verbatim and analysed using inductive thematic analysis. Written notes were not made during the interview but were made straight after each interview to record observations and reflections and formed part of the dataset. Thematic analysis (TA) is “a method for identifying, analysing and reporting patterns (themes) within data” (Braun & Clarke, 2006). TA can be used across epistemological and theoretical positions and this flexibility means it can provide a rich and complex account of the data (Braun & Clarke, 2006), particularly when analysis is exploratory. Inductive TA takes a ‘bottom-up’ approach to the analysis, in which analysis is not shaped by existing theory. It was decided that this was an appropriate and pragmatic starting point, given the exploratory nature of the situated study. However, this analysis was conducted with an awareness that “researchers cannot free themselves of their theoretical and epistemological commitments, and data are not coded in an epistemological vacuum” (Braun & Clarke, 2006). I reflect on my own life experiences and epistemological position and how these may have impacted on the analysis below (section 5.6.1).

TA involves six stages of analysis:

1. Familiarisation and note-taking
2. Coding across the dataset
3. Searching for themes
4. Review of themes and production of a thematic map
5. Defining and naming themes

6. Writing up the analysis

I began the analytical process by immersing myself in the data in order to become intimately familiar with the content: I made notes around what Braun & Clark (2013) call “noticings”, that is, messy ideas and loose overall impressions of the data. This engagement with the data was active and critical and intended to extend my thinking beyond surface understanding of the most obvious observations presented by the data: I tried to think about how participants were making sense of their experiences and why they were doing so in particular ways; I tried to put myself in the participant’s position and interrogated the assumptions they (and I) were making. These noticings were the initial stages in the process of moving towards complete coding of the data. As analysis continued, I took a more interpretative and constructionist approach by exploring and developing latent themes, by thinking about what implicit assumptions, ideas and conceptual frameworks informed and extended the explicit content of the data (Braun & Clarke, 2006). I considered the broader implications of the data and how it represented the socio-cultural contexts of the participants.

Although this study was designed as a sensitising exercise with the aim of better understanding contextualised use of perinatal digital resources, the findings of the study needed to be fit for purpose in order to be translated into the first stage of a candidate design solution. The main goal was to identify which aspects of perinatal wellbeing might be tractable by a DHI and to then operationalise these, using a theoretical paradigm. The initial, ‘sensitising’ inductive analysis was followed by a more explicit theoretical analysis in which the data was re-examined using the guiding principle of wellbeing as balance (Dodge et al., 2012) and the theoretical framework of self-determination theory (Ryan & Deci, 2000). This moved the analysis towards the pragmatic operationalisation of key wellbeing constructs.
5.4 Results

Results are presented thematically. The inductive analysis is presented first, followed by the theoretical mapping and an analysis of user needs and requirements. Participants are identified by participant number and perinatal status, antenatal (AN) or postnatal (PN).

5.4.1 Participant characteristics

Participant characteristics are reported in Table 5.1. Interviews were conducted with 4 pregnant women and 7 women with young babies. The average age of participants was 33 years. All of the participants were in long-term relationships and well educated, and most were regular and proficient users of the internet. Most pregnancies were planned, and all pregnant women were in full time work (or on maternity leave). All participants had used digital health and wellbeing resources, and many had downloaded perinatal-specific applications (see Table 5.2). All participants had normal pregnancies and the majority of postnatal participants had clinically healthy births. Two women described sudden complications towards the end of pregnancy, leading to early deliveries, caused by undiagnosed pre-eclampsia in both cases. One of these babies had then been born with unexpected significant physical complications which were not life threatening but which impacted significantly on the family’s return home and the participant’s overall experiences of new motherhood.
<table>
<thead>
<tr>
<th></th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of participants</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Pregnant</strong></td>
<td>4</td>
</tr>
<tr>
<td><em>Mean number of weeks pregnant</em></td>
<td>34</td>
</tr>
<tr>
<td><strong>Postnatal</strong></td>
<td>7</td>
</tr>
<tr>
<td><em>Mean baby age (weeks)</em></td>
<td>17</td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
<td></td>
</tr>
<tr>
<td>A level/further</td>
<td>3</td>
</tr>
<tr>
<td>Graduate level</td>
<td>1</td>
</tr>
<tr>
<td>Postgraduate/professional level</td>
<td>7</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
</tr>
<tr>
<td>Cohabitating</td>
<td>3</td>
</tr>
<tr>
<td>Married</td>
<td>7</td>
</tr>
<tr>
<td>Civil partnership</td>
<td>1</td>
</tr>
<tr>
<td><strong>Ethnicity (self-defined)</strong></td>
<td></td>
</tr>
<tr>
<td>White-British</td>
<td>6</td>
</tr>
<tr>
<td>White-other</td>
<td>2</td>
</tr>
<tr>
<td>Black African</td>
<td>1</td>
</tr>
<tr>
<td>Black Caribbean</td>
<td>1</td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
</tr>
<tr>
<td><strong>Internet access at home</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Internet access on mobile phone</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Mean self-reported digital literacy (range)</strong></td>
<td>7.5 (7-9)</td>
</tr>
</tbody>
</table>

*Table 5.1 Participant characteristics.*
<table>
<thead>
<tr>
<th></th>
<th>PN0 1</th>
<th>PN0 2</th>
<th>PN0 3</th>
<th>PN0 4</th>
<th>PN0 5</th>
<th>PN0 6</th>
<th>PN0 7</th>
<th>PN0 8</th>
<th>AN0 9</th>
<th>PN 10</th>
<th>AN 11</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shopping</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argos</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boots</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eBay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gumtree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mothercare</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perinatal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tracking / information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby Buddy†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby Bump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby Centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby Tracker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraction Timer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emma’s Diary†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Talk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KellyMom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mumsnet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Baby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT Baby Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.2 Digital resources used by participants.

† indicates resources recommended by a participant’s healthcare team
5.4.2 Themes

Inductive analysis of the data led to the development of two overarching themes in relation to the first two research questions. These themes were used to describe participants’ perception of their wellbeing and their relationship with, usage of and preferences for digital perinatal resources. Participants talked about perinatal wellbeing in terms of losing and taking control; digital resources played an integral role in both. A summary of themes and subthemes is reported in Table 5.3.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling out of control during the perinatal period</td>
<td>Unpredictability of the perinatal experience</td>
<td>Experience not fitting the expectation</td>
</tr>
<tr>
<td></td>
<td>Feeling overwhelmed</td>
<td>By online information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>By ‘well-meaning’ others</td>
</tr>
<tr>
<td></td>
<td>Feeling disappointed</td>
<td>Media representations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statutory services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Postnatal life</td>
</tr>
<tr>
<td>Taking back control during the perinatal period</td>
<td>Seeking out information</td>
<td>Before birth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Following birth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online/offline</td>
</tr>
<tr>
<td></td>
<td>Seeking out others</td>
<td>Face to face</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The importance of shared values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For ‘mummy’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For ‘me’</td>
</tr>
</tbody>
</table>
Proactive engagement

<table>
<thead>
<tr>
<th>Committing to the process and resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committing early</td>
</tr>
</tbody>
</table>

Proactive disengagement

<table>
<thead>
<tr>
<th>Active avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing maternal instinct</td>
</tr>
</tbody>
</table>

Tracking and monitoring

<table>
<thead>
<tr>
<th>The linear process of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-Scaffolding new skills</td>
</tr>
</tbody>
</table>

Table 5.3 Inductive themes and subthemes.

5.4.3 Feeling out of control during the perinatal period

5.4.3.1 Unpredictability of the perinatal experience

Women described the physical and emotional complexity of the perinatal journey, even when pregnancies and births were clinically ‘normal’. All women talked about how the journey had been both worse and better than anticipated; women described a settled/disruption cycle in which periods of stability would be disrupted by a novel pregnancy symptom or newborn behaviour which required action before returning to a (temporary) settled state. Women anticipated pregnancy-specific physical discomfort such as morning sickness and fatigue and knew it would be physically demanding. However, the reality of the embodied experience of pregnancy was still surprising.
And I think I sort of over intellectualised motherhood so I thought about it from various aspects. It came as a shock to me just how physical the whole process was and how a sort of embodied process it all was.

AN02

The experience of pregnancy could also be unpredictably good, with internalised scripts of pregnancy as a time of delicacy or anxiety often unfounded.

I thought I would just sort of lie down for nine months and just yes, just lie down, and I don’t know, eat organic grapes or something. I didn’t realise I’d feel so good. I think there is an image of a pregnant woman having to take it easy, and… I felt amazing. I had so much energy. So yes, it was, I was able to do a lot more than I thought I would.

PN04

All the women interviewed were in stable relationships and all pregnancies were desired (in some cases, meticulously planned). These circumstances were acknowledged as contributing directly to women’s enjoyment of pregnancy; being in a wanted situation gave women ‘permission’ and space to enjoy the experience and manage any unpredictability. Conversely, it also gave them the time to ruminate about their relationships with the trope of ‘motherhood’ and this could raise difficult emotions. Internalised scripts of what pregnancy was ‘supposed’ to be like and the ‘mother role’ surfaced unexpectedly.
I guess it's partly it was this massive identity shift that I wasn't quite ready for, and I'm still not sure if I'm ready for it, but I seem to have been thrown into it anyway. And I suppose it was this resisting becoming somebody that I didn't like very much.

PN01

Pregnancy itself was seen as being emotionally and physically challenging but not particularly 'biographically disruptive' (Bury, 1982). This was in contrast to postnatal life with a newborn, which was typically described in terms of unpredictability and uncertainty. The time immediately after giving birth was seen as especially challenging, largely because expectations were not met. Struggles centred around practical skills in caring for a newborn, breastfeeding and access to statutory services. Women felt that they had prepared for life with a new baby by attending appointments and classes, gathering information and engaging with the process. However, theory and reality of life with a new baby often did not match and this was unsettling.

...having come through the other side, I'm not sure anything would have prepared me for I suppose what's happened.

PN03

While the unpredictability of pregnancy had been somewhat tempered by the routine of antenatal care appointments, routine care following birth was often inconsistent. This was especially pertinent in the case of one mother who did not see a healthcare professional for six weeks following birth.
5.4.3.2 Feeling overwhelmed

Internet access and use was ubiquitous and the transition to parenthood was intimately connected to engagement with online resources throughout the perinatal journey. Women spent a significant amount of time grazing for information, online and offline: questions were typically typed straight into a search engine and the search results scanned with a critical eye.

*So I did Google quite a lot, and so I guess I was kind of exposed to quite a lot of pregnancy related internet. Most of which is really stupid.*

PN01

The women rated their own skills in critical evaluation and digital literacy reasonably highly and stated that they were confident of being able to appraise resources. Many women reported conducting a creative approach to quality control, often utilising multiple digital and offline resources simultaneously, gauging which offered information and advice in a consistent and appealing way before rejecting those that were superfluous to their needs, targeted them for commercial gain or provoked anxiety. However, this quality control required constant attention.

*I always have to sort of, you know, how do I filter this stuff in terms of what’s useful, what’s not useful and could actually be negative?*

PN03

In addition, the sheer volume of information required active management.
I've registered with like everything under the sun... I must unsubscribe because I just delete them. So, I've got like Baby Centre. That one sends me updates and then like the Boots Parenting one and the NHS send me e-mails and texts and things. So, I've got all that carry on as well.

PN05

Women talked about feeling like they needed to protect themselves from well-meaning others who had a story to tell or a tip to share. Not all interactions were seen as entirely well-meant:

But people who are kind of in the trenches took enormous pleasure in telling me about how horrific the sleep deprivation was, and how my life was going to be kind of ruined forever.

AN01

Advice from healthcare professionals could also be demoralising.

I know a lot of women who've sort of felt they've gone to sessions, have got advice and just come away feeling as though there's just a whole list of things they're not doing right

PN12

5.4.3.3 Feeling disappointed

Women talked about feeling disappointed by the way in which the media portrayed pregnancy, birth and early motherhood. This was particularly true of popular television documentary series. Postnatal participants were particularly critical, with one participant commenting that such programmes had a moral responsibility to depict the process of birth accurately. Pregnancy in the media was thought to be presented as an overwhelmingly positive ‘lifestyle choice’, complete with its own set of implicit rules and expectations, guided by prevailing
social norms. This ‘lifestyle choice’ was populated by crude stereotypes which participants often found amusing, if disingenuous.

_They look like models with a bump. That lady there looks very pleased with herself with a strawberry, but she doesn’t really look like someone that’s trying to juggle a full-time job and be pregnant._

PN04

Media portrayals of pregnancy and parenthood were seen as being synonymous with commercialisation of the entire pregnancy experience, targeting women at a time of particular vulnerability. In general, women tried to avoid engaging with media portrayals of pregnancy and birth. One participant had bought pregnancy magazines but others ‘admitted’ to looking through them while waiting to see their midwife.

Perinatal digital resources were perceived by many women to be heavily heteronormative and this was particularly undesirable. One participant described the way in which, as a lesbian parent, her default position was outside the mainstream and articulated how the implicit assumptions of highly generic perinatal resources repeatedly highlighted this.

_And so those kinds of spaces seem really like massive when it comes to pregnancy and babies. It's just like it's just straight talk._

PN01

This was even the case for women who recognised themselves as fitting a more traditional mould. Being confronted by gendered information which went against contemporary narratives of equality was both surprising and disappointing.
It did have the odd horrendous thing on it as well… it was coming up to my 20 week scan and it said, 'this is the update, will he think I'm a failure if I give birth to a girl?'

AN02

Digital applications were also often perceived as being “saccharine” (PN08). The questionable information did not have to be particularly objectionable in order for it to become dissonant with women’s lived experiences. Trust in digital resources was important and conflict between information and experience both damaged trust and highlighted the fact that resources had been designed for generic ‘women’ rather than for complex, contextualised individuals.

Experiences of community antenatal care were mixed, with most women describing their midwives positively as individuals but their overall care as transactional, inconsistent and disappointing. Few participants saw the same midwife throughout pregnancy (which was perceived negatively by all but one woman) and many talked about appointments that were delayed or cancelled due to staff shortages; appointments were short and impersonal, with the midwife typically seeing their notes for the first time in the consultation; women had to repeat concerns they had brought up in previous appointments which had not been addressed. This impacted on trust and rapport. Pregnancy was highly medicalised: information provision was interpreted as being generic and heavily focused on the physical health of mother and baby. Women talked about the frustration of knowing that good antenatal care was available elsewhere.

I've got friends who live in Liverpool where there's been the one to one midwives and I’m really envious, you know, that they had the same midwife throughout.

PN07
This awareness of the inconsistency of antenatal care provision frustrated some women: while many were explicitly sympathetic about the perceived professional challenges faced by midwives, others simply demanded alternative care. One participant perceived her midwife’s advice and support to be consistently vague and demanded that she be moved to an alternative practice late in the second trimester, where she received care that she was happy with. This was unusual: most women believed that they could not change practices and that, as the care wasn’t ‘that bad’ they could support and supplement their antenatal care in other ways. This rhetoric of disempowerment was echoed in the way that women described the implicit assumptions made about them as individuals by healthcare professionals. Women described the way in which healthcare professionals assumed they needed less time and support than women who were more ‘obviously’ vulnerable: this was especially true of women who themselves had medical training or who were academics, who noted that they were not invited to ask questions or were trusted to find the answers to questions on their own. Whilst this gave some women confidence, others felt undermined and disempowered, particularly when these assumptions were made postnatally.

*I think there are some assumptions made about my ability to cope or my knowledge and some of the assumptions are fair, that, you know, I’m… I suppose I’m still, you know, a human being who’s never looked after a baby before.*

PN03

Women typically attended antenatal appointments on their own: the ‘tick-box’ nature of the consultation made it difficult for women and their partners to justify both of them taking time off work. None of the women referred to their experiences of appointments with their GP. However, women were able to articulate clearly
what good care looked like and were also able to provide examples of having received it, even though they perceived their overall experience of antenatal care to be disappointing. They valued being directed to local resources; women particularly valued a midwife sharing experiences as well as clinical knowledge and liked being encouraged to ask questions, especially if they felt that their questions were 'silly'. Above all, they valued being given the opportunity to develop a relationship with their midwife and to be given time to do so.

Whilst women had fully anticipated that life with a newborn would be challenging, they also expected to have continued statutory support in addressing these challenges. Interviews demonstrated that many women had thought about what support they might need after birth and had taken action to put certain strategies in place. However, it became clear that these strategies had assumed the availability of appropriate statutory support services, in particular breastfeeding support. Instead, what women reported was absence. Women operationalised this absence as a falling away of the routine and predictable information and support structures they had become used to during pregnancy. This was largely due to funding cuts which had impacted heavily and suddenly on existing community services. Once the big event of birth was over, women were often quite literally on their own and forced to find alternative sources of support in the community.

*I'm surprised that it took a charity organisation of volunteers to help more than those that were being provided by the government.*

PN07
As a result, women had low expectations of statutory services and this impacted on their willingness to engage with them, postnatally.

I feel like my expectations of Health Services, are just lower, maybe through my experience, where I don’t get a very personal sense. Usually when you go there they think something’s wrong so tell them what’s wrong and they’ll fix it. So I don’t get the sense that they are really interested to know what’s going on.

PN10

Biographical disruption is a term first used by Bury (1982) in which chronic illness is described as a disruptive event which necessitates meaning-making and adaptation on the part of the patient in order to find a new kind of ‘normal’. The majority of postnatal participants described the event of birth and early motherhood in a similar way, talking about it as a brief but unique time of limbo and intense adjustment, which they felt unprepared for, despite being highly informed and having done what was ‘expected’ in pregnancy in terms of proactive self-care. All participants had described their pregnancy as largely fitting into life. As all pregnancies were desired and planned, women were able to enjoy the experience and dedicate time to planning; this practical preparation was implicitly assumed to be predictive of coping. While experiences of antenatal care had often been disappointing, postnatal women acknowledged that it had been comparatively simple to follow the ‘rules’ of pregnancy. Women felt that they had done what was expected of them: engaged in their care, attended parenting classes, bought ‘stuff’ and, as a result, some felt disappointed that early motherhood was still a time of such confusion. Following birth, some women perceived that there were suddenly no rules to follow; women felt that their role
had switched overnight from the generic ‘pregnant woman’ to complex, highly subjective, ‘mother’. In addition, routine information offered postnatally suddenly became much less directive. At a time when women wanted to know the answer, statutory guidelines existed but could be rejected. However, acceptance or rejection depended on having a personal philosophy of parenting, something that the majority of women were only tentatively developing at this stage, if at all. The role of mother came quickly, and laden with implicit assumptions about capabilities, knowledge and skills.

For some, disappointment was exacerbated by the perceived disconnection between women’s preparation for life with a newborn and the reality; however, women reflected that the peculiar difficulties of contemporary early motherhood were perhaps inevitable. Women typically prepared for parenthood by conducting a significant amount of research (which was factually overwhelming), attending routine care (which was focused on generic physical health messages) and by attending parenting education classes (which were often focused on birth and labour).

Mothers were surprised and conflicted by the demands of their new role and this impacted on help-seeking: the dominant social narrative of a woman’s ‘natural’ role as mother contrasted with how unnatural, difficult and tedious much of it all felt.

_I think you can just feel so lonely, really lonely sometimes. I certainly have moments where I convince myself that I just do not know what… I don’t… I’m not good at this. This is not for me._

PN12
Critically, whereas women had not felt especially influenced by idealised narratives of pregnancy, social norms relating to ‘motherhood’ impacted on confidence and subjective wellbeing. It was important to appear to be managing and women were aware that their insecurity and anxieties were generally borne out of a lack of confidence and experience rather than a lack of instinct. However, instinct was not valued or encouraged when help or advice was sought from statutory services: experiences were often negative and directly contradicted ‘care’ received antenatally. Whereas women had been guided down a formulaic but inherently protective care pathway during pregnancy, many now could easily recollect situations where they had experienced or witnessed what they perceived to be inappropriate treatment of new mothers. The mothers interviewed were unanimous in their recognition of their need for encouragement, reassurance and kindness. Instead, statutory ‘care’ now seemed insensitive and impatient.

I saw some of the health visitors being a bit aggressive to other mums. An example is when you get to the baby clinic they have changing for you and they don’t tell you what you’re supposed to do. They stand around, they don’t tell you what you should or shouldn’t do, so you change your baby and you look around for the diaper bin. I think there was a mum who kind of stepped away from her week old, two week old baby, whatever it is, who was clearly not going to do anything but then got a telling-off by the health visitor in a not-nice way.

PN10

The struggle to manage the expectations and reality of ‘natural’ motherhood was encapsulated by women’s experiences of breastfeeding. Women had become used to encountering a widespread ‘rhetoric of desperation’ around life with a newborn and many ruminated about how they had assumed that such rhetoric
could not be representative of the majority or admitted to thinking that such experiences were not applicable to them. Taken together with the dominant social narrative that motherhood is natural and therefore easy, many women assumed that breastfeeding would be a simple and instinctive act. Often, it was not and the challenges of breastfeeding were compounded by a perceived lack of statutory support. Mothers reported not being signposted to local free support services and therefore used this early period to explore and find help in the private and charity sector, where, critically, they received tangible and emotional support from volunteers and peers.

…the difference with peer support and any other kind of support from the NHS is, the peer supporters, they, of course they’re interested in the baby. But they’re really interested in the mum, and that I think’s the massive difference. Whereas, you know, like you see the health visitor, oh is the baby doing this, doing this, how much does it weight? There’s not really that much about the mum. So yes, no, I think peer support is vital. And we’ve had really, really positive experiences with that.

PN07

5.4.4 Taking back control

Postnatal women talked somewhat ruefully about having the illusion of control while pregnant. Much as it might have felt like they were riding an emotional and physical rollercoaster, they reflected that, in hindsight, it had been a relatively linear process with a reasonably certain outcome. In comparison, the antenatal conveyor belt of statutory care fell away when the baby was born, and all the postnatal women described a discernible gap in postnatal information and support. Women managed this in different ways, largely through engagement and disengagement with valued online and offline resources. The process of taking
back control started in late pregnancy as information and support needs narrowed and many women took a more focused and proactive approach to 'managing' the perinatal experience. Digital resources which facilitated face to face contact with other people played a critical role in this. Women primarily used laptops and smartphones to engage with online information throughout pregnancy and smartphone use became even more pronounced after birth, for reasons of ease and efficiency. Women’s phones were always to hand. Although women reported having their phones with them at all times, this was for their convenience and not in order to be available to others. The convenience of the smartphone was highly valued; in very early motherhood, women might find themselves ‘stuck’ for long periods at any time of day or night, feeding or holding a sleeping baby. The smartphone enabled women to connect with the outside world for support, information and relaxation. It also allowed women to perform activities such as catching up with current affairs and online shopping which contributed to a sense of managing and ‘doing’ at a time when much of life felt static and isolated. The isolation of early motherhood was keenly felt, especially at night, and smartphones were an important tool in managing this.

5.4.4.1 Seeking out information

Women described an intense process of information gathering throughout pregnancy. Knowledge was seen as power, even if it came with the downside of often feeling overwhelmed and unsure of the information’s accuracy or relative value. Factual information did not always support or align with lived experience but information gathering (positive and negative) was an important strategy that helped women feel prepared and reassured.
Information seeking in the first trimester was largely focused on medical fact-finding; apps that documented the baby’s developmental progress and maternal physiological changes were useful for some women who had not yet told anyone about their pregnancy. Women also talked about using the internet largely in the first trimester to make sure they were asking the ‘right’ questions in antenatal appointments and to ensure that they were receiving appropriate antenatal care. Digital resources were not acknowledged or recommended by their healthcare professionals, with the exception of two participants, whose midwives recommended specific apps, one of which was undergoing formal evaluation (Baby Buddy); the woman felt that it was directed at a different target user and did not use it. Another participant’s midwife suggested that she access a birthplan template via the NHS Choices website. Women tended to avoid talking about information they had encountered online as they were concerned that this would not be taken seriously. Instead, they asked questions about information they had been ‘told by others’ or ‘read in a magazine’.

The second trimester was characterised by a shift towards more exploratory online behaviour, with a wide range of resources accessed and trialled. All women interviewed had signed up to receive regular email updates on their baby’s developmental progress, some of which delivered ‘soft’ information comparing baby’s size to a particular fruit or vegetable for example, which women found amusing and accessible. These emails were pushed through from trusted statutory and commercial online sources. Women described this kind of information as being important in helping them to see the pregnancy as a process which was time-bound and reasonably predictable. The information also helped cement the developing relationship between mother and baby. Women had
initially been reasonably passive recipients of information ‘pushed’ at them by online resources but the second trimester saw a change towards more proactive filtering. The second trimester was characterised as a time of excess information and participants developed a proactive, *bricolage* approach to information seeking, tending to type questions into a browser in the first instance and snowballing their search from there.

*I Google! I have friends who are also, you know, also just moved into this country, not a while ago, so it’s like replacing Grandma, you know, you can Google everything.*

AN09

The third trimester was characterised by a material change in information seeking, which narrowed towards searching explicitly for practical tips, local resources, shopping and looking for alternative forms of expert information, both online and offline. Women spoke of actively avoiding more medicalised information and, instead, wanting to know more about the reality of life with a newborn.

*I spent the first, probably the first two trimesters of pregnancy concentrating on pregnancy and then the third trimester it suddenly dawned on me, oh, my goodness, once I’ve had this baby I’ve got to bring it home and then I need to find a circle to actually socialise with.*

PN07

However, it was at this point that women encountered what they perceived as a large-scale digital rhetoric of desperation: narratives of life with a newborn focused on coping, managing and struggling.
And I was like, does anybody ever write anything about, like, actually having a nice time? I mean, you know, I am quite sleep deprived, but I’m all right. And everyone keeps saying I kind of look fine, and I’m feeling all right, and I’m really enjoying it. So what is this? And I Google. There’s nothing. It’s really interesting. I couldn’t, you know... you just... there’s just entirely advice about how to survive when you’re feeling really desperate.

PN01

Even if a blog post recounted life with a baby with humour, the underlying message was perceived to be one of self-deprecation and difficulty. This rhetoric was positively reinforced when women began to connect directly with other women: women who attended parenting education classes described their interaction as one of a unified group preparing for battle.

...it’s more like everyone is going for the marathon and we are trying to support each other.

PN12

This rhetoric was seen as being particularly unhelpful by interviewees whose postnatal experiences had been far better than expected. In addition, women said that ‘knowing’ that life with a newborn would be ‘awful’ had only served to highlight what they felt to be a lack of preparedness. In the fourth trimester, the digital grazing of pregnancy resumed and quickly became much more focused on accessing specific information and reassurance, connecting with others and reconnecting with the outside world (see sections 5.4.3.2 and 5.4.3.3). As women moved beyond the immediate disruption of birth and settled into early motherhood, differences between mothers in their use of digital resources
became more marked between those who proactively engaged with them and those who proactively disengaged.

5.4.4.2 Seeking out others

As women moved beyond fact-finding and into a stage of thinking about the transition to parenthood, online resources which aligned with personal values became increasingly important, as did other people’s experiences. The perinatal journey was perceived as a time of intense adjustment and skill building, and specific practical information was increasingly sought. A consequence of this exploration was that women encountered digital resources that contradicted, challenged and frightened them when they felt most vulnerable and uncertain. This cycle of experimentation, anxiety and recovery was arduous, and women described a conscious movement towards what were considered to be ‘safe’ digital and offline spaces. This was particularly true as birth approached and in the early weeks of motherhood.

God, I felt quite vulnerable at that stage and I think so my initial reaction [to a website] was one of sort of panic and I remember feeling really anxious for a couple of days just getting my…very upset that I was doing…I wasn’t doing things right.

PN03

Navigation of overwhelming amounts of information meant that the development of a personal philosophy of parenting was a fast and forced act. Women negotiated this act by avoiding certain resources (section 5.4.3.5) or finding spaces online that calmed, reassured or simply made them laugh. Some women found humorous parenting blogs to be reassuring spaces which gave them permission to feel conflicted and unsure about their new role. Although the blogs’
humour performed a normalising function, it was simple connection to another person’s experience that was appreciated. Experience was increasingly seen as the most desirable form of evidence and women started to rely on other women for reassurance and support in order to fill the gaps left by patchy, birth-focused antenatal education.

In particular, women started to use closed groups on social networking sites which were centred on specific topics of interest or need and, crucially, aligned with personal parenting choices. Such resources were valued for their straightforward functionality: shared values meant that conversation was useful and considered to be non-judgmental. While some women felt that the shared experience of pregnancy and motherhood was enough of a ‘bond’, others looked for what they perceived to be a more meaningful connection, based on outside interests or shared (sometimes taboo) parenting values such as co-sleeping.

So it does take time to make new friends when you’re just basing on the, well it’s based largely basically on the fact that you’ve both got a baby. And then you do sort of wheedle out people that you would have perhaps been friends with naturally. Because it’s, although it seems at some point like a strong tie, it’s not really, is it? The fact you just, been like if you just both had a dog or something.

PN04

...hopefully you find a group that doesn’t judge, for example, breastfeeding vs formula feeding or sleep training, crying out vs no-crying sleep, that kind of stuff. And you tend to eventually find mums and friends who share similar philosophies to the way you want to do it...

PN11
Local resources were also sought online, particularly those that facilitated face to face contact and, subsequently, synthesised information. However, finding those resources was difficult, due to the need to negotiate and navigate the volume of available information.

There’s plenty of stuff nationally that I can access, there’s the NCT website, the NHS website, there’s quite a lot, you know BabyCentre, Mumsnet. It seems like it’s quite easy to find information and connect with people nationally and internationally but I suppose what I’ve had to work harder to do is connect with people locally and for me having face to face contact with people is really important. You know, I don’t just want to be sat at home, typing into some forum and waiting for people to respond. That to me is just like, no [laughs]. Rather than just receiving information and clicking on things that sound useful or interesting it’s more, actually, I now need to find people who can help us get these things or give advice about which things I need, given that there’s so much choice.

AN11

Fostering a sense of control in early parenthood relied on the presence of a stable and supportive team. Teams were primarily formed of partners and friends, with parents and close family often far away. The main way that women found their team was by attending baby activity classes, although one woman in particular actively avoided such classes: she felt that they did not cater for anyone even moderately outside the mainstream and also found her existing social network provided her with the support she wanted. Some women talked about the importance of being up and about as soon as possible after giving birth. One woman in particular had started attending baby activity classes within two weeks of her daughter being born in an effort not to be home alone.
I knew that I couldn’t be stuck in the house. I’m just an outside, busy kind of person. And I made a massive list of all the available groups.

PN04

Most postnatal women valued the opportunity to attend baby activity classes and did so because they believed it would benefit their child; however, most also admitted that they did not enjoy them and that it took a significant amount of effort and bravery to get up off the sofa and engage with others at a time when they were feeling vulnerable and exhausted.

I suppose, you probably incorrectly feel that people are watching you and sort of passing judgement on, oh, she’s a new mum…you don’t want to go out the house looking like you’ve had two hours sleep with no makeup on and sick down one shoulder.

PN03

Classes like this were seen almost as an uncomfortable yet necessary step towards developing a critically valuable support network. Women described a process of gradually filling up their time with attendance at classes and groups, only to begin to filter these facilitated meetings out as friendships developed.

We’ve all still got our babies with us, we’re all still mummies, first and foremost, but we’re sat down and we’re have a conversation and it isn’t all baby, baby, baby, so that’s where I feel like it’s not just all about her, it’s her accommodating with me and me with her, it’s sort of both, it goes hand in hand.

PN05

Women spoke about needing to be brave as a new parent: finding, contacting and testing out postnatal groups and resources was often intimidating and required a
certain amount of emotional resilience. In addition, online information about classes was often out of date. Being able to manage the emotions stirred by their perinatal experiences and talk about them with significant others was important. Although support and reassurance from their partner was critical in managing this, it was sharing experiences with other new mothers who were slowly becoming *friends* that women valued the most. Critically different to support from loved ones, support from particular other women was simultaneously and uniquely calming and empowering. As such, other new mothers were considered core team members and these relationships were different even to old friendships formed pre-pregnancy. Women described old friendships as being precious but lacking, particularly those friendships with women who had not had children. As connections deepened into friendships, there was a sense of co-constructing a shared ‘new normal’ based on a mutual understanding of a significant life event. One woman laughed as she described the way that her partner had labelled her newly-formed, tight-knit group of new mothers the “*mummy mafia*” (PN07).

Having access to a supportive team helped women to unlock what one woman called the “secrets” (PN07) of early motherhood. This could be knowing about the ‘best’ baby groups or other particularly valuable resources in the local area. Being able to contribute to a group was a vital part of maintaining a successful group dynamic: women talked about group membership in terms of investment, feeling valued, creating safe spaces and being mothered. Giving support was as valued as receiving it and all women talked spontaneously about the importance of being able to test out ideas and share experiences with others as they developed a personal philosophy of parenting that might challenge mainstream advice. A
distinctly ‘bimodal’ model emerges of tailored, authentic support in which online searching led to critically valuable face to face interaction with local others with shared values, lightly supported by simple digital contact.

Even if it’s just a WhatsApp, a message, a how are you…

PN03

5.4.4.3 Proactive engagement

Harvesting information and making connections with other women in the local community was an important part of feeling in control and this was amplified when women described doing so consciously and proactively. For much of the perinatal journey, women described themselves as passive recipients of information, unsolicited advice and targeted advertising. As women perceived themselves as becoming increasingly ‘expert’ at being pregnant, many proactively engaged solely with a narrowing set of resources or made conscious decisions to seek out information on specific topics, such as sling wearing or attachment parenting.

I don’t like the feeling of being bombarded with information so I would definitely prefer to keep it to a small number of things that I definitely find useful. Yeah, I wouldn’t use things [apps] out of curiosity. The thing about this local group is that, because of the attachment parenting thing, there’s kind of a theme to it that means that I feel like I’m more likely to meet more likeminded people there because they have a particular philosophy than an NCT class where the only thing we have in common is that we’re pregnant, literally that’s it.

AN11
Some women took a project management approach to managing the flow of information and advice, using spreadsheets and other tools to document and plan resources and activities. They talked about the intense effort and work required to manage the transition to first time parenthood, even in the context of clinically 'normal' pregnancy.

Postnatal women who had taken this proactive approach and established contacts with others during pregnancy particularly noted the benefit of this. Those women who had not connected with many other pregnant women felt their absence keenly and tried to widen their circle. This was noted as being effortful and these women were aware of how different their early experiences might have been if they had put a support network in place antenatally.

*I've made some, made some mum contacts, mum friends it’s sort of... it might have felt better to have some, you know, to have established those sort of friendships earlier as a means of sort of support over those first few weeks.*

PN03

Preparing for motherhood was typically interpreted as preparing for *birth* and postnatal women acknowledged the limitations of this approach but also stressed the tendency of prenatal resources and statutory services to focus on birth as the ‘big event’. There was explicit focus on managing the practicalities of pregnancy and birth and some women reflected that they felt they had neglected their psychological health during pregnancy and that proactive and earlier focus on the potential impact of the transition to parenthood might have been more useful. Nearly all women had attended private antenatal classes as a matter of course.
Although they were deemed to be of some informational and practical value, the classes still typically focused on birth.

5.4.4.4 Proactive disengagement

Women reported that their information and support needs changed significantly over the course of pregnancy; resources that were able to keep up with this change were valued and those which provided out of date, irrelevant or unappealing advice were jettisoned. Three women with very different circumstances actively avoided antenatal parenting classes, the unifying reason being that they felt they were outside of the ‘normal’ group and that they had the confidence and support in place to get through birth and early motherhood with their existing social networks.

This proactive disengagement with what was not considered valuable was an important characteristic of women’s growing confidence as pregnant women and new mothers. The third and fourth trimesters can be characterised as a period of rapid digital experimentation, rejection and evolution as confidence grew. A wide variety of resources were tested out and there was limited loyalty to or dedicated use of individual websites: resources were seen as valuable if they successfully combined functionality with a positive, evidence based narrative and limited advertising.

Quality of information supplanted quantity as online searching became increasingly targeted. Women described their rejection of large, public-view
parenting forums. Although there was broad acknowledgment that forum content allowed women to normalise or rationalise their experiences, it was also noted that the huge scope of forum content allowed the user simply to confirm existing positive and negative beliefs, much as it had done during pregnancy. As such, forums offered very little added value. Women stated that they no longer had the time or inclination to scroll through substantial amounts of what was perceived as primarily subjective opinion. Women also perceived a sharp change in the way in which women conducted themselves online as mothers rather than as pregnant women.

...people aren't quite so sort of snooty about their pregnancies as they are about their babies. But I don't know, Mumsnet's got such a bad reputation. I mean, it's so ubiquitous but it's got such a weird reputation.

PN01

The enthusiastic camaraderie of pregnancy had shifted, and women suddenly found themselves to be part of - or at least witnessing - the strangely competitive rhetoric of desperation many had sought to avoid. This was especially true for women whose experiences of very early motherhood had been extremely positive and who were looking online for a narrative that reflected their experiences. These women in particular noticed a distinct gap in the digital conversation.

I suppose because all the people having a nice time are too busy having a nice time. They're not sitting around and moaning. It's the people that are having a bad time who are moaning, but... I don't know, I think it's a real shame.

PN04
Women left social media groups and some even left social media altogether as they discovered a new tension between wanting to be online and simultaneously maintain privacy and preserve integrity. Decisions about how to use digital resources postnatally (particularly applications which involved sharing of photographs) were often made together with partners. As such, fewer resources were used but they were valued and understood as aligning with core values.

5.4.4.5 Tracking and monitoring

Many women had downloaded applications to their smartphone to help them track and monitor their baby’s development during pregnancy and the early weeks. Pregnancy-related apps were valued for providing frequent snippets of light-touch information which was often (unintentionally) humorous.

…it’s very informing but quite funny as well, because they always refer to your baby as either a fruit or vegetable, so that’s really funny, but sometimes I compare some of the vegetables and the fruit, and I think, oh, you know, I’ve seen some really, really big cucumbers, and I’ve seen some really tiny, sort of, cabbages or whatever, but in that sense it can cheer your day up because it’s different, it’s put across very differently.

AN06

Applications had typically been downloaded on a whim or recommended by a friend and all women had refused to pay to download content. Although applications could provide somewhat questionable content (section 5.4.2.3), women described having a positive experience with apps, largely because their expectations of them were low; women did not use the applications to source medical or ‘important’, credible information. Rather, apps were the ‘snack food’ of
the digital perinatal experience, providing a neat scaffold to the pregnancy experience, pushing information by email or push notification and giving the antenatal journey a certain structure and linearity.

This predictability fell away following birth and digital applications were less frequently used. Women talked about having to source, download and become expert users of new applications at just the wrong time as existing applications did not cover the transition to parenthood in a meaningful way. Instead, women now experimented with applications that helped with lightweight ‘monitoring’ and understanding routines, particularly around breastfeeding. Establishing routine was synonymous with establishing confidence and uninstalling or forgetting to use the application took on a certain symbolic meaning.

…she was breastfeeding something like 400 minutes and that’s how... four, five, hours, down to three hours, two hours, so to see that also felt pretty good. So I think I ended up stopping [using the application] because she was... she was stable.

PN10

As women built confidence around key skills, the use of applications which measured and monitored behaviour also jarred with an increasing awareness of a social narrative around the ‘management’ of babies. Many were tentatively experimenting with baby-led parenting and felt uncomfortable with evaluating their baby's behaviour against what they considered to be arbitrary norms. Applications offering developmental information were also rejected if they did not offer flexibility or tailored information: for example, most babies were not born on their due date, which had directed information content during pregnancy. The application
became defunct if it did not offer the option of changing fundamental information such as birth date. The importance of flexibility and tailored information was especially pertinent for women whose babies were either born prematurely or with complex needs.

Then we stopped using them because we were eight weeks out of time, so they would be like telling us what would be happening and we’d be like, oh, but she’s already two months old.

PN08

Generic information with clumsily heteronormative references had been a source of irritation during pregnancy; information that now ‘excluded’ the baby or highlighted ‘difference’ was simply rejected. For example, one woman became increasingly aware of commercial applications’ near-ubiquitous usage of white children. While many women took an anti-management approach and actively disliked the tendency of many digital perinatal applications and resources to measure and ‘normalise’ infant development, they were happy to make use of certain applications that claimed to predict and explain cognitive leaps and developmental shifts in the developing baby. Women spoke of how this deepened their understanding of what their baby was experiencing and helped them to attend to their needs in a more informed way.

5.4.5 What women want from a digital resource

Inductive analysis led to the development of two themes in relation to the third research question. These themes were used to describe participants’ wants from a perinatal digital resource to support transition to the fourth trimester, in terms of
desirable content and outcomes. A summary of themes and subthemes is reported in Table 5.4.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wants from a perinatal digital resource (content)</td>
<td>Content</td>
<td>Individual stories, positive and negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professional content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reassurance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advice/tips</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indicator of credibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signposting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Covers transition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Synthesised information</td>
</tr>
<tr>
<td>Design/features</td>
<td>Required login</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unstructured/browsable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Searchable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tailored</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multimedia</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>Easy to use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simple layout, no ads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiplatform, across devices</td>
<td></td>
</tr>
<tr>
<td>Wants from a perinatal digital resource (outcomes)</td>
<td>Cognitive outcomes</td>
<td>Understanding of ‘truth’ of birth and motherhood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased knowledge about life with a newborn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge of where to seek help</td>
</tr>
</tbody>
</table>
Table 5.4 Themes and subthemes from the perinatal women dataset relating to user needs and requirements.

<table>
<thead>
<tr>
<th>Emotional outcomes</th>
<th>Knowledge of whether professional help is needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reduced anxiety</td>
</tr>
<tr>
<td></td>
<td>Improved self confidence</td>
</tr>
<tr>
<td>Behavioural outcomes</td>
<td>Gain practical skills to better manage care of newborn</td>
</tr>
<tr>
<td></td>
<td>Gain practical skills to support early breastfeeding</td>
</tr>
<tr>
<td></td>
<td>Ability to talk about what is needed</td>
</tr>
</tbody>
</table>

5.4.5.1 Content, design and usability

Part of the interview took the form of appreciative enquiry (Cooperrider & Srivastva, 2013), in which women were asked to design their ideal perinatal digital resource. Women were asked to reflect on what they liked about digital resources in general and how these factors might be operationalised in the development of a novel resource for use in pregnancy and early motherhood. Women’s responses to the appreciative enquiry part of the interview were analysed alongside their descriptions of digital resource use in general, and categorised in terms of content, design and usability. Desirable content and outcomes are presented in italics.

Women valued advice and practical support from other new mothers who had recently experienced the transition to motherhood. Women who were temporally just ahead were seen as ideal sources of support. Participants said that they
wanted to see and hear positive and negative stories from such women, who would tell the ‘truth’ about the birth process and life with a newborn and offer tips and strategies for dealing with the unexpected. In addition, participants wanted content that was provided by a professional; this might be tips and advice relating to more specialised aspects of care, such as breastfeeding or information that was reassuring, encouraging and positive in tone. Together with some form of trusted branding (e.g. UCL research), professional input helped women to perceive the resource as being credible. Some participants were keen to connect with a professional or with other women. This human support might be face to face in the form of a facilitated support group, attached to the online resource as part of a ‘package of care’, a closed Facebook group, or an online forum, which would be moderated by a healthcare professional. Signposting to local resources was an important factor. Some of the women had experienced loneliness or had struggled with breastfeeding and had not known how to access community-based help. The resource needed to address the transition between the third and fourth trimesters. Pregnant participants described how their information needs had narrowed significantly as pregnancy progressed and this was echoed by new mothers who talked about needing specific information about the early days and weeks with a newborn. This specificity was articulated as a desire for synthesised information which did not replicate existing resources, but which met very distinct needs and requirements around the transition to motherhood.

In terms of design, some participants described a perception of resources that required the user to log in as being ‘more credible’ as the user had to commit to usage rather than skim past. This was thought to imply that the content behind
the log in had more value. Women liked resources that were unstructured and browsable. Rather than being a structured intervention, perinatal resources needed to be responsive and searchable, able to answer questions women had on a variety of often-unconnected topics. Nonetheless, the resource also needed to be tailored and personally relevant. Therefore, a certain degree of interactivity was important, in which contribution from the user leads to increased content which was relevant to the user. Women described a range of preferences for how this material would be presented: a multi-media approach was optimal, in which the user could watch videos or read content in the form of transcripts. Above all, the resource had to be easy to use, with a simple layout and no advertising and had to operate across operating platforms and across a variety of devices.

5.4.5.2 Cognitive, emotional and behavioural outcomes

Women were asked how they would know that the ideal resource was ‘working’ and asked to describe what kind of outcomes they would want to see from such a resource. Their responses are categorised into cognitive, emotional and behavioural outcomes and presented in italics.

Unsurprisingly, new mothers provided responses grounded in their recent experiences rather than hypothetical situations, echoing the importance of recognising the critical difference between anticipated versus experienced engagement (Sekhon et al., 2017) and designing for lived experience with target users. Nonetheless, all women wanted to improve their knowledge and understanding of birth and the early days and weeks of motherhood. New mothers were able to articulate more precisely what form that knowledge should take (e.g.
episiotomy aftercare or how to dress baby). Practical information was prioritised, alongside knowing when to seek further help and from whom.

Women talked about wanting to ‘feel better’ as a new mother and some described the early days and weeks of motherhood as being fraught with anxiety. Birth anxiety was also common. Women knew that a certain amount of worry was inevitable but wanted to be better able to manage it and put it into perspective. Personal wellbeing was articulated vaguely and the sense of self beyond that of ‘just’ being a mother was a factor that women talked about trying to ‘find’ again. Women wanted to improve their self-confidence as new mothers.

Behavioural outcomes centred around the development of practical parenting skills to support caring for a newborn and practical skills to support and maintain breastfeeding. In addition, women wanted to feel better equipped to talk about the difficulties they were facing, with healthcare professionals, partners, friends and family members.

5.4.6 Mapping the data

A two-stage process to the analysis was taken whereby the data was first analysed inductively and emergent themes were then mapped onto the three constructs of self-determination theory (SDT). The strength of using the SDT framework as a lens through which to view the data was that it enhanced understanding about how the theory might be operationalised within the context of maternal wellbeing in the transition to motherhood and provided an evaluative
tool that moves the analysis beyond description. Applying a theoretical lens to the
perinatal data relating to women’s overall experiences and their specific digital
user needs and requirements was the first stage in operationalising the
mechanisms of the proposed novel digital resource.

The two-stage approach was taken to avoid forcing the data into predetermined
categories. The preliminary inductive analysis allowed key themes to be derived
from the data and ensured that data which perhaps could not be covered by the
theoretical constructs of SDT would still be captured and included in the overall
synthesis of the evidence. For example, aesthetics and other, less tangible
components of the user experience such as the need for reassurance, a positive
tone and evidence of the resource’s credibility were not covered by SDT
constructs. These, however, could be argued to directly influence uptake and
engagement and demonstrate the utility of the two-stage analytical process.

SDT states that people need to feel that they are influencing events in their lives
(Deci & Ryan, 2008) and that a person’s quality of life is largely determined by the
degree to which they believe three key needs are fulfilled: autonomy is the sense
that one’s actions are volitional and self-motivated; competence is the perception
of self-efficacy; relatedness is the degree to which we feel connected to other
people. Deficits in the satisfaction of these three needs limits the ability to respond
to a crisis and also provides the motivation required to do so. Individuals will vary
in the relative importance of these needs and deficits in one construct may
undermine strengths in the others. It seems apparent that the transition to first
time motherhood may compromise the satisfaction of all three needs: the women
interviewed in this study talked explicitly about the degree to which their sense of wellbeing depended upon (i) feeling in control of the process, (ii) feeling competent in caring for their baby, and (iii) connecting with other new mothers and maintaining existing relationships. A summary of themes relating to SDT are presented in Table 5.5.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>Content</td>
<td>Advice/tips</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professional content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signposting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Synthesised information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Covers transition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding of ‘truth’ of birth and motherhood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased knowledge about life with a newborn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge of where to seek help</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge of whether professional help is needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain practical skills to better manage care of newborn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain practical skills to support early breastfeeding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain practical skills to talk about what is needed</td>
</tr>
<tr>
<td>Usability</td>
<td>Easy to use</td>
<td></td>
</tr>
<tr>
<td>Autonomy</td>
<td>Content</td>
<td>As in Competence</td>
</tr>
<tr>
<td>Usability</td>
<td>Required login</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unstructured/browsable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Searchable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tailored</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interactive</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.5 Themes and subthemes from the perinatal women dataset relating to the operationalisation of self-determination theory constructs.

<table>
<thead>
<tr>
<th>Multimedia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatedness</td>
</tr>
<tr>
<td>Human support</td>
</tr>
<tr>
<td>Local information</td>
</tr>
</tbody>
</table>

5.4.6.1 Competence

Women described the importance of simply knowing what to do at critical stages in the perinatal journey. Birth and the first postnatal month were times when practical advice was most needed. Supporting perinatal women’s competence could be addressed through the content of the novel digital resource, which would need to provide synthesised, targeted information which does not duplicate existing resources but instead, provides women with the specific information they say they need: practical birth and babycare tips and advice from peers and professionals, signposting to local resources, skills-based information on how to communicate well with healthcare providers and how to manage new and old relationships. A sense of competence would also be supported by ensuring that the resource is easy to use.

5.4.6.2 Autonomy

Receiving and understanding information about caring for one’s self and a new baby should impact on autonomy by making it clear that choices exist and can be pursued. Therefore, supporting a sense of autonomy could also be addressed
through the provision of information, as described above. However, individual autonomy could also be supported through certain specific usability features, which would encourage free choice about how the resource is used and which information is viewed. A simple login process could encourage proactive engagement with the resource and could also meet the objective of providing the resource with a degree of credibility through the implication of added value. Unstructured, browsable and searchable multimedia content would allow users to choose to view information of interest in a variety of formats. The content would therefore be tailored to the immediate needs of the user.

5.4.6.3 Relatedness

The perinatal journey can impact on a woman’s identity and make it difficult to connect with members of her existing support system. In addition, perspectives on a shared experience are sought from similar others. A sense of relatedness could be supported through provision of information told from the perspective of a similar other. The resource could provide opportunities for new social connection through the provision of human support and information about local resources.
5.5 General Discussion

5.5.1 Principal findings

Interviews showed that women engaged with digital resources at all stages of the perinatal journey. However, the purpose and manner of use changed over time. Women took a creative, bricolage approach to managing digital resources, proactively engaging and disengaging from tools according to their perceived utility. All postnatal women articulated a perception of a distinct information and support gap between the third and fourth trimester, which influenced their subsequent use of technology, with specific information sought from targeted, niche sources. Peer support was seen as a vital part of maintaining good wellbeing, managing the transition to parenthood and co-constructing a new biographical narrative. Peers with shared values were sought online and these relationships were maintained digitally but face to face contact was preferred. Development of a novel digital resource underpinned by self-determination theory might focus on the delivery of a combination of synthesised, targeted parenting information and opportunities for social connection in a shared geographical area.

5.5.2 What this research confirms

Interviews with perinatal women highlighted the complex subjectivity of the supposedly universal perinatal experience, particularly one mediated by an ever-evolving digital age. This study confirms the ever-changing nature of women’s support and information-seeking practices in the transition to first-time motherhood and many of the themes identified in this research are those which
arise repeatedly in the perinatal literature. Substantial existing research has established that women struggle with the transition to parenthood (Barclay et al., 1997; Barkin & Jani, 2016), and that women seek out alternative forms of expertise and social support (Johnson, 2015); we know that women seek out reassurance, often from private, online resources (Holtz et al., 2015; Johnson, 2015) and that they trust in their own ability to critically evaluate and use a combination of perinatal resources in order to accomplish parenting tasks (Barkhuus et al., 2017). Previous research has highlighted the importance of women needing to feel that they are more than ‘just a mother’ when constructing a new, postnatal biographical narrative (Gibson & Hanson, 2013) and that construction of this narrative is difficult (Collett, 2005), with women given “few cues, hints, and stage directions” (Goffman, 1995:72).

All women interviewed in this study referred to accessing perinatal websites and forums. Substantial research (e.g. Johnson, 2015; Madge & O’Connor, 2006) acknowledges that women access these sites as a matter of course particularly during pregnancy as a complementary source of information and support. Some studies describe the importance of such sites as being safe spaces for women to discuss personal topics (O’Higgins et al., 2014), and although the women interviewed in the present study accessed forums, they did not report using them in this way. While they recognised the value of anonymity on a forum, they reported themselves to be ‘lurkers’ rather than ‘posters’ on forums, preferring to read others’ comments rather than post their own. Analysis of data gathered in this study aligns with previous work which has suggested that accessing perinatal resources serves an important normalising function (Orton-Johnson, 2017) and
allows women to view alternative perspectives as they create a personal philosophy of parenting (Pedersen & Smithson, 2013).

Some women in the present study talked about viewing parenting blogs. The women who used them liked them and found them a valuable resource, in line with previous work which has reported how some women described feeling empowered by the presentation of motherhood offered in the blogs and note how the humour and ‘realism’ of the blogs helped them to navigate perceived tension between their sense of self and the realities of motherhood seen in previous studies (Gibson & Hanson, 2013).

Prolific smartphone use was referred to in the present study, particularly during early pregnancy and early motherhood. The convenience and ubiquity of mobile devices and ready access to Wi-Fi meant that women were able to access information, get and give support and maintain contact with other people and the outside world in general, easily and cheaply. Previous studies (Balaam et al., 2015; Gibson & Hanson, 2013; Toombs et al., 2018) have recognised the reliance of mothers on smartphone functionality to allow them to perform key tasks at the same time as caring for their children, such as online shopping or texting while holding a sleeping baby or breastfeeding in the middle of the night.

Digital perinatal applications were used by most women in the present study. They were valued for their convenience and ease of use as well as for the ‘light-touch’ information they provided, which allowed some women to feel more connected to their unborn baby. Previous work (Thomas & Lupton, 2016) has acknowledged that such apps encourage women to engage with their pregnancy and several
studies have demonstrated that many women find pregnancy and parenting apps to be useful and convenient sources of information and support (Hearn et al., 2014; Lagan et al., 2010; Peyton et al., 2014). One study in particular has suggested that women engage with apps to fill their knowledge gaps because current perinatal services do not meet their needs (Kraschnewski et al., 2014). The heavily gendered and heteronormative formats of such resources was reported by some participants in the current study. This is echoed in work which claims that perinatal forums are mainly used by white, middle-class, heterosexual women and serve to reinforce traditional parenting stereotypes and unequal gender roles (Brady & Guerin, 2010; Madge & O’Connor, 2006).

5.5.3 What this research adds

Previous work exploring the role of technology in the perinatal experience has typically concentrated on the use and efficacy of a specific website or a specific type of activity, such as blogging. This study adds to the literature by exploring where technology, the transition to motherhood and statutory care intersect and the subsequent implications for design of novel technologies to support maternal wellbeing.

In particular, the women in this study contributed to a more nuanced understanding of how digital resources are used over the course of the perinatal period and specifically, how usage narrows as birth approaches and what kinds of information and support women prioritise during the transition to parenthood. Women in this study proactively disengaged with unhelpful or irrelevant resources and actively sought out experiential information or pragmatic tips and advice. In
addition, women described the negative tone of online content, and how it focused on coping and struggling. The women in this study noted a distinct support and information gap between the third to the fourth trimesters and expressed frustration with the way in which existing digital resources were unable to keep up with their transition to motherhood. They described the frustration of needing to find, download and learn how to use new digital applications. Although motivation outweighed skill, women saw this transitional gap as burdensome.

The importance of peer support in the perinatal journey is well-established (Niela-Vilén et al., 2014) but the women in this study talked about the importance of making connections antenatally and the critical need to make connections with others with shared values in a constrained geographical location. They described a uniquely bimodal support model, in which digital resources were used specifically to initiate and maintain new *face to face* relationships. Previous research has suggested that mothers tend to regard social media as a reliable source of parenting information (Madge & O'Connor, 2006; O'Higgins et al., 2014; Pedersen & Smithson, 2013) and Facebook is the most widely used social media platform for this purpose (Lupton et al., 2016). Previous studies have reported how women used Facebook to announce their pregnancy and birth and post updates and images of their children (Bartholomew et al., 2012). In contrast, participants in the present study reported some reluctance to post frequently on social media and noted that social media presence was something to be negotiated as a family. In addition, women in the present study were aware of the number of social media platforms available and actively chose to avoid the burden.
of posting repeated content on multiple platforms, preferring to use one trusted and familiar resource (Facebook).

This study also adds to our understanding of the role of statutory care in the perinatal journey and provides some evidence of the negative impact of austerity on community perinatal services. In this study, women spontaneously described repeated dissatisfaction with perinatal care, stating that it was generally brief, inconsistent and focused on physical health and preparation for birth. In addition, a lack of continuity of care in the postnatal period - largely due to cuts in community-based services for all but those deemed “vulnerable” - led women to talk about a service support and information gap parallel to the one they also experienced digitally. Postnatal women described specific measures that might mitigate this, such as a more holistic focus on wellbeing rather than birth, access to local resources, the influence of positive role models and empowering and encouraging messages to the new mother. Postnatal wellbeing was acknowledged by all as being fragile and the provision of a protective structure was deemed complicated. Most participants specifically related positive postnatal wellbeing to feelings of competence and relatedness to others and to feeling supported and encouraged, especially by peers. Peer support was recognised by all as being of particular value in supporting perinatal wellbeing and helping to bridge the perceived gap in postnatal support and information. Critically, participants described being prepared to work hard to create a value-based group of friends, connected by more than just being pregnant or having young children. Much of this work occurred online, in late pregnancy and was focused on a local area or key perinatal concern, such as breastfeeding.
This study contributes to perinatal research by applying a theoretical framework to participant-generated data. According to Dourish (2004b), “turning social observation into technical design seems to be problematic.” The judicious application of theory is one method of moving beyond description and operationalising data so that it can become useful in digital form and addresses the call to design novel, better digital tools for perinatal women (Toombs et al., 2018). No previous study has used self-determination theory to support development of new technology in the context of digital motherhood.

5.6 Reflective account of the research process

5.6.1 Reflexivity

Reflexivity is the “turning of the researcher lens back onto oneself to recognize and take responsibility for one’s own situatedness within the research” (Berger, 2015). This continual process of critical self-evaluation is an important part of the process of interpreting data and generating understanding in qualitative research (Attia & Edge, 2017). Relevant positions include personal characteristics such as age, gender, personal experiences and ideological stances and can affect the research in a variety of ways (Berger, 2015). Participants may or may not be more willing to talk to someone whom they perceive to be knowledgeable about their situation and the relationship between interviewer and interviewee can be influenced by a participant’s willingness to share information with someone they perceive to be an ‘appropriate’ listener.
I was reflexive in my approach to the research by critically examining my different roles and identities (e.g. mature PhD student, mother of three, researcher) as well as my own experience of becoming a mother, of experiencing severe post-natal depression and of raising three daughters. I considered how these factors may have influenced the research process, my behaviour during the interviews, the participants’ impression of me (and mine of them) and the analytic decisions I made (Britten, 2006). Throughout the PhD process, I maintained a journal in which I reflected on my thoughts, decisions and actions and their influence on the research.

I believe that my age, life experiences and previous professional experiences of working in the areas of mental health and performance coaching enabled me to develop rapport with participants and communicate with empathy in the interview setting. I aimed to preserve neutrality as much as possible by avoiding leading questions and keeping my opinions private whilst still being open and engaged with the participant’s story. If I felt that I was in possession of information that might be of use to the participant (for example, information about community resources), I would share it at the end of the interview. Having older children meant that I was able to empathise with women’s experiences with the added benefit of temporal distance. This was both an advantage and a disadvantage: some women found the opportunity to talk about their experiences of birth and early motherhood with a sympathetic ‘stranger’ somewhat therapeutic (Murray, 2003); at the same time, I wondered whether others felt that my being a mother meant that I was ‘assessing’ them in some way or that an assumption of shared knowledge impacted on the depth of their storytelling.
5.6.2 Rigour and transparency

In their consideration of the meaning of rigour and accountability in the context of participatory design, Frauenberger et al. (2015) state that “it becomes apparent that accountability and rigour in a post-modern scientific context is delivered through debate, critique and reflection”. This is arguably the case for all research which prioritises the participant voice and seeks to demonstrate its rigour in ways which go beyond positivist paradigms of statistics and ‘proof’. As well as maintaining a reflective journal, I took a self-conscious approach to the design, data collection, analysis and reporting of the research. I discussed the (anonymised) data with my supervisory team and with other PhD students and experienced qualitative researchers in order to gain a broad range of perspectives. Divergent views were sought from participants. For example, while many postnatal participants framed their experiences of early motherhood negatively, two women in particular described it in very positive terms. Furthermore, some participants expressed views that contradicted those of other women (e.g. one woman stated that her experience of seeing multiple midwives was positive in that she was exposed to a wider range of information).

5.7 Methodological strengths and limitations

5.7.1 Approach

The use of qualitative methods allowed me to explore and understand participants’ complex, subjective experiences. Specifically, through the use of in-depth interviews, I was able to gather rich and detailed data about perinatal women’s evolving information and support needs and their contextualised use of
digital resources. This facilitated nuanced understanding of how women’s needs change over the course of the perinatal journey and how we might meet these needs through the development of a digital resource underpinned by an appropriate theory. The two-stage process of data analysis ensured that the participant voice was prioritised. However, some of the complexity and richness of individual accounts was perhaps lost in the search for ‘actionable’ patterns within a general context. This is acknowledged as being true of thematic analysis (Braun & Clarke, 2013) and certain strands of the data, particularly relating to those women with culturally complex or alternative lifestyles are worthy of future, more focused work.

5.7.1.1 Use of the Probes

Cultural and technological probes were used during some interviews to prompt reflection and discussion. Use of these tools provided valuable scaffolding in early interviews and largely helped to build my own confidence. In addition, initial interviews were conducted with perinatal women who were also academic researchers; field notes made immediately after these interviews indicate that their awareness of the interview process resulted in what could be considered to be ‘sympathetic’ behaviour: abundant personal narrative, keeping to the topic, patience with the process. The introduction of the prompts in subsequent interviews was far less smooth and demanded that I question the purpose they served and the optimal way in which to gather the relevant data. Some participants tended to focus and become ‘stuck’ on the content of the probe rather than the concept represented by it. This was particularly true of the screen shots. I therefore increasingly used the probes as and when suitable, preferring to ask
about attitudes to different forms of digital perinatal information as the idea arose in the interview rather than disrupt the interview by introducing the visual prompt for the sake of doing so.

5.7.2 Setting

The study was based in and around Oxford and the local nature of the setting is a strength. Focus on a specific group may assist in the appropriate design and development of resources tailored to their needs. Although participants were not attending the same healthcare providers, the comparable setting enabled a detailed understanding of perinatal experiences within a localised geographical context. However, a relatively narrow geographical focus may be considered a limitation: the relevance of the findings to other areas of England may be questionable, particularly with regard to the degree and manner which women used digital resources in response to dissatisfaction with perinatal care.

5.7.3 Sample

The sample size could be considered a limitation of the study. However, it can be argued that an appropriate sample size for a qualitative study is one that adequately answers the research question and with sufficient ‘power’ (Malterud, Siersma, & Guassora, 2016). Sampling was conducted using a pragmatic combination of convenience and purposive approaches and sampling was adjusted accordingly as certain themes gained prominence. In particular, this prioritised the postnatal voice which was grounded in experienced engagement rather than hypothesised engagement with digital resources. The perinatal
sample was self-selecting and representative of women who are willing and able to take part in research of this kind. Although such homogeneity has important implications for the scope of claims made, rich understanding of a reasonably homogenous group can also be considered a strength of the study. Whilst the group was homogenous in certain ways, it included a variety of women with distinct cultural backgrounds and lifestyles.

This was not a stand-alone study and the themes and explanations drawn from the data do not carry the weight of determining intervention principles. Rather, the study forms a composite part of the evidence base which informed development of the digital intervention.

5.8 Conclusion

Navigation of the perinatal journey is complex, even in the context of clinically healthy pregnancy and birth. The ‘typical’ perinatal experience does not exist, and women do not consider their experiences to be ‘routine’, even when low-risk and clinically uncomplicated. This chapter identifies a distinct and nuanced pattern of use of digital resources in the perinatal period, grounded in participant experiences. Usage of digital resources was ubiquitous amongst this group of perinatal women and characteristics of use were interconnected with perceived levels of support and maternal wellbeing in early parenthood. Numerous digital applications and resources were accessed during pregnancy and in early parenthood with the majority of women reporting a creative trial and error approach to resource use, often in response to dissatisfaction with statutory care
and perceived digital and statutory information and support gaps in the fourth trimester. The impact of funding cuts on local services was noted. This study demonstrates that a novel perinatal digital resource underpinned by self-determination theory has the potential to address some of the concerns and problems described by perinatal women. Such a resource might support perceived autonomy, competence and relatedness by providing women in late pregnancy with synthesised, browsable and positively-framed digital content and connecting the user to other women experiencing a similar situation in a shared geographical location.
Chapter 6 Synthesising the evidence

6.1 Chapter overview

Previous chapters in this thesis have described the approaches taken to generating, synthesising and critically evaluating evidence in relation to the role of digital resources in the perinatal journey and the methods used to develop and evaluate them. The next step, and the purpose of this chapter, was to synthesise this evidence in order to move forward with the development and formative evaluation of a digital resource (see Figure 6.1). The chapter begins with an overview of considerations and challenges regarding the synthesis of different sources of evidence and moves on to a brief summary of the evidence from the integrative review (Chapter 4) and the qualitative study (Chapter 5). The chapter then outlines the way in which this evidence was synthesised to form a set of evidence statements, a preliminary logic model of the digital resource’s proposed mechanisms of action and subsequent design hypotheses. Reflections on the process are then presented.
6.2 Introduction

This chapter draws together findings from previous chapters in order to develop a set of candidate design hypotheses, intended to support maternal wellbeing in the transition to first time parenthood. The literature review (Chapter 4) was conducted in order to explore and synthesise the existing evidence relating to digital wellbeing interventions for pregnant women; this was used as a basis for the subsequent qualitative work (Chapter 5) which looked at additional key requirements in the context of first time pregnancy and early motherhood. This chapter will describe how an iterative approach was taken in turning this core
evidence into a set of requirements specific to a subset of pregnant women. The evidence was grouped using self-determination theory with the intention of addressing challenges identified across the literature synthesis and qualitative study. A logic model was developed in parallel together with a set of candidate design hypotheses.

As described in Chapter 3, I explored how eHealth and HCI approaches to the development and evaluation of digital resources might be used to complement each other, and the importance of documenting such an approach in a systematic and transparent way. However, documenting and describing the development of digital resources is notoriously challenging (Danaher et al., 2015) and perhaps even more so when the aim is to synthesise and integrate evidence from different sources. The planning and development of the bump2bump study was guided by a commitment to taking an evidence-, theory- and person-based approach. Key papers from the eHealth and HCI literatures were influential in supporting the development of a stepped approach to the synthesis and are discussed below.

Synthesis of evidence necessitates the reduction and ‘operationalisation’ of evidence in order to plan, structure and guide ongoing development. Abstractions from primary data (e.g., ‘pregnant women want to feel more competent’) require transformation into ‘something’ that can be evaluated (e.g., provision of targeted parenting information and assessment of women’s self-reported competence). Such evidence takes various forms and as described in Chapter 2, different approaches to development may prioritise certain types of evidence over others, in practice. For example, the most recent guidance from the MRC (Craig et al.,
2013) recommends the rigorous appraisal of (academic) evidence and appropriate theory. This systematic and theoretical approach facilitates evaluation and replication of the intervention but is challenging in reality, with a lack of established methods to guide the operationalisation of evidence comprising in-depth understanding of the user and the context of use (Greenhalgh et al., 2014). Integration of stakeholder involvement in the design and development of health interventions is valued and now routinely expected (Ocloo & Matthews, 2016); however, as described in Chapters 2 and 3, existing frameworks have struggled to keep up with the growing call for interdisciplinarity in supporting the meaningful synthesis of mixed-methods findings. This is explicitly acknowledged by interdisciplinary teams working in the field of digital health who have explicitly sought to address what they perceive to be a critical methodological gap (Band et al., 2017; Blandford et al., 2018; Curtis, Lahiri, & Brown, 2015; Hekler et al., 2013; Klasnja, Hekler, Korinek, Harlow, & Mishra, 2017; Murray et al., 2016; O’Brien et al., 2016). Of particular interest are the reflections described by Curtis et al. (2015), O’Brien et al. (2016), Band et al. (2017) and Klasnja et al. (2017) on their approaches taken to documenting, synthesising and operationalising quantitative and qualitative evidence in the development of digital health and wellbeing resources. The authors’ descriptions of the synthesis and operationalisation of primary data into evidence statements and causal pathways and the separation of outcomes into proximal and distal goals are of relevance to the bump2bump study and are described below.

Curtis et al. (2015) describe the development of a childhood weight management healthy eating app. They specifically acknowledge the need for interdisciplinary
collaboration in order to harness the best of evidence-based and commercial approaches and criticise existing development frameworks’ lack of clarity, comprehensiveness and acknowledgment of user context. Their approach to the development of the app follows three stages: (1) understanding the problem and user preferences, (2) translating research findings into app features, and (3) pre-testing the app features for further refinement. The method used in the second stage to turn data into intervention components was of particular interest and is more fully described below in section 6.3.3.

The sequential approach taken by O’Brien et al. (2016) in developing the LEAP retirement project has been described in Chapter 3 (section 3.2.2). The project sought to take an inclusive approach to the process of intervention development through its commitment to the systematic integration of scientific and qualitative evidence and expert knowledge. The authors’ description of the generation of outputs at each stage which then became inputs for subsequent stages of work was influential in the approach taken in this thesis; in particular, the initial synthesis of the evidence base into a set of evidence statements used to underpin the intervention and inform the first co-design exercise with target users. The process taken to developing the set of evidence statements is not fully described by the authors; however, the principle of distilling key primary findings down into such a set of ‘take-home’ messages, appropriate to the scope and aim of the overall study, was influential in the synthesis of primary bump2bump data.

The development of Home and Online Management and Evaluation of Blood Pressure (HOME BP) by Band et al. (2017) was motivated by a similar commitment to inclusion of the user voice. However, HOME BP is explicit in its
focus on how the Person-Based Approach (PBA) (Yardley et al., 2015) was applied to the more traditional MRC development process (Craig et al., 2013). As described in Chapter 2 (section 2.7.1), the PBA aims to develop a deep understanding of the contextualised use of a digital intervention. While the novelty and formalisation of the approach might be contested, the partnering of the PBA with the MRC guidelines is an important step in addressing a methodological gap. Band et al. echo the evidence statements of O’Brien et al. (2016) in their synthesis of multidisciplinary evidence into a set of guiding principles: these principles are (as in O’Brien et al., 2016) used to underpin the development of the digital resource. Band et al. also describe how they developed a logic model which hypothesises theoretical relationships mediating intervention outcomes and, although the bump2bump study does not focus on behaviour change to the extent that is common in studies utilising logic models, the approach was deemed useful as a guiding framework to explain and consider the mechanisms of how the bump2bump resource might have an impact on its users.

The importance of a systematic development process has also been raised by those working at the crossroads of behavioural science and HCI, who argue that while HCI uses sophisticated and innovative methods to develop technologies to support health decision making and self-management, the wider field lacks detailed evaluation methods to support nuanced understanding of how something works, why and for whom (Hekler et al., 2013; Klasnja et al., 2017). Klasnja et al. (2017) argue that only ‘usable evidence’ can contribute to an understanding of a digital tool’s mechanisms of action. The authors focus specifically on behaviour change and granular, dynamic evaluation methodologies; however, their
overriding philosophy is one of prioritising the pragmatic accumulation of *actionable knowledge*. Indeed, this is echoed by Murray et al. (2016) who argue for the wider benefit of constructing an agile evidence base to the field of digital health in general.

Klasnja et al. (2017) focus on how the synthesis and articulation of usable evidence early on in the development process can open the ‘black box’ of intervention design and suggest an iterative framework, grounded in previous work in Agile Science and knowledge generation (Hekler et al., 2016). Specifically, they acknowledge the messiness inherent in moving from an initial idea or ‘hunch’ about an intervention, through to specification of who the digital tool is being designed for, why and how it might work. A hunch about a potential digital solution to a specified problem can be refined through collection of qualitative data. Echoing the *logic model* of Band et al. (2017), Klasnja et al. then propose the production of a *causal pathway* in the form of a visual diagram, in order to support the specification of a prototype and its component parts. The causal pathway starts as a simple articulation of ‘problem-and-outcome’ and evolves into a more substantial articulation of how the resource intends to meet both *proximal* and *distal outcomes*: the achievement of a long-term goal such as ‘feeling more competent’ is a distal outcome which occurs over time. Steps along the pathway (such as logging in to a resource and viewing different forms of information) are proximal outcomes, incremental changes which help to create the more global, distal change.
The approaches described above synthesise quantitative and qualitative evidence in different yet systematic ways with the intention of developing digital tools that are effective, grounded in user needs and contribute to the interdisciplinary methodological evidence base. In addition, O'Brien et al. (2016), Band et al. (2017) and Klasnja et al. (2017) show a commitment to making the process of knowledge accumulation and transfer easier by fundamentally prioritising understanding of what aspects of design matter, when and for whom. As described above, elements of each were adapted for use in the synthesis of the evidence and planning of bump2bump, the process of which is described below.

6.3 Developing a set of evidence statements

The first stage in developing even the most basic of design hypotheses was to anchor the process in a set of evidence statements drawn from a synthesis of the evidence. These statements would be used to initiate development but would also be returned to throughout the subsequent iterative development and evaluation process, serving as reminders and clarifiers. The evidence statements comprise the key messages drawn from the literature review (Chapter 4) and the qualitative study (Chapter 5).

6.3.1 Evidence statements drawn from the narrative synthesis of the literature

In Chapter 4, I presented a rationale for and methods used in a critical synthesis of the evidence regarding digital wellbeing interventions for women in clinically
healthy pregnancy. The main findings are drawn directly from the chapter and listed below as a set of evidence statements:

(i) Few digital health interventions have been developed specifically for first time mothers

(ii) Digital health interventions for maternal wellbeing largely lack theoretical underpinning

(iii) Digital health interventions for maternal wellbeing rarely conceptualise or measure perinatal wellbeing as a specific domain

(iv) Digital health interventions to support wellbeing in new motherhood are not often evaluated in a meaningful way, across the transition to the fourth trimester and using qualitative approaches

(iv) Interventions which best articulate the relationship between usage and potential impact and acceptability are those that are small in scale, target a specific subgroup of pregnant women, are simply designed and grounded in user needs and formed of relatively few interacting components

Evidence from Chapter 4 suggested that key user requirements included:

- Information perceived to be credible, personalised and relevant to stage of pregnancy
- Synthesised and practical parenting information
- Culturally and locally congruent information
- Direct access to healthcare professionals or FAQs
- Multiple ‘hooks’, including general lifestyle advice and support
- Experiential information/access to other mothers
- Tracking or self-monitoring facility
- Positive or encouraging tone

6.3.2 Evidence statements drawn from the qualitative study

In Chapter 5, I presented the rationale and methods used in an in-depth qualitative study conducted to explore the human factors of perinatal women that might influence their use of digital resources during pregnancy and early motherhood. The main findings of the inductive analysis are drawn directly from the chapter and listed below as a set of evidence statements:

(i) First time pregnancy feels unpredictable, even when clinically healthy

(ii) Perinatal care can be inconsistent

(iii) New motherhood feels physically and emotionally overwhelming and challenging

(iv) Anticipated support services are increasingly absent due to funding cuts

(v) Women routinely access digital information, but this requires active management and critical evaluation

(vi) Perinatal digital resources are perceived as heteronormative and generic

(vii) Use of resources narrows as birth approaches

(viii) Late pregnancy and postnatal use of digital resources is guided by immediate need
Evidence from Chapter 5 suggested key user requirements included:

- Targeted, synthesised information and support from other new mothers and credible professionals
- Reassuring, encouraging and positive tone
- Information should cover positive and negative examples
- Access to human support (face to face or online)
- Signposting to local resources
- The resource should bridge the transition from late pregnancy to early motherhood
- Information should be presented in a multi-media format
- The layout should be simple, with no advertising
- The resource should work across operating platforms and devices
- Required login, indicating credibility of content
- Browsable rather than tunnelled content
- Searchable content
- Tailored content
- Interactive content

The data suggested that women in their first pregnancy would want a digital intervention that helped them to achieve the following outcomes:

- Understanding of ‘truth’ of birth and motherhood
- Increased knowledge about life with a newborn
- Knowledge of where to seek help
- Knowledge of whether professional help is needed
- Reduced anxiety
- Improved self confidence
- Gain practical skills to better manage care of newborn
- Gain practical skills to support early breastfeeding
- Ability to talk about challenges, with healthcare professionals, partners, friends and family members
6.3.3 Evaluating and operationalising the evidence statements

Klasnja et al. (2017) describe the process of moving from an initial, messy idea or ‘hunch’ to a clear diagram outlining hypothesised mechanisms of action. They underline the reality that thinking about what component parts of an intervention might look like starts as soon as we become aware of a problem that might be addressed by a digital solution. Evaluating relevant literature, together with speaking to potential users and other key stakeholders influences this further. This process of refinement ultimately leads to the articulation of exactly for whom the intervention is (and is not) being developed and in what context it might be used, an activity that Klasnja et al. term ‘niche specification’.

As Klasnja et al. (2017) suggest, the intellectual process of moving from idea to data to design involves significant creative leaps, the abstraction of which can be mitigated through documentation of what was drawn from the key findings, how and why. Acknowledgment of the importance of insight and creativity is markedly absent from literature describing digital intervention development, even in studies such as those described above, in which the research is largely presented as a logical and linear sequence. However, there are gaps in such sequences, whereby data is ‘transformed’ into the component parts of a digital resource and decisions made about what to include and why “through consultation and discussion” (Band et al., 2017) or “brainstorming” (Klasnja et al., 2017). Rogers, Sharp and Preece (2011) state that designers are “well known for their back-of-an-envelope sketches that capture the essence of an idea” but go on to underline the importance of combining creativity with focused and formal documentation of
requirements using a format such as the Volere shell (Robertson & Robertson, 2000).

Curtis et al. (2015) describe an approach taken to the translation of findings into intervention features, in which user preferences are individually considered. Their decision to reject or accept each user preference was guided by the following criteria: (1) relevance to the target behaviour/goal, (2) availability online, (3) ease of implementation, (4) alignment with usability and user experience recommendations, and (5) supported from theoretical findings and/or evidence. I took a similar approach in evaluating the evidence statements. I combined the evidence statements listed above in sections 6.3.1 and 6.3.2, merging overlapping statements from the literature review and qualitative study (e.g. user preference for synthesised information), and then evaluated the statements using the following criteria:

1. Relevance to target outcome
2. Availability online
3. Ease of implementation within scope and scale of the project
4. Supported by self-determination theory and/or evidence

Although this documentation of the movement from evidence to design is presented as considered and rational, I recognise that these were not entirely objective decisions: the process was influenced by what was perceived to be feasible to implement within the scope and scale of the project and my own skill set. In addition, the early literature review presented in Chapter 2, together with
the experience of interviewing pregnant women and new mothers, played an
important part in alerting me to what appeared to matter to new mothers and how
a digital resource could address the challenges they described.

Only three of the evidence statements were rejected. All three were derived from
the findings from the review but were either explicitly not supported by the
qualitative data or were beyond the scope of the project: direct access (face to
face or online) to credible healthcare professionals or FAQs; access to other
mothers in the form of a forum; a tracking facility. All other evidence statements
appeared feasible for implementation and were included in the subsequent logic
model and design hypotheses. They were also explicitly used as inputs in the first
codesign workshop (Chapter 7). The refined evidence statements were grouped
according to type and are listed below:

6.3.3.1 Intervention features

- Targeted, synthesised information and support from other new mothers
  and credible professionals
- Lifestyle advice and support (diet, emotional wellbeing, physical activity;
  breastfeeding; intimate relationships)
- Information relevant to stage of pregnancy or new motherhood
- Culturally and locally congruent information
- Signposting to local resources
- The resource should bridge the transition from late pregnancy to early
  motherhood
6.3.3.2 Usability

- Required login, indicating credibility of content
-Browsable rather than tunnelled content
-Searchable content
-Tailored content
-Interactive content
-The resource should work across operating platforms and devices

6.3.3.3 Aesthetics and tone

- Reassuring, encouraging and positive tone
-Information should cover positive and negative examples
-The layout should be simple, with no advertising
-Information should be presented in a multi-media format

6.4 Developing a pathway of action

Having refined the evidence statements, the next step was to explore the relationship between the statements and the key user outcomes described in section 6.3.2. This relationship would be underpinned by self-determination theory and was articulated by visually representing the proposed chain of effect in a logic model. The process of producing a logic model, causal map or causal pathway is relatively commonplace in behavioural science and is typically represented as a directed graph, with arrows showing what is proposed to change what. Producing a logic model encourages the articulation of proposed effects of different parts of an intervention and this can in turn be referred back to in order to evaluate whether or not these proposals were correct and how they might be altered or improved in practice. At the most basic level, it was hypothesised that use of the bump2bump digital resource would result in an improvement in new
mothers’ overall wellbeing through the user’s repeated engagement with synthesised, specific parenting information, presented in a positive manner by peers and credible professionals (Figure 6.2).

The detail provided in the evidence statements, together with the theoretical mapping, supported the addition of mediating features (Figure 6.3), which are described below. The logic model begins with a statement of the problem that the digital resource is trying to address. New mothers often describe feeling unprepared for parenthood and surprised by the reality of caring for a new baby. This is often attributed to having unrealistic expectations of what life with a new baby will be like, together with a limited awareness of the importance of preparing for life beyond birth. Practical parenting skills have to be acquired in a very short time and support in developing these skills is often lacking. This set of circumstances leads to a reduced sense of personal autonomy, competence and relatedness to others, which in turn may prompt entry into a reciprocal loop of isolation and loneliness, which can impact on breastfeeding and support-seeking and lead to difficulties in interpersonal relationships. In addition, usage of digital resources narrows around the time of birth and women proactively engage and

Figure 6.2 Simple articulation of ‘problem-and-outcome’, showing the relationship between digital resource and maternal wellbeing.
disengage with resources that share their values and meet their immediate needs; digital perinatal resources do not bridge the gap between late pregnancy and early motherhood and digital perinatal resources are often perceived to be overly broad in scope, offering little in the way of tailored, relevant information and support.

It was proposed that usage of a resource underpinned by self-determination theory and guided by the refined evidence statements may address these challenges. Figure 6.3 illustrates how the evidence statements have been synthesised and grouped underneath an appropriate self-determination theory construct. In reality, evidence statements might fit within more than one construct (e.g. information presented by peers may impact on autonomy as much as on relatedness; tailoring is important for the user experience but may also influence

---

**Figure 6.3 Full logic model of the bump2bump digital resource.**
perceived autonomy). It was hypothesised that competence is supported by repeated engagement with components offering skill augmentation and relevant information presented by trusted and credible sources; autonomy is reinforced by these same resources, and additionally supported by the unstructured nature of the resource, allowing the user free choice in what content is viewed; relatedness is supported through engagement with components which provide access to networks of care and shared communities of knowledge – a perception of virtual social connections is supported through the provision of experiential information and real social connection can be provided through access to local resources.

As a working example, the curated and specific information about the stages of birth, presented by a credible healthcare professional, allows the user to understand and prepare for her situation and her choices, which supports her in feeling more competent when dealing with both health information and healthcare professionals.

Engagement with the resource is aimed at achieving optimal distal outcomes described by target users in Chapter 5, specifically, improved knowledge, skill, perceived support, reduced worry and improved self-esteem and self-efficacy in the early postnatal period. However, proximal outcomes which may indicate that the resource’s active ingredients are supporting progress along this path could include number of times the resource is accessed by a user, the way in which the resource is used (such as which pages are most accessed) and acceptability of the content and its delivery, the way in which users perceive and describe their own competencies or social support and interpersonal relationships, and the degree to which they access local resources. These proximal outcomes are
narrow, specific expressions of overall autonomy, competence and relatedness. In addition, it was hypothesised that repeated use of the resource would encourage thinking and reflection in response to the resource’s active ingredients, thus making them even more ‘active’.

6.5 Design hypotheses

The guiding principle of the bump2bump intervention was to improve the subjective wellbeing of mothers in early new motherhood. Referring to Dodge’s model of wellbeing introduced in Chapter 2 (section 2.3.2.3), the aim of the intervention was to facilitate growth in the user’s perception of their personal resources. At this stage of development, the way in which this would be operationalised was intentionally not fixed upon. However, as part of the process of ‘niche specification’ (Klasnja et al., 2017), it was important to establish some parameters to use as a starting point through a highly iterative process of ‘evidence-based brainstorming’. These are presented in Figure 6.4 and described below.

Evaluation of the wider literature in Chapter 2 indicated that there exists an opportunity to address the unmet wellbeing needs of first time mothers in clinically healthy pregnancy through a digital intervention. This led to the synthesis of multidisciplinary literature regarding evidence relating to digital wellbeing resources developed for use in pregnancy (Chapter 4), which in turn led to deeper exploration of specific user needs and requirements in the context of first time pregnancy and early motherhood (Chapter 5).
The findings of these chapters, together with the work presented in this chapter, confirmed that the bump2bump resource would target first-time mothers with clinically healthy pregnancies. In recognition of the narrowing of information needs as described in Chapter 5, the resource would cover user needs and requirements relevant to late pregnancy, birth and the first month of motherhood only; local resources were identified as being of particular importance and therefore I decided to narrow the geographical focus of the resource on my home city of Oxford. The intention was to create a digital model which could be applied in any geographical context to meet the wellbeing needs of women in late pregnancy and new mothers. Much of the information was expected to be relevant to fathers, multiparous women and women with more complicated pregnancies such as carrying twins. However, the focus was on provision of just-in-time,
specific and credible information for first-time mothers which was grounded in user needs and explicitly designed with the intention of helping women meet objectives typically connected with giving birth for the first time.

The range of design hypotheses was kept deliberately open. The aim was to ensure that the evidence statements would be presented for consideration and discussion at the subsequent codesign workshop. Feedback from the workshop around viable solutions that were within the scope of the project would be actioned and new ideas considered.

6.6 Reflections on the process

Synthesis of the evidence was a challenging but valuable process. The systematic steps of gathering, summarising and synthesising the evidence, and collating and operationalising the resulting evidence statements into a logic model increased confidence in the developmental process. The design objectives and subsequent choice of intervention components was grounded in user needs and requirements together with the wider context of digital intervention development as evidenced by the integrative review.

However, although the systematic process of synthesising the evidence was critical, it was not without its problems. For example, the suggestion that the synthesis and operationalisation of evidence is an objective process is misguided. The exemplar research described above (Band et al., 2017; Curtis et al., 2015; Klasnja et al., 2017; O'Brien et al., 2016) was important in signposting current
approaches to documenting the transparent synthesis of interdisciplinary evidence but even such work inevitably refers to ‘conversations with experts and colleagues’ that informed understanding and decision-making. The synthesis process highlighted the reality that while it is critical to open the black box of development and design, implicit and undocumented knowledge inevitably contribute to the development of digital resources. The commitment to interdisciplinary working accentuates this issue as expert knowledge is sought from others. Indeed, both O’Brien et al. (2016) and Band et al. (2017) attribute much of the success of their projects to the input of large, multidisciplinary teams. This raised the question of ‘who is the expert?’ and the importance of documenting decision making in the development process and balancing this with commitment to the user voice.

6.7 Summary

The planning and development of the bump2bump study was guided by a commitment to taking an evidence-, theory- and person-based approach. The synthesis of the evidence was a useful but challenging process and existing interdisciplinary work served as an important guide. The evidence collected by way of a systematic narrative review and a qualitative study with target users was synthesised into a set of evidence statements which were evaluated, refined and then used to guide the development of a logic model. The logic model outlined the problem, proximal and distal outcomes and the intervention components that might help to achieve the desired objectives. The intervention components were then operationalised into a set of design hypotheses to be used as inputs into the next stage of development.
Part 2: Development Work
Chapter 7 Developing a Clickable Prototype

7.1 Chapter overview

Part 1 of this thesis outlined the work undertaken to understand the wellbeing challenges of new motherhood as reported in the academic literature and described by women and healthcare professionals. The previous chapter synthesised this work into a set of evidence statements and presented a logic model and design hypotheses. This chapter begins Part 2 of the thesis (Figure 7.1) and describes the first stage of the iterative work undertaken with target users and subject experts to develop and refine a high functioning prototype. This chapter is presented in three parts: (i) preparation, (ii) the workshop, (iii) the design response. I begin the chapter by providing background to the study and outlining the study aims. The study was the first of three codesign exercises and took the form of a collaborative workshop with first time mothers which was conducted in order to explore and extend the synthesised evidence. Participants were invited to discuss the degree to which existing digital resources met their needs, suggest digital solutions to problem scenarios and sort and evaluate perinatal information. Whilst the workshop validated existing user-defined outcomes, key requirements were refined, namely those relating to the provision of synthesised and credible parenting and lifestyle information, the nature and purpose of maternal wellbeing support and the facilitation of contact with similar others. The analysis of the workshop data was used to construct a preliminary framework for the bump2bump clickable prototype, which is described in full.
7.2 Introduction

Synthesis of the evidence (Chapter 6) facilitated the articulation of evidence statements and the digital resource’s underlying principles and key features were summarised in a logic model and a set of design hypotheses. The next step was to move from data to design and to do so by engaging with target users in a design workshop. This chapter describes the processes of developing workshop materials and tasks and engaging design and topic experts. The chapter then moves on to describe how the findings from Chapter 6 were used as inputs to the workshop through the construction of personas, scenarios and evidence-based
prompts and how analysis of workshop output was used to generate a clickable prototype. The rationale and philosophy underpinning the inclusion of the user voice in the creative development of the bump2bump digital resource has been outlined previously (Chapter 2). If we acknowledge that “the people whose activity and experiences will ultimately be affected most directly by a design outcome ought to have a substantive say in what that outcome is” (Carroll & Rosson, 2007), then it is a pragmatic next step to determine how best to elicit their contribution. The ‘workshop’ is a staple of the HCI approach to the design process (Vines et al., 2013). A typical design workshop involves the gathering together of key stakeholders, such as target users, designers and researchers, in order to articulate the nuances of the challenge and co-construct a digital solution in the form of what Ehn (1991) terms ‘boundary objects’ or physical representations of that shared thinking. The field has moved on somewhat from Ehn’s original descriptions of researchers acting out scenarios using cardboard ‘computers’ and there has been significant contemporary interest in the development of ‘toolkits’ detailing techniques and methods for engaging in user-centred design of services and artefacts.

Perhaps the most well-known toolkit is that developed by design consultancy, IDEO, who published their ‘Methods Cards’ in 2002 (Figure 7.2). The deck of 51 cards represents specific ways in which a team can better understand their target user group through a process of Learn, Look, Ask or Try. Methods include competitive product surveys, cross cultural comparisons, error analysis and extreme user interviews.
The cards are simple and provide an important function in demystifying the design process by suggesting pragmatic alternatives to the inherently creative process. The same principles are seen in the frogThink® Toolkit and in the Experience Based Design toolkit (Robert, 2013) published by the NHS in the UK: both provide a series of tools for groups and teams to explore existing challenges and barriers to positive experiences of health products and services with a view to improving experiences in the future. As well as making the design process accessible to the more biomedical researcher, such toolkits also enable multidisciplinary teams to reframe problems from multiple perspectives and facilitate communication through a universal language of conventional research techniques (interview, ethnography) combined with those that are more agile and design-focused or ‘creative’.

The growing variety of user-centred design toolkits are united by their focus on empathy with the target user (Resnick et al., 2005). As described in Chapter 3 (section 3.4.3), empathy is a powerful tool for establishing rapport with potential users, and design situated in a user’s context acknowledges the “necessity for a
close and personal connection with the end user” (Segal & Suri, 1997). The paradigm of the ‘design workshop + toolkit’ is therefore an appropriate vehicle by which design might be grounded in the narrative of users rather than solely in more abstract personas and scenarios. However, designing new technologies together with mothers of young children can be particularly challenging. Participants’ attention can be divided between the needs of their child and the design task. This fundamental barrier to ‘full’ engagement with traditional toolkit design activities has been reflected upon by other researchers exploring the potential of digital resources to support women in the early stages of motherhood (e.g Wardle, Green, Mburu, & Densmore, 2018). For example, in the development of Feedfinder (an application that helps women to find local breastfeeding-friendly spaces) Balaam et al. (2015) concluded that codesign activities with mothers and their young children needed to be “flexible, quick and undemanding”. D’Ignazio, Hope, Michelson, Churchill, & Zuckerman (2016) and Gibson & Hanson (2013) also made use of brainstorming workshops with new mothers and described the valuable contribution of group conversation to their understanding of the design context; however, Gibson & Hanson in particular also described the impact of deviations from ‘normal’ workshop practice, for nappy changing and feeding, as being disruptive but also as offering opportunity for researcher reflection.

It is therefore important to view the application of any design toolkit through a critical lens. Although toolkits provide important scaffolding of the data-to-design process, users’ challenges are frequently nuanced, complicated and focus on addressing abstractions and experiences. This was amplified by the pragmatic challenges of facilitating a workshop involving new and nursing mothers and
therefore necessitated the articulation of clear outcomes and adaptation of tools and exercises. Existing research was examined for insight into which strategies had been effective in eliciting key user needs and opportunities; a set of activities was developed and is described further below.

The overall aim of the workshop was to build a clickable prototype as a basis for further development in subsequent stages of the research. To best guide development of the prototype, it was prudent to assess the work conducted so far with a new group of perinatal women and in doing so, refine and gather information about user needs and requirements. The present study therefore aimed to answer the following 3 questions through the use of qualitative methods:

1. What is the face validity of the synthesised evidence relating to key user requirements and outcomes?
2. To what extent do other new mums agree with the proposed design hypotheses?
3. What just-in-time information do new mums want a digital resource to provide?

**Part 1 - Preparation**

**7.3 Pre-workshop activities**

**7.3.1 Collaboration with professionals**

Prior to the workshop, I sought to engage the services of a developer who would attend the workshop and then collaborate with me in building the clickable prototype and refining it in response to iterative feedback from target users. As
described in Chapter 6, signposting to local resources was identified as being of particular importance and therefore I had decided to narrow the geographical focus of the resource on my home city of Oxford. I subsequently explored opportunities to work with design companies local to Oxford and approached seven design agencies. It quickly became apparent that both the budget and iterative nature of the work were perceived as obstacles: although the research funding available to me was comparatively generous, it was a significantly limiting factor when consulting for web development services. In addition, the iterative nature of the work was perceived as unusual (and largely unappealing) by the majority of agencies, who were explicit in their expectation of simply being provided with an actionable brief and content. Subsequent iteration would be limited and conducted on a cost-per-hour basis. Following a challenging process of negotiating with two companies over a period of three months, I engaged the services of Hut Six Digital (hutsixdigital.co.uk), a small local company who expressed particular interest in the iterative nature of the work and involvement in the research process. In addition, I sought input and guidance from parenting professionals. The evidence statements (Chapter 6) included the provision of just-in-time information provided by peers and credible professionals. I engaged the services of Birth Baby Balance (birthbabybalance.co.uk), a local doula and antenatal service provider who was also a former teacher with the National Childbirth Trust (NCT).
7.3.2 Preparing workshop materials

Prior to the workshop, five activities and corresponding materials were prepared:

(i) A persona for each group, plus a paper-based framework to support the group in the persona development activity (section 7.5.1);

(ii) A paper-based ‘day in the life tool’ which the groups used to complete the scenario activity (section 7.5.2);

(iii) A set of ‘concept cards’, which were used as prompts in the solution-focused activity (section 7.5.3);

(iv) A paper-based storyboard framework used in an activity focused on the relationship between goal and digital solution (section 7.5.4);

(v) A set of parenting and lifestyle information topics and an example of a brief video, which were used in an activity intended to evaluate the content and presentation of just-in-time information (section 7.5.5).

As outlined above (section 7.2), it was important to strike a balance between taking advantage of an opportunity for rich data gathering and minimising participant burden. Women were invited to attend the workshop with their babies, which immediately limited activity number and type: for example, it was anticipated that women would be holding their babies and might only be able to work with one hand at a time. It was important therefore that the workshop goals were clearly articulated at the outset and that time was managed well without impacting on rapport.
Previous research and existing workshop toolkits were consulted: in particular, Balaam et al. (2015), Gibson & Hanson (2014), the HCI studies included in the systematic integrative review (Chapter 4), the IDEO Method Cards and the ‘participatory innovation’ toolkit developed by Vines, Wright & Olivier (2014, personal communication) as part of the SALT project (Designing Scalable Assistive Technologies and Services). Collectively, these provided an appraisal of approaches which combined established design practices with a commitment to the inclusion of the user voice. The workshop was subsequently structured around codesign techniques that enabled the combination of rich narratives with evidence gathered in previous stages of the research. Small-group activities were used primarily as a way of eliciting participant stories. In-depth interviews had previously generated rich data and the workshop activities sought to test and extend this data by encouraging participants to generate ideas and discuss trade-offs, differences in use, values and system requirements through interaction with each other. A structured approach was taken to the workshop, in which targeted activities were intended to progressively narrow participants’ focus and input: general discussion of challenges and needs was funneled down over the course of the workshop into a more specific focus on design and ideation.

Part 2 – The Workshop

7.4 Methods

7.4.1 Design and setting

The study took the form of a 2-hour long collaborative workshop with new mothers who had not previously been involved in the bump2bump project. Participants
took part in semi-structured, small group activities and their discussions were audio recorded. The workshop was also photographed. A pragmatic approach was taken to deciding upon an appropriate location for the workshop. It was important that the venue was easily accessible, quiet, comfortable and baby-friendly. I approached Oxford-based participants from the earlier qualitative study and asked for suggestions: a local community-based family centre in central Oxford was recommended. The Hut Six Digital designer and a fellow UCL eHealth Unit PhD student were also present and assisted with facilitating workshop tasks.

7.4.2 Ethics and research governance approval

UCLIC’s Departmental Research Ethics Committee granted ethical permission (UCLIC/1213/015). Participation was voluntary, and participants were recruited in the same way as any other healthy adult able to give informed consent. Personal identifiers were removed from the data and the data were stored securely, according to the principles of research governance (Northway, 2017). Permission was granted to use photographs in workshop output.

7.4.3 Participants

This study sought the views of new mothers. Women were eligible to take part if they i) were aged ≥ 18 years, ii) had one child under the age of 6 months, iii) had experience of using digital perinatal resources, iv) lived in or near Oxford. As in the interview study, women who were actively using or who had used digital perinatal resources were recruited in order to gather more valid data. It was supposed that these women would be more able to reflect on design
considerations than women who were not interested in engaging with digital resources.

7.4.3.1 Recruitment

Participants were recruited via social media and the same online community forum used in the recruitment of interview study participants (Chapter 5). The recruitment avenues used successfully in the qualitative study were used again in anticipation of recruiting a similar group of participants. Participants were given a £10 high street voucher in thanks for their contribution.

7.5 Procedure

Prior to the workshop, all women were sent an information sheet and workshop agenda by email. Participants were invited to re-read the information sheet (Appendix 3); they then provided informed consent and demographic information. Participants were placed in two groups of three and invited to introduce themselves and chat informally. The workshop ‘began’ with a simple drawing activity used as an icebreaker and an invitation to use visual prompts of online resources referred to by interview study participants to stimulate discussion (Figure 7.3).

Figure 7.3 Examples of the drawing exercise and visual prompts used as icebreakers.
7.5.1 Activity 1: Persona development

The first technique used in the workshop was the co-design of a persona. The concept of personas originated from ethnographic observation within organisations (Cooper, 1999) and are rich descriptions of typical users, realistic rather than idealised (Rogers et al., 2011). A persona is typically a composite of a number of real users and will include a description of the user’s goals, attitudes, skills, social environment and as many precise, credible details that support seeing the persona as a real, potential user. The aim of the activity was to utilise the strengths of the persona as a design tool by focusing attention on how a resource might be developed to meet the needs of specific users rather than accommodating those of a stereotype. The key strength of the persona is that it is a “composite archetype based on behaviour patterns” (Cooper, Reimann, Cronin, & Noessel, 2014), that is, grounded in usage patterns or behaviours which have been seen across similar individuals during an earlier research phase. In addition, the proxy nature of personas allows for the accommodation of sensitive or otherwise challenging behaviours or beliefs.

In order to prompt reflection, each group was given an example persona to respond to which was created prior to the workshop. The persona was a synthesis of accounts, experiences and goals described by participants in the interview study (Chapter 5), for example: Kate is a GP with a 4-month-old son. She wishes she knew more new mums in her local area to talk to face-to-face, who might help her build up her confidence. In order to ground the workshop in participants’ own experiences, women were encouraged to develop their own personas, influenced
by their own experiences of early motherhood, using a persona template adapted from that used by Vines et al. (2014) (Figure 7.4).

The persona template invited women to name and describe a new mum and to provide information about her interests, personality, skills and social environment. In addition, the template provided the opportunity for women to brainstorm pros and cons of a new digital resource developed to support new mothers. Figure 7.4 shows an example of the activity output: a description of a new mum called Donna, who has been married for seven years and has an eight-week-old baby. New motherhood is described as being 'different to what I expected' and 'boring' and Donna wishes she had more friends with babies as most of her friends have children of school age. Donna is interested in a range of activities including cycling and going to the cinema and describes herself as ‘a people person’. She describes her skills as being work-related and that she was valued for her contribution and she misses the social aspect of work life as well. Donna likes bump2bump because she can access it whenever she likes, she can explore subjects she is interested in at that moment in time and it reminds her of what a good job she is doing; Donna dislikes bump2bump because she still feels lonely,
she wants to meet people face to face and sometimes the resource seems too general.

7.5.2 Activity 2: Persona-based scenarios

The second technique used in the workshop was the construction of persona-based scenarios. These scenarios were intended to get participants to think about what a typical day in the life of their persona might look like. Scenarios were originally developed as a design tool which 'concretised' the abstraction of design by describing how users might accomplish specific, well-defined tasks (Carroll, 2000). The use of scenarios has subsequently been refined (e.g., Cooper et al. 2014) in order to mitigate the abstraction of earlier iterations of the scenario and its role-oriented 'actors': persona-based scenarios are narrative descriptions of how a persona might use a product in order to achieve specific goals. A story is constructed in which a user can describe their perception of what an ideal interaction with the product looks like by grounding it in the user’s lived context and actual behaviours. The aim of the activity was to describe the broad context of use and was essentially the first stage of design, albeit at a high level: the persona-based scenarios established and clarified the primary points of contact that the user might have with a digital tool over the course of a day.

Each group was given a simple ‘Day in the Life’ tool (Figure 7.5, adapted from Vines et al., 2014) which they were asked to complete, using the personas developed in the previous task. This activity required the women to discuss how the persona might feel and behave during the course of a ‘normal’ day as a new mother, again reflecting on their own experiences.
Each group was then invited to discuss digital tools that would help to tackle the specific challenges that their persona had faced. This and the previous persona development activity supported the gathering of more information about user needs and requirements and prepared participants for the presentation of the evidence statements and design hypotheses.

The activity highlighted the fact that participants perceived there to be no such thing as a ‘typical’ day with a young baby: routine was relatively non-existent in the first few weeks of motherhood and changed as quickly as it was implemented. The activity was therefore adjusted, and women were asked to think instead about which aspects of the day struck them as being memorable or meaningful: e.g. feeding for long periods of time; walking alone in the park; handing baby over to a partner in the evening.

Figure 7.5 Sample ‘Day in the Life’ tool.
7.5.3 Activity 3: Concept cards

The third activity involved interaction with ‘concept cards’ (Figure 7.6). Vines et al. (2012) describe the use of ‘questionable concept cards’ in the development of banking technologies for the elderly, in which workshop participants were presented with deliberately provocative design sketches of financial service technologies in order to encourage criticism and debate. Their cards included “outré and silly concepts” such as an exploding handbag intended to deter thieves. Similarly, O’Brien et al. (2016) used ‘wild cards’ in their development of digital tools to support the transition to retirement, in which random events which might disrupt the transition were introduced to mimic the unpredictable nature of real life. In order to prompt reflection and debate and discourage polite agreement with ‘credible’ ideas, Vines et al. (2012) provided participants with a mixture of ‘questionable’ and ‘plausible’ cards.

A similar approach was taken in the third activity. The aim of the activity was to address the study’s first and second research questions by asking participants to respond collectively to digital solutions generated by previous interview participants and the design hypotheses developed in Chapter 6. The cards featured an anonymised excerpt from an earlier interview (Chapter 5) which represented a key user outcome (Chapter 6), together with questions to prompt discussion and a digital solution which could address the perceived challenge. The structured stimuli were used as thinking tools in order to help participants recall their own experiences which might extend, challenge or reject the problems and solutions presented on the cards. Solutions presented were a mixture of credible design hypotheses (Chapter 6) and more controversial, funny, interview participant-generated ideas (Chapter 5) (Table 7.1).
Quotation (+ example key user outcome) | Prompt | Design hypothesis
---|---|---
*I think you can just feel so lonely, really lonely sometimes. I certainly have moments where I convince myself that...I'm not good at this. This is not for me.*
(Reduced anxiety; improved self-confidence) | What do you think ‘wellbeing’ means as a new mum? | A perinatal version of Tinder

*...having come through the other side, I’m not sure anything would have prepared me for I suppose what’s happened.*
(Understanding of ‘truth’ about motherhood; improved practical skills) | How much can you prepare for parenthood? | Synthesised lifestyle and parenting information from other new mums and healthcare professionals

*I feel like my expectations of health services are just lower, maybe through my experience. Usually when you go there they think something’s wrong and they’ll fix it. So I don’t get the sense that they are interested to know what’s going on.*
(Talking to others about challenges) | What are your experiences of interacting with healthcare professionals? | A wellbeing ‘toolkit’

*It seems like it’s quite easy to find information and connect with people nationally and internationally but I suppose what I’ve had to work harder to do is connect with people locally.*
(Increased knowledge; improved practical skills) | How much do you think face to face contact matters? | Local mummy mentors

Table 7.1 Example of concept card content.

Figure 7.6 The concept cards.
7.5.4 Activity 4: Storyboarding

The fourth technique used in the workshop was a storyboarding activity that aimed to refine the work of the previous activity by asking women to further appraise and apply the design hypotheses. Storyboarding is a well-established technique in the HCI design process, drawn from the televisual arts, which allows the designer to visually predict and explore a user’s interaction with a product (Truong, Hayes, & Abowd, 2006). Traditionally, storyboards within HCI represent a “sequence of actions or events that the user and the product go through to achieve a task” (Rogers et al., 2011). The application of the technique in this workshop intentionally remained focused at a higher level in order to draw together the previous discussion and focus attention on the description of precise challenges and digital solutions.

Working in their groups, the women were asked to complete a paper-based storyboard, using the persona from the first activity, who was experiencing a challenge from the second activity and who used a solution from the third activity to address that challenge (Figure 7.7). The activity asked the women to describe a character who wanted to achieve a specific goal and to specify why the character was unable to achieve this goal; the women then described specifically how the discovery of the bump2bump digital resource ‘changed the character’s life’ by enabling them to do something novel. The women were invited to include as much detail as they wanted, from the character’s emotions to the specific desirable components of the digital resource. The storyboard template was adapted from Vines et al. (2014).
The example in Figure 7.7 shows a simple description of a heavily pregnant woman called Kate who is a bit anxious about how she is going to cope with feeding her new baby. She feels that there is too much information online for her to navigate and is unsure about who she can ask for advice about bottle feeding and formula, particularly as she is worried about being told that she has to breastfeed. When she discovers bump2bump, she is able to watch videos about feeding options that just offer information; as a result, Kate feels happier about making decisions for herself about what she feels is an important topic.

7.5.5 Activity 5: Evaluating and critiquing parenting and lifestyle information

The final workshop activity addressed the third research question by asking participants to evaluate and sort just-in-time information topics. Provision of targeted information covering a range of parenting and lifestyle topics had been identified as a key component of the digital resource (Chapter 6). Prior to the
workshop, I generated 36 potential topics by examining categories of parenting content on websites named by previous participants. Whilst many of the proposed topics were specific (e.g. *Nappy changing & what’s inside / Why is my baby crying*?), some were vague or might be considered challenging (*Tokophobia*) and it was hoped that this would stimulate discussion of what made a topic appealing or, conversely, unnecessary.

The groups were rearranged to encourage fresh interactions, and participants were asked to reflect on the topics in their groups, to sort them into lists according to perceived priority and to add anything they thought was missing (see Figure 7.8). The groups were then invited to examine each other’s categories and we discussed major differences as a whole group.

Multimedia presentation of the just-in-time information was identified as having potential value in engaging users (Chapter 6). Therefore, having reflected on the
content of the parenting and lifestyle information, the whole group was asked to provide feedback on a sample ‘Two Minute Topic’ video (http://bit.ly/2LBfYkv) provided by Birth Baby Balance. The video was one of a proposed collection of videos on birth and focused on signs of labour starting. Participants were told that the presenter was a doula and antenatal educator but not that she was a bump2bump collaborator. Participants were invited as a single group to evaluate the video’s content, length, tone and delivery and to offer suggestions for improvement.

7.5.6 Data analysis

The workshop was audio-recorded, transcribed verbatim and analysed using inductive thematic analysis (Braun & Clarke, 2006). Written notes were not made during the workshop but were made straight afterward to record observations and reflections and formed part of the dataset. The transcripts were coded using the key user outcomes and design hypotheses as a loose guiding framework. The analysis and actions taken are presented sequentially, to best reflect the process taken. The analysis of the workshop data is presented first, followed by the design response.

Part 3 – Results and the Design Response

7.6 Results

Participant characteristics are reported in Table 7.2. Six participants took part in the workshop and none had participated in the early qualitative work. The average
age of participants was 32 years. Two participants knew each other, having met at antenatal NCT classes. All women attended the workshop with their babies, who ranged in age from 8 weeks to 6 months old. Study advertising materials, the participant information sheet and the consent form all indicated that the workshop was for new, first time mothers; however, it emerged towards the end of the workshop that one of the mothers had two older children. This was considered during analysis of the workshop data.

<table>
<thead>
<tr>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of participants</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td>25-30</td>
</tr>
<tr>
<td>30-35</td>
</tr>
<tr>
<td>35-40</td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
</tr>
<tr>
<td>A level/further</td>
</tr>
<tr>
<td>Graduate level</td>
</tr>
<tr>
<td>Postgraduate / professional level</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
</tr>
<tr>
<td>Cohabiting</td>
</tr>
<tr>
<td>Married</td>
</tr>
<tr>
<td><strong>Nationality (self-defined)</strong></td>
</tr>
<tr>
<td>White British</td>
</tr>
<tr>
<td>Asian British</td>
</tr>
</tbody>
</table>

*Table 7.2 Workshop participant characteristics.*
The workshop generated a significant amount of data, much of which validated the principal findings of the earlier interview study (Chapter 5) and is therefore not replicated in full here. A pragmatic summary of how analysis of the workshop data confirmed, contradicted and extended previous findings is presented below. Participants are identified by a number and their baby’s age in weeks.

7.6.1 Confirmation

The perinatal journey was perceived by all to be a highly subjective and complex experience, even in clinically healthy pregnancy and birth. Usage of perinatal digital resources was ubiquitous and exploratory and women in the workshop described a tension in their relationship with online resources, similar to that expressed by interview participants: resources could hinder and confuse as much as they supported and helped. Women primarily used digital resources in order to access factual perinatal information and information regarding local resources. Many of the digital resources identified in the interview study were referred to again in the workshop and participants described knowing a little about a lot of parenting topics but the gaps in their knowledge became apparent when having to deal with the reality of caring for a newborn.

You need specific information rather than general that everyone knows how to find, you know, the proactive thing that you would do

Participant 1, daughter aged 15 weeks

All women talked about the importance of being in regular contact with other new mothers with shared values. Online contact was valued by all participants, particularly membership of WhatsApp groups. However, face to face contact with
peers was prioritised by all women, especially postnatally, as a critical conduit for managing and normalising new motherhood. Women described the difficulty of meeting other women and the potential role of digital resources in addressing this challenge.

*I mean it’s nice to meet people face to face but I wouldn’t trust meeting someone that I had met on a forum. So I know on Babycentre there’s a group [that meets face to face] and I was like erm, I just don’t know because there’s some right weirdos around and knowing my luck, I’d find one.*

Participant 6, daughter aged 14 weeks

Accurate information about local resources was important, as was ease of access. As in the interview study, workshop participants described the way that much of the information was presented in a way that made them doubt that new mothers’ needs had been taken into account. Women talked about information being presented in unintuitive ways, often hidden within social media or another large website, or presented as a long list. Access could be simplified.

*You tend to work on a day and a time basis rather than next Wednesday I’m going to do this. Generally you wake up and say oh great, he’s in a good mood, I’ve got a couple of hours free, let’s go out.*

Participant 5, son aged 14 weeks

Participants envisaged a resource that supported autonomous access, and which was tailored and personally relevant. Participants did not want to receive information passively. User interactivity included being able to access information directly, depending on immediate need. It was important to be able to save content for later and to be able to contribute or feedback in some way. Women
talked about the cognitive, emotional and behavioural impact of good digital perinatal resources. Fundamentally, such resources simply made women feel ‘better’ about being a new mother and they described this as a combination of having gained knowledge and feeling reassured. Factual content combined with credible support of some sort was seen as ideal.

One participant summed up the way an ideal digital perinatal resource would inform and encourage new mothers by using the metaphor of a digital perinatal assistant:

What would be really good is to have a very easy to use resource for when you’ve got the baby and you just need an answer to something quickly and you don’t want to go through all the forums maybe for various problems but then having maybe just one thing that you could consult. You know, if you had a live-in midwife, that would be, I’d want the sort of, the online live-in midwife basically, where I could ask a question 24 hours a day, who’d be very reassuring.

Participant 6, daughter aged 14 weeks

7.6.2 Contradiction

In contrast to the participants in the interview study, social media use was very limited. A key value ascribed to the use of WhatsApp groups was the privacy they afforded, and all workshop participants described how their personal understanding of digital resources’ privacy policies directly impacted on their use.

In an interesting counterpoint to the views expressed by participants in the qualitative study (Chapter 5), workshop participants actively avoided Facebook as an information resource during pregnancy. This was summarised by one workshop participant to wide agreement:
I think anything to do with social media is just too open and you just don't know who’s seeing it.

Participant 6, daughter aged 14 weeks

This inhibited women’s use of Facebook in particular until the end of pregnancy and into early motherhood, when the need for knowledge about local resources and particular topics outweighed their previous reservations. Women managed this by seeking out and joining closed groups that resonated with personal values and specific needs.

They’re really useful because you can post questions amongst a trusted group, a secure trusted group, and I respect that more than I would a big community.

Participant 5, son aged 15 weeks

7.6.3 Extension

Analysis of workshop data supported a better understanding of what the new online resource needed to provide in terms of meeting users’ wellbeing and information needs.

7.6.3.1 Wellbeing

Participants reflected on their own wellbeing needs and described the difficulty of seeing maternal wellbeing as separate to that of the baby’s. As in the interview study, antenatal wellbeing was perceived as being synonymous with physical health and efforts by healthcare professionals at promoting postnatal wellbeing typically focused on averting postnatal affective disorders in the first six weeks of
new motherhood. However, women in the workshop suggested that maternal postnatal wellbeing could be reframed as being of benefit to baby and this needed to be underlined during pregnancy. Whilst pregnant, the connection between maternal and baby health was obvious; it became less so postnatally. Attendance at postnatal clubs and classes was driven by the primary aim of stimulating and entertaining their baby; the idea that mum could attend a class for her own enjoyment was a novel idea.

Women described stages of postnatal wellbeing and argued that it was important to talk about postnatal maternal wellbeing without a focus on avoiding postnatal depression and without exclusive focus on the first six weeks. Talking realistically about the difficulty of early motherhood was critical but equally important was considering wellbeing when a new kind of normal started to emerge, typically when the mother’s partner had returned to work, and mother and baby were on their own. Participants wondered if this was in fact just as hard as the early weeks of parenthood and described it as a time they felt uniquely unprepared for.

*It’s weird, like you have the baby and then friends come over, lots of people cook meals and by 3 months it was like, well we’ve had a baby for 3 months now and it was kind of like it was old news. And it was a bit like that nobody talks about postnatal depression or anxiety, well certainly not in my experience after the first kind of six weeks and I actually think it’s harder at kind of three or four months when the novelty has worn off a bit and babies are awake a lot more and it’s kind of, it’s a lot more, well yeah, that was my experience and I think that kind of gets lost somehow.*

Participant 4, son aged 24 weeks
Knowing that they were doing a good job as a parent impacted on confidence and receiving external validation from healthcare professionals in particular was valued. However, as attention and validation from statutory healthcare diminished, women described a gap in their ability to manage their own wellbeing.

And I wasn’t interested in the feelings stuff until recently, maybe that’s because I’m on my own a lot more now… I’ve wanted a bit more of the support side of things.

Participant 1, daughter aged 15 weeks

7.6.3.2 Practical information

Women talked about the importance of having access to practical information in the first six weeks of motherhood. A perception of parenting competence contributed to a sense of wellbeing. Participants described their perinatal information needs and concerns in terms of specificity, credibility and usefulness. Having found specific information that they perceived to be credible, the information then had to teach them an important skill or make them aware of doing/knowing/considering something that they might not have been aware of before. The difficulty came in not knowing what information would be useful in advance of having a baby.

I wasn’t proactively looking for stuff about what it would be like to have a baby in pregnancy.

Participant 4, son aged 24 weeks
Usefulness was also related to continuity of information. Women noted a distinct lack of digital resources that covered the transition to parenthood. Resources were perceived as being preoccupied with – and stopping at – birth.

Yeah, there was a lot on the birth as well and with the best will in the world, the birth is going to be the birth, it’s going to happen; It probably needs nappy changing, how to breastfeed, latching, soothing your baby, what to if…those sorts of things would be way more important.

Participant 5, daughter aged 14 weeks

For information to be useful it also had to be usable and presented in a manner that made it fit for purpose. Logical and tidy curation of information which was limited by geography or topic was an important consideration. The transition to parenthood could involve a large amount of research and fundamentally similar information was often presented in subtly different ways. Women used multiple resources and therefore navigating, evaluating and sorting information could be difficult. Participants talked about the importance of feeling like they were in control of the amount of information that they were exposed to. It was easy to get lost online and one way of managing that was only to view information that was relevant to their stage in the perinatal journey.

The information was quite clear and they had the bit for when you’re trying and the bit for your pregnancy and the bit for when you’ve had your baby so it’s easier to find the information.

Participant 6, daughter aged 14 weeks

Women also recognised poor curation of information. Some women tried to avoid information overload by avoiding information that seemed vague.
Yeah, I wouldn’t click on that video. If someone said ‘adapting to a new life’, I wouldn’t click on it because I wouldn’t know what’s in it whereas practical things like ‘why is my baby crying?’ or ‘breastfeeding latching problems’, ‘feeding a baby’, ‘bathing your newborn’, I know what they are so I’d click on them.

Participant 5, son aged 14 weeks

Functionality and efficiency were important considerations. Participants wanted online resources to be instinctive to use and able to deliver answers to pressing questions, quickly.

    When you’re looking for something, functionality is more important, being able to find what you want, quickly.

Participant 4, son aged 24 weeks

### 7.6.4 Revision of the logic model

Analysis of the workshop data led to the re-evaluation and clarification of aspects of the logic model presented in Chapter 6. Motivations and key user objectives (goals) were refined and are highlighted in a revised logic model (Figure 7.9).
7.6.5 Revision of motivations

The overarching problem statement remained unchanged: new mothers often describe feeling unprepared for parenthood. However, analysis of the workshop data supported a better understanding of which aspects might be worthy of closer attention.

- Women’s expectations about life with a new baby are not necessarily unrealistic; exposure to a broad range of positive and negative stories leads to an abstracted appreciation of the many ‘realities’ of early motherhood.
- Birth remains the main antenatal focus; awareness of the importance of preparing for the first 4-6 weeks of motherhood needs to be prioritised.
Loneliness rather than isolation is a common aspect of new motherhood: however, this does not necessarily lead to reduced help seeking. Indeed, help is actively sought but frequently not found, due to a combination of reduced services and poor signposting. This is particularly true in the case of breastfeeding.

Postnatal maternal wellbeing was still perceived as being synonymous with absence of postnatal depression. Maternal wellbeing is vulnerable at unexpected points in the postnatal experience.

7.6.6 Revision of user goals

Critical evaluation of the synthesised evidence supported the revision of the core user objectives or goals presented in the logic model (Chapter 6) and are highlighted in a revised logic model (Figure 7.9).

**Goal 1: Women want to feel prepared for life with a newborn**

Preparation for new motherhood is currently synonymous with preparation for birth and the purchase of material goods. There is a gap for provision of information about practical skills.

**Goal 2: Women want to connect with others like them**

Women want to connect with local peers online and face-to-face; some want to be able to meet other couples; others want to feel like they are part of a community; all want to provide their child with opportunities for learning and play. Women want to be able to access reliable information about local resources. Spending time with others with shared values is important.
Goal 3: Women want to feel that their resources outweigh their challenges

Women want to feel that they are managing a complex situation to the best of their abilities.

Goal 4: Women want support to be credible and trustworthy

Women want a comprehensive resource which is private, evidence-based, easy to use, visually appealing and free. They want to be able to access and manage key content, based on timing and need.

7.6.7 Revision of the design hypotheses

Refinement of the core user goals and evaluation during the workshop compelled re-evaluation of the early design hypotheses (Chapter 6). The proposed digital solutions had been kept intentionally broad; however, certain hypotheses were refined or removed, as highlighted in a revised set of hypotheses below (Figure 7.10).
Evaluation of the design hypotheses at the workshop suggested that bump2bump would be comprised of three main components:

1. **Parenting and lifestyle information**

   Just-in-time, tightly curated practical information; content to be determined by pregnant women and new mums; content to be presented by credible healthcare professionals and peers; taboo or ‘difficult’ topics (e.g. postpartum psychosis or perineal massage) were perceived as being of less value than practical knowledge.
2. A wellbeing ‘toolkit’

Curated wellbeing information covering the key aspects of the perinatal experience: managing relationships, shifting perspectives, supporting resilience, managing emotions, communicating with others. Content to be produced and presented by credible professional; to prompt reflection and to include brief exercises to support practice of key emotional skills.

3. Access to local resources

Information and access to local people and places.

A design feature which would facilitate a buddy/mentor option was rejected by all workshop participants. Although social media was not used by workshop participants to the same degree as seen previously, involvement in an online community was valued and therefore the option of a closed bump2bump Facebook group was retained. The option for meetups facilitated by a bump2bump parenting professional was also retained: Birth Baby Balance had expressed interest in facilitating this and the idea was kept, with the expectation of needing further exploration as to its feasibility.

7.7 Developing a conceptual model

Analysis of the workshop data provided a deeper understanding of user goals and motivations. The next step was to develop an overarching conceptual model of bump2bump. Johnson and Henderson (2002) describe a conceptual model as a “high-level description of how a system is organised and operates”. A key benefit of conceptualising design at this level of abstraction is that it “enables designers
to straighten out their thinking before they start laying out their widgets” (Johnson & Henderson, 2002). A conceptual model provides an idealised view of the system, its structure and mechanisms that is as close as possible to the user’s mental model (Figure 7.11), as well as the mechanisms by which the user will accomplish the tasks that the system intends to support.

A conceptual model is based on metaphors, concepts and analogies that manage user expectations by conveying what the resource is for. For example, online shopping is commonly based on the ‘real life’ customer shopping experience of placing items in a shopping trolley or basket and going through a checkout process. How these metaphors and concepts are arranged impacts on the fundamental user experience; therefore, optimal conceptual models are those which are grounded in user needs and which provide simple, intuitive solutions (Rogers et al., 2011). The application of guiding metaphors is discussed further below in section 7.7.1.

![Figure 7.11 Conceptual model (Cooper et al., 2014).](image)
7.7.1 Interface metaphors and interaction types

As outlined above, metaphors are considered to be an important component of a conceptual model. They are intended to provide familiar entities in the shape of icons or images to enable users to easily understand the resource and know what to do as instinctively as possible. Examples of metaphors include magnifying glasses or binoculars as a cue to ‘zoom in’ or find things, folder icons to show containers of documents or web catalogs that ‘turn pages’ like a book. Metaphors are used in three main ways (Rogers et al., 2011): (i) as a way of conceptualising what we are doing (e.g. surfing the web); (ii) as a conceptual model instantiated at the interface (e.g. the desktop metaphor); (iii) as a way of visualising an operation (e.g. an icon of a shopping basket which we place items into when shopping online). The way that a user interacts with a resource, or ‘interaction type’, underlies the user experience. Rogers et al. (2011) suggest that there are four main ways of interacting with a resource - instructing, conversing, manipulating and exploring - and underline the importance of systematically considering which interaction type will best support a user experience.

The approach to the use of metaphors in the development of bump2bump was twofold and was related to interaction type: while using the resource, it was important for users to feel that they were ‘in discussion’ with an experienced friend. One workshop participant had referred to the desirability of interacting online with a digital midwife who was always on hand to answer questions. While it was important that the interface maintained a clear position of being an academic project and did not imply that interaction with its component parts was intended as a substitute for normal care, the guiding principle of ‘friendly,
reassuring information’ was used as an overarching metaphor. It was therefore anticipated that the interaction type would be one that combined instruction with manipulation and exploration: users would type in commands and select options from menus (instruction); users would interact with objects such as opening videos or placing desirable content in an online scrapbook (manipulation); users would move around the online space, browsing content based on timing and need (exploration). The interaction types would be supported by an icon-based metaphorical framework which reduced the need for interpretation of labels and facilitated quick access to just-in-time content.

7.8 Creating the interaction framework

7.8.1 Defining the interaction framework

Having reconsidered the bump2bump logic model and refined the design hypotheses, I worked with the bump2bump designer to define the interaction framework. A systematic approach was taken to the translation of data into concrete design by using the Framework Definition process proposed by Cooper et al. (2014) (Figure 7.12). Defining a digital resource’s interaction framework is intended to prompt systematic reflection of the high-level structure of screen layout and also the resource’s flow and organisation and is grounded in user data rather than technical idealism.
The first stage of the iterative process was to define bump2bump’s form factor and input methods: what would the resource be viewed on and in what contexts? How would the user physically interact with the system? The second stage was to define the functional and data elements. These represent information and functionality that is revealed to the user in the interface during the use of the resource and represent “concrete manifestations” (Cooper et al., 2014) of design requirements. Grounding these elements in user goals ensured that each element was evidence-based. The third stage was to begin the process of grouping the data elements into a simple and user-friendly hierarchy. This involved thinking about which elements required more screen space and which elements served as containers for other elements. This initial definition of the interaction framework
was then translated into low-fidelity paper-based wireframes, described further below.

7.9 Moving from data to design

7.9.1 Wireframes and sketching the interaction framework

The border between conceptual and physical design is not rigid (Rogers et al., 2011). The development of a clickable prototype was intended to be a manifestation of the workshop output which would support testing by target users in the following evaluation phase. The following section describes how low-fidelity paper-based wireframes were iterated upon and developed into a clickable prototype.

The first step was to determine the overall framework of the user experience and to establish the basic organising principles and functionality of the DHI. This involved retaining a top-down approach and focus on how the core components of the design requirements would fit together within a comprehensive framework that met users’ goals. Having established a basic hypothesis of what bump2bump should be doing, I began sketching and rendering simple design solutions. Initial user journeys were mapped using pen and paper and PowerPoint wireframes (Figure 7.13). The interface was kept simple with screens subdivided roughly into rectangular areas corresponding to content holders and control components such as toolbars and menu headings. Relationships between functional areas were indicated with arrows. Different ways of presenting information and functionality were explored and tested through informal rapid validation before deciding upon
acceptable solutions. The aim of this phase of creating the design framework was to determine ‘good enough’ interaction solutions that adhered to user goals and the evidence-based interaction framework; these would be tested in the next development phase through functionality testing with target users.

Once sketches achieved a reasonable level of detail, I worked in tandem with the developer, and we began to work towards production of a clickable prototype. We developed increasingly detailed computer-based representations of key path scenarios, first using Powerpoint and then WordPress. This allowed us to continue working roughly and at a high level, but we were also able to render related, sequential screens to depict bump2bump’s behaviour through key path scenarios. The clickable prototype and key content were being produced in parallel, with the intention of testing bump2bump’s key functionality and usability with target users once a basic framework was in place. The following section outlines the development of the key components, from basic paper renderings to the testable pages of the clickable prototype.
7.9.2 The homepage

The homepage was designed as a ‘shop window’ and intended to offer sufficient information for potential users to actively choose to log in to access full website content. Initial ideas around delivering this information through the primary medium of video were revised as was the inclusion of prominent stock imagery. Aesthetic simplicity was prioritised and images were removed and replaced with icons. The use of icons increasingly became part of the aesthetic based on recognisable, simple metaphors and therefore this was matched on the homepage (Figure 7.14). The icons at the base of the homepage represented information about the site’s rationale, suggestions for optimal use of the site and information about the team behind the content (Figure 7.15). The intervention overview provided an overview of the bump2bump content and objectives as well as general guidance on functions and features and how to use the site. This information was intended to contribute to the credibility and clarity of the site.

Figure 7.14 Screenshots of the homepage from Powerpoint to WordPress test page.
7.9.3 Logging in / registering

A simple registration page was designed with the intention of reducing user burden as much as possible. Again, user trust in the resource was an important consideration and therefore brief text was added on the registration page to reassure potential users that their information was safe and that they would not receive any unsolicited contact from the website in the form of newsletters or promotional emails (Figure 7.16).

7.9.3.1 Logged in landing page

Once users had logged in, they were taken to a logged in landing page, from where they could view, access and manage the full website content (Figure 7.17).
7.9.4 Parenting information

The workshop had established key priorities around parenting information content and presentation. Participants had found brief videos accompanied by transcripts acceptable. Content needed to be curated in a meaningful way. Content was being generated in parallel with development of the design framework and we decided to complete one parenting information ‘section’ prior to evaluation of key functionality. We focused on the section on Birth as the key information was relatively easy to determine and produce in comparison to some of the topics generated by workshop participants. We developed a basic template and dropped information in, with the intention that each section would follow the same pattern. It was anticipated that section names and content curation would be assessed in subsequent validation testing. Production of experiential content was ongoing and

Figure 7.17 Screenshots of the login landing page from Powerpoint to WordPress test page.
this would be added when complete. From the My Home page, users clicked through to the Parenting Information landing page, from where they could select content (Figure 7.18).

![Figure 7.18 Screenshots of the parenting information landing page from Powerpoint to WordPress test page.](image1)

From the parenting information landing page, users clicked through to a topic-specific landing page (Figure 7.19).

![Figure 7.19 Screenshots of a parenting topic page from Powerpoint to WordPress test page.](image2)
Each topic contained a number of videos, which were listed on the left hand side of the page. The first video on the list was ready to play but did not play automatically. Users could read a transcript or save the video for later viewing (Figure 7.20). Initial ideas around information management included the suggestion that users could create a ‘scrapbook’ of preferred content. This term was changed in favour of ‘My favourites’ when rapid validation testing suggested that people were more familiar with the idea of liking, choosing and saving ‘favourites’ online.

![Screenshot of the My Favourites WordPress test page.](image)

**Figure 7.20 Screenshot of the My Favourites WordPress test page.**

### 7.9.5 Wellbeing support

The content and design of the wellbeing support section was the least developed. The workshop confirmed the importance of bump2bump including some kind of wellbeing content. However, it was unclear what form this wellbeing content would take. Through a series of preliminary consultations with One-Eighty, professional psychologists who specialised in providing CBT-focused support to young families, initial ideas for reasonably generic content were brainstormed and a template was produced for future content to be dropped into. The template matched that of the parenting information, in that it supported video content with accompanying transcripts and downloadable content (Figure 7.21). The functionality of the section could be evaluated by proxy through testing of the
parenting information template. Core content development was ongoing and it was acknowledged that functionality of this section might change significantly as a result.

7.9.6 Local resources, meetups and social media

From the My Home page, users could click through to the sections on local resources, local meetups and safe social media. These three sections were kept separate on the logged in landing page with some expectation that they may be collapsed into one during subsequent testing. Workshop participants had talked about the importance of being able to access well organised and useful local information. The opinions of other mothers mattered, and recommendations were highly valued. Users were interested in being able to provide their own suggestions for places to be included on the website. In particular, women talked about the way that local information was frequently hidden within large parenting websites or was not organised in an intuitive way. I evaluated existing examples of this and developed the bump2bump preliminary local resource listing as a direct alternative. Content for the local resources section was generated by contacting previous study participants and asking them to provide examples of clubs, classes

Figure 7.21 Screenshots of the provisional wellbeing toolkit WordPress test pages.
and local services they valued in the Oxford area. Resources included facilitated postnatal groups and baby-friendly coffee shops. A simple template was developed with the aim of testing presentation and key functionality in the next codesign exercise (Chapter 8) (Figure 7.22).

The interaction framework supported access to free local meetups, facilitated by a parenting professional. Intended to supplement rather than replace existing antenatal parenting classes, the meetups schedule was devised as an opportunity for women to attend informal discussion groups on their own or with their partner. It was hypothesised that the functionality of the meetups section on the website simply needed to offer users the options of selecting times, dates and meeting types, with the added option of suggesting discussion content. With this in mind, basic calendar-style functionality was used (Figure 7.23).
Presentation of the safe social media section was not prioritised at this stage. This content was viewed as a design challenge rather than one of functionality: a bump2bump Facebook group would be set up during the evaluation process and presented in a manner in line with the general bump2bump DHI aesthetic.

7.10 Discussion

7.10.1 Principal findings

The workshop generated a set of design requirements and a design framework which informed the development of a clickable prototype of the bump2bump digital resource. This was achieved by systematically examining and refining the face validity of the synthesised evidence. The workshop explored what women perceived to be critical component parts of an optimal digital perinatal wellbeing resource. The study focused on determining core user goals and these were revised and articulated as: (i) women want to feel prepared for life with a newborn, (ii) women want to connect to others like them, (iii) women want to feel that their resources outweigh their challenges, and (iv) women want the resource to be credible and trustworthy. The solutions hypothesised to meet these goals were
revised and articulated as: (i) parenting and lifestyle resources, (ii) a wellbeing 'toolkit', (iii) access to local resources. The study demonstrates that a goal-directed design approach is feasible in the development of a digital resource for supporting maternal wellbeing in the transition to first time motherhood. The study also demonstrates that a digital resource to support maternal wellbeing in the transition to first time motherhood is acceptable and the provision of web-based support based on user goals has potential to positively influence the experience of new parents.

7.10.2 Wellbeing support

The workshop was critically important for refining and extending the evidence relating to provision of wellbeing support. Previous participants had found it hard to talk about their own wellbeing and qualitative data collected earlier in the project was marked by an absence of conceptualisation of wellbeing and how to support it in early motherhood. Again, workshop participants found it difficult to talk about their own wellbeing but reflected on the way that poor wellbeing is framed within the perinatal context: antenatally it is synonymous with physical health, postnatally with affective disorder in the first 6 weeks. Participants considered the idea that wellbeing information offered antenatally was only relevant to those at risk of developing postnatal depression and therefore not of relevance to them as none considered themselves to be actively at risk. For this reason, many women had actively avoided wellbeing support framed, as they perceived it, as being concerned with managing difficult emotions and feelings. However, women talked about struggling with difficult emotions later as a new mother, exacerbated when what they described as the ‘novelty’ of motherhood wore off. They reflected that
wellbeing support would have been useful in helping them to manage their own feelings and develop a more self-compassionate attitude. Their anxiety may have been sub-clinical but it was distressing nonetheless. Wellbeing support framed as a vital component of managing holistic health rather than prevention of mental illness would have been useful.

7.10.3 Information provision

Women talked about the specific need for practical information to support the first six weeks of motherhood, describing how gaps in their knowledge relating to the care of their newborn impacted on their confidence. Madge & O’Connor (2006), Gibson & Hanson (2013) and Pedersen & Smithson (2013) described how women in their studies needed online spaces to test out and legitimise their new role, with Gibson & Hanson stating that the women in their study saw the “potential of the Internet to provide a safe place to ask embarrassing questions”. The immediate needs of the workshop participants regarding online resources were far more prosaic and echoed the findings of the interview study, in which women actively avoided large forums, and did not identify with the contemporary representation of online spaces such as mumsnet as places for discussion of taboo or challenging topics. Difficulties were much more likely to be discussed in person with trusted peers and only later in the perinatal journey. In addition, concerns about privacy and limited usage of social media were also prevalent amongst the workshop participants. In combination, this may just be a reflection of the views of a different group of women.
This meeting of basic needs was also a theme in participants’ descriptions of accessing information about local resources. Gibson & Hanson (2013) described mothers’ frustration at not being able to access local community groups and resources easily and this remains an important consideration. Women were proactive about seeking out and attending groups and developing a supportive peer network but struggled to navigate and trust online information. However, women described how these needs could be met by sensible curation of what were perceived to be credible resources. Multiple studies describe the burden of navigating online perinatal information (Barkhuus et al., 2017; Barkin & Jani, 2016; Prescott & Mackie, 2017; Slomian, Bruyère, Reginster, & Emonts, 2017; Toombs et al, 2018) and call for resources to be designed with specific user needs in mind.

7.10.4 Strengths and limitations

Using qualitative methods and developing rapport with participants in an informal workshop setting enabled me to explore and understand subjectively defined, complex phenomena, something that would have been impossible to do using evidence statements and design hypotheses alone. Even though these were developed from rich qualitative data gathered earlier in the project, it was critically important to check my interpretation of this data before determining user goals which would form the foundation of the resource’s design requirements. More specifically, through using a workshop format, I was able to gather detailed data on how women conceptualise their own wellbeing, what women perceive to be important factors in maintaining and supporting wellbeing in early parenthood, key parenting and lifestyle information topics and key aspects of preferred digital
solutions. A further strength was the focus of the workshop on being pragmatic and fit for purpose. Participants’ needs were considered and the activities were planned with the intention of gathering rich data, quickly. Activity goals were explained, and the activities fed into one another. Active reflection and inclusion of personal experiences was encouraged; activity steps were kept to a minimum; the designer working on the project attended and this was critically important both in the way it immersed her in the topic and also for the way it allowed discussion of what was technically feasible. In addition, the methods used in this study enabled the development of an interaction framework and clickable prototype grounded in user data. The process endeavoured to be systematic and fully transparent, supporting the retrospective identification of the origin of key ideas.

Paper prototyping and simple iteration which focused on meeting user needs encouraged discussion of the proposed design and contributed to my understanding of the prototypes as work in progress. This form of rapid iteration ensured that I did not become attached to early, rudimentary designs as all prototypes were seen as being disposable (Cooper et al., 2014; Snyder, 2003). A limitation of the study design is that I had to rely on participants’ retrospective, self-reported use of digital resources. In addition, co-facilitation of the workshop by non-experts led to some variation in the data collected. The workshop generated a significant amount of data which both validated and challenged previous findings. It was important to interpret, reflect upon and apply the data in a way that acknowledged and accommodated previous evidence. For example, a compromise was sought between the interview participants’ usage of social media and the workshop participants’ comparative dislike for it.
7.10.5 Conclusions

Supporting maternal wellbeing in the transition to parenthood is complex. This study demonstrated the feasibility of taking a systematic approach to the critical appraisal and application of user requirements through a staged process of codesign and prototyping. As a consequence, an evidence-based digital resource which provides information, wellbeing support and access to local others may be acceptable and of potential value to the perinatal target audience. The following chapter describes the first stage of evaluating the clickable prototype produced as a result of the workshop.
Chapter 8 Formative Evaluation of the Prototype

8.1 Chapter overview

The previous chapter described the first stage of the iterative work undertaken with target users to develop and refine a high functioning prototype through a systematic process of goal-focused codesign. The workshop described in Chapter 7 contributed to a deeper understanding of user needs and supported the generation of a set of design requirements and a preliminary design framework. The aim of this preliminary design framework was to support the development of a clickable prototype, comprised of ‘good enough’ interaction solutions that adhered to user goals and which would be tested in the next development phase. This chapter focuses on this next development phase (Figure 8.1).

![Figure 8.1 Position of the study within the overall thesis (highlighted).]
The main purpose of this study was to test and refine basic prototype functionality and navigational coherence and to use participant feedback to inform the development of a high functioning prototype. As in Chapter 7, this chapter is in 2 parts: Part 1 describes the approach taken to refining and extending the basic interaction framework through a process of usability testing with target users and Part 2 describes the subsequent design response. I begin the chapter by providing some background to the study rationale and outlining the study aims and objectives. The study was the second of three codesign exercises and took the form of one-to-one ‘cooperative evaluations’ with first time mothers that required participants to explore the clickable prototype, offer spontaneous feedback and respond to a series of semi-structured questions and tasks. Participants provided positive and negative immediate feedback, identified a need for critical modifications and made suggestions for modifications which might improve uptake and engagement with the resource for target users. Analysis of the cooperative evaluation data was used to refine the tool’s core interaction framework. In addition, reflection upon and discussion of this feedback led to three significant revisions: the complete removal of the resource’s meetups and social media sections and significant modification of the wellbeing toolkit.

8.2 Introduction

In order to benefit from a digital perinatal tool, users must actively choose to engage with it and perceive their use of it to provide tangible value. The focus of this study was to test and refine the basic usability of the clickable prototype and also to determine how best to enhance the tool’s overall appeal. As described in Chapters 2, 4 and 5, perinatal women frequently use resources found during
spontaneous online searching or those which are recommended by trusted others. In addition, women take a bricolage approach to the use of perinatal digital tools, using and discarding websites and apps according to their usability and evolving usefulness. The management of this was described by participants as being burdensome. At the time of writing, more than 1,000 pregnancy-specific apps were currently available on the market (Thomas & Lupton, 2016). Together with multiple websites offering information or opportunity for social connection, options for engagement with digital tools claiming to support the perinatal experience are overwhelming. Public health organisations such as the UK’s National Health Service (NHS) and the Royal College of General Practitioners (RCGP) as well as perinatal organisations (e.g. National Childbirth Trust) provide online libraries and lists of endorsed pregnancy and childcare applications and websites but there is little evidence to suggest that usability or overall acceptability have been considered as key inclusion criteria. Nor do such lists offer guidance as to how individual resources might meet specific user needs.

As outlined in previous chapters, an important goal in the development of perinatal digital resources is to determine how the usability of such tools can be improved so as to encourage and support a positive user experience. The decision to use and to continue using any digital resource is likely to be influenced by rapid, intuitive reactions to the tool’s appearance (Lindgaard, Fernandes, Dudek, & Brown, 2006; Norman, 2004). Congruence with the user’s needs, goals and values is also likely to be important (Peters et al., 2018) and was described as such by participants in Chapters 5 and 7. Previous chapters describe the steps taken to determine user needs and goals and how these were translated into design hypotheses and an interaction framework. The aesthetic and usability of the subsequent operationalisation of this interaction framework in the form of a
clickable prototype was interrogated in the present study using qualitative methods.

### 8.2.1 Cooperative evaluation

The participation of users in the interface design process is one of the key strengths of an interdisciplinary approach and can serve as a system of quality control in the development of digital tools, facilitating the production of more than just a usable system (ISO, 2000a; Maguire, 2001; Yardley, Morrison, Andreou, Joseph, & Little, 2010). Greenberg & Buxton (2008) refer to the importance of “getting the right design before getting the design right” by using approaches which collaboratively generate meaningful data that refines rather than stifles early ideas. A cooperative evaluation methodology was used in the current study which harnesses the best of controlled usability testing and contextual, in-the-wild methods by engaging the user as an active participant in the evaluation process (Monk et al., 1993). Cooperative evaluation can be thought of as a pragmatic extension of the think aloud method (Ericsson & Simon, 1998) in that it allows for, and actively encourages, spontaneous user feedback on the overall user experience rather than in response to a predefined task (Melo & Baranauskas, 2006), enabling participants to explain why a given design feature is ‘good’ or ‘bad’ rather than just being functional. Cooperative evaluation allows the evaluator to work more deeply with a target user, to obtain real-time feedback about re-design and aims to elicit information relating to what works well as well as identifying critically important fixes.
In order to interrogate the interaction framework, it was useful to probe the actions taken so far to operationalise user goals and to identify aspects of design and functionality that users perceived to be important for engagement and positive interaction. The overall aim of this study was to test and refine basic prototype functionality and navigational coherence and to use participant feedback to inform the development of a high functioning prototype. The present study therefore aimed to answer the following 2 research questions through the use of qualitative methods:

1. Is the clickable prototype acceptable to naïve users in terms of its basic functionality and navigational coherence?

2. Is the clickable prototype acceptable to naïve users in terms of its proposed interaction framework?

The study was also used to continue to gather insight into the online needs and requirements of first time mothers.

**Part 1 – The Formative Evaluation**

**8.3 Methods**

**8.3.1 Design and setting**

A cooperative evaluation methodology was used in which 5 participants provided feedback, responded to a series of semi-structured questions and completed set tasks. Semi-structured interview techniques were also used to elicit participants’
experiences of and attitudes towards usage of digital perinatal resources and to allow participants to elaborate on statements made during the cooperative evaluation process. The study took the form of one-to-one meetings at each participant’s home. Meetings lasted around 2 hours and participants received a £20 high street voucher as compensation for their time.

8.3.2 Ethics and research governance approval

UCLIC’s Departmental Research Ethics Committee granted ethical permission (UCLIC/1213/015). Participation was voluntary, and participants were recruited in the same way as any other healthy adult able to give informed consent. Personal identifiers were removed from the data and the data were stored securely, according to the principles of research governance (Northway, 2017).

8.3.3 Participants

This study sought the views of new mothers. Women were eligible to take part if they i) were aged ≥ 18 years, ii) had one child under the age of 6 months, iii) had experience of using digital perinatal resources, iv) lived in or near Oxford. As in the previous interview study and workshop, women who were actively using or who had used digital perinatal resources were recruited in order to gather more valid data. It was supposed that these women would be more able to reflect on design considerations than women who were not interested in engaging with digital resources.
8.3.3.1 Recruitment

Participants were recruited using snowballing techniques (Biernacki & Waldorf, 1981) and the online community forum previously used. Nine expressions of interest were received but 4 participants were unable to take part in the study. Five first time mothers were recruited: 1 from the interview study, 3 from the codesign workshop, and 1 new participant. All workshop participants were invited to participate in the cooperative evaluation, with the exception of one participant who did not meet the sampling criteria. The decision to include previous research participants was taken on pragmatic grounds: previous participants had expressed enthusiasm for and interest in the research and had asked to be considered for future studies; an active, core group of lay ‘research champions’ helps with building and sustaining a community of practice around new technology (Oduola, Wykes, Robotham, & Craig, 2017); the inclusion of previous participants intended to address the lack of a formal project steering group and acted as a process of checking that user needs and requirements identified in earlier studies were being interpreted appropriately. Inclusion of a new participant was intended to provide a fresh perspective and guard against “group think”.

8.4 Procedure

Prior to the workshop, all women were sent an information sheet by email (Appendix 4). Participants were invited to re-read the information sheet; they then provided written consent and completed a demographics form as used in the interview study and design workshop (see Appendix 5). Participation required an Internet connection in order to access the prototype; it was anticipated that participants would access the prototype using their own device, which would allow
for testing across platforms and browsers. However, 2 laptops were also provided (Mac OS and Windows OS) in case this was not possible.

8.4.1 Pre-evaluation interview

A brief semi-structured interview was conducted prior to the cooperative evaluation in order to elicit participants’ experiences of and attitudes towards usage of digital perinatal resources (see Appendix 5). Knowledge of participant’s experiences was anticipated to support interpretation of data gathered during the cooperative evaluation itself; for example, knowledge of a participant’s dislike of social media would clarify a desire for the removal of social media content.

8.4.1.1 Evaluation tasks

The process of cooperative evaluation (Monk et al., 1993) consists of four key stages: (1) recruit users; (2) prepare tasks; (3) interact and record; (4) debrief. The preparation of tasks prior to evaluation is structured to ensure that they are representative of the work the product is designed to support, are achievable, explore the prototype thoroughly and are stated specifically. Tasks were designed to test the prototype’s preliminary design and interaction frameworks, to examine usability issues and offer opportunity for discussion of potential remedies with the user (Appendix 5). The preliminary interaction framework was constructed in response to the goals and requirements identified in previous studies and the resulting clickable prototype included 5 key components hypothesised to address these requirements (see Chapter 7, Figure 7.10): (1) parenting and lifestyle
information; (2) a wellbeing toolkit; (3) access to local resources; (4) information about trusted social media resources; (5) provision of facilitated meetups.

Following the pre-evaluation interview, I introduced the principles of cooperative evaluation and asked the participants to complete a practice task: thinking aloud whilst searching the Mothercare website for a pushchair. bump2bump was then accessed on the device of the participant’s choice and the participant was invited to perform the following tasks:

(i) navigate to the bump2bump homepage and provide initial impressions;
(ii) register on the site and comment on landing page;
(iii) watch a video from the Birth collection;
(iv) save a video to watch later;
(v) watch a video from the wellbeing collection;
(vi) read a review of a local parent-baby class;
(vii) provide a recommendation for a local listing;
(viii) register for one of the local meetups;
(ix) log out.

The tasks were designed to simulate an initial, exploratory encounter with the website and to elicit feedback on the functionality and appearance of the site.
Prompts and positive reinforcement were used to encourage the participant to continue providing general feedback (e.g. How would you do that? / What do you want to do? / What will happen if..? / What were you expecting to happen then? / What are you thinking now?). Screen shots of the prototype pages that participants were asked to interact with and respond to are included in Appendix 5.

8.4.1.2 Debrief interview

The naturally discursive style of the cooperative evaluation approach generated extensive data during the session. However, following task completion, participants were asked some general questions in order to give them the opportunity to elaborate on statements made during the evaluation (e.g. You mentioned[...]. Can you tell me more about that?) and to elicit more feedback about their overall impressions and suggestions for modification.

8.4.2 Data analysis

Full field notes were made following each session, focusing on general impressions of the evaluation process and any key themes that had emerged relating to functionality and design. The sessions were audio-recorded, transcribed verbatim and analysed initially using an inductive thematic analysis approach (Braun & Clarke, 2006). Having familiarised myself with the data, the data were coded pragmatically, using the study objective of developing a high functioning prototype as an overarching framework. As in the previous chapter, the analysis and actions taken are presented sequentially, to best reflect the
process taken. The analysis of the evaluation data is presented first, followed by the design response.

8.5 Results

8.5.1 Participant characteristics

Participant characteristics are reported in Table 8.1. All women were aged 30-35 years and all had received some form of further education. Most women were married and all were English. All women participated with their babies present, who ranged in age from 12 to 25 weeks. All women rated their ability to use the Internet as at least 8/10 (with 10/10 being most able) and all used a variety of digital devices, with mobile phone (smartphone) and laptop being the most common. All women chose to access the resource on a laptop.

<table>
<thead>
<tr>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of participants</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td>30-35</td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
</tr>
<tr>
<td>Postgraduate / professional level</td>
</tr>
<tr>
<td><strong>Relationship status</strong></td>
</tr>
<tr>
<td>Cohabiting</td>
</tr>
<tr>
<td>Married</td>
</tr>
<tr>
<td><strong>Ethnicity (self-defined)</strong></td>
</tr>
<tr>
<td>White British</td>
</tr>
</tbody>
</table>

*Table 8.1 Cooperative evaluation participant characteristics.*
Participant feedback was examined with regard to how women described their immediate impressions of the site, any critical usability issues and any suggestions for improvement (Table 8.2). Participants are identified by a number and their baby's age in weeks and pseudonyms are used where appropriate.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First impressions</strong></td>
<td>Positive feedback</td>
<td>Prototype perceived as reputable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visually appealing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clean and organised layout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Easy to navigate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interesting and relevant content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Geographical focus valuable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Autonomous and tailored</td>
</tr>
<tr>
<td></td>
<td>Negative feedback</td>
<td>Browser/platform instability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-registration information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Registration process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information labelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wellbeing toolkit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local resources submission</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meetups section</td>
</tr>
<tr>
<td><strong>Modifications</strong></td>
<td>Critical</td>
<td>Cross-platform/browser stability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Homepage information &amp; branding</td>
</tr>
</tbody>
</table>
Immediate impressions and suggestions for improvement.

<table>
<thead>
<tr>
<th>Recommended</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Login/registration process</td>
<td></td>
</tr>
<tr>
<td>Breadcrumbs &amp; signposting</td>
<td></td>
</tr>
<tr>
<td>(Re)labelling</td>
<td></td>
</tr>
<tr>
<td>Experiential content</td>
<td></td>
</tr>
<tr>
<td>Local resource functionality</td>
<td></td>
</tr>
<tr>
<td>Wellbeing toolkit rethink</td>
<td></td>
</tr>
<tr>
<td>Meetups rethink</td>
<td></td>
</tr>
<tr>
<td>Removal of social media</td>
<td></td>
</tr>
<tr>
<td>Removal of external links</td>
<td></td>
</tr>
<tr>
<td>Transcripts</td>
<td></td>
</tr>
<tr>
<td>Video straplines</td>
<td></td>
</tr>
<tr>
<td>Glossary</td>
<td></td>
</tr>
<tr>
<td>Search function</td>
<td></td>
</tr>
</tbody>
</table>

8.5.2 First impressions

8.5.2.1 Positive feedback

Overall, there was general consensus in that participants found the prototype easy to use, friendly in tone and visually appealing. In addition, the site was perceived to be credible, due to the content on the homepage which explained the prototype’s provenance.
It’s nice to know where things have come from because anyone can build a website with anything these days and there’s definitely people who would be interested to know that it’s evidence based. It also makes it personal and personable.

Participant 3, daughter aged 25 weeks

Participants were able to navigate around the site and complete core tasks relatively easily. All participants rated their own ability to use digital resources highly and used different strategies to navigate and view prototype content (e.g. using the back button versus using the toolbar across the top of the screen). The use of icons to denote key content was perceived to contribute to an impression of a clean and organised layout as was the overall simplicity of the prototype and use of familiar form layouts and action buttons.

Yeah, there’s a clean design and it feels quite modern.

Participant 4, daughter aged 24 weeks

Parenting and lifestyle content was considered to be interesting, useful and relevant to new mothers and four participants recognised themes drawn from the interview and workshop studies. Participants reflected in particular on their perceived lack of practical baby knowledge and felt that a good resource should meet that need.

We all wished there had been more about life with a new a baby and not just about getting it out, especially when you’ve had your emergency c section and your forceps and your epidural that you didn’t want.

Participant 3, daughter aged 25 weeks
In the final month of my pregnancy and the first month of motherhood, I was really desperate for good resources that would help me understand how to keep [baby] alive (laughs).

Participant 5, son aged 20 weeks

All participants expressed interest in the idea of a wellbeing toolkit that focused on supporting a mother’s perinatal emotional needs and commented on its novelty.

A wellbeing toolkit sounds great, that’s the kind of thing that could be really helpful, I haven’t heard of that.

Participant 1, son aged 12 weeks

A toolkit that could have supported me to be kinder to myself would have been useful.

Participant 4, daughter aged 24 weeks

The prototype’s focus on signposting to local resources was particularly highly valued and seen as a critical aspect of its potential usefulness.

It draws together what’s happening in Oxford today and that’s really valuable. This is one of the key things that I would have used this website for, 100%. It relies on local input which is great because the things that have been recommended to me by people I know have tended to be really brilliant. That would be really meaningful for me.

Participant 3, daughter aged 25 weeks

One mum talked about the extent to which her geographical frame of reference contracted following birth; the importance of having access to nearby resources was a critical part of managing the practicalities of going out and the anxiety that could be associated with it.
Even though Oxford isn’t very big, you end up actually looking for people who are really close to you. A ten-minute drive or a half hour walk suddenly takes on a whole different level of planning.

Participant 5, son aged 20 weeks

The overall tone was considered to be friendly and positive and women liked the way that the user could tailor the site to their own needs by browsing, saving and revisiting personally relevant content. Most participants commented on the prototype’s comparative novelty: the curated synthesis of local parenting and lifestyle content was perceived as being of particular potential value.

Very realistic prototype, it would tick all the boxes, particularly having that local contact thing which is something that a lot of information sites don’t have and not being too much information either, I think it’s very focused on giving you the nitty gritty of what you need to know.

Participant 2, daughter aged 24 weeks

**8.5.2.2 Negative feedback**

Browser and platform choice affected font, sizing and use of screen ‘real estate’. This immediately impacted on the overall impression of the site and led to negative feedback relating to presentation. Although women were positive about the homepage in terms of general appearance and aesthetic, some wanted to see more information, presented more explicitly, about what the site was for, who was behind it and the implications of signing up.
I normally would want to know a bit more about the website before I register for anything, so I’d want to look at a menu and see what I could access or what would I be interested in.

Participant 3, daughter aged 25 weeks

However, when prompted, participants acknowledged that in reality, they would probably register straight away, as usage of perinatal digital resources was typically driven by a strong desire for new information.

If I think there’s information on the other side that’s helped me work out if I’ve fed [baby] enough at 3 o’ clock in the morning then definitely I’ll just jump in and register.

Participant 5, son aged 20 weeks

Some participants described that a site appearing to be ‘good enough’ was sufficient for them to engage with it. Two women spent time actively engaging with the information on the homepage relating to the development and purpose of the site but reflected that they probably only did so because they were being asked to explore the site and had time to do so. The three women who moved straight to the registration process acknowledged being influenced by their understanding of the resource being developed as part of a doctoral research project. Nonetheless, all women wanted to feel more reassured that there were no hidden financial costs, that their data would be safe and that they would not receive unsolicited email.

All this is making me wonder is this going to cost me money because this is sounding very good and more than other websites offer so I’d be wondering if I’d have to pay to subscribe.

Participant 2, daughter aged 24 weeks
I suddenly feel like I need to see who the team is because you’re asking for my email address and name and saying that you’re not going to spam me but are you going to send me lots of newsletters.

Participant 1, son aged 12 weeks

Critically, all but one participant stated that the homepage did not indicate clearly that the prototype was intended for use by women in and around Oxford. They only became aware of this key aspect of the prototype over the course of the evaluation.

The registration process was not considered problematic except for the password requirements. The current template required passwords to contain certain configurations of upper and lower-case letters, numbers and symbols. The process of getting this configuration ‘wrong’ was frustrating to the user as only one ‘error’ was revealed to the user at a time. In this way, a user received up to 4 error messages if the chosen password did not include upper and lower-case letters, numbers and symbols. This was a clear potential barrier to use and burdensome.

Now my baby brain is going oh I can’t do this.

Participant 1, son aged 12 weeks

Once women had successfully registered on the site, they all skipped any assessment of the logged-in landing page and navigated straight to the parenting and lifestyle content.

..that’s obviously what I’m on here for..

Participant 4, daughter aged 24 weeks
Some information content labels were perceived to be unhelpful in distinguishing what was behind the icons.

*Meetups and local resources – are they the same? How are they different?*

Participant 1, son aged 12 weeks

In addition, some video titles were not sufficiently descriptive. Women found it hard to determine the focus of some of the parenting videos without having to take additional steps to click on the videos and watch the first few seconds. One video title within the wellbeing toolkit (‘Carrying a Heavy Load’), which focused on managing difficult emotions was misunderstood by all participants, to their great amusement.

*Is that about being heavy, like still having baby weight?*

Participant 4, daughter aged 24 weeks

*Oh yes, I get a really sore elbow, carrying [baby] around all the time.*

Participant 1, son aged 12 weeks

The wellbeing toolkit was under developed but women were asked to watch and comment on existing draft content. As described above, all women expressed enthusiasm for the idea of a toolkit and appreciated its potential value although they articulated the importance (and difficulty) of signposting to it as an important antenatal investment.
I think it’s really important but I think it’s something that the other side of having a baby I would have been dismissive of because I had a good pregnancy physically, very happy emotionally and fulfilled and it wasn’t something I thought would get called into question but definitely within a month of having baby the stress of no sleeping and [partner] going back to work and feeling really alone and just feeling really anxious about everything caught up with me.

Participant 5, son aged 20 weeks

Knowing what I know now, it would have been good to know what I could have done to manage. I knew I was going to be overwhelmed and it was going to be exhausting but it’s really hard to prepare yourself for that other than just saying to yourself oh I know that’s how it’s going to be and not to commit to having people come and stay and that sort of thing.

Participant 4, daughter aged 24 weeks

Although the potential value of the toolkit was appreciated by women, their experience of using it in its current form was overwhelmingly disappointing. The toolkit was functional, but the current content was not fit for purpose: videos were lengthy and unstructured, and, having watched one video, one participant observed how a poorly-developed toolkit could contribute to new mothers’ anxiety.

I would have checked out ages ago, to be honest. I would have thought what’s this got to do with me having a baby? It started to make me think not only do I have to keep a baby alive and fed but now I have to worry about their emotional wellbeing!

Participant 3, daughter aged 25 weeks
Similarly, although the local resource information was highly valued by all participants, the current functionality and layout were unhelpful. Women wanted to be able to access local clubs, classes and resources, antenatally and postnatally and to be able to access key, simple information. Ratings of local resources were not valued but reviews were and all but one participant expressed how important it was that other mothers provided this information rather than local service providers themselves.

*If the rating doesn’t come with an explanation, then maybe it’s not that useful. You know, you’d want to see comments from mums like it was great, I was able to find a quiet corner to breastfeed or the changing facilities are really easy to access, you know what kind of thing. Often you see that something’s been rated 1 star and you read the comments and think oh well that doesn’t apply to me.*

Participant 4, daughter aged 24 weeks

Women found it challenging to suggest a listing of their own, using the current form, and made suggestions on how to structure a simpler form, based on what information they considered important. The information provided by the parenting information and local resources sections was perceived to fulfil most participants’ immediate needs as new parents; as such, women expressed a certain degree of ambivalence towards the idea of local meetups. Women felt that the meetups essentially duplicated the ‘expensive dating agency’ facility of antenatal classes and that the conversations they wanted to have were with other local new mothers, ideally focused around a shared interest (e.g. yoga, babywearing, co-sleeping), rather than taking part in an organised session facilitated by a professional.
8.5.3 Modifications

The modifications suggested were divided between those which were critically important to facilitate navigational coherence and prototype functionality, and those which would improve the user experience.

8.5.3.1 Required modifications

As described above, immediate modifications were required relating to cross-platform and browser stability and password requirements. Although women described the prototype as being trustworthy, there was also recognition that they were engaging with it as part of a research study and that their implicit knowledge of its provenance may have impacted on their perception of its credibility.

*I’m more interested in what I’m going to get, partly because I know who the team is and I trust you.*

Participant 1, son aged 12 weeks

The bump2bump logo was an unknown entity and therefore the addition to the homepage of branding or other signposting to indicate that the resource was part of an academic research project was suggested. In addition, more content needed to be added to the homepage to outline what the site was about and what the potential value was of signing up. This was also an opportunity to promote the value of the content itself, reassure users that their data was safe and that there were no hidden financial costs. Critically, it was important to use this space to highlight the resource’s geographical constraints.

Once inside the site, certain simple navigational features were missing or required alteration: ‘breadcrumbs’ indicating where a user is within the site needed to be
added. The parenting content icon labels required amendment so as to be more intuitive and representative of a section’s content; in addition, the local resource section required reorganisation of resources into more meaningful sections and the form for submitting resources required revision. The star ratings system was superfluous.

*Rating not important: not like you’re buying something for the baby, not a safety issue.*

Participant 2, daughter aged 24 weeks

Although all women liked the parenting videos delivered by a parenting professional, most described the need for more personal stories of how to manage the process and practicalities of becoming a new mother. Engaging with others’ personal stories were considered a critical part of a successful transition to motherhood and women wanted more of the parenting content to be delivered by lay experts rather than a health professional. Indeed, one participant was surprised not to see it from the outset:

*It’s expected to see that kind of stuff*

Participant 3, daughter aged 25 weeks

Some videos were best presented by a parenting professional, but others would benefit from being presented by a peer, for example when performing the important function of normalising negative experiences.

*It’s that ‘people who’ve been through it’ thing that professionals can’t necessarily help you with. It’s not an advice thing, it’s reassurance, I’ve been through it and I was ok.*

Participant 1, son aged 12 weeks
The largely negative feedback relating to the wellbeing toolkit and the meetups section required significant reflection. The decisions taken regarding these two sections are described further below (section 8.7).

### 8.5.3.2 Recommended modifications

Users made several key recommendations regarding improvement of user experience. The evaluation had touched on use and perceived value of social media in the context of parenting. All women used social media but did not necessarily perceive it as a parenting resource beyond searching for information about local groups and activities. All participants saw the presentation of recommended or ‘safe’ closed Facebook groups for example as superfluous to the site’s main purpose. Face to face contact with other new mums was prioritised and participants felt they were more likely to respond favourably to recommendations for social media safe spaces from peers. This was echoed in the recommendation to remove external links from the site, with the primary rationale being that a single out of date or incorrect link would impact on user experience and trust. It would also have the obvious impact of leading users away from the site. Video transcripts were valued by most of the participants and it was suggested that they be presented below the video rather than opening in another browser window. The videos themselves needed the addition of a short strapline to signpost the content. A general search function and glossary were also considered useful changes.
Part 2: The Design Response

8.6 Reviewing the design hypotheses

The evaluation exercise compelled re-evaluation of the design hypotheses (Chapter 7) as part of the iterative response to feedback, and two hypotheses were removed, highlighted in Figure 8.2.

While analysing and reflecting on the evaluation data, it was important to distinguish between subjective preferences and those which would improve the overall user experience and were within the scope of the project. Consideration of individual preferences was undertaken using a systematic approach akin to...
that described in Chapter 6 (section 6.2.3), whereby the decision to reject or accept each user preference was guided by the following criteria: (1) relevance to the target behaviour/user goal, (2) availability online, (3) ease of implementation, (4) alignment with usability and user experience recommendations, and (5) supported from theoretical findings and/or evidence. As described in Chapter 6, the decisions were not entirely objective in that I was influenced by what I perceived to be feasible to implement within the scope and scale of the project and my own skill set. In addition, consideration of user preferences was now more constrained by the frameworks of the prototype’s design hypotheses and interaction framework.

8.7 The response to participant feedback

With the removal of the meetups and social media sections, the prototype was streamlined around the three core design hypotheses of parenting information, a wellbeing toolkit and access to local resources. Many of the required modifications relating to functionality and navigational coherence were relatively straightforward to implement. Cross-platform and browser stability were primary considerations and required modification of WordPress settings as well as further testing-modification-retesting on a range of platform/browser combinations. Breadcrumbs were added to guide navigation. In addition, a search function was added to the toolbar. The response to feedback on each main section is described and illustrated below.
Amendments were made to the homepage to address feedback relating to branding, provenance and geographical salience (Figure 8.3). Branding was added in the form of university and funder logos, as well as those of the collaborators (see sections 8.7.4 and 8.7.6 for information regarding the involvement of new collaborators). A tag line was added underneath a larger bump2bump logo, which intended to make clear who the site was for and its primary purpose. Information was added to inform potential users about key content presented in the form of people’s stories. Information regarding the site’s provenance was condensed into two pages, accessible from the homepage and throughout the logged-in site: information about the prototype’s development process (Figure 8.4) which included images taken at the design workshop.
(Chapter 7) and information about the team behind the prototype, which was adjusted to present new collaborators (Figure 8.5).

Figure 8.4 About bump2bump page.

Figure 8.5 Meet the team page.
8.7.2 Registration

The registration process had been relatively easy for most participants. However, the women had been very clear about wanting to know what signing up involved. Text was added to reiterate that use of the site was free and that the minimum amount of information was sought to enable a user to create an account. Simple text was included to explain how a username would be visible to other users; in addition, password requirements were eased and the instructions for formulating a password made clearer (Figure 8.6).

![Registration Page](image)

*Figure 8.6 Registration page.*
8.7.3 My home

As described in the previous chapter, once users had registered or logged in, they were taken to a landing page, from where they could view, access and manage the prototype’s full content (Figure 8.7). All participants in the evaluation had ignored this page and instead immediately accessed prototype content. The icons used in the previous iteration of the prototype were adjusted to reflect the changes made to the content: the Facebook icon was removed, as was that representing the Meetups. Brief text was added to explain what the page was for, and text was added underneath each icon to indicate what the user could expect to find in each section.

8.7.4 Parenting content

The parenting content was perceived by all participants as being the main driver for accessing bump2bump. As a result, the categorisation and content of the
parenting and lifestyle content was revised significantly. The content was reorganised into more linear categories, representing information relating to before, during and after birth. In addition, the topic of breastfeeding had been raised throughout the project, by interview, workshop and evaluation participants and was therefore presented as an easily-accessible, stand-alone section. Although the provisional content was viewed positively in terms of delivery and content, participants particularly wanted to see more experiential content, delivered by peers. Experiential content was underdeveloped but certain key priorities around delivery and presentation had been highlighted by participants’ responses to the video content presented by a parenting professional. In particular, women wanted video content to be brief and the duration and focus made clear from the outset; stories needed to represent a range of views and experiences, positive and negative, telling the ‘truth’ about the perinatal experience. Initially, I had anticipated that I would create all the experiential content, using audio clips from the interview study and short clips of films made with participants talking about salient topics. However, this was neither feasible nor desirable: re-interviewing and filming participants was outside the scope of the project and I was aware of existing resources which such an activity would essentially duplicate. Therefore, I approached DIPEx, a charity working in partnership with the Health Experiences Research Group at the University of Oxford to produce the healthtalk.org website, which is populated with people’s experiences of health issues and has been awarded The Information Standard. Permission was gained to use short video clips and accompanying transcripts on topics relating to the perinatal journey which matched user goals and priorities identified during the course of the project.
Subsequently, each category of information (Getting ready, Birth, Life with a new baby, Breastfeeding) was separated into professional content and experiential content, or ‘people’s stories’ (Figure 8.8). Selecting an experiential content tab took the user to a landing page from where they could access a curated set of videos on a particular topic. Figure 8.8 shows the display of content in the Maternity care and antenatal visits section: each woman’s face is clearly shown, along with a brief strapline about the focus of their video and the video duration.

A transcript for each video was accessed by clicking the tab underneath the image (Figure 8.9).

![Figure 8.8 Parenting information main page.](image)

The professional content had been evaluated favourably and further brief video content was developed in accordance with the topics identified in the workshop and evaluation.
Figure 8.9 Parenting information – experiential content.

Figure 8.10 Parenting information – transcript shown below the video image.
8.7.5 Local resources

The local resource section required revision. The earlier iteration of an icon-based listing page was replaced by a tabbed set of lists and an accompanying map (Figure 8.11). Star ratings were removed and previous participants who had recommended resources for inclusion on the site were contacted and invited to provide a brief review for inclusion alongside the listing. Further suggestions were also crowd-sourced using Oxford-based Facebook contacts who were mothers of young children. All respondents consented to display their name alongside their review, to support the prototype’s claim that reviews were ‘real’. Some evaluation participants had suggested that a calendar function would suit the listing of resources as activities in the early weeks and months were often done on an *ad hoc* basis. However, this would have required resources to be listed according to the day of the week which required a level of moderation that was not feasible. In addition, resources such as recommended cafes, did not ‘fit’ within a calendar function and therefore the suggestion was rejected. Evaluation participants had also indicated that they were likely to do the ‘work’ of exploring a resource they were interested in anyway; consequently, hyperlinks to external content were added to the resource titles where possible, enabling users to find out more about a recommended resource, without the information cluttering up the page.

Users were encouraged to suggest a listing by using the tab underneath the map. This form was heavily revised following the evaluation, to enable the user to add the least amount of information possible (Figure 8.12). The suggestion would be received by the site administrator, checked and added manually to the site and pinned to the map.
8.6.6 Wellbeing toolkit

The wellbeing toolkit was completely revised. The workshop and evaluation exercises had confirmed that there was clear appetite for some kind of wellbeing toolkit but that women wanted a resource that was highly practical, useful and evidence based. The current draft content focused on emotional health and was not fit for purpose in its current form. Reflection on how best to deliver this part of
the site led to the termination of the collaboration with One-Eighty and the decision to source and include existing content; the development of a novel perinatal wellbeing toolkit was beyond the scope of the project. Rather, the objective was to explore women’s usage of a toolkit, its acceptability and how users could best be persuaded to engage with it.

Existing resources were limited, largely taking the form of lists of articles or brief infographics presented within a larger information offering on the websites of large perinatal charities. A mutual contact introduced me to a practitioner who informed me that The Royal College of General Practitioners (RCGP) was about to launch a ‘Perinatal Mental Health Toolkit’. The toolkit was launched in 2016 (rcgp.org.uk/clinical-and-research/resources/toolkits/perinatal-mental-health-toolkit.aspx) and intended to provide a set of relevant tools to assist members of the primary care team to deliver the highest quality care to women with mental health problems in the perinatal period (Figure 8.13).

![Figure 8.13 The RCGP Perinatal Mental Health Toolkit.](image)
Despite its overt focus on mental health and resources for clinicians, the toolkit included holistic wellbeing resources for women to access independently (Figure 8.13). The toolkit essentially took the format of a list of resources which had been ‘approved’ by a clinician involved in its maintenance. Within the listings for women were three resources recommended for women to use as self-directed support tools: (i) a two-page pregnancy and post-birth wellbeing plan which focused on avoidance of mental health problems (www.tommys.org), (ii) self-help techniques to support recovery from postnatal depression, and (iii) resources aimed at supporting women in the perinatal period called the Two in Mind Project developed by the mental health charity Mind Cymru for parents in Wales.

Correspondence with the team behind the Two in Mind project led to Enjoy Your Bump and Enjoy Your Baby: online courses developed by Living Life to the Full (www.llttf.com), led by Dr Chris Williams, Emeritus Professor of Psychosocial Psychiatry and Honorary Consultant Psychiatrist at the University of Glasgow, Scotland. The courses teach key CBT-based life skills for the perinatal period and promote attachment and wellbeing through repeated exposure to information, practice of guided activities and completion of printable worksheets. Course modules focus on problem solving, facing avoidance, making and reviewing plans and building skills around self-management and communication. Additional content focuses on interrogating and reflecting on perinatal-specific concerns, such as sleep, sex and self-care and offers suggestions for brief, specific activities that may support wellbeing during pregnancy and in early motherhood. Automated emails prompt users to interact with the system (this can be disabled).
A license agreement was signed between myself and 5 Areas (the parent company of Living Life to the Full), permitting a fixed number of user accounts to be created as part of the bump2bump project, using a specific activation code, in order to access the Enjoy Your Bump course. At the time, the online resources were accessed through referral by a healthcare practitioner. Usability and independent use of the resource had not been evaluated and exploring this through the subsequent formative evaluation of bump2bump was of interest to the 5 Areas team. The course was based around a dashboard format (Figure 8.14), from where users could progress through modules at their own pace, make plans and set up reminders.

Figure 8.14 The Enjoy Your Bump dashboard.
However, privacy and security settings made it challenging for the course to be embedded within bump2bump. Therefore, the course was accessed via a hyperlink within bump2bump which linked to a registration page in a new window (Figure 8.15).

8.7.6 Meetups

The ambivalence shown towards the facilitated meetups led to reflection upon the section’s purpose. The meetups had been intended to facilitate new friendships and conversation between pregnant women on topics that might be considered difficult or may not be covered in traditional antenatal classes. Interrogation of the rationale for this and further discussion with collaborators led to the decision to remove this section from the prototype. The aim of bump2bump was to deliver a pragmatic digital resource, grounded in user needs, rather than a complex intervention supported by face to face contact; women had described that being pregnant was not a sufficient reason to attend a meeting; facilitating the meetups required unpaid effort from a collaborator and ran the risk of largely replicating what many women were already accessing. The added value of meeting other
pregnant women or new mothers could be gained by accessing the local resources recommended by other users on the site.

8.7.7 Social media

Early ideas regarding the provision of safe social media had included the option of a closed bump2bump Facebook discussion group and signposting to other closed groups. This idea was rejected following the evaluation as it was perceived as again duplicating existing online activity and resources. In addition, establishing an active and engaged online community was over-ambitious and outside the scope of the project.

8.8 Discussion

This study found that the immediate look and feel of the prototype influenced whether or not a user would proceed to registration. Evaluation participants described how the need to ‘accumulate’ perinatal information could be overwhelming, but that trust in the resource was important, as was information about what content was on offer and reassurance that there were no hidden consequences to signing up in the form of unsolicited emails or newsletters. Features that supported the immediate and autonomous use of the prototype, such as clear labelling, intuitive functionality, familiar form and action buttons and the use of icons, were also perceived to be important. Participants also described features such as browsing and saving personally relevant, accurate content and the use of a non-judgmental communication style, as engendering a sense of
credibility. Moreover, users valued a resource provided a curated minimum of relevant content and ignored features which they viewed as attempting to replicate or replace existing resources and groups.

The findings draw together and validate disparate conclusions from a number of other studies. Firstly, the finding that the immediate look and feel of a digital resource is critical to a user’s subsequent choice to engage with it is consistent with the argument that instinctive reactions lead to lasting first impressions (Lindgaard et al., 2006; Norman, 2004). However, participants also described the importance of knowing more about what content was behind a registration page before providing personal information, suggesting that the decision to use a resource (at least one requiring sign-up) is not entirely based on affect. Secondly, the preference for - and positive impact of - peer-based information and recommendations, both online and offline, is well established (McLeish & Redshaw, 2015, 2017; Niela-Vilén et al., 2014) as is the idea that digital perinatal resources need to fit within an existing ecology of use rather than attempt to replicate it (Peyton et al., 2014). In addition, the importance of the prototype’s positive communication style is consistent with previous research underlining the important role of a digital intervention’s ‘tone of voice’ in avoiding user drop out (Murray et al., 2013; van Zutphen, Milder, & Bemelmans, 2008). The finding that evaluation participants were not interested in broad social sharing (online or face to face) echoes the findings of Peyton et al. (2014) and challenges the contemporary narrative of perinatal women as prolific social sharers (Balaam et al., 2013; Gibson & Hanson, 2013; Holtz et al., 2015; Hui et al., 2012; Morris, 2014) and is also an important contrast to the views expressed in the early
sensitising interviews (Chapter 5). This is interpreted with caution however, in view of the small number of participants.

A key strength of using digital resources to deliver complex health interventions is their capacity for delivering 'just-in-time' information and support (Spruijt-Metz & Nilsen, 2014). Although this approach is commonly applied to complex behaviour change interventions such as smoking cessation and management of mental health crises, the principle of accessing the right information at the right time was of particular importance to evaluation participants and underlined the value of providing curated, searchable information.

Women in the workshop (Chapter 7) and the cooperative evaluation expressed interest in using a wellbeing toolkit and commented on its novelty. Previous studies report the use of CBT and positive psychology interventions in pregnant women with and without clinically significant levels of distress (e.g. Burns et al., 2013; Corno et al., 2018) but the evidence is mixed. However, qualitative work (O'Mahen et al., 2012) has explored the importance of modifying CBT approaches to the perinatal population, with a specific focus on addressing what they reported as the salient topics of self-efficacy, interpersonal relationships, identity and resilience. Such topics echo those highlighted as being important to women in previous chapters (Chapters 5 and 7) and are core topics within the toolkit incorporated into bump2bump. In addition, this study added depth by exploring the importance of addressing fluctuations in perinatal wellbeing. Research has typically focused on the immediate postnatal period as 'the' time of risk; participants in the workshop and evaluation study raised the issue of wellbeing
dipping later on, when the novelty of a newborn had ‘worn off’. This echoes a recent study (van Scheppingen, Denissen, Chung, Tambs, & Bleidorn, 2018) which concluded that childbirth triggered a spike in self-esteem, followed by a fall lasting up to three years, with the dip being worst in first time mothers. Chapter 10 explored whether, how and why hypothesised use of bump2bump translated into actual use.

8.8.1 Strengths and limitations

The rationale and process for developing a robust, clickable prototype were described in Chapter 7. The development of a digital prototype was considered appropriate based on earlier work in the project that showed that people were likely to engage with a digital intervention. It was therefore necessary to prototype a digital tool as a “probe” to better understand people’s needs and responses to that concept. Using the WordPress platform to develop a digital prototype allowed candidate design solutions regarding core functionality and user interface to be quickly altered in response to user feedback following completion of the study. Alteration allowed target users to engage with a preliminary design framework that was realistic, responsive and triggered useful comparison with known or familiar websites. Efficiency of engagement was also an important consideration for the types of user recruited for this study: mothers of young babies were asked to explore a website, provide spontaneous feedback and make suggestions for improvement. It was anticipated that participants would have their child with them and would therefore need to be able to engage with the required tasks while preoccupied with caring for an infant. The study demonstrates an ongoing commitment to a user-centred and pragmatic approach to the development of a
new digital perinatal prototype. A systematic approach was used for the gathering and analysis of data and translation of findings, which permitted earlier user requirements to be modified through the removal of features considered to be superfluous to addressing core user goals.

Feedback was gathered from a relatively small, homogenous group of participants and therefore may not generalise across the wider population. However, the target population has previously been described and characterised and the participant group was representative of this. Guidance for the methods used to elicit feedback in the study recommend a sample size of 1-5 users (Monk et al., 1993; Nielsen, 1994) in order to determine critical usability issues. The question of how many participants are required in usability testing remains contentious: more recent work argues that functionality testing of ehealth websites requires a significantly higher number of participants due to the complexity of choice architecture (Bastien, 2008). However, the combination of semi-structured interviews and the cooperative evaluation technique was intended to capture more than just functionality problems by encouraging users to discuss, compare and reflect on the prototype and tasks. Indeed, the nuanced findings regarding preferences for information content and presentation and the willingness to engage with structured wellbeing support at critical ‘pinch points’ in the perinatal journey may be interpreted to suggest that it is important to gather rich data from a smaller sample of well-characterised participants rather than task-completion data from a larger group.
It has been argued that the think-aloud methodology may be problematic for participants. Although the technique is credited for its simplicity and pragmatism (Alhadreti & Mayhew, 2018; Nielsen, Clemmensen, & Yssing, 2002), the cognitive burden of verbalising thoughts whilst performing a task has been noted as potentially problematic (Hertzum, Hansen, & Andersen, 2009; Rogers et al., 2011). Quantitative approaches for determining the potential acceptability of a digital prototype do exist (e.g. Nielsen, 1994; Read, 2009). However, the purpose of the present study was to explore the prototype’s functionality, explore faults and fixes and to continue to gather insight into the use of digital resources by first time mothers, and therefore a think aloud methodology and semi-structured interviews were deemed to be consistent with a user-centred approach to intervention design. Additional insight into how new mothers engage with digital perinatal resources might be gained from having two users collaborate and discuss the DHI together.

8.8.2 Conclusion

Perinatal women report being willing to provide limited personal information in order to sign up for online resources. Such resources need to be aesthetically pleasing, free to use and free of commercial advertising, and offer clear indication of what information will be provided. Simple functionality is critical, as is being able to easily access curated, specific information which is clearly labelled, presented in a number of formats by credible sources and does not replicate existing online activity. Online resources need to offer practical parenting information and the opportunity to engage with similar, local others. Users are prepared to do the work of finding out more about relevant resources if this is
supported through design and prefer accurate information that they have sourced themselves rather than the provision of excessive, potentially inaccurate information. Perinatal women may be willing to engage with a resource which offers structured wellbeing support. Participants were asked to reflect upon what features and content they found useful. However, evidence suggests that hypothetical engagement differs from actual usage (Sekhon et al., 2017). In addition, the boundary between aesthetic appeal and usefulness is not always clear. Therefore, the next study was designed to explore whether the inclusion or omission of features judged by participants to be important or extraneous did in fact impact on usage. Given that all participants in the study reported here chose to access the prototype on a laptop despite evidence from previous studies suggesting a preference for mobile phone access, this was identified as another critical aspect to explore in the next evaluation phase.
Chapter 9 Expert Review of the High Functioning Prototype

9.1 Chapter overview

The previous chapter described the second phase of iterative development undertaken with target users in order to test and refine basic prototype functionality and navigational coherence. A series of one-to-one cooperative evaluations provided immediate positive and negative feedback and identified critical modifications and those which might improve uptake and engagement with the resource for target users. Analysis of the data was used to refine bump2bump’s core interaction framework and supported the removal of the meetups and social media sections and significant modification of the wellbeing toolkit. It was observed that users sometimes conflated aesthetic appeal and usefulness; therefore, the next step was to optimise design before exploring whether the inclusion or omission of features judged by participants to be important or extraneous impacted on usage. This chapter focuses on this next development phase (Figure 9.1). In the following section, I provide some background to the study and outline the study aims and objectives. The chapter reports two sequential studies. In this final codesign exercise, human computer interaction (HCI) and usability professionals critically evaluated the prototype design; their feedback is reported, followed by a description of the subsequent design response. The acceptability of the prototype’s content and design was then evaluated in the wild, by a small group of perinatal women (lay experts). Significant challenges with recruitment were encountered during the lay expert evaluation; these are described, as are the steps taken to address them. All
participants provided positive and negative immediate feedback and contributed to a prioritisation of necessary modifications. Analysis of the data was used to refine the prototype in preparation for the final in-the-wild evaluation with target users.

9.2 Introduction

A positive subjective user experience is critical to meaningful engagement with a digital resource. As described in Chapters 2, 5, 7 and 8, sub-optimal user experience impacted on perception of and re-engagement with digital tools.
Design of bump2bump had thus far been strongly guided by the interpretation of data gathered in earlier stages of the project in order to help users achieve certain goals and therefore its function and usability were prioritised. This study sought to address questions of form and acceptability by optimising prototype design.

The field of HCI has increasingly concerned itself with the experiential quality of interactive digital tools. User enjoyment and pleasure are seen as commensurate with efficient task completion and overall usability, and the contemporary notion of UX (user experience) has emerged as an alternative to the dominant task- and work- related paradigm (Hassenzahl & Tractinsky, 2006). Understanding why and how technology is used is challenging but conclusions drawn from research exploring models of adoption and usage (Hornbæk & Hertzum, 2017) show that enjoyment and perception of aesthetic appeal are critical aspects of UX and are positively associated with perceived usability and intention to re-engage (Hassenzahl, 2004; Hassenzahl & Monk, 2010; Hassenzahl & Tractinsky, 2006). Within the field of HCI, UX models posit that interface quality encompasses hedonic and pragmatic aspects of use, which are tied intimately to need fulfilment and positive affect (Hassenzahl, 2003), evaluated in terms of appeal, satisfaction or so-called ‘goodness’ of an interface. This relationship between digital resources and need fulfilment has also been heavily influenced by Self Determination Theory (SDT) (e.g. Deci & Ryan, 2008) and positioned within the wider ‘positive design’ movement (see Chapter 2). As described more fully in Chapter 2, SDT proposes that activities which meet three key human needs for competence, relatedness and autonomy can enhance intrinsic motivation to
continue engaging in that activity. Human-computer interaction is thus conceptualised as dynamic, context-dependent, and highly subjective.

However, there is an acknowledged gap between the imperative to meet users’ needs and actionable design practice (Peters et al., 2018). In the case of bump2bump, SDT was identified as an appropriate theoretical underpinning to meet the eudaimonic wellbeing needs of the target user and substantial evidence pointed to the utility of also using SDT to meet the user’s hedonic needs in design of the interface. Yet the process of doing so in the design of digital health tools has been identified as a fundamental problem (Van Velsen, Wentzel, & Van Gemert-Pijnen, 2013). Competing priorities of multidisciplinary teamworking, iterative design practice, user-centred design and systematic documentation may mean that ‘theoretically-informed creativity’ is limited in reality (Ludden, Rompay, Kelders, Gemert-pijnen, & Horst, 2015).

Previous work has acknowledged and addressed this challenge in different ways. In Chapter 6, I described work in particular by Curtis et al. (2015) and O’Brien et al. (2016) in which a multidisciplinary approach was taken to the integration and operationalisation of different forms of evidence in order to develop digital health tools. These papers were influential in supporting the development of bump2bump and were consulted for guidance on how to balance stakeholder input with creative design. Neither of these projects positioned itself within the ‘positive design’ movement and therefore none makes explicit any intention to use a theory associated with it - such as Self-Determination Theory - as a guiding framework for creative design. Rather, evidence was gathered, operationalised
and iteratively optimised. How this was achieved in practice remains unclear and reiterates that implicit and undocumented knowledge inevitably contribute to all stages of the development of digital resources (see Chapter 6, section 6.2). Curtis et al. (2015) and O’Brien et al. (2016) describe the process of evidence gathering through to development of a high functioning prototype. Both studies refer extensively to the critical importance of guidance and contributions from design experts and software engineers; both studies refer to the resource and labour intensity of the process and the “pragmatic compromises” (O’Brien et al., 2016) required which may not have been directly influenced by stakeholder input.

The physical design of bump2bump had been outsourced to a developer. The approach taken thus far had been to inspire design based on factors theorised to support maternal wellbeing, taken from theoretically informed primary data, grounded in user needs. Care had been taken to follow general good design practice guidelines (Buley, 2013; Cooper et al., 2014; Krug, 2013; Norman, 2013; Rogers et al., 2011). The cooperative evaluation had highlighted that the resource was perceived as being efficient, appealing, easy to use and to learn to use, protected the user from making errors and was reasonably flexible and tailored. However, my concerns regarding the site’s function versus its form prompted this two-part expert review of the intervention’s design, navigation and functionality. In part one, HCI professionals contributed to a structured feedback session, which identified and prioritised modifications. Pragmatic changes were made in response to this feedback before the prototype’s overall acceptability was evaluated once again by lay expert users through a process of cooperative
evaluation. This study informed the final iteration of development before the resource was evaluated ‘in the wild’ with target users.

In order to interrogate the design of the resource, it was important to identify aspects of the design that HCI experts perceived to be important for a positive user experience. The current study aimed to refine the design of the high functioning prototype and test the prototype’s overall acceptability. The present study therefore aimed to address the following 4 research objectives through the use of qualitative methods:

1. To identify and resolve problems with design, navigation and functionality;
2. To optimise prototype design;
3. To maximise overall acceptability of the prototype to naïve target users;
4. To categorise modifications and examples of what works well according to the three SDT constructs.

**Part 1: HCI Professionals**

**9.3 Methods**

**9.3.1 Design and setting**

Eight HCI and usability professionals took part in a structured evaluation of the prototype design held on the UCL campus.
9.3.2 Ethical approval

UCLIC’s Departmental Research Ethics Committee granted ethical permission (UCLIC/1213/015). Participation was voluntary, and participants were recruited in the same way as any other healthy adult able to give informed consent. Personal identifiers were removed from the data and the data were stored securely, according to the principles of research governance (Northway, 2017).

9.3.3 Participants

9.3.3.1 Sampling

Participants were eligible to participate if they had experience of designing websites, experience of critical evaluation of web resources from an HCI perspective and were comfortable with small group work.

9.3.3.2 Recruitment

Eight HCI and design experts were recruited from the UCL Interaction Centre using existing communication channels (Slack and email). An invitation to participate was also emailed out to postgraduate students and staff. Anyone who expressed an interest in participating was emailed an information sheet and asked to indicate their availability (Appendix 5).

9.3.4 Procedure

The study followed the format of a ‘Black Hat’ evaluation session (Buley, 2013) (Figure 9.2). The concept of the Black Hat session originated from Edward de
Bono’s *Six Thinking Hats* (de Bono, 1985), a collaborative thinking technique where groups adopt deliberate mental attitudes in order to direct and focus group work. Each of the figurative hats signifies a point of view, e.g. red for emotion and yellow for optimism. The black hat signifies logical judgment and scepticism and a person ‘wearing’ the black hat is obliged to point out weakness or risks and to be candid and honest about what might be improved. The black hat is powerful in the context of design critique, especially when conducted between people who know each other and may be reluctant to offer critical feedback. Participants attended a 90-minute-long evaluation session held at the UCL Interaction Centre. Large screen shots of the user journey through the bump2bump prototype were displayed on the walls (see Figure 9.3 for examples). Participants were introduced to the project and the session’s purpose and structure.

*Figure 9.2 Black Hat’ design critique session with HCI professionals.*

They were asked to explore the designs with a critical perspective and were given 20 minutes to do so; they were asked to write down every issue they saw on a sticky note and to place the note near to the design issue in question. Feedback needed to be specific and actionable. Critique could be done in collaboration with
others or solo. Participants were asked to consider the following, in order to prompt reflection (Buley, 2013):

- When you look at the screen, do you understand its fundamental purpose?
- What jumps out at you?
- Do you know what you would click on to advance to the next step?
- What questions do you have about the information and functionality that you’re seeing?
- Are you satisfied that this is a reasonable number of steps?
- Is there anything that feels too complicated or cumbersome?
- Is there any language that doesn’t make sense? Instructions? Labels?

When the group completed the critique process, they were asked to look at each other’s notes with the purpose of looking for themes and priority issues. These priority issues were then synthesised in the form of affinity maps and discussed as a group and recorded (on a flip chart and on an audio recorder). SDT as a guiding framework was also discussed: suggested modifications and examples of what was perceived to work well were grouped under the three SDT constructs. The discussion closed with an evaluation of what worked well in the designs and

*Figure 9.3 Examples of screenshots used in the Black Hat session.*
the co-construction of a list of what needed to be changed as a matter of priority. Criteria for determining changes focused on a balance between the ease and importance of making such changes. Full notes were taken following the expert review sessions, focusing on a general impression of the evaluation process and any key data that had emerged relating to functionality and design. The session was also photographed.

9.3.5 Data analysis

The session was transcribed verbatim and analysed using an approach of structured thematic analysis (Braun & Clarke, 2006) guided by the study aim of identifying positive and negative first impressions and actionable modifications. The audio data was examined in parallel with the affinity maps generated during the session. Data analysis was pragmatic and focused on the generation of actionable points, paying particular attention to the way that participants described their overall impressions of the prototype and their suggestions for modifying or refining the prototype’s usability or appearance. The analysis of the evaluation data is presented first, followed by the design response.

9.4 Results

Twelve people responded and were sent information sheets; of these 10 agreed to take part. Two withdrew, resulting in 8 participants for the expert review.
9.4.1 Participant characteristics

Participant characteristics are reported in Table 9.1. Eight participants took part in the 90-minute-long session at the UCL Interaction Centre. The group comprised 5 PhD students, 2 postdoctoral researchers and 1 faculty member. Results are grouped thematically and participants are identified by a number and their professional role.

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Professional role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PhD student</td>
</tr>
<tr>
<td>2</td>
<td>PhD student</td>
</tr>
<tr>
<td>3</td>
<td>PhD student</td>
</tr>
<tr>
<td>4</td>
<td>PhD student</td>
</tr>
<tr>
<td>5</td>
<td>PhD student</td>
</tr>
<tr>
<td>6</td>
<td>Postdoctoral researcher</td>
</tr>
<tr>
<td>7</td>
<td>Postdoctoral researcher</td>
</tr>
<tr>
<td>8</td>
<td>Faculty member</td>
</tr>
</tbody>
</table>

Table 9.1 Black Hat session participant identifiers.

Participant feedback was examined with regard to how participants described their immediate impressions of the site, critical usability issues and suggested modifications (Table 9.2). The session was unusual in that it specifically sought out and prioritised critical feedback on design and usability. The overall impression of the site was that it appeared to be a credible digital product which largely achieved its stated aims of delivering specific information to a clearly specified user group. With some exceptions, content appeared to be categorised and arranged logically - participants were not content experts and feedback on content specifics was not sought. However, participants identified usability issues
relating to general layout across all sections of the site, the use of text throughout the site to signpost and inform, the lack of personalisation and problems with the search facility.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First impressions</strong></td>
<td>Positive feedback</td>
<td>Prototype perceived as credible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prototype content perceived as appropriate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Icons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Familiarity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>User journey clear</td>
</tr>
<tr>
<td><strong>Negative feedback</strong></td>
<td>Text-heavy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unique purpose of prototype unclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Registration as barrier to entry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient personalisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Categorisation of content requires revision</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search function unclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usability of local resources section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accessibility of content</td>
</tr>
<tr>
<td><strong>Modifications</strong></td>
<td>Required</td>
<td>Homepage layout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Registration clarification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Personalisation of My Home</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local resources usability improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search facility</td>
</tr>
<tr>
<td></td>
<td>Recommended</td>
<td>General text reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarification of Parenting Information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal links need clarifying</td>
</tr>
</tbody>
</table>

*Table 9.2 Immediate impressions, critical usability issues and suggestions for improvement from the Black Hat session.*
9.4.2 First impressions

9.4.2.1 Positive feedback

Participants perceived the site to be credible. The choice of icons to denote key content was considered appropriate and contributed to an overall impression of a clean and coherent layout. The overall simplicity of the prototype and use of familiar form layouts and action buttons was perceived positively. All participants commented favourably on the site’s use of colour, imagery, the logo and overall appearance.

I like that it looks like a finished product, it looks professional, it’s something I would probably be happy to pay a subscription for.

Participant 5, PhD student

9.4.2.2 Negative feedback

The session explicitly sought out negative feedback. Although participants valued the overall simplicity of the site, this simplicity was perceived to impact negatively on the site’s usability. Certain pages contained too much text, whereas other pages did not contain enough text to signpost the user towards the next step in the user journey. The site’s home page was particularly singled out as being text heavy.
It’s a website not a research product...these are real users who will use it as a tool. You play down the research, you just say this is a UCL product or something that makes sense and shortens some of this blurb because they don’t need all that detail.

Participant 8, Faculty member

The way in which the homepage tried hard to communicate the site’s credibility, content and purpose meant that the communication of the unique value of the site was lost.

*It needs to be more simple and direct as in what’s in it for me if I’m going to use this website?*

Participant 6, postdoctoral researcher

The registration page was perceived to ask for a minimal amount of information but it was unclear which information was required and which was optional. In addition, participants described the current form as not including sufficient safety nets to mitigate user input error.

For example, if a user entered their email address incorrectly or did not know how to formulate a user name, this could be costly:

*It’s a one-off situation but it’s a real pain and it can stop people from entering your site forever.*

Participant 7, postdoctoral researcher

Once a user had logged in, the landing page’s title of *My Home* jarred with what was perceived to be a fundamental lack of personalisation.

*You need to acknowledge that they’ve logged in.*

Participant 5, PhD student
This page was perceived to be missing the opportunity to offer users a personalised and tailored experience which would become increasingly important as users moved from being novices to expert users of the site. In addition, personalisation of this page would encourage users to return to the site; in its current form, the page appeared functional but impersonal. Although participants were not asked to comment on specific content, spontaneous feedback on categorisation and presentation of content was valuable. This feedback was applied to the My Home page. The icons were perceived positively but the way in which they were laid out and the equal prominence given to all was questioned.

Similar feedback was provided in relation to the parenting information page. Content on the parenting information page had been categorised according to feedback received in previous iterations of the development cycle. As such, breastfeeding was a standalone category. This provoked a significant spontaneous reaction in the participants who questioned the validity of singling out the topic and questioned whether it might go against the site’s ethos of inclusion and choice.

*If you’re not breastfeeding, you might be a bit put off by that.*

Participant 4, PhD student

It was advised that this categorisation should be checked during the subsequent evaluation with target users.

Participants also described the current parenting information page as being unclear in that the topic headings were not mutually exclusive. Even if they were grounded in user data, the topic headings needed explanatory text to provide
users with information about what might be within the sections. Participants felt that the page would benefit from including a list of each of each category’s subsections.

\[\text{Put the categories within each of the parenting information sections on the main page – there’s space and it would be nice to have an example video per category as well.}\]

Participant 7, postdoctoral researcher

The local resources section was perceived favourably overall but participants’ interrogation of the layout and function identified some critical usability issues. The page in its current form lacked the facility to amend or remove an existing review and it was unclear how numerous reviews for one resource would be visible on the page; in addition, participants queried the value of only encouraging positive reviews. The group also discussed the advantages and disadvantages of the form used to submit a resource and recommended some minor adjustments.

Site accessibility was discussed in terms of ensuring equal access to information and functionality and also in terms of site flexibility and overall responsiveness. Colour contrast, keyboard accessibility and heading levels were seen as appropriate although one participant queried the font size.

\[\text{On the icons, you won’t have a problem but where the writing is thin on say the login page, it might give people issues.}\]

Participant 3, PhD student

The search function was also seen as critical to facilitating flexible and autonomous use of the site. The search facility in its current form only returned the names of large sections of the site which contained the search term. More granularity was recommended to improve the user experience. A seemingly minor
aspect of the site provoked a significant response: the footer style. All participants agreed with Participant 8 (Faculty member) when they stated that “the smear along the bottom has got to go”.

9.4.3 Modifications and the design response

In order to guide decision-making around site modifications, participants were asked to provide specific and actionable feedback. Over the course of the session, this feedback was classified into modifications that were critical to improving the functionality and user experience and those that would be good to include if time and resources allowed. Evaluation sessions can generate significant amounts of feedback and determining which feedback to implement can be difficult (Yardley et al., 2010). Feedback was prioritised that recommended pragmatic, feasible modifications that acknowledged the evidence generated by target users in previous iterations. A decision tree was used (Figure 9.4) to facilitate consistent and transparent decision making.

The decision tree required the designer to ask three key questions when assessing the severity of a usability problem:

1. Does the problem occur on a ‘red route’ (categorised as a critical pathway into/around the site)? If the problem occurs on a page or during a task that is critical for the system to support, it will affect more users and will therefore be severe.
2. Is the problem difficult for users to overcome? If a user is unable to complete an action because the facility does not exist or the action button is hidden in some way, this is critical to address.

3. Is the problem persistent? Problems that persist have an impact on user satisfaction as well as usability in general. Even when the user works out how to overcome the problem, they still have to encounter it repeatedly and therefore are likely to stop using the site.
9.4.3.1 Critical modifications

Feedback was assessed according to the decision tree. Critical changes were required on the following pages: Homepage, Registration, My Home and Local Resources. The search facility was improved, and the layout of the footer was also amended.

9.4.3.2 Homepage

All participants recommended the use of an alternative layout for the homepage. In particular, they referenced websites such as www.empatica.com or www.peanut-app.io (Figure 9.5) as examples of websites that provided health-related content in a structured and visually appealing way.

These sites were based on a familiar, structured layout that featured brief, clickable content accessed by scrolling down a responsive page. Key content prioritised by the homepages of such sites included explanation of the site's provenance and purpose.

*Figure 9.5 Alternative homepage layouts suggested during Black hat session.*
Participant 1, PhD student

Replacing the existing heavy text with indicators to all key content in the form of short tag lines would improve the communication of the site’s unique value and academic provenance. Sliding images with accompanying brief text could improve both visual appeal while also allowing the inclusion of more content.

The homepage was completely redesigned according to the recommendations (Figure 9.6). The page was reframed and centred on the screen with straight lines and a neutral background in order to create a more structured, tidy look. The footer style was altered to match the site’s style. Heavy textual information was replaced by a scrolling images which each featured a brief, explanatory tag line detailing a key feature of the site; text which had been used to describe the resource’s potential value was replaced by icons. These icons matched the site’s logged-in content and were also hyperlinked and turned into action buttons in order to allow users to access explanatory information in the form of pop-out light boxes (Figure 9.7).
Figure 9.7 (a) Pre-evaluation Homepage and (b) post-evaluation Homepage.

Figure 9.6 Pop-out light box providing information on the home page.
9.4.3.3 Registration

The registration process was acceptable in its current format but required modifications to ensure that the process was as easy as possible to avoid losing users at the critical entry point. Asterisks were placed next to all required user information and a double email entry box was added. This required users to enter their email address a second time, manually, in order to mitigate potential problems with users’ existing auto-fill functionality on their devices.

Figure 9.8 Pre-evaluation My Home and (b) post-evaluation Registration page.

Text at the top of the page which provided explanation about acceptable usernames was removed and a hovering information action button was added to the username input box (Figure 9.8).

9.4.3.4 My Home

The My Home page required significant modification in order to improve its usability and personalisation. Feedback recommended that the user’s first name be placed at the top of the page along with a welcome to the site. The page required restructuring to represent a more personal ‘dashboard’: from here, it was
recommended that users should be able return to what they had recently been viewing, amend their account details, and view, amend or delete their reviews (Figure 9.9).

*Especially as a longer time user, those are things that would become more important for me to see.*

Participant 7, postdoctoral researcher

In line with the feedback received, this critical page was re-imagined as a springboard for action. As the first page encountered following login or registration, its value had been underestimated. The new format echoed the site’s homepage in terms of styling, with a banner across the top containing a personalised welcome and signposting regarding what could be achieved from this dashboard. The icons from the homepage were replicated with brief information about their purpose and content. Tabbed links were added to enable users to view videos they had saved and to view, amend or delete listings and reviews they had contributed to the local resources section. The breadcrumb navigation trail was removed as it was considered unnecessary to highlight the user’s location on the first page of logged in content.
Minor modifications to the form used to submit a resource were suggested, for clarity (Figure 9.10), but it was the facility that enabled addition and management of multiple reviews that was prioritised. In its current form, local resources only displayed the one review solicited for the prototype. In the event that multiple reviews would be added to a resource, participants recommended that the most recent review be shown alongside the resource with a clickable link to show more...
reviews. The link could open a pop-out light box (Figure 9.11) which would contain further reviews and which the user could close by clicking a cross clearly displayed in the top right-hand corner. The box would also include the option to add a review of the place in question.

Figure 9.10 Pre-evaluation Suggest a Listing and (b) post-evaluation Suggest a Listing
Participants questioned the solicitation of recommendations for local resources with the use of the term ‘reviews’. The group felt that asking users to provide ‘reviews’ would necessarily solicit positive \textit{and} negative feedback about a resource. If positive experiences were exclusively sought, participants suggested changing the section to include ‘People’s recommendations’. This was perceived to match the use of ‘People’s Stories’ elsewhere in the site. It was decided to evaluate this in the next evaluation phase.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{pre_evaluation.png}
\caption{Pre-evaluation Local Resources page and (b) post-evaluation Local Resources page, showing more than one review.}
\end{figure}
9.4.3.6 Search Function

The search function was implemented on the site in response to earlier user feedback describing frustration when forced to browse large volumes of content in order to find answers to specific questions. However, the search function in its current format was not fit for purpose and there was a risk of negatively impacting on the user experience by making users do the very thing they were trying to avoid when searching for specific detail. The search function required refining in order to bring up useful search results. Participants strongly recommended employing keywords to filter content and to allow individual videos to be found when searching a topic (Figure 9.12). This was also recommended as an important step should the resource ever become a commercial product, making it highly discoverable by search engines.

Figure 9.12 Keywords were added to the Parenting Information content.
Improving the search facility was considered important for facilitating movement around the site and improving the user experience. Participants recommended that the same goal could be achieved by including clickable links on all pages connecting to pages featuring complementary content (Figure 9.13).

![Search results for: sleep](image)

Figure 9.13 Example of the search results returned for ‘sleep’.

### 9.4.3.7 Recommended modifications

Following assessment of which modifications were critical, participants discussed which further changes would enhance the site but which were not perceived as being crucial to the users’ experience or understanding of the information architecture. These changes fell under a general idea of ‘tidying up’ the site: reducing superfluous text, signposting with brief text and adding internal links. Following discussion with the designer, the majority of the recommended modifications were actionable, with the exception of adding internal links.
9.4.3.8 Reducing text

Information and images regarding the development and provenance of the site were removed from the homepage and replaced by a large action button inviting people to find out more about the site. Participants felt that a better balance needed to be struck when informing users of the site’s provenance: the text heavy pages could be perceived as unappealing and might make even interested users click out of the site. Text needed to be edited down and collaborators who had not played an integral role in the site’s development should be linked to rather than included as equal contributors (Figure 9.14).

Figure 9.14 Pre-evaluation About and Who We Are pages and (b) Post-evaluation About and Who We Are pages.
Parenting information

It was recommended that the parenting information categories be better signposted so that users were aware of what was in each category; although the experts were not asked to comment on content, all agreed that the sections were not mutually exclusive in their current format. Even if they were guided by previous evaluation exercises, the current labels were unclear and illogical if left with no explanatory text to guide the user. In addition, it was recommended that lay experts be consulted regarding the potentially controversial standalone category of Breastfeeding. It was anticipated that this section could be renamed Feeding and subsumed into the Life with a new baby section. A similar suggestion was made to clarify the professional video content. In response, the Breastfeeding section was subsumed into a general Feeding section and explanatory labels were added to the information categories (Figure 9.15).
The experiential videos all featured explanatory straplines (Figure 9.16); the professional content did not have these. It was acknowledged that a curious user would probably simply click on the video anyway but participants highlighted the inconsistency and potential negative impact on the user experience.

Figure 9.15 Pre-evaluation Parenting Information and (b) Post-evaluation Parenting Information.
Straplines were added to the professional content (Figure 9.17).

Participants recommended facilitating navigation around the site by adding internal links to complementary content on each page. In consultation with the designer, it was decided not to add these links. The search function had been improved to enable users to find all content relevant to their specific search. In addition, the internal links would only signpost users to information contained
within the parenting information section and it was felt that numerous internal links might become irritating.

9.4.4 Following up

Participants consented to be contacted once the modifications had been made to the site with the view to checking that the feedback received during the Black Hat session had been interpreted and actioned appropriately. Participants were contacted by email approximately two weeks after the initial evaluation session and provided with a link to the live site. They were asked to log in and browse the site. They were asked to acknowledge the changes made and provide further brief feedback if they felt it was necessary. Three participants acknowledged the second email and 2 participants returned feedback. Both confirmed that the feedback from the evaluation session had been interpreted correctly and that priority changes had been actioned to a satisfactory standard.

*Much clearer than before – sets out the required info in a way which is much easier to process quickly.*

Participant 3, PhD student

Asking experts to log into the live site allowed for more realistic interaction with the prototype. It was suggested that the experiential videos needed to be named in a more meaningful way (Figure 9.18). Videos of women talking about their experiences were currently identified in the website’s code with numbers and this oversight became particularly apparent when items were saved to My Favourites for future viewing: upon opening My Favourites, the user couldn’t determine the video content without clicking on the link to the video.
In addition, one participant noticed that some of the videos did not follow a logical order.

*On professional tips – the birth process, it’s like the videos are in the wrong order. The top ones are the end of labour whereas as the ones at the bottom are the first bits.*

Participant 3, PhD student

Further feedback included suggestions to use features that users might be familiar with from other web resources, to enhance the user experience.

*Can the ‘add to favourites’ have a heart or star to the left of the text? Makes the purpose of the button more immediate. Also the hear/star could be empty (just an outline) before you save it, then it gets filled – mimicking Twitter and Instagram format.*

Participant 1, PhD student

Feedback that was received before recruitment of lay experts began was implemented: the video order was amended where necessary and the experiential videos were given more meaningful labels (Figure 9.18).
Part 2 – Lay experts

9.5 Methods

9.5.1 Design

Following the changes made to the prototype in response to professional feedback, lay experts were invited to evaluate the overall acceptability of a live version of the full prototype for a period of one week. Users took part in semi-structured exit interviews. Challenges with recruitment and the steps taken to address these problems are described below.

9.5.2 Participants

9.5.2.1 Sampling

As in the previous studies women were eligible to participate in the evaluation if they were adult first time mothers whose pregnancies were clinically healthy, lived in the Oxford area and had a baby aged 6 months or less. The sampling criteria were subsequently amended in response to difficulties with recruitment, as described below.

9.5.2.2 Recruitment

It was intended that lay experts would be recruited from the Donnington Doorstep Children’s Centre in Oxford, where the first iteration of prototype development
took place in the form of a collaborative workshop (Chapter 7). The Centre hosted a variety of weekly drop-in sessions aimed at new mothers: consultation with the centre determined that the bi-weekly ‘stay and play’ groups would be likely to include potential participants. The centre was provided with posters and information sheets and the study was advertised on the centre’s social media pages. Potential participants were invited to make contact via email and ask questions prior to taking part.

I attended four groups over the course of two weeks. Each group lasted around 3 hours and was based on a casual drop-in format. Groups were aimed at pregnant women and parents with children up to the age of 4 years. In reality, the groups were attended by mothers with older toddlers and by carers, such as childminders. Group attendees expressed interest in participating in the evaluation study, but none met the inclusion criteria. For example, there were first time mothers of toddlers who were able to talk about their information needs but any discussion about the transition to parenthood was highly retrospective; the same was the case for second and third time mothers whose needs differed greatly. All the women I spoke to offered interesting perspectives that informed general understanding of mothers’ use of digital resources and information needs and requirements; however, these perspectives were considered to be outside the scope of the study and so women were not consented to take part and the conversations were not recorded. In addition, it became clear that the groups did not offer the opportunity for anything other than superficial data collection. The groups could be busy, and children were supervised by their carers rather than
by centre staff. This meant that women who did look at the website were only able to do so in a ‘quick and dirty’ way.

As it became clear that the study objectives were not going to be met using the planned recruitment methods, alternative methods were considered. An advertisement was placed on the online community board used successfully in previous phases of development (dailyinfo.co.uk). One response was received but there was no further communication following provision of more information. Previous bump2bump study participants whose children were now around 1 year of age were approached but no responses were received.

Recruitment for the in the wild evaluation study (Chapter 10) was being conducted in parallel. Funding and study aims limited recruitment to the in the wild study to 10 participants and 23 expressions of interest had been received. Interest was received from women who were excluded from participation in the study due to being in the very late stages of pregnancy. Therefore, the pragmatic decision was taken to invite them to take part in a week-long evaluation of the bump2bump website. Four women were invited to take part and three women were consented. This compromise was not ideal but offered an important opportunity to determine whether or not the website was robust enough to be used in the forthcoming in the wild study. Participants were given a £10 high street voucher as a thank you for their time.
9.5.3 Procedure

The study extended the approach of one to one cooperative evaluation utilised in the previous study (Chapter 8). Participants were provided with a link to the live prototype, login information for the wellbeing toolkit were and invited to use the prototype as little or as much as they wanted to over the course of a week. Participants then took part in a semi-structured, audio-recorded telephone interview.

The primary aim of the study was to maximise overall acceptability of the prototype to naïve target users. Women were asked to talk about their first impressions of the prototype (positive and negative) in order to determine the extent to which participants liked the site and the ease with which they understood the site’s information architecture, and to gather suggestions for modifications. Women were also invited to reflect on their use of perinatal technologies and how this informed their response to the prototype.

Questions that were used as prompts during the interviews included:

- Tell me your overall impressions of the site.
- Is there anything about the site that you particularly liked / disliked?
- Was there anything missing from the site?
- Tell me about how you used the site.
- Tell me about the online resources that you’ve used generally while you’ve been pregnant.
- What is important to you when you’re choosing a digital resource to use?
9.5.4 Data analysis

Interview data was transcribed by the researcher and analysed using a process of structured thematic analysis (Braun & Clarke, 2006) in order to generate actionable points to inform the final process of refinement prior to the in the wild evaluation. Data analysis was guided by the study aim of identifying positive and negative first impressions and actionable modifications, paying particular attention to the way that participants described their overall impressions of the prototype and their suggestions for modifying or refining critical usability issues.

9.6 Results

9.6.1 Participant characteristics

Participant characteristics are reported in Table 9.3. All participants were a minimum of 37 weeks pregnant. The average participant age was 34 years. The average length of the follow-up interview was 20 minutes. One participant had accessed the website at work and the other two participants had access it on their smartphones and laptops.

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Number of weeks pregnant</th>
<th>Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 9.3 Lay expert evaluation participant identifiers.
Feedback was examined with regard to how participants described their immediate impressions of the site, critical usability issues and suggested modifications (Table 9.4). Participants are identified by a number and pseudonyms are used where appropriate.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>First impressions</td>
<td>Positive feedback</td>
<td>Content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Layout and design</td>
</tr>
<tr>
<td>Negative feedback</td>
<td>Simplistic style</td>
<td>Wellbeing toolkit problematic</td>
</tr>
<tr>
<td></td>
<td>Actors versus real people</td>
<td>Limited variety of content</td>
</tr>
</tbody>
</table>

*Table 9.4 Immediate impressions from lay expert evaluation.*

### 9.6.2 First impressions

#### 9.6.2.1 Positive feedback

**9.6.2.1.1 Content**

Participants were asked about their information needs in late pregnancy and what an optimal digital resource would provide. All participants were particularly focused on exploring practical tips and advice for the birth process and the early weeks of motherhood. They described being saturated with knowledge about the physical realities of birth and instead sought out factual content that would contribute to their sense of readiness and help them build confidence in particular when handling their new baby. The website's parenting information section
appeared to meet many of those needs, with the professional tips video content being particularly well received.

*I thought it had a lot of really useful information on it.*

**Participant 1**

The way in which the information was synthesised and targeted towards use in late pregnancy was valued.

*It’s broken down into different stages so that you can make sure you’re getting ready for birth and you’re understanding labour and sort of the afterwards as well so I thought that was well geared towards the last month of pregnancy.*

**Participant 2**

The experiential content was valued; however, it was recognised that some users might value them more than others.

*The interview videos were, well some of them were more helpful than others but I didn’t watch all of them because it got to a point where I just felt that I had already discussed a lot of that with friends and with my fellow NCT classmates and so I didn’t need to watch all of those videos. But I could see how they would benefit someone who was maybe a bit more isolated and doesn’t have people to chat to about everything, as it kind of gives different perspectives which I thought was quite good.*

**Participant 2**

The suggestion was that women who lacked strong support networks might value the experiential content more; however, all acknowledged that the potential value of the experiential information would be fully realised in the early postnatal weeks when, depending on an individual’s experiences, they might want to return to the
site and revisit the videos that resonated. This was particularly true of the caesarean and breastfeeding video which, antenatally, were perceived as somewhat abstract. However, women thought that the practical and supportive utility of such content would become useful once immersed in a postnatal reality.

*I think that obviously if I have a bad birth then I’ll go back and watch a few videos of the women who had bad births. So then the feeding and maybe the birthing videos if I have a bad time or if I’m struggling, I’ll go back and if I’m not struggling then I probably won’t.*

Participant 3

Parenting content was also recognised for its novelty. The local resources offered practical solutions to everyday postnatal problems.

*I really liked the café, sort of food places, places to go out that are kid-friendly, I hadn’t actually seen that anywhere before so I thought would be really useful because that’s probably going to be something that when me and my new mummy friends are going out in a group, we’ll be like oh, where can we go.*

Participant 1

The synthesised information delivered by real mothers was noted as offering something different to generic pregnancy web resources.

*It is something new I think because there’s loads of different experiences and types of women.*

Participant 3

One of the key requirements drawn out from previous iterations of development was women’s desire to know the ‘truth’ about pregnancy, birth and early motherhood. Previous study participants referred to the shock of the early weeks
of motherhood and described their frustration at not being prepared for the messy, boring, confusing reality of life with a newborn baby. Mismanagement of expectations could lead to maternal feelings of disappointment, a lack of confidence and could impact negatively on help seeking. Experiential videos were therefore selected to reflect a wide range of lived experiences and study participants acknowledged this.

*I quite liked just the fact that in the videos there were people who were being negative as well, it wasn’t all just the positive aspects of people, saying like in the NCT classes, oh they were irrelevant or the midwives just weren’t very nice. You know, it was honest, I liked that.*

Participant 3

The parenting information also contributed to women’s sense of readiness in the way in which it allowed women to ‘refresh’ key, ‘forgotten’ information.

*A lot of the stuff again I had already learned in NCT and speaking to my midwife but especially in the last week I’ve found it quite helpful just to listen to the professional advice because it is getting close to the time when I am going to have to look out for signs of labour and getting ready for the first few months with baby and the practicalities around that so I found those videos the most helpful and I used it more as a refresher just to get my head round it.*

Participant 3

Another critical user requirement drawn from previous development work centred around the importance of the user feeling that she was part of a community of like-minded women. One way in which the site attempted to foster a sense of community was to be geographically constrained to a small, defined locality.
However, being pregnant or a mother and living in the same location was not considered sufficient to connect women together; rather, shared values or interests were seen to be more binding. Therefore, the site offered the opportunity for site users to recommend and review local resources and this potential for community building was acknowledged by study participants.

"The other thing that I liked was on the local resources, the fact that you could also suggest something, because I had a look at what was listed but then I thought that adding a resource allows people to build on local knowledge as well so you could kind of contribute to it."

Participant 2

Provision of positive content was a key objective in the development of bump2bump. Much existing perinatal digital content was considered by previous project participants to be paternalistic and generic, often focused on risk mitigation and the negative aspects of new motherhood, such as coping and managing. Women described how they wanted to feel supported, reassured and encouraged to make informed choices rather than feeling coerced into making decisions about birth and feeding, for example. Lay experts described the site as achieving this objective.

"I think it does have a good, positive message. I think that the way that the videos are presented are quite encouraging, especially the professional tips and the fact that the local support and resources are also offered."

Participant 2
9.6.2.1.2 Layout and design

Following changes made to the site in response to the design expert feedback, users did not describe any problems with navigating the site and did not identify any usability issues. Users complimented the overall appearance and styling of the site, with all referring in particular to the logo.

*It was nicely laid out...it was quite easy to follow.*

Participant 1

The categorisation of content was perceived to be useful in helping users navigate the site and find specific information.

*I liked the way that the website was broken up into the three simple sections so you could easily find the information, whether the videos, the course modules or the local resources as well.*

Participant 2

9.6.2.2 Negative feedback

9.6.2.2.1 Simplistic style

The revisions made in response to the Black Hat evaluation were not to everyone’s tastes. Although the site aimed to be simple, clean and neutral in appearance, one lay expert perceived the site as aesthetically simplistic.
One thing that did strike me was that it did look a little bit unfinished, it looked slightly stark, like there should be a background or something but content wise, it was really good.

Participant 1

A priority in the development of the resource was to make sure that the site did not replicate existing resources in terms of content, function and form. Synthesis of parenting information was considered important, as was simplicity of categorisation and presentation. However, once participant wanted more by way of variety of content.

...just the fact that it’s all videos. I think that maybe different ways of showing, maybe like diagrams, a few quizzes. I like stats and things.

Participant 3

9.6.2.2.2 The wellbeing toolkit

The majority of the negative feedback received from lay experts focused on the wellbeing toolkit. All users completed the registration process, but their expectations of what a wellbeing toolkit should be were not met in terms of function or form. The toolkit being delivered by a third party was viewed with suspicion, despite efforts being taken to describe and confirm the toolkit’s credibility and provenance. This nearly put one participant off completing registration.
It took you to another sort of bit which didn’t look like it was associated with your site and I found, yeah, I can’t remember the exact process of it but there was something that I was having to do or sign up with that I was kind of like, oh I don’t really know if this is legit or it was just a little bit more trouble than I could be bothered doing right now, so I’ll not do that.

Participant 1

Throughout the development of bump2bump, participants acknowledged a lack of focus on maternal psychological wellbeing. Digital and non-digital resources focused on wellbeing in terms of maternal somatic experience and accessing treatment for postnatal depression. There was acknowledgment that the relatively abstract concept of maternal wellbeing can be hard to articulate, particularly for women who have not necessarily been encouraged to actively reflect on the importance of their own postnatal wellbeing. One participant recognised the potential value of actively reflecting on her own personal wellbeing over the course of her pregnancy. However, because she encountered the course very late in her pregnancy, she felt that it was of limited value and so didn’t explore other modules.
Well I only accessed the first module of the toolkit and that was all about your emotions to finding out you’re pregnant and the tension release and getting to know your expectations about pregnancy and parenthood and I think that module would have been much better at the very beginning of pregnancy and actually would probably be a course I would want to have happening throughout my pregnancy but I didn’t see the later modules so I can’t really comment on those.

Participant 2

There were further problems with navigation and content. One participant was confused by the toolkit’s modular structure and mixed-media content, unintentionally opening a meditation activity.

*It was hard to navigate. It seems a bit airy fairy.*

Participant 3

She also questioned the content’s utility.

..maybe like ideas of nice things to do for yourself. I mean, that could have been in it, I clicked around a few sections and I’m sure that is in there somewhere it’s just finding it and having to go through the sections, I don’t know, it just didn’t appeal to me.

Participant 3

9.6.2.2.3 Actors versus real people

Provision of a range of maternal experiences was a key priority in the development of the resource. However, women who featured in the experiential videos retained the right to anonymity and, in these cases, their stories were performed to camera by an actor. Although all the participants understood why
this might be the case, it was distracting for one participant, who felt that the mother’s message was lost.

One thing I didn’t like was some of the actors reading the stories. It felt a little bit too fake. And I actually ended up turning off those ones because it just got a little, it didn’t feel genuine, if that makes sense. And I understand why sometimes you have actors and I liked the fact that it told us they were actors as well but some of the actors I didn’t like more than others. One or two of them I was fine to watch but I felt that some of them were a bit annoying [laughs].

Participant 2

9.6.3 Modifications

The aim of the study was to determine overall acceptability of the prototype prior to the in the wild study. It was intended that the first part of the expert review with HCI professionals would identify critical design and usability issues that could be remedied prior to the lay expert review. The usability problem decision tree (Figure 9.4) used in the earlier analysis of the HCI expert review data indicated that none of the negative feedback provided by lay experts could be categorised as critical or persistent problems. They indicated features that would be ‘nice to have’ or which were beyond the scope of the project (e.g. alterations to the wellbeing toolkit) rather than impacting on fundamental usability of the website. For this reason, no further modifications were made to the site.

9.7 Discussion

This study demonstrated that prior development work had been well grounded in academic rationale and user data but had not always been well translated in
practice. For example, the design workshop and subsequent cooperative evaluation had informed understanding of the importance of including information regarding the website’s provenance and purpose, but this had been translated into suboptimal design solutions. Lengthy text and excessive highlighting of the site’s status as a research project on the homepage served to achieve the opposite of their intended aims: instead of informing and reassuring, the sections placed burden on the user and were perceived by the design professionals to impact negatively on the site’s credibility. The granular feedback provided by the design experts in particular highlighted the range of skills beyond academic interrogation that go into making a credible digital resource: writing brief yet engaging copy; selecting appropriate images; usage of a coherent design protocol; the developer’s implicit toolkit.

The question of how we ‘transform’ data into engaging and pleasing digital resources is long-standing in digital health and the wider field of HCI (e.g. Hassenzahl & Tractinsky, 2006). The decision to outsource the task of prototype design was pragmatic in order to develop a credible and engaging digital resource. I acknowledged that, in employing a developer to design the resource, I was necessarily relinquishing some control over the design process and, to an extent, the finished product. However, once key content and engagement features had been put in place, the creative process stalled. In conversation, the developer reported feeling reluctant to experiment with the prototype’s form in case it compromised its function. The current study was therefore designed with the aim of identifying and resolving problems with design in order to optimise the prototype’s appeal, by involving other design experts. The value of harnessing the
key skills of experts echoes that described by Curtis et al. (2016) and O’Brien et al. (2015).

The current study aimed to improve prototype design and explore the relationship between hypothesised versus actual use (Sekhon et al., 2017). In particular, it was important to explore whether the inclusion or omission of features judged by previous study participants to be important or extraneous did in fact impact on usage. Participants in the cooperative evaluation (Chapter 8) wanted to be able to access curated, specific information which was clearly labelled and presented in a number of formats by credible sources. Any resource had to be simple to use and aesthetically pleasing. Desirable information included practical parenting information and the opportunity to engage with similar, local others. Inclusion of social media platforms was rejected, and perinatal women described being willing to engage with a resource which offered structured wellbeing support. The feedback from HCI experts supported the clear operationalisation of this and lay experts specifically highlighted the prototype’s novelty, clear labelling and useful categorisation of content.

Challenges and novel approaches taken to the recruitment and involvement of perinatal women to participate in codesign activities have been described (Balaam et al., 2015; Gibson & Hanson, 2013; Wardle et al., 2018; Westerlund, Lindquist, Sundblad, & Mackay, 2003). It was anticipated that recruitment of 10 eligible women to the in the wild study would be extremely challenging and therefore all expressions of interest were valuable and seriously considered; however, there arose an opportunity to revise the lay expert study and also honour
the interest shown by potential in the wild participants. This solution was not perfect as the four women invited to take part in the present study were at such a late stage of pregnancy. This influenced their information needs and information seeking behaviours: although all were engaged by the parenting content in general, all also described a desire for a limited amount of very specific practical information. They were actively able to filter out information they did not perceive as useful in their focus on practicalities and getting ready for bringing their baby home. This may also have been reflected in their limited interest in engaging with the wellbeing toolkit (navigation challenges notwithstanding). There may be a critical time point at which information saturation occurs and maternal focus narrows, to the exclusion of all information considered superfluous.

9.7.1 Strengths and limitations

The current study was guided by the principle of harnessing two distinct sets of expertise from two groups of experts: feedback was sought from HCI and usability professionals, followed by feedback on a revised version of the site from target users. The aim of the study was to optimise prototype design and acceptability; this was best achieved by encouraging feedback appropriate to the participant’s professional or lay expert skill set. Rather than asking lay experts to provide usability and acceptability feedback on an unfinished resource, professional expert feedback was sought first as it was anticipated that such feedback would more likely influence the site’s information architecture and/or appearance. Professional expert feedback was anticipated to be specific, actionable and grounded in rationale rather than instinct. Changes made in response to such feedback might lead to pragmatic yet significant changes, intended to improve the
user experience. The lay expert review produced rich and detailed feedback from target users prior to the in the wild study. Participants described and demonstrated what realistic use of the site in late pregnancy might look like: participants accessed the site whilst at work and also on a smartphone, for example. Obtaining data from women in late pregnancy rather than new mothers served as an important sensitising exercise for what issues may arise in the in the wild study and highlighted the importance of designing and evaluating prototypes with the right people at the right point in the developmental cycle. In addition, data gathered from lay experts contributed to the ongoing development of a set of recommendations regarding the use, development and evaluation of digital resources (Chapter 11).

However, follow-up evaluation of the live site was only conducted with 2 of the 8 Black Hat session participants. The study would have benefitted from follow up being made a formal requirement of participation from the outset. Recruiting new mothers from a local children’s centre was extremely challenging. In addition, none of the previous project participants responded to an invitation to examine the live site. This was disappointing, and it can only be surmised that women were either no longer interested in the project or that life with a young child prevented them from taking part. As a result, it was decided to revise the inclusion criteria rather than delay the project by trying to recruit new mothers. However, only three lay experts provided feedback on the live site and so the extent to which the comments received reflect the views of the total target population is questionable.
9.7.2 Conclusion

The expert review was a critically important part of the iterative development process: specific, actionable feedback from design professionals was used to make important changes to the prototype prior to the in the wild evaluation. The full prototype was perceived positively by women in late stage pregnancy in terms of the breadth and depth of the content. Features hypothesised to support a positive user experience in previous studies were enhanced through consultation with the professional experts and were subsequently largely valued during actual use by lay experts. Professional and experiential content was perceived to be useful and appropriate for use in late pregnancy. Content was seen as engaging and novel as was the prototype’s positive and encouraging tone. The experiential content voiced by actors was not always acceptable. Negative feedback largely focused on the utility and presentation of the wellbeing toolkit and this was noted as being potentially problematic for the next stage of evaluation. Crucially, the lay expert user study demonstrated that bump2bump was robust enough to be used independently by women in the wild. Therefore, the next study was designed to explore contextualised use of the prototype in the target population over a period of time as users moved from late pregnancy into early motherhood.
Part 3: Evaluation
Chapter 10 In the wild evaluation of the bump2bump prototype

10.1 Chapter overview

The previous chapter outlined the final iteration of the development phase in which human computer interaction (HCI) and usability professionals critically evaluated the prototype design. Analysis of feedback provided was used to refine the prototype in preparation for the final in-the-wild evaluation with target users. That study aimed to refine the design and acceptability of the high functioning prototype and provided valuable information regarding realistic usage and how the prototype might be appraised in this final study. The next step was to evaluate the prototype 'in the wild'. This chapter focuses on this final phase of evaluation (Figure 10.1).

Figure 10.1 Position of the study within overall thesis (highlighted).
I begin the chapter by providing some background to the study where the methodological considerations and overarching rationale are presented. This is followed by the study aims, objectives and results. The study took the form of a mixed-methods, in the wild, formative evaluation which was guided by the principle of using the bump2bump prototype as a technology probe. Study-naïve participants were invited to use the prototype over a period of 8-12 weeks, across the transition from late pregnancy into early motherhood; prototype usage and subjective wellbeing data were collected, using an experience sampling methodology and tracking software. In depth entry and exit interviews provided rich contextual data regarding the varied use and perception of the prototype and its relative position within a broader digital ecology. Certain aspects of the prototype were consistently highly valued while others were consistently disliked or avoided. There were limitations of the methods used to collect real-time subjective wellbeing and usage data. These challenges are described, as are the steps taken to address them. All participants provided positive and negative feedback and contributed to the development of a deeper understanding of hypothetical versus actual user needs and requirements over the perinatal period and the fundamental challenges of developing digital information and support resources for times of life transition as a whole.

10.2 Introduction

The process of evaluation highlights differences between the paradigms of eHealth and HCI (Blandford et al., 2018). As described in Chapter 2, eHealth practice typically takes a summative approach in using a highly controlled, large sample to determine any clinically significant effect and impact of a static
intervention; in contrast, HCI evaluation remains more (in)formative and focused on usefulness and user experience and may use a variety of methods, including expert review, think aloud and in the wild studies. The approaches ask fundamentally different questions (Cresswell, Blandford, & Sheikh, 2017). The rationale for this final study was also informed by reflection on my own previous involvement in evaluation practices in the context of digital health (Newhouse et al., 2016; Ziebland et al., 2016). A full understanding of the context of use could be best achieved through harnessing the best of both approaches. The study combined contextual interviews and the delivery of a high-functioning technological probe in the wild (HCI) with the collection and interpretation of quantitative data in the form of usage data and responses to validated measures (eHealth).

10.2.1 Going into the wild

The formative testing of prototype technologies has typically been conducted in relatively small-scale, controlled laboratory settings. The alternative approach of testing new systems outside these settings - 'in the wild' - has emerged to better understand the complexity of socio-technical practices. Papers with titles such as Doing innovation in the wild (Crabtree et al., 2013) or Calls from the wild (Cappadonna, Brereton, Watson & Roe, 2016) are increasingly common in the HCI literature and are a response to the call to free highly context-dependent technologies from the constraints of what might be considered inherently limiting evaluation processes. Technological advances, particularly with regard to the possibilities afforded by ubiquitous computing, have pushed evaluation out of the laboratory and into the wild, so as to exploit the opportunities for unconstrained
and naturalistic use. An example of technologies tested in real-life settings include an exploration of how baby wearable technologies are adopted and used (Wang et al., 2017).

The move towards creating and evaluating technologies in-situ is also representative of a shift away from simply developing digital resources that fit in with existing practices (Chamberlain, Rodden, Jones, Park, & Rogers, 2012). Blandford et al. (2013) have argued for research that examines the experience of using health technologies in a realistic context, reasoning that complex and unexpected findings can only emerge when used by the target population in naturalistic settings. Instead of observing the status quo with the view to offering up suggestions for design implications, there is increased willingness to experiment with technologies that may disrupt existing behaviours or routines. Exploration of how, when and why such potentially disruptive technologies are integrated into ‘normal’ life can only occur when the technology is released ‘into the wild’ and the potential for unanticipated use is welcomed (Brown, Reeves, & Sherwood, 2011). The notion that the process of evaluating technologies might allow us to see ‘what might be’ rather than simply ‘improve’ what already exists is indicative of the person-centred, constructivist epistemology of in the wild research in general and reflective of the stance taken in this thesis.

However, the somewhat exploratory approach to in the wild testing may be considered problematic (Brown et al., 2011). Indeed, some question the fundamental utility of testing in the wild (e.g. Kjeldskov, Skov, Als, & Høegh, 2004), arguing that the potential cost, time and complexity of the approach yields little to distinguish it from a more traditional lab-based study, with controlled
studies more likely to uncover critical usability problems. Robust counterarguments include findings which demonstrate how in the wild research can reveal more than ‘just’ usability problems, illustrating how people use prototypes differently in the wild when compared to the laboratory (Homecker & Nicol, 2012) and, critically, how a person’s context of use impacts on the inventiveness and creativity they apply to mitigate any frustration caused by the technology (Marshall et al., 2011).

Nonetheless, Rogers & Marshall (2017) acknowledge that research conducted in the wild is inherently ‘agnostic’ about the methods employed in the act of operationalising and exploring a research question. Methods include participant observation or remote logging using tracking software; participants can be asked to complete surveys or diaries; qualitative methods include focus groups and participant interviews. This pragmatic approach promotes a certain flexibility and studies tend towards taking a ‘seeing what happens’ approach, drawing conclusions from an aggregated mix of quantitative and qualitative data. This is in direct contrast to the experimental design of lab-based usability trials and summative RCT evaluation methodology (pragmatic RCT approaches notwithstanding), considered standard in eHealth (see Chapter 3), which typically tests the efficacy of a resource, itself considered to be static and finished, against an appropriate alternative or ‘control’. Although an in the wild approach arguably allows for greater ecological validity, it also leads to an inevitable loss of control over what the participant actually does with the technology. Whereas in a controlled laboratory setting, participants follow instructions to complete set tasks or can only interact with a fixed resource, in the wild testing is inherently messy.
Brown et al. (2011) underline the extent to which the results gathered from any study are a \textit{co-produced} artefact of the methods used, the epistemological stance, the interaction between participants and researcher and the design of the technology under investigation.

\textbf{10.2.2 Technological probes as a guiding principle}

This study was guided by the principle of using the bump2bump prototype as a technology probe. The use of probes aims to prompt and elicit information from people about their lives and \textit{"local culture"} (Gaver et al., 1999). In particular, probes aim to explore the messiness of normal life and the ways in which people \textit{“explore, wonder, love, worship and waste time”} (Gaver, 2001). Probes encourage the participant to provide data without the intervention or presence of a researcher. This facilitates the collection of data from contexts in which researcher presence would be problematic or compromise ecological validity. Data can also be collected over longer periods of time and in multiple locations. The literature documents the debate regarding the nature and purpose of ‘cultural’ versus ‘other’ probes (Hutchinson et al., 2003): cultural probes typically comprise a ‘kit’ of items to be used by participants in the setting of interest, in order to gain insight into a community in which a digital design idea may yet be developed. The probe approach has evolved and now includes technology probes (Hutchinson et al., 2003). Brown et al. (2011) offer a unifying definition of a probe as a \textit{“lightweight technological intervention that attempts to investigate current practice and experience to inform the design of new artefacts”}. 
The use of a technology probe extends the traditional HCI approach to system design and evaluation. Hutchinson et al. (2003) argue that the process of interview-design-test-change might discourage active participation by users as the design concept is - or at least appears to be - well-established by the time the participant sees it and feedback is then naturally limited to opinions of the user interface. Crucially, they recognise the inherently multidisciplinary nature of developing technology to support wellbeing and underline the imperative of developmental work to address three key goals: i) the social science goal of collecting data about technology use in a real-world setting; ii) the engineering goal of field testing the technology; and iii) the design goal of inspiring participants and researchers to think of new kinds of technology. This approach is aligned with the interdisciplinary positioning of the wider bump2bump project.

However, Hutchinson et al. (2003) firmly oppose the main features of a successful technology probe against those of a prototype. In their view, technology probes are limited and contain few accessible functions. They should be offered early in the design process as a provocative tool, used primarily to challenge pre-existing ideas and influence future design. By contrast, the functionality of a prototype is complex but fixed; used in the last stages of design, a prototype can be discarded. The current study positions the bump2bump clickable prototype as a technology probe, based on the counter-argument that the concepts of prototype and probe are not necessarily mutually exclusive. The principle of using any minimally viable digital product as a stimulus in order to explore and encourage reflection on current practice echoes Crabtree’s description (2004) of technology trials in general as “breaching experiments”. Such ‘breaching experiments’ disturb current
practices in order to better understand how things are done now and to support practices which may not yet exist and encourage the collection and analysis of unexpected data rather than simply confirming what we think we know. As described below, the aim of this study was not simply to determine acceptability of the bump2bump prototype as a finished resource; rather, the prototype was offered to participants as part of a research package, to be used 'naturally' in order to probe the lived experience of using perinatal digital health resources in general over the course of the transition to first time motherhood.

10.2.3 Experience sampling

The pervasiveness of new technologies has led to novel methods for capturing data about the real-world use of technology. Diaries and interaction logs are two techniques traditionally used when indirect observation of user behaviour is required. Interaction logging is discussed further below (section 10.2.5). Diaries are useful in that they require no particular equipment or expertise; templates can be used to standardise responses but the process of maintaining a diary can be burdensome and drop off has been shown in studies lasting longer than two weeks (Rogers et al., 2011). In addition, participants’ memories are often exaggerated, and such studies also rely on participants being motivated and reliable.

Experience sampling methodology (ESM) (Larson & Csikszentmihalyi, 1983), also called Ecological Momentary Assessment (EMA) (Shiffman, Stone, & Hufford, 2008), is a way of gathering contextualised, real-time data on, for example, how digital resources might be embedded in daily life. EMA echoes the
traditional diary approach in that it relies on participants recording detail about their lives. However, it differs in that participants may be prompted at random times using a mobile phone or similar device, to answer specific questions about their context, actions and feelings in that moment. Questionnaires may be sent electronically to a participant’s mobile phone, which can also be used to respond to and submit questions. Study exit interviews may be conducted in order to probe the context of the real-time responses provided (Wang et al., 2017).

EMA has been used to study a variety of behaviours, attitudes and symptoms in a range of settings, including studies into psychosis, eating disorders and addiction as well as research into quality of life and social relationships (Carter, 2016). The approach has been used largely within the discipline of psychology: participants are asked to respond to simple, unambiguous questions (e.g. ‘Right now, I feel cheerful’) and rate their current experience, thus capturing the variable cognitive state rather than the more stable trait (Csikszentmihalyi, 2014; Larson & Csikszentmihalyi, 1983). Response type depends upon the nature of the validated measure used and, increasingly, on the possibilities afforded by any technology used to deliver the measures. Multiple examples of mobile EMA systems exist, usually with their own in-built features which make them relatively inflexible for off-the-shelf use. Systems may be licensed or open-source, with Android-based systems being more readily available for free. Examples of experience sampling toolkits and applications include Funf (www.funf.org), the Aware framework (www.awareframework.com) and Paco (www.pacoapp.com).
EMA compliance can be defined with two metrics: the overall number of participant responses and the temporal delay between prompt and response. A high response rate and short temporal delay are ideal. However, many factors can influence this, such as the participant’s social setting, mood, location and time (Kini, 2013). Responding to prompts via the small screen of a mobile device may also impact on response rates: the type and presentation of questions need to be taken into account (Kini, 2013). Scheduling and sampling for EMA studies are highly dependent on the overarching aim of the research. Participants may be alerted to complete a diary in response to a pre-programmed, fixed or random signal (signal contingent design) or they may be asked to complete a diary following a pre-determined event (event contingent design) (Bolger, Davis, & Rafaeli, 2003). Signal contingent designs require participants to complete diaries at predetermined times, when signaled to do so. This may lead to familiarity with the routine and skewed data. Randomising this signaling may address this issue but may instead increase participant burden as signals may be sent in rapid succession. Event contingent designs require participants to complete a diary following a specific event, such as using a technology probe. The obvious vulnerability with this method of data gathering is the possibility for significant missing data, particularly if the event in question is relatively rare or unpredictable in nature.

The momentary nature of EMA allows for the monitoring of attitudes and behaviours as they occur in daily life. Just as Sekhon et al. (2017) underline the importance of considering temporality in measures of intervention acceptance, Kahneman & Riis (2005) remind us that retrieval and temporal integration of
actions and emotional experiences are prone to error and that retrospective evaluations are less authoritative than real time reports. The strength of EMA methods is that they enable researchers to explore in detail the impact of deployed technologies and permit unanticipated phenomena to be documented and explained. EMA aims to minimize recall bias, maximize ecological validity, and allow study of microprocesses that influence behaviour in real-world contexts (Shiffman et al., 2008). To my knowledge, no prior studies have used EMA approaches to examine the real-time usage of digital resources in the perinatal period over time.

Following consultation with experts and consideration of appropriate literature the Paco application was selected as most appropriate for this study for the following reasons:

• appropriate for mixed platform usage
• appropriate security and privacy
• high level of user acceptability
• limited coding experience required
• affords collection of quantitative and qualitative data
• free to use

10.2.4 Measures of wellbeing

In addition to collecting data about usage, the Paco EMA application was used to prompt participants to complete brief pregnancy-specific measures relating to subjective wellbeing. The use of quantitative measures was not intended to establish any causal relationship between usage of bump2bump (or any other digital resources) and subjective wellbeing. Rather, an optimal outcome for the final study would be for bump2bump to be not only highly acceptable and much
used, but also to be perceived as having some beneficial impact. Thus, the EMA approach provided the opportunity to collect real-time, self-reported data regarding subjective wellbeing across the transition from late pregnancy to motherhood, which could be explored during follow-up interviews, supported by individual usage data and general questions about online behaviour. To my knowledge, no examples of studies attempting this had been reported in the literature at the time of writing.

However, the selection of validated tools to assess subjective perinatal wellbeing was complex. As described previously (Chapter 2), domain-specificity has been shown to be critical in the measurement of wellbeing (Alderdice et al., 2013; Linton, Dieppe, & Medina-Lara, 2016) and yet tools developed in order to assess perinatal wellbeing focus largely on the presence/absence of pathology and do not address the transition to parenthood (Chapter 4). The theoretical underpinning of bump2bump (Chapters 5 & 6) indicated that optimal outcomes might include self-report of improved autonomy, competence and relatedness, which could be best assessed using measures other than those designed to capture clinically significant pathology. The measures selected as being appropriate for use in this study were determined through examination of the relevant literature (including the articles included in the synthesis presented in Chapter 4), personal correspondence with academics working in the area, and discussion with the supervisory team. In addition, key reviews of wellbeing measures were consulted (Linton et al., 2016; Mogos, August, Salinas-Miranda, Sultan, & Salihu, 2013; Morrell et al., 2013). This process and the measures subsequently used are described in section 10.4.3.1 and shown in Table 10.1.
10.2.5 Interaction logging

Usage of a digital tool can be logged for later examination. A variety of user actions can be recorded, from key strokes to time spent looking at certain aspects of pages or time spent on tasks or on the system as a whole. When conducted as part of a usability study, such logs might be used in conjunction with video or audio data to help assess how a user addressed a problem or navigated through a system (Rogers et al., 2011). In the context of research conducted in the wild using digital probes, interaction logging allows for the remote, unobtrusive assessment of how a user interacts with a website. Such data can track how long a user stays on a webpage, where they spend most of their time on a website and whether or not they are able to meet their goals. Logging such activity is unobtrusive but raises questions of the implications of remote observation. For example, participants may alter their behaviour, knowing their online activity is being monitored (Ziebland et al., 2016). Extrapolating from such usage data must also be undertaken with caution. For example, Khoo et al. (2008) discuss the validity of session length as a useful metric but warn that it is important for any such metrics to be triangulated with other research. This is underlined by Ziebland et al. (2016), whose mixed method study examining the role of patients’ experiences as a resource for choice and decision-making in health care found that contextual interviews were vital for explaining user behaviour. Time spent online looking at a website was not necessarily indicative of active engagement: users went through websites page by page in order to provide detailed feedback; other users simply left pages open while performing other tasks whilst other participants were able to meet their goals through one meaningful visit to the website rather than through protracted engagement. The current study used
Slimstat, a WordPress analytics tracking plugin, to record the number of logins, pages viewed, and total time spent on the prototype.

10.3 Study aims and objectives

The primary aim of the study was to explore the use of bump2bump in the transition to first time motherhood in a naturalistic context; a secondary aim was to explore the feasibility of collecting data using experience sampling methods.

The specific research objectives were as follows:

1. To describe the uptake of the DHI;
2. To describe the use made of the intervention;
3. To explore user perceptions of the acceptability, pros, cons and impact of the intervention.
4. To understand the user experience of the DHI and any impact of the data collection methods on this.

10.4 Methods

10.4.1 Design

Women in the third trimester of their first pregnancy were invited to take part in a mixed-methods longitudinal evaluation of the high functioning prototype.
10.4.2 Participants

10.4.2.1 Sampling

Participants were eligible to take part if they were over the age of 18 years, between 34-38 weeks pregnant and had not previously given birth. Women were required to be resident in the Oxfordshire area, own a smartphone and have access to a laptop/desktop/tablet computer which was connected to the Internet. They could not have participated in previous iterations of the bump2bump study.

10.4.2.2 Recruitment

Eleven women were recruited through an approach to the Oxford branch of the National Childbirth Trust (NCT). The bump2bump study was accepted by the NCT as an approved study in 2015 and this proved critical in allowing me to attend a ‘Nearly New Sale’ in Oxford in September 2017. Nearly New Sales are a core aspect of the NCT’s offering and are heavily attended by members and non-members for the purpose of buying used but high-quality baby clothes and equipment. Researchers are permitted to approach attendees waiting in the queues which form up to an hour before the sale begins. As the only permitted researcher in attendance, I was able to approach women and introduce the study, informally determine eligibility and obtain contact details from those who expressed an interest in participating. Twenty-three expressions of interest were obtained and, following more in-depth screening, 16 women were invited to take part in the evaluation study. Women who had not replied after 1 week were contacted again, with an assurance that no further contact would be made if no
reply was received. Eleven women were recruited in total. One participant subsequently withdrew prior to the entry interview, due to being hospitalised with complications. One further participant did not respond to emails regarding arranging the entry interview.

Of the 23 expressions of interest received, 7 women did not meet the eligibility criteria due to being within two weeks of their due date. Two women who were within one week of their due date were contacted and thanked for their interest. The other 5 women were approached and invited to take part instead in the final iteration of development work, as described in Chapter 9. Three of these women replied and took part in a week-long evaluation of the prototype, as described in the previous chapter.

Three advertisements were also posted at weekly intervals on the online community notice board used previously for recruitment. One expression of interest was received but there was no response to the emailed participant information sheet.

10.4.3 Procedure

Prior to the entry interview, eligible participants were provided with an electronic copy of an information sheet and consent form by email for their consideration. Participation in the study lasted approximately 12 weeks, from around one month prior to giving birth and for around 8 weeks postnatally. Participants provided written consent and completed a demographics form as used in previous formative evaluations. The study took the form of an antenatal entry and a
postnatal exit interview and an invitation to use the bump2bump prototype as little or as much as desired over the course of the study. Participants were provided with a study pack which included instructions on how to access the wellbeing toolkit and information about the Paco application. Women received a £100 high street voucher in thanks for taking part. See Appendix 7 for all participant-facing materials.

10.4.3.1 Quantitative data

As described in section 10.2.4, a number of wellbeing measures were reviewed for inclusion in the study: The Whooley Questions (Whooley, Avins, Miranda, & Browner, 1997); The Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987); the Wellbeing in Pregnancy Questionnaire (Alderdice, McNeill, Gargan, & Perra, 2017); the Flourishing Scale (Diener, Wirtz, Oishi, & Biswas-Diener, 2010); the Cambridge Worry Scale (Green, Kafetsios, Statham, & Snowdon, 2003); the Basic Psychological Needs Scale (La Guardia, Ryan, Couchman, & Deci, 2000); the MOS Short-Form General Health Survey (Stewart, Hays, & Ware, 1988); the Assessment of Quality of Life (Hawthorne, Richardson, & Osborne, 1999); and the Pregnancy Experience Scale (Dipietro et al., 2004).

Subsequently, the Flourishing Scale and an amended version of the Cambridge Worry Scale were used. These scales best addressed key criteria of validity, reliability and being sensitive to change as well as placing minimal response burden on the participant. In addition, the measures were feasible to use in that they were open access and could easily be adapted for use within the Paco application. Correspondence with the team behind the Baby Steps study (Hamilton et al., 2016) informed the development of questions relating to
perception of parenting-specific competencies and acceptability of the resource. The resulting measures used in the study are shown in Table 10.1. Participants were asked to complete all measures twice per week.

The current study used Paco, an open-source EMA platform which includes a web interface and mobile app, compatible with both Android and iOS devices. Using the Paco web interface, the researcher sets up an experiment which may be made up of one or more triggers and actions. Triggers tell Paco when to take action, such as to prompt participants to answer a set of questions, called inputs. Experiments are published to an invited audience, who receive an invitation to join the experiment via the Paco app. Prompts and responses can be monitored and data downloaded via the web interface. Measures relating to subjective wellbeing and resource usage were sent to participants twice per week on a variable schedule. Participants were permitted to alter the time of day at which notifications were received but not the schedule itself. Setup and completion of the measures were piloted on mobile phones running Android and iOS. Formatting and usability issues were addressed following discussion with the Paco developers.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Items</th>
<th>Scoring</th>
</tr>
</thead>
</table>
| **Cambridge Worry Scale** | Are you worried about your housing?  
Are you worried about money?  
Are you worried about your relationship with your partner?  
Are you worried about your relationship with your friends or family?  
Are you worried about your own health?  
Are you worried about the possibility of something being wrong with your baby?  
Are you worried about going to hospital?  
Are you worried about giving birth?  
Are you worried about coping with the new baby? | 5-point Likert scale  
Not a worry (0) - Major worry (5)  
Scale dichotomized: 0-3 less than major worry, 4-5 major worry |
| **Flourishing Scale** | I lead a purposeful and meaningful life  
My social relationships are supportive and rewarding  
I am engaged and interested in my daily activities  
I actively contribute to the happiness and well-being of others  
I am competent and capable in the activities that are important to me  
I am a good person and live a good life  
I am optimistic about my future  
People respect me | 7-point Likert scale  
Strongly disagree (1) - Strongly agree (7)  
Scored from 8-56 with higher score indicating higher subjective wellbeing |
### Parenting self-efficacy

<table>
<thead>
<tr>
<th>Question</th>
<th>Likert Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking about the next 8 weeks, how confident are you about feeding your baby?</td>
<td>5-point Not at all (1) - Extremely (5)</td>
</tr>
<tr>
<td>Thinking about the next 8 weeks, how confident are you about managing your emotional health?</td>
<td>Scored from 3-15 with higher score indicating higher perception of self-efficacy</td>
</tr>
<tr>
<td>Thinking about the next 8 weeks, how confident are you about managing life with a new baby?</td>
<td>Free text option</td>
</tr>
<tr>
<td>Is there anything else you would like to tell us about how you're feeling this week?</td>
<td></td>
</tr>
</tbody>
</table>

### Resource use and acceptability

<table>
<thead>
<tr>
<th>Question</th>
<th>Likert Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Have you used bump2bump over the past couple of days?</td>
<td>5-point Not at all (1) - Extremely (5)</td>
</tr>
<tr>
<td>If you did, how <em>satisfied</em> were you with the website overall?</td>
<td>Scored from 3-15 with higher score indicating higher acceptability</td>
</tr>
<tr>
<td>(ii) Have you used bump2bump over the past couple of days?</td>
<td>Free text option</td>
</tr>
<tr>
<td>If you did, how <em>useful</em> was the website?</td>
<td></td>
</tr>
<tr>
<td>(iii) Have you used bump2bump over the past couple of days?</td>
<td></td>
</tr>
<tr>
<td>If you did, how easy was it to <em>find</em> what you wanted?</td>
<td></td>
</tr>
<tr>
<td>Is there anything else you would like to tell us about your experience of using bump2bump today?</td>
<td></td>
</tr>
<tr>
<td>Which other digital resources have you used over the past couple of days?</td>
<td></td>
</tr>
<tr>
<td>What have you used them for?</td>
<td></td>
</tr>
</tbody>
</table>

*Table 10.1 Measures used in the final study to assess wellbeing, parenting competency and resource acceptability.*
10.4.3.2 Entry interviews

Participants took part in a two-part, semi-structured entry interview (Appendix 7). Interviews were conducted in the participants’ home and were audio recorded. The first part of the interview was designed primarily to build rapport and explore women’s use of digital, analogue and face to face information and support resources over the course of their pregnancy. As in earlier formative work, women were asked to describe and reflect on the meaning of perinatal wellbeing. The participant was then supported in downloading the Paco EMA application to their smartphone. Verbal and written instructions were provided on how to respond to notifications from the application, how to troubleshoot any problems and how to tailor the timing of notifications. The participant was then provided with a link to the bump2bump prototype and asked to access the prototype on the device of their choice. The second part of the interview was used to explore women’s first impressions of the prototype before and after logging in. Iterative revisions were made to the processes of providing instructions on the use of Paco and the way in which women were invited to log into the prototype and this is discussed below. Full field notes were made following each entry and exit interview, focusing on general impressions and any key data that had emerged relating to the study objectives.

10.4.3.3 Exit interviews

After having access to bump2bump for around 8-10 weeks, all participants took part in a semi-structured exit interview (Appendix 7). The first two interviews were challenging: participants were struggling with physical recovery and I perceived the interview to be adding unnecessary burden. I decided to adjust the timing to at least six weeks postnatally, or as soon as the participant was comfortable with being interviewed. In addition, the interview schedule was adjusted to foster rapport and focus on appreciative enquiry from the outset. All interviews were conducted in the participants' home and were
audio recorded. The aim of the interview was to explore the general experience of using the prototype and the EMA application; the interview was guided by prompts taken from participants’ entry interviews. The interview schedule was revised following the first two interviews to take more of an appreciative enquiry approach and this is discussed further below.

10.4.4 Data analysis

10.4.4.1 Quantitative

Inferential analysis of the quantitative data was not appropriate in this context due to the small sample size. Instead, the quantitative data was used to generate descriptions of usage and engagement patterns which could support the contextual data generated by the exit interviews.

10.4.4.2 Qualitative

The interviews were transcribed verbatim and analysed using an inductive, six-stage thematic analysis approach (Braun & Clarke, 2006) as described in previous chapters (e.g. Chapter 5). Transcripts were initially coded according to the topic guide categories, and subsequently free-coded thematically. Emergent themes were discussed with other researchers at intervals and explored in subsequent interviews. Once all transcripts had been coded, codes were grouped into parent and sub-themes, and both common and divergent themes identified.
10.4.5 Ethical approval

Revised ethics was required for this study. UCL Research Ethics Committee granted ethical permission (UCL/8657/002). Participation was voluntary, and participants were recruited in the same way as any other healthy adult able to give informed consent. Personal identifiers were removed from the data and the data were stored securely, according to the principles of research governance (Northway, 2017).

10.5 Results

The results are presented in two parts. The quantitative usage data is presented first, followed by qualitative data from the entry and exit interviews.

10.5.1 Participant characteristics

Nine women took part in the two-month in the wild study. Participant characteristics are reported in table 10.2. The mean participant age was 34 years (SD=2.73, range 31-39 years). Mean stage of pregnancy at study entry was 36 weeks (SD=1.12, range 34-38 weeks). The sample was more varied in comparison to groups involved in earlier formative work in terms of participant nationality, education, work and lifestyle. All participants lived with their partner but 4/9 were unmarried, and one participant was in a same-sex relationship. All women used the internet regularly and rated their ability to do so as at least 8/10 (with 10/10 being most able); all reported ownership of at least 3 digital devices, with the smartphone being the preferred device for all forms of online activity. The majority of participants had chosen not to attend National Childbirth Trust parenting classes.
### Number of participants

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-34</td>
<td>6</td>
</tr>
<tr>
<td>35-40</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Highest level of education</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>A level/equivalent</td>
<td>2</td>
</tr>
<tr>
<td>Degree</td>
<td>2</td>
</tr>
<tr>
<td>Postgraduate / professional level</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment status</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part time</td>
<td>1</td>
</tr>
<tr>
<td>Full time</td>
<td>6</td>
</tr>
<tr>
<td>Self employed</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relationship status</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohabiting</td>
<td>4</td>
</tr>
<tr>
<td>Married</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>White - British</td>
<td>4</td>
</tr>
<tr>
<td>White - Other</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NCT membership</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
</tr>
</tbody>
</table>

*Table 10.2 in the wild study participant characteristics.*
10.5.2 Usage data

Participant interaction with bump2bump was logged from the point of registration using a WordPress plugin (Slimstat). The 9 users logged in a total of 22 times and looked at 242 pages (Table 10.3). Users spent a total of 19.5 hours on the site, with individuals spending an average of just over two hours on the site. Variation in use was wide, ranging from one participant who logged in once and viewed 6 pages across 4 minutes, to another who logged in 5 times and viewed 68 pages across more than 5 hours. Participants’ experiences with the ecological momentary assessment tool (Paco) varied widely. It was intended that each participant would receive 2 notifications per week to complete brief wellbeing, self-efficacy and website acceptability measures for the duration of their participation in the study. Participation was intended to be around 8-10 weeks in total, initiating approximately 180 notifications in total across all participants. Problems with individual phone settings and updates to the Paco application resulted in 99 notifications being sent out and 54 responses received, indicating a response rate of 54.55%. In addition, it is noted that many of the responses were provided not in direct response to a notification but in an ad hoc manner, when the participant remembered to do so.
<table>
<thead>
<tr>
<th></th>
<th>Total (N=9)</th>
<th>Mean (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total logins</td>
<td>22</td>
<td>2.33 (1.32)</td>
<td>1-5</td>
</tr>
<tr>
<td>Page views</td>
<td>242</td>
<td>27.11 (17.89)</td>
<td>6-68</td>
</tr>
<tr>
<td>Total time on site (mins)</td>
<td>1170</td>
<td>130 (118.84)</td>
<td>4-337</td>
</tr>
<tr>
<td>Number of PACO notifications sent</td>
<td>99</td>
<td>11 (8.83)</td>
<td>1-25</td>
</tr>
<tr>
<td>Number of PACO responses received</td>
<td>54</td>
<td>6 (6.82)</td>
<td>1-23</td>
</tr>
</tbody>
</table>

Table 10.3 Aggregated usage data by all participants and information relating to ecological momentary assessment notification and responses received.

Information was collected regarding pages viewed and search terms used (Table 10.4). All participants except one viewed all sections of the website, including at least the landing pages of the wellbeing toolkit and the local resources section of the website. All except one participant browsed the local resources section and clicked on outward links to external resources; none submitted a listing or review of their own. Participants viewed content delivered by both peers and the parenting professional: preferred peer content focused on experiential information around birth and feeding and preferred professional content focused on the birth process and practical baby care. One participant used the search function.
The Paco application was used to collect responses to measures regarding self-reported flourishing, worry, parenting self-efficacy and resource acceptability (Table 10.1). Two participants only provided one set of responses across the study time period. There was no clear indication of a common reason for this being the case. The remaining 7 participants provided at least one set of responses antenatally and postnatally, although some data was missing. These responses were examined for pre-post patterns and individual-level data is presented in Table 10.5.

<table>
<thead>
<tr>
<th>Pages most viewed</th>
<th>N= views</th>
<th>N= participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General pages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenting Information</td>
<td>69</td>
<td>9</td>
</tr>
<tr>
<td>Local Resources</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>Wellbeing Toolkit</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Who we are</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Leave a review</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Suggest a listing</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Peer content</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Looking back: vaginal birth</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Antenatal classes and preparation for birth</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Feeding</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Maternity care and antenatal visits</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Finding information and support</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Emotions and relationships during pregnancy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Emotions and relationships in early parenthood</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pain and pain relief</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Looking back: caesarean birth</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Thinking about where and how to give birth</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Professional content</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional tips - practical baby care</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Professional tips - impact of a new baby</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Professional tips - preparing for birth</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Professional tips - understanding life with a new baby</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Professional tips - the birth process</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Search terms used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rash</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Breast</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Table 10.4 Most viewed pages and search terms.
The responses indicated high levels of subjective flourishing and a moderately high perception of parenting self-efficacy and resource acceptability across the study time period. 3/7 participants reported a drop in subjective flourishing across the study period, 3/7 reported an increase and 1/7 reported the same score. 4/7 participants reported an increase in self-efficacy and 3/7 reported a drop. Resource acceptability remained relatively high and stable for all but 1 participant, who described problems with engagement relating to platform incompatibility. There was wider variation in the worry score and this is explored more below. As outlined above, rather than looking at within-person worry as a whole, the scoring of the scale recommends the dichotomization of scores for the examination of individual items (0–3 less than major worry, 4–5 major worry). Table 10.6 shows the aggregated mean score per worry scale item over the course of the study period for all women and the number of women who indicated at least once that a particular item was a major worry. All items were described as being a major worry at least once, with money, baby’s health, giving birth and coping with a newborn being most frequently highlighted.

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Flourishing score (pre-post)</th>
<th>Self-efficacy score (pre-post)</th>
<th>Resource acceptability score (pre-post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>50</td>
<td>44</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>50</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
<td>55</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>48</td>
<td>49</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>54</td>
<td>52</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>43</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>43</td>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

*Table 10.5 Individual pre-post scores on measures of flourishing, self-efficacy and resource acceptability.*
## Table 10.6 Women’s responses to the Cambridge Worry Scale.

Although active participation in the study lasted around 8-10 weeks, participants were made aware that they would be able to access bump2bump for a period of around six months. Individual-level usage patterns are shown in Figure 10.2 and illustrate the way in which users engaged with bump2bump around the points of registration, birth, exit interview and postnatally. All participants used the site antenatally and 4 continued to do so postnatally. Three participants used the site following the exit interview with one using bump2bump nearly 3 months later.
Figure 10.2 User engagement (October 2017-May 2018) with bump2bump (number of pages viewed) around the points of registration ○, birth ○ and exit interview ○
### 10.5.3 Qualitative data

The main themes and subthemes of the qualitative data can be seen in table 10.7. The table is split into antenatal data, followed by postnatal data. Participants are identified by a number and pseudonyms are used where appropriate.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants’ antenatal wellbeing</strong></td>
<td>Major influences</td>
<td>Pregnancy ‘narrative’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Previous experiences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guilt &amp; worry (information; choices; money)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access to good resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fixation on birth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physicality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relationships with others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Autonomy</td>
</tr>
<tr>
<td></td>
<td>Legitimacy of negative feelings</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Participants’ use of digital resources in late pregnancy</strong></td>
<td>Self-directed</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Proactive disengagement from digital life</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Increased importance of connecting with other people</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Wants from a parenting resource (content)</strong></td>
<td>Content</td>
<td>Stories providing real-life examples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reassurance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Normalising</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advice, tips and strategies</td>
</tr>
<tr>
<td>Wants from a parenting resource (outcomes)</td>
<td>Physical outcomes</td>
<td>Ability to breastfeed</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved postnatal physical recovery</td>
</tr>
<tr>
<td>Cognitive outcomes</td>
<td>Increased knowledge of baby care</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge of when to seek help</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased confidence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acceptance of difficult feelings/coping strategies</td>
<td></td>
</tr>
<tr>
<td>Emotional outcomes</td>
<td>Reduced feelings of worry (about birth and coping with a new baby)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoidance of PND</td>
<td></td>
</tr>
<tr>
<td>First impressions (before using bump2bump)</td>
<td>Positive feedback</td>
<td>Visually appealing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Registration easy</td>
</tr>
</tbody>
</table>
The following themes arose in the second interviews, after participants had access to bump2bump for around 8-10 weeks.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants’ postnatal wellbeing</strong></td>
<td>Major influences</td>
<td>Breastfeeding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Birth experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactions with HCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physicality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reality of new motherhood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peer support</td>
</tr>
<tr>
<td><strong>Participants’ postnatal use of digital resources</strong></td>
<td>To find information</td>
<td>Browser search</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Websites and forums</td>
</tr>
</tbody>
</table>

- Easy to navigate
- Interesting and relevant content
- Credible information
- Comprehensive
- Self-paced and browsable
- No advertising
- Unclear purpose
- Exclusive (registration)
- Hidden credentials
- Volume of information
- Problems with devices, personal settings and preferences
<table>
<thead>
<tr>
<th><strong>Perinatal apps</strong></th>
<th><strong>YouTube</strong></th>
<th><strong>Social media</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>To connect with others</td>
<td>WhatsApp</td>
<td>n/a</td>
</tr>
<tr>
<td>To connect with ‘real life’</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>(Pro)active disengagement</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Positive feedback (after using bump2bump)</strong></th>
<th><strong>Content</strong></th>
<th><strong>Informative and comprehensive</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Authenticity of peers</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Relevant content</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Just-in-time content</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Truthful content</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Synthesised content</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Multimedia content</strong></td>
</tr>
<tr>
<td><strong>Usability</strong></td>
<td>Easy to navigate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clear layout</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reassuring tone</td>
<td></td>
</tr>
<tr>
<td><strong>User experience</strong></td>
<td>Found it useful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Felt more prepared</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Value of postnatal access</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Negative feedback (after using bump2bump)</strong></th>
<th><strong>Content</strong></th>
<th>Not enough of the right information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lack of information for partners</td>
</tr>
<tr>
<td>Barriers to use</td>
<td>Unclear credentials of birth professional</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site’s overall purpose unclear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wellbeing toolkit not interesting or appealing</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>Platform incompatibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Media content not loading</td>
<td></td>
</tr>
<tr>
<td>User experience</td>
<td>Resource was disappointing</td>
<td></td>
</tr>
<tr>
<td>Of ESM</td>
<td>Inconsistent/absent notifications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measures - intrusive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measures - burdensome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measures - unrepresentative</td>
<td></td>
</tr>
<tr>
<td>Intrinsic or person-related factors</td>
<td>Feeling prepared enough</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forgetting about the resource</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proactive disengagement with digital resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of motivation</td>
<td></td>
</tr>
<tr>
<td>Extrinsic or contextual factors</td>
<td>Lack of time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not knowing how to access the resource</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lost login details</td>
<td></td>
</tr>
<tr>
<td>Factors to do with the website</td>
<td>Problems with layout</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resource not a good fit (e.g. preference for face to face support only)</td>
<td></td>
</tr>
<tr>
<td>Suggested modifications</td>
<td>Content and design</td>
<td>Remove registration/login</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add more information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add the number of reviews to each resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present information in different ways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide fewer videos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integrate and amend wellbeing toolkit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include information to access urgent help</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarify purpose and provenance</td>
</tr>
<tr>
<td>Usability</td>
<td>Include guidance on how to use b2b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure platform compatibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Add prompts and reminders to use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reconsider the timing of deployment</td>
<td>n/a</td>
</tr>
<tr>
<td>Perceived impact of using perinatal digital resources in general</td>
<td>Needs still unmet</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Fundamental limitations of digital perinatal resources</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Table 10.7 Main themes and sub-themes in the dataset.*
10.5.4 Participants’ antenatal wellbeing

10.5.4.1 Major influences

How pregnant women conceptualise and talk about their wellbeing, in terms of what they believe to be key influencing factors, has important implications for the uptake, use and perceived acceptability of a perinatal digital wellbeing tool. Important positive and negative influencing factors varied according to personal context. All women talked about the burden of pervasive mixed messages regarding pregnancy and impending early motherhood. The perinatal journey was simultaneously portrayed in the mainstream as fulfilling and yet intensely disappointing, as serene and yet crippling lonely, natural and yet potentially traumatic. One participant talked about the hard work of staying positive during pregnancy particularly when confronted with negativity from peers, online and offline.

*There’s a lot of negativity around pregnancy, largely from people who are pregnant, who aren’t necessarily as lucky as I am and they’re less comfortable, just having a worse time or they’re just negative. I’ve worked very hard to try and be positive.*

Participant 4

Previous experiences played an important role in influencing how women felt about their pregnancies and how they managed their expectations around pregnancy, birth and early motherhood. Personal experience of mental illness, miscarriage, witnessing others’ stillbirth, birth and breastfeeding experiences and living in different cultures were highlighted as being especially influential. One participant talked about the way in which her life-long experience with depression made her more aware of her mental health and what she needed to do in order to maintain positive wellbeing. Rather than
feeling more vulnerable or 'at risk', this insight made her feel more prepared for life as a new mother and less likely to romanticise early motherhood. Although all women were in late pregnancy for the first time, previous personal experiences of miscarriage or awareness of close others’ stillbirths were highly influential in moderating excitement and impacted on the degree to which one participant had prepared for the arrival of her baby. Awareness of negative breastfeeding and birth experiences were usually perceived as useful rather than frightening and helped some women manage their expectations of what was to come.

*My sister is a useful sort of person to compare to really because she’s had her first child she had a horrendous birth, horrendous, in spite of her best attempts at preparation, they didn’t treat her well at all and she was left in a corridor in active labour for quite some time and there was kind of a Benny Hill moment where they took her in for a forceps delivery but the guy who was carrying her didn’t know where the forceps unit was, you know, and was carting her around on this, just horrendous, horrendous, horrendous, awful first birth. Participant 9*

Managing expectations was also heavily influenced by women’s own cultural narrative: 5 of the 9 participants had come to live in the UK from other countries. This cultural narrative influenced women’s experiences and expectations of care: those who had low expectations were reassured and excited by having choices and information to support those choices whilst others felt that they constantly needed to ensure they were getting the right care. For example, one woman came from a country where elective vaginal birth was rare while another had expected far more testing during pregnancy and was therefore often concerned that potential health issues had been missed.
While awareness of negative experiences was described as being useful by some women, all women also described how pregnancy and impending motherhood were characterised by feelings of worry and guilt. From the outset, holistic wellbeing had been predicated on ‘doing the right thing’: eating ‘correctly’; planning for the ‘best’ birth; preparing ‘enough’ in terms of both information acquisition and purchasing the correct items, often on a very limited budget. Money was described as being a significant concern by four participants. Access to good information and local resources was an important part of mitigating worry and most women described having high expectations of postnatal community support and how this was an important factor in moderating their stress about impending early motherhood. Two women who described having taken active steps to find out more about how to access community-based postnatal help and support linked this to a reduction in their worry. Conversely, this was also true of those who had found out that service provision was likely to be reduced; this helped to manage expectations and had prompted one woman to make alternative plans.

*I know the care that we’re going to get after birth is not really as great as it could be because they’ve rather had to pare things down a bit and it’s not as it was, so I’m aware that might be a little bit scant.* Participant 9

Physical health impacted on personal wellbeing. While all women had experienced clinically normal pregnancies, there was variation in women’s experiences of the *physicality* of pregnancy. One woman had put on more weight than anticipated and although this had not been of clinical concern, it had impacted on her sense of self and ability to be as active as she wanted. Another participant had experienced severe pelvic pain throughout pregnancy and was now unable to sit for more than short periods. Her sleep was very disturbed, and she linked this directly to her negative
mood. Women also echoed previous study participants in their perception that healthcare professionals tended to focus on the physical health of the baby rather than that of the mother.

*When you visit your midwife, they never ask you how you feel, they are more focused on the baby and whether the baby’s growing.*

**Participant 2**

All women talked about the importance of being able to ‘get back to normal’ - physically - after giving birth and yet the physical process of birth itself was an overwhelming prospect which made it difficult to focus on anything else.

*The thing is that I can’t really project myself past the birth so when people say oh you must be really excited, I feel like they are more excited than I am because I have no idea how things are going to go and I know other people feel like that, that it’s sort of difficult to look past the birth because it doesn’t really feel real.* **Participant 8**

Relationships with other people were critically important and face to face support and interaction were key. All women described at least one relationship that impacted positively on their subjective wellbeing: with their partner, healthcare professionals, exercise class leaders, friends and family. The relationship that had been influential was sometimes unexpected: one participant talked specifically about the importance of her pet dog to her wellbeing. Peers and one-step-ahead ‘mentors’ were particularly valuable: WhatsApp groups with parenting class cohorts gained particular significance in this late stage of pregnancy, even though women also described these relationships as new and strange. Women described very different support structures: four women had family and friends living relatively nearby; two participants described having no support other than their partners; three women would be hosting family members from late pregnancy who would be visiting briefly from Poland, Brazil and
Spain to provide care. For most women, the relationship with their partner was the most important and they described the hard work that went into maintaining it and trying to make sure it was robust in the face of what was to come.

*We’ve been very vocal about what it’s going to be like and how it’s going to put us to the test and how we’re going to deal with that and how we’re going to communicate and we’ve been talking about friends who are parents already and what we like about what they do and what we don’t like, you know what kind of thing, so we’ve been very communicative about how we’re going to support each other when the baby comes.* Participant 3

Although relationships with others were critically important to maintaining positive wellbeing, women also talked about the role of personal autonomy. Women described a strong need to regain control. All participants described pregnancy as a time of loss of control and intense vulnerability.

*You know you have to be very brave to be a mother because that’s it, you’re now vulnerable.* Participant 5

Advice and information were sometimes overwhelming, as was the pressure to make ‘critical’ decisions about abstractions such as birth and ‘parenting styles’. Their bodies were no longer their own; advice and information were frequently unsolicited, and all opinions were considered equal. Women felt uniquely accountable for the decisions they made in pregnancy and described the tension between doing what felt right and doing what others determined was right. Women described ways in which they consciously took control and acknowledged how this moved them from novice to expert pregnancy status. For example, women proactively searched for reassuring information.
I didn’t like the lack of control I felt, so all of these resources and Googling why I felt a certain way actually made me feel better about what was going on and that I wasn’t going to lose the baby at any given moment. Participant 3

Autonomy was exercised in a variety of ways, from proactively engaging and disengaging with online and offline sources of stress, to making highly detailed lists and plans.

10.5.4.2 Legitimacy of negative feelings

Although all women rated their own wellbeing relatively highly on a scale of 0-10, most also found it very difficult to articulate what wellbeing in the context of pregnancy actually meant to them.

I suppose a wellbeing of a pregnant woman is determined by… I don’t know… I really don’t know. Participant 3

When probed further, women largely described wellbeing in pregnancy in terms of their physical health. Negative wellbeing was ascribed physical causes. Women readily talked about sometimes feeling ‘down’ but were quick to connect this to being tired, uncomfortable or in pain. There was a sense that a physical cause gave legitimacy to negative emotions and, critically, that positive emotion was dependent on the elimination of these physical problems. This focus on the physical was heightened by the perception that maternal emotions were not prioritised by healthcare professionals.

They do kind of go ‘how are you feeling?’ but maybe only once or twice they actually asked me how I feel [participant’s stress]. Participant 1
One woman spontaneously described the way she compartmentalised her wellbeing in terms of emotions versus physical health, her relationships, her feelings of preparedness for birth and parenthood. She talked about how this enabled her to identify gaps and to acknowledge that her wellbeing was not random or all-encompassing but connected to how she was feeling on any given day about any one of her self-defined wellbeing variables.

10.5.5 Participants’ use of digital perinatal resources in later pregnancy

Usage of digital perinatal resources varied widely. Similar to previous study participants, women described extensively browsing for information online; feeling overwhelmed by the need to critically evaluate different forms of ‘evidence’; downloading, using and discarding pregnancy tracking applications; lurking and participating on closed Facebook groups and public forums. Some had used the internet more than expected, others less. Some relied extensively on books. One woman who had previously experienced a miscarriage said that she had not engaged with any perinatal information at all beyond statutory care until more than halfway through her pregnancy.

10.5.5.1 Self-directed

Throughout pregnancy, women’s use of digital resources had been self-directed. One woman talked about being pointed to a perinatal tracking application by her midwife, which she didn’t use because she felt it wasn’t relevant to her; otherwise, participants were provided solely with large amounts of paper-based information about resources and support by their healthcare teams. Women wanted their midwives to recommend
online resources, and to have a rationale for doing so; they particularly wanted signposting to resources that were evidence-based, useful and appropriate for their contextual needs. Instead, women described an absence of information about online resources from their midwives and the perception that their willingness to engage in self-care negated the need for appropriate signposting.

*Right yeah, I wasn’t expecting that to be honest. And yeah it’s kind of like I’m the patient at the moment right now and I do have the doctor background but it’s still kind of different as you get emotional at certain aspects and it’s sometimes difficult to really get into the depth of how good is the information you are getting and how can you trust those recommendations or are they just commercialised and it’s not really needed. Participant 6*

10.5.5.2 Proactive disengagement from digital life

As birth approached, women described their usage of digital resources as increasingly focused. General searches, motivated by anxiety and risk mitigation, had been replaced for most by reasonably confident and specific searching for practical information on birth and baby care. Taking a project management approach, women talked about how they now spent a lot of time online researching and buying items and looking for information and reassurance online from healthcare professionals about managing the birth process.

*The further I get, the more I want specific information whereas at the beginning I was like oh what do I want to know, it’s all so exciting. Participant 4*

The ‘rediscovery’ of common sense was raised by nearly all women. Women described becoming more confident in their critical evaluation of online information
and actively withdrawing from resources which were not reassuring and positive or which did not align with their developing values around birth and parenting choices.

_I think for me I couldn’t manage the information, so I was starting to think I don’t know who to believe, I couldn’t distinguish opinion from fact and while I welcome hearing about people’s experiences… I just found that the wealth of information became unmanageable…now I am withdrawing from it and I’m just trying for the next 4 weeks to find my own way and figure it out._ **Participant 3**

However, for women who had spent much of their pregnancies triangulating information in more than one language, the consolidation of cultural differences in care and approaches to pregnancy and birth became increasingly valuable, facilitating reflection on the rationale behind their decision making. One woman talked about still actively using a tracking application, which she valued for the connection she felt it fostered between her and her baby; however, the majority of women now found the information provided by the apps irrelevant, superficial and unhelpful.

### 10.5.5.3 Increased importance of connecting with other people

Participants talked about wanting to connect with peers as birth approached. Crucially, they wanted online resources to facilitate _face to face_ interaction. Although online experiential information was acknowledged as ‘a’ form of evidence, most women viewed online interaction (passive or active) with unknown peers negatively. At this point in the perinatal experience, information search was motivated by _efficiency_ rather than by desire for close connection.
If you have the opportunity to get the information from your community I think that is the best since that is an interaction and you can ask questions... [pregnancy is] quite a research process and you get lots of information which just frightens you and it’s more easy just to show up in a group and ask your questions and get everything but on those topics. Participant 6

Most women talked about not having had time to build a community of peers other than through attendance at parenting classes and the subsequent, slightly awkward setting up of WhatsApp groups. They described how they would focus on establishing a peer group in early motherhood. However, community building was an important part for some women. One woman described the unexpected benefit of having to meet people in order to collect things she had bought online.

I think a really big part of it has been Facebook, the selling sites that have popped up and are developing more and more have been absolute godsend...when you kind of agree to pick things up you think you recognise their face and you've seen their profile picture and stuff and so yeah it has just connected me more with some mums in the area which has been quite nice. Participant 7

10.5.6 Wants from an online parenting resource (content)

Women were asked to describe their ideal parenting resource for use in later pregnancy. The responses fell into three areas: content, design and features, and usability. Participants said that they wanted to see information provided by real-life peers that was reassuring and normalising and which presented the truth of early parenthood. Participants also wanted practical advice, tips and strategies to manage birth and early parenthood (breastfeeding in particular) and they wanted some way of knowing that they could trust the information. The credibility of the resource was
an important factor in translating its information into action. Two women talked about the importance of including information about the financial impact of having a baby and advice on how to return to work. It was critically important to participants that any resource provided clear signposting to local postnatal peer- and professional-run resources, especially those which were accessible through self-referral and didn’t require clinical input. Most women were unclear about what postnatal care they should expect to receive and wanted clarity on this and where to go if they needed extra support. One woman expressed a desire for human support (lay and professional) through the inclusion of a Q&A chat function and online discussion forum. Two women explicitly mentioned the importance of including gender-neutral content that was relevant for partners.

In terms of design, women wanted the resource to be tailored, unstructured and relevant to their context and information needs. Although women did not articulate specific features that would facilitate tailoring, they expressed interest in the inclusion of wellbeing support and preferences for design that allowed them to browse - and return to - content which they needed at any given time. Participants had reasonably high expectations of digital resources in terms of design: aesthetic mattered and one participant acknowledged that she trusted and used a resource more because of its overall look. Information needed to be presented in a variety of ways and needed to be heavily synthesised and not text-heavy.

With regard to usability, women wanted the resource to be simple, easy to use and for it to provide reminders about the value of using it. Participants talked about the
value of individual resources being lost in the general noise of online life: meaningful prompts could be useful to steer them back to a good resource.

**10.5.7 Wants from an online parenting resource (outcomes)**

Participants were asked about how they would know that a perinatal digital resource was ‘working’. Unsurprisingly, the most common answers coalesced around feeling reassured, feeling more confident and feeling more in control. However, women talked about other desirable outcomes.

**10.5.7.1 Physical outcomes**

Desired physical outcomes focused on breastfeeding and postnatal physical recovery. All but one woman (whose partner had breastfed their son) talked about the importance of being able to breastfeed and described being provided with information which had felt incomplete. Women were also aware of others’ experiences which ranged from easy to extremely challenging but did not feel equipped to understand what influenced each outcome. Physical recovery was an important factor in returning to some kind of normal and this was perceived to be a gap in most women’s knowledge, particularly caesarean after-care.

**10.5.7.2 Cognitive outcomes**

Desired cognitive outcomes included increased knowledge of practical baby care; clarification of when, how and where to seek professional help; increased confidence; increased awareness of coping strategies and management of challenging feelings.
10.5.7.3 Emotional outcomes

Desired emotional outcomes could be grouped under the simple umbrella of ‘feeling better’ about early parenthood. Explicitly, women talked about feeling reassured which would lead to a reduction in feelings of worry about birth and coping with a new baby. Two women talked about avoiding postnatal depression and the importance of knowing when baby blues had developed into a more serious condition that required expert help.

10.5.8 First impressions (before using bump2bump)

As part of the setup process, participants were supported in accessing the non-indexed site. They were asked about their first impressions of the homepage before being invited to register on the site and provide brief comment as they browsed.

10.5.8.1 Positive feedback

All participants described the website as visually appealing and commented on the contemporary aesthetic, use of colour and likeable logo. The registration process was described by all as being very easy and requiring just enough information to achieve a balance between speed and user privacy. The site itself was perceived as being easy to navigate and participants liked the information topics presented, describing them as interesting and relevant to their context. The information was perceived as being credible and this was attributed to three reasons: being linked to a known university; the presentation of information by both peers and professionals; and the lack of advertising.
So it does look interesting and also the fact that it’s done by somebody who actually knows what they’re doing, it’s not just a marketing thing, it’s not commercial, but it’s someone who is trying to customise a site to the needs of new mothers, that is quite reassuring. **Participant 1**

The synthesised information was appealing, and participants liked the way that information was categorised into a few sections.

*It seems to have a lot of information in one place that I would have searched for in lots of different places. Such as this, the local stuff, would have been what I would use Facebook for, the parenting information would be stuff I’d kind of use the Bounty app and search on Google for but it looks like it’s already the kind of stuff that you’ve worked out as being important and so I’ll definitely log in and see those and listen to people and see that they’ve got to say.*  

**Participant 7**

Women liked that it was unstructured and talked about how this allowed for the accidental discovery of information they did not know they would find interesting or relevant.

10.5.8.2 Negative feedback

Several women commented on not being clear about the purpose of the site, pre-registration. They talked about needing more information about content, format and rationale before they were prepared to register.

*Could be helpful if I could see a bit more about what is inside.*  

**Participant 2**

Not only was the site’s purpose unclear, but some of the women noted that its key messages were not clear enough on the homepage.
I had no idea that you were just looking at Oxfordshire, I didn’t know it was a local thing, which is really nice. **Participant 3**

Although none of the women refused to register on the site, most acknowledged that registration might put them off using the site at all, even if registration might indicate credibility.

*You know, honestly, if I’m looking for information, it matters how quickly I can access it, you know if you’ve got three other websites where I don’t have to log in then I might just think oh I can’t be bothered to register… It does give the site credibility and it’s good if you already know about it and if you know that you can find useful stuff on it but you’re new to it then it’s more like a barrier to access it, honestly. I guess the only way around that would be to promote the website so much that people trust it and want to go into it.* **Participant 9**

Some women felt that the credentials of the parenting professional needed to be made clearer. The branding of the site was insufficient to reassure users of why this person was offering parenting advice.

*Yeah, just whether she’s a midwife, just a nice lady, just kind of where she was coming from to talk to me. Ok great, but why are you telling me this?** **Participant 3**

One woman felt that the site offered too much information; another commented on the limited information contained in the local resources section. Platform incompatibility and settings on participants’ devices caused three women significant issues in viewing the site. One woman had previously accidentally adjusted her screen so that content was viewed at extreme magnification. She had been unable to work out how to adjust this herself for some time and was supported in resolving
this during the interview. The other two women had unexpected problems with device incompatibility, where the white-text menu was displayed on a white background.

Yeah, I've got to admit that when I see something like that that's not mobile compatible, that sort of thing can put me off, it depends how much time I've got and how interested I am and how desperate I am for the information. but I can get frustrated by things that aren't compatible for my mobile because I use my mobile so much. I mean I'm only looking at this because you're telling me to look at this at the moment, you see. Participant 9

10.5.9 Participants’ postnatal wellbeing

All but one woman described a perceived drop in their wellbeing, and all women talked about their wellbeing in positive and negative terms. However, while antenatal wellbeing had largely been described in ways relating to physical and financial health, pregnancy-specific worries, and the autonomous actions taken to manage these, postnatal wellbeing was perceived as being far more complex.

10.5.9.1 Major influences

Breastfeeding was raised by all participants as directly impacting on postnatal wellbeing and dominated the conversation for those who had struggled with it. Six out of the nine participants talked about the intense difficulty of breastfeeding and described either an absence of professional support or extremely challenging interactions with healthcare professionals who provided little or conflicting advice or whose approaches were perceived as insensitive.
A ‘lovely’ girl, a ‘lovely’ midwife [participant’s stress], put my precious baby by the back of the neck and was smashing her into my bleeding nipple and I looked over at Tom and he said that I didn’t say anything but he said that he knew then that you know, it’s fine, you don’t have to do this. I can’t. It was awful. Her face was covered in blood, it was horrible. And she just kept smashing her onto me and then she’d latch and the midwife would go ‘there you are’ and then walk away and then in that moment, she’s let go. Participant 3

At the time of interview, two women had decided to stop breastfeeding completely and another four were topping up with formula. Getting to this point was described as demoralising and extremely effortful.

I went into it just thinking we’ll breastfeed but if it doesn’t work or doesn’t suit us, it’s fine but I also went into it thinking everyone can breastfeed, it’s a really natural thing, it just takes a bit of work. But I struggle to find any people who have worked harder, I know there are other people who have to work hard as well but I don’t think there are many people how have worked harder than I have to make breastfeeding work. And it doesn’t work, for us, at the moment. Participant 4

Struggling with - and particularly deciding to stop - breastfeeding took on enormous significance and impacted on women’s sense of self.

I realised that we would have to give formula…it’s a very emotional decision where you think you are not good enough to support your child. Participant 6

One woman talked about how much it had affected her relationship with her partner, who struggled to understand the stress that being unable to breastfeed was causing her. She acknowledged that his attempts to help by buying bottles and formula were well-intentioned but ultimately only made her feel alone and unsupported. Conversely, breastfeeding was described as a positive and relatively easy experience.
by the three women who had breastfed with little to no problem at all and who were all now breastfeeding exclusively. However, one woman did reflect that she was aware of how difficult breastfeeding was for others in her peer group and that her enjoyment of it was a difficult topic to raise with anyone other than selected others. Interestingly, she and the other two participants referred to themselves as being ‘lucky’ to be able to breastfeed to easily.

If most of the women were disappointed with their breastfeeding experiences, they were also surprised that this was the dominant influence on their wellbeing. All women talked about the assumption that they would feel more traumatised by the birth. Antenatally, birth had been the overwhelming focus but had come and gone, and some women described the realisation that it signalled the start of the process rather than the end. Five women described difficult births, including emergency caesareans and readmissions to hospital due to complications. However, all described the experiences quite pragmatically before turning back to the overriding disappointment of breastfeeding.

*I was disappointed that we had to go to hospital and I was disappointed that I went in an ambulance and he went in the car, you know, within an hour of his birth, but I had other feelings, my mental health and mental wellbeing didn’t really suffer at that point. And so the main issues that we have had are the issues with the breastfeeding and not being prepared for how difficult that could be, and for the disappointment that’s come with it.* Participant 4

Interaction with healthcare professionals around breastfeeding was a negative experience for all but one woman. However, other interaction with healthcare professionals was generally perceived positively, although one woman talked about clashing with the delivery midwife who would not acknowledge that she was in active
labour. The women who had been readmitted to hospital described the unexpected benefit of being able to ask questions on a wide variety of topics and receive hands-on help and reassurance which also mitigated the need to search for information.

"That was actually quite helpful postnatally. I did actually end up spending two nights in hospital so when we were discharged they gave us all the numbers which we needed if something happened, for her and for me, so that was quite easy, and I didn’t need to do any research in that regard." Participant 6

"Because we’ve seen quite a lot of people so just between the community midwives and the breastfeeding clinic, I think we’ve seen all the midwives from the JR hospital anyway [laughs], so when we’ve had questions there was someone to ask directly, rather than you know, having to sort of look for it." Participant 8

The reassurance afforded by postnatal community care was also valued by one woman in particular.

"I’ve really valued the midwives coming. I’d say that was really valuable and I definitely felt like you know, great after each meeting. Suddenly my day had been lifted because I had someone telling me you’re doing everything great." Participant 9

Antenatally, women had talked about their wellbeing in terms of physical health. This was also relevant postnatally and was particularly so for those who had recovered quickly from caesarean or debilitating pregnancy-specific pelvic pain. Conversely, participants also talked about their disappointment in their postnatal physical appearance.

Participants described the reality of new parenthood as a ‘shock’, a ‘rollercoaster’, and ‘crazy’. Echoing previous study participants, there was the general perception
that nothing could prepare them for managing the first few weeks of life at home with their baby. Keeping a sense of humour was important.

*I feel like you could read everything in the entire world but when it comes to changing a nappy, when it comes to that day, that glorious day when we found out that you can get poo on your shoulder blades through force alone [laughs], and nobody can hear you shouting for help to run a bath at 11pm, nothing can prepare you for that, for that sheer moment of ‘I’ve got to deal with this and I don’t know what I’m doing and just don’t let any poo get in her mouth’ [laughing] or up her nose. Participant 3*

All except one woman talked about the impossibility of understanding new parenthood in advance; the exception was the participant who was a childminder and whose partner had given birth to their own baby two years previously. However, one participant speculated if it might be more helpful to support women in developing a certain kind of postnatal resilience, instead of focusing on wellbeing.

*People say to you ‘oh it’s a massive change’ and you can’t overestimate it, your life will never be the same again, your life isn’t your own, but these are such well-worn phrases that you just go oh but we’ll be OK. How hard can it be? I think the resilience that you need to get through childbirth, maybe you need a different kind of resilience to get through the first few weeks at the very least. Participant 4*

This kind of resilience was thought to be particularly important when partners had returned to work and the novelty of the baby had worn off for other people. Some women described how much they had underestimated the negative impact of being alone at home with sole responsibility for a small child. Conversely, the experience of early motherhood had been better than expected for some women. One participant
had returned to part time work, while another had found that her rapid physical recovery meant that she was able to go out and meet other people sooner than expected.

Participants reported that the decision to delay the exit interview meant that they were better able to reflect on their experiences of early motherhood. In particular, they described noting the ‘progress’ they had made since coming home and how much this positively impacted on their wellbeing. Women talked about turning a corner (Participant 4) and life just feeling better (Participant 6). They talked about having increased confidence in understanding and caring for their babies and how this enabled them to establish routines which in turn supported confidence and decision making. One woman wondered if this was mainly because she was lucky and just had an easy baby (Participant 9). However, all women talked about the powerful positive impact on their wellbeing of what they described as the emergence of maternal instinct. Control and autonomy had been an important aspect of maintaining positive antenatal wellbeing and women talked about early attempts to impose similar control over early parenthood. They reported doing things such as scheduling too many meetings with friends and family or trying to impose a routine on the baby. These actions increasingly went against their burgeoning maternal instinct and women reported being quite happy to give up ‘control’ over the situation, preferring instead to do what ‘felt right’.

An important facilitator for this instinct was peer support. All women described at least one peer relationship that was perceived as being actively important in supporting
them in understanding their babies, decision making and maintaining positive wellbeing.

*I make decisions based on what they say or the encouragement that they give me, so it’s other mums who give me the confidence to do something and so much of it is just ‘do what works for you’, whatever works for you, it doesn’t matter, don’t worry about it.*

**Participant 4**

A few women had actively sought out peers antenatally while others found that they were needing to make more effort postnatally than anticipated. Shared values were more important for some women than for others.

*I mean people so often compare babies with animals and dogs and in a way [laughing] I do think they have lots of things in common. I mean people who have dogs, you go out with your dog and then you find other dog owners and then you’re chatting [both laughing] and I think it’s similar.* **Participant 5**

However, it was also acknowledged that peer interaction could be challenging. Women reported how, looking back, pregnancy had been a linear and reasonably generic process. Postnatally, fundamental differences around approaches to child rearing resulted in difficult conversations and an avoidance of peers whose views were challenging. Peer interaction was also difficult for women who had been unable to breastfeeding, who found that local peer support was often hosted as part of a breastfeeding café or similar. Attending such groups was upsetting and two women talked about feeling doubly isolated as a result.
10.5.10 Participants’ postnatal usage of digital resources

10.5.10.1 To find information

The main driver of all usage was meeting immediate needs for just-in-time information. All women reported typing questions into the browser when they had a question or concern. Frequently, this was just to find a telephone number in order to access human support. Online resources were not returned to as known, ‘safe’ spaces and, again, none were recommended by healthcare professionals. Rather, the resource ‘worked’ if it provided the solution needed at that moment in time. The extensive browsing and research which characterised pregnancy was now described as a luxury. Recommendations from other mothers were highly valued.

_KellyMum, that’s really good, although it’s in America and you have to take things with a pinch of salt, but it’s amazing. She has such a wealth of information and I know to look there because somebody, a real person in the real world, who I met at a baby café after having my baby, has told me to look there._ Participant 9

Women described mixed experiences of using perinatal apps. As described in Chapter 5, all women who had used antenatal apps noted a distinct gap in information provision at the transition point between the third and fourth trimesters. Although some of the apps moved into offering postnatal advice and information, the perception was that this was often clumsy and only highlighted individual differences. Again, women described how antenatal information had been relatively generic; although the information had come to be perceived as increasingly superficial as they became increasingly expert in their pregnancies, it had nonetheless supported their
understanding of the linear, predictable pregnancy process. New babies seemed to be more different than similar.

There’s things like BabyCentre, which I’m using less and less now, because I feel like there are so many variables now, they’ve become less useful. Participant 4

Conversely, other women found the familiarity of the developmental content and how it was delivered reassuring.

Wonderweeks has fitted in with her age, it has fitted in with her behaviour and actually it gives you clues, it’s just general, like just give her cuddle type information but certainly it made me feel better that she was OK, I wasn’t doing anything wrong, it was something developmental that was happening. Participant 3

Women who struggled with breastfeeding reported watching videos on YouTube to try and get a better understanding of how to position their baby and achieve a good latch.

Social media was notable largely for its absence from women’s narratives as a source of perinatal support or information. One woman talked about her conscious decision not to post pictures of her baby online and another talked about just losing interest in it over time and not viewing it as a valuable resource in general. Two women talked about using it mainly to access local groups for purchasing baby products. One of these women and only one other talked about using it as a social platform, and only for connecting with existing friends rather than using it to make new connections. Facebook was problematic for one of these women who described being irritated by large amounts of advertising offering a confusing mixture of antenatal and postnatal products and services.
10.5.10.2 To connect with others

All women reported using WhatsApp as their main way of connecting with peers. While only one participant reported using Facebook regularly to catch up with friends, the WhatsApp groups set up at the end of antenatal classes were starting to be used extensively, even by women who were initially sceptical about the value of connecting with relatively unknown others.

Well, actually recently it has been a lot of WhatsApp messaging even with new people because we did NCT classes before she was born and we were the first ones to be born even though we were the second or even the third due date but you know oh everyone is saying this one’s born and this one’s born now and it’s quite nice actually… but actually they have been quite good, I’m trying to take part a little bit. Participant 7

Some women had rediscovered the value of forums in postnatal life but for the very specific purpose of reading product reviews. The women who used forums lurked rather than actively contributed to conversation.

I’ve been using forums again now… we haven’t bought a proper sling for her so going to forums and seeing and reading different opinions about which sling would be better and things so yeah, not so much apps now but more mothers’ forums. Participant 5

10.5.10.3 To connect with ‘real life’

Participants talked about the importance of using ‘spare’ time online wisely. One woman laughed as she described how her postnatal online activities had largely been limited to completing her tax return. Other women were keen to make sure that they used the time to answer emails, shop or read the news.
..some feeding sessions do take some time but I usually use the time to catch up on the newspaper, what’s going on around myself, less about her. So that’s my time off so to speak [laughs]… It’s more for me as a person and less about me as a mum. Participant 6

10.5.10.4 (Pro)active disengagement

Women talked about reduced use of online resources in general. Usage was now far more nuanced and served to meet an immediate need. For some, reduction in online activity was proactive choice based on a decision to avoid overwhelming or contradictory information. Human support was increasingly prioritised as a more efficient and satisfying way of accessing information.

I’ve not been online so much. I still haven’t done that. That seems less important now. And I think before, when I was looking for information, it’s much easier now to find people, I think I’m less online than I was before. Participant 4

Another woman talked about the value she placed on learning from interacting directly with her baby.

Since she’s been born it’s much less, I would say almost none, since it’s more spending all the time you have with her and figuring out what an expression of her face means, and the whole day just fills up with interactions with her so it’s just, it’s not only that you don’t have the time but also you gather much more information from just observing her instead of just Googling things or finding out things. Participant 6

One woman who had begun actively avoiding online resources in later pregnancy due to feeling overwhelmed by the information available described how she was now consciously moving away from online postnatal resources as a way of reassuring
herself that she did not need to rely on others for information and approval of her parenting choices.

I just decided to stop using my phone in bed and if I’m bored to do a crossword… because there is just so much and so much contradictory and you know what, I just need to trust myself a bit more. Participant 3

10.5.11 Positive feedback (after using bump2bump)

Participants expressed a wide range of positive views about bump2bump, and much of the positive feedback matched with what participants had said they had wanted in the first interviews relating to content, design and usability.

10.5.11.1 Content

Women found the content informative, useful and comprehensive. They reported liking the way that the information reminded them of and reinforced key content they might have encountered during the perinatal journey but forgotten about.

It was really good because it was the basics that you need to know and things that you want to know to start off with. Participant 1

Participants commented on the authenticity of the peer content. They identified with the women and found the simplicity of the delivery reassuring and normalising.

I liked it and I liked the videos because they were clearly real people, they weren’t, it wasn’t glossy, it wasn’t staged, it was like this but with a camera. Participant 3
The combination of peer and professional content was perceived to be a good way of combining different forms of expert input and users liked the option of engaging with women’s stories alongside more directive, factual information from a parenting expert. The information itself was perceived as being relevant, appropriate, broad and reassuring.

*Very, very useful and very relevant. Again, I keep going back to the expert lady but she was you know, you felt that the information she was giving you was explained very well and it definitely was relevant and it was useful to consider the different aspects of your life with a baby, not just sort of coping with a baby but your own emotional wellbeing as well.* Participant 9

The information was also perceived to meet immediate needs. One woman commented that parenthood was totally fine *until it wasn’t* (Participant 4) and then quick access to just-in-time information was critical. Two women talked about how specific information read on the site had come back to them at a critical moment during the birth process. Postnatally, women reported finding the information on feeding and practicalities of newborn care valuable. As well as finding the peer content authentic, women reported that the information on the site as a whole was truthful in its presentation of a range of positive and negative experiences. This supported feelings of trust in the site and also helped some women manage their expectations around the birth process itself.

*I think it was realistic, like don’t go with high expectations and anything can happen and you know I think it was very useful for that.* Participant 5

The multimedia content was valued for the emotional connection it afforded with the women on screen.
I really liked the fact that you know, it was an interview, especially a video interview rather than just reading a text. Not only was it more sort of made to feel that it was a real testimony but also it's almost like you're talking to them and you can feel their emotions and stuff. Participant 5

Users liked the local resources section and valued the absence of advertising on the site as a whole.

10.5.11.2 Usability

Participants found the site easy and intuitive to use and reported being able to navigate around the site without any problems. Women liked the clear and simple layout and found the tone of the language used reassuring.

Everything was very clear, easily signposted, especially if you’re having a ‘three am, she’s not breastfeeding, help’ kind of click on something. Participant 7

It was helpful and it took some fears from you because you see the mums are happy with their babies and you see that no matter what happens, it will get sorted and it will settle and if they are happy, I can be happy. Participant 2

10.5.11.3 User experience

Participants talked about finding it more useful than they had expected to. Some women reported that they had initially been sceptical about the value of the heavily synthesised content, particularly those who had attended parenting and birth preparation classes. Overall, women found the site useful and a good resource for meeting their parenting needs.

For what I wanted it to do when I wanted to use it, it was great. It did everything I needed it to. Participant 7
Women described how using the site in late pregnancy had been a useful ‘top-up’ and had complemented and reinforced known information. This contributed to them feeling reassured and better prepared for the early days of parenthood.

One was I think called ‘preparing for life with your newborn and caring for them’, I found those really useful because as I said, the first few days, it’s really manic and you’re not really sure what you’re doing. **Participant 1**

Women liked the convenience and accessibility of the website; most commented positively on the way it condensed and synthesised existing information under one geographically-constrained ‘umbrella’. They found the videos thought provoking and helpful in terms of offering choices without an ulterior motive of product placement or strict adherence to a prescribed parenting style. Participants liked the way that some of the videos encouraged involvement of the mother’s partner. The local resources section was perceived as particularly intuitive and was valued for the way it encouraged women to meet peers in spaces considered ‘safe’ due to being recommended by other new mums. Women liked the fact that they could access the site across the transition to parenthood and the way in which the site specifically covered the transition. Postnatal access to the site as a whole was valued and some women talked about the way in which the site took on a new value when they were better able to understand some of the content in a new context.

What was interesting was watching them once I’d had the baby I knew I was watching, and I’m thinking especially of the ones from that main lady who had all the information, it’s suddenly really clicked in, a lot of them, afterwards, because it was relevant. **Participant 9**
10.5.12 Negative feedback (after using bump2bump)

10.5.12.1 Content

Some women felt that the site lacked enough nuanced information around the detail of caring for a new baby. One woman who used the search function was not able to find information relating to her (primarily medical) queries and this was frustrating. Participants wanted to see information presented in different ways and this was particularly relevant for information around breastfeeding, where images, diagrams and videos on placement would have been more useful. One woman felt that there were too many peer-content videos. Participants also reported needing to see more content in the local resources section in order to encourage them to return repeatedly to the site. In addition, women wanted to see more content presented by and for partners. Although the content was generally acceptable, women were still unsure of the site’s credentials and this was especially the case for the parenting professional.

Yeah, there was something in particular that I remember. I may be wrong but the lady who gives the professional tips, I don’t remember knowing or seeing any credentials. Like why this lady was telling me anything. She was very nice and seemed really saying exactly what other people have said as well as really useful information but at the same time I wasn’t sure where she was coming from. Participant 3

The site’s overall purpose was unclear to some women who felt that they might have made better use of bump2bump if they had been made more aware of its geographical specificity and focus on the transition to parenthood.
All women who accessed it reported negative feedback regarding the wellbeing toolkit. Participants did not like having to register on another site external to bump2bump. This alone prevented some women from using it at all. Most women were more focused on accessing practical information and did not want to invest valuable time on a toolkit they felt they did not need. One woman who used it felt that the content was presented inappropriately and actively avoided it after first use.

_I didn’t like the negativity of the titles. It was kind of like ‘you’re losing your mind and how to stop it’ [laughs] and I was like I’m not sure that I am, or like ‘how to stop yourself from losing your temper’ and I was like I don’t want to lose my temper and that’s not really something that I want to consider happening right now. I was put off by the informal and quite real titles but at the same time when I’m worried about losing my temper and losing my mind and life going to shit, it was a bit too real maybe [laughs]._ Participant 3

Another woman talked about it being highly structured. It was not intuitive to use, and she perceived it as being very medicalised.

_It was quite structured wasn’t it? I think. if I recall and I think I was put off by that, a lot of that stuff I just want to dip in and out. I didn’t necessarily want, I don’t know if it was based around a CBT course thing…I felt that I didn’t want something structured like that. Had my wellbeing been, had I not been so well, then maybe that would have been helpful._ Participant 4

10.5.12.2 Usability

Usability problems were reported by two women, one of whom accessed the site on a tablet. For both, the site’s menus were difficult to view and scrolling through the many videos was effortful. Two other women reported that some of the video content took a long time to load.
10.5.12.3 User experience

While the majority of women were generally positive about their experience of using the site, one woman expressed being disappointed that the site had not lived up to her expectations. In particular she had wanted human support and the ability to ask medically-related questions.

10.5.12.4 User experiences of EMA

All women provided important feedback regarding the use of PACO as a data collection tool during the transition to first time parenthood. Participants acknowledged that the application was a good idea in principle in that it was not intrusive, it was easy to use and the prompts to complete measures were also useful reminders to engage with the site itself. However, participants reported significant issues with the notifications, which were either inconsistent or absent for some of the women. This placed considerable burden on participants who felt compelled to remember to complete measures on their own. In addition, women often snoozed the notifications with the intention to complete them at a later time point. They reported needing additional reminders to complete the initial prompt. One participant felt that the measures themselves were intrusive and was initially sceptical about what wellbeing had to do with using the website. Another woman described being frustrated that she could not skip questions within the measures and that this was off-putting (although this function had been piloted successfully prior to recruitment). One participant talked about the problem of receiving prompts and completing the measures at the point of transitioning from pregnancy to motherhood: she described being very careful to complete all notifications but that this had slipped when she went into hospital to give birth. She noted that she had been sent a prompt during birth;
she did not complete any measures postnatally. Some women talked about consciously providing answers to the measures that indicated they were feeling more positive than they actually were. Conversely, other women wondered if they should lower their responses so as to provide a more interesting picture of their generally-positive wellbeing.

10.5.13 Barriers to use

The main reasons women gave for not accessing bump2bump fell into three areas:

(i) Intrinsic or person-related factors: feeling tired, feeling prepared enough, forgetting about the resource, proactive disengagement with all digital resources, preferring face to face interaction, feeling unmotivated.

(ii) Extrinsic or contextual factors: lack of time, forgetting how to access the resource, lost login details.

(iii) Factors to do with the website: problems with the layout, wanting some kind of additional online human support, wanting to access it on another device.

10.5.14 Suggested modifications

After using bump2bump, participants provided a wide range of useful suggestions for how to modify and improve the website.
10.5.14.1 Content and design

- Remove registration/login
- Add more information to the local resources page to encourage women to use and contribute resources of their own
- Add the number of reviews provided to each resource to encourage women to read reviews and provide reviews of their own
- Present parenting information in different ways: videos of latching; infographics of suggested clothes according to weather conditions; printable list for packing hospital bag or ‘top tips’ from new mothers
- Provide fewer videos
- Integrate and fundamentally revise wellbeing toolkit
- Include information to access urgent help
- Clarify purpose of the site as a whole and ensure its key selling points and provenance are clearly highlighted on the homepage

10.5.14.2 Usability

- Include guidance on how to use b2b in the form of a pop up at first use which could offer pointers on how to use the site effectively in terms of signposting to the search tool and save-for-later function
- Ensure platform compatibility
- Add prompts and reminders to use; all women described the exit interview as being an important reminder of the site and described the value of meaningful prompts

10.5.14.3 Reconsider the timing of deployment

Five participants commented that they would have liked to have been given access to bump2bump earlier in their pregnancies. For two women this was because their visitors’ arrival coincided with taking part in the study and they described having limited time to engage with the site antenatally. Another woman talked about actively
avoiding all but a small collection of trusted online resources in late pregnancy. The other two women talked about pregnancy in terms of being a ‘teachable moment’ and that access to a site at around six months gestation would have been ideal, when they perceived that information gathering became more organised and meaningful.

10.5.15 Perceived impact of using perinatal digital resources in general

Participants were asked to reflect on the impact of using perinatal digital resources in general.

10.5.15.1 Needs still unmet

Women had described ideal outcomes from using perinatal digital resources which broadly coalesced around the ability to breastfeed, increased general parenting knowledge and reassurance. Participants talked about the volume of information they had digested over the course of the perinatal journey and, while they recognised how much they knew, women still felt that the core needs identified in the entry interviews were largely unmet. Exposure to so much information had resulted in an inability to discern the signal from the noise (Participant 4).

I’ve looked at all the websites and read all the books and I don’t think any of the information or any of the courses we did had any impact on how I felt. Participant 1

Certain websites were valued but were insufficient in meeting new parents’ unique, in-the-moment information needs.

All of them were useful, particularly the official ones, but incomplete.

Participant 2
10.5.15.2 Fundamental limitations of perinatal digital resources

Digital resources were broadly valued for their ability to fill in the gaps, connect peers and provide welcome distraction. However, women also reflected on the fundamental utility of perinatal digital resources in some critical contexts.

*I mean I think the Internet is great, don’t get me wrong on that, but for certain things where you need practical advice, someone just to show you how to do something, that doesn’t necessarily work. I’m just thinking for breastfeeding, let’s say it doesn’t work for whatever reason, you can search online for however long you want but that might not help you much.* Participant 8

10.6 Discussion

10.6.1 Summary of key findings

At the time of writing, this mixed methods, in the wild study was the first to explore pregnant women’s wellbeing and their real-time usage of digital resources in the transition to first time motherhood. The methods and measures used to collect wellbeing information were generally acceptable as were the content and design of the prototype. Women’s usage of digital resources in late pregnancy and early motherhood varied widely. The study found that women’s online behaviour in the late stages of healthy first time pregnancy narrowed significantly and was largely limited to a need for reassurance and brief information regarding birth and the practicalities of baby care. Such information was used to confirm existing knowledge, and to fill in information gaps. Women preferred antenatal information to be delivered by a credible professional. Postnatal online behaviour was driven by a need for just-in-time
information delivered by a credible professional and opportunities to reflect on birth and parenting experiences, provided by peers. The women in this study overwhelmingly preferred face to face over online peer support. In general, features perceived to be important for inclusion in a resource to support the transition to motherhood were those which provided heavily curated and synthesised, credible information about practical baby care and birth, ‘real life’ stories, and information about ways to meet peers in the local area. Wellbeing support was hypothesised as being useful but was not used in reality. Engagement with the prototype varied widely and women described the need for prompts and reminders to engage with useful resources. Women described a shift from a high antenatal need for autonomy to a postnatal need for competence and connection to others.

These findings lend support to and extend previous research. First, previous work has illustrated the variety and complexity of the perinatal experience ‘even’ in the context of routine pregnancy (Doherty et al., 2018; Peyton et al., 2014). Existing research has described the disconnection between the expectation and reality of new motherhood, often attributed to a perceived lack of knowledge or support, particularly relating to breastfeeding and practical care of a newborn (Barkin & Jani, 2016; Brady & Guerin, 2010; Eastwood, Kemp, & Jalaludin, 2015; Gibson & Hanson, 2013; Lazarus & Rossouw, 2015; Olander et al., 2019; Slomian et al., 2017). The ‘shock’ of early motherhood described in the current study echoes research (Luce et al., 2016) which questions contemporary women’s over-reliance on the media to provide realistic portrayals of birth, breastfeeding and early motherhood. This reliance on (incomplete) media representation has been connected to dissatisfaction with parenting education and disconnection with geographically disparate friends and family and a parallel finding is seen in the current study. Women’s subsequent and
effortful reframing of the perinatal experience can be explained as a consequence of a significant perceived ‘biographical disruption’. Previous literature has described such disruption in the context of chronic illness (Bury, 1982), in the way in which “structures of everyday life and the forms of knowledge which underpin them are disrupted” and “individuals, their families, and wider social networks [are brought] face to face with the character of their relationships in stark form, disrupting normal rules of reciprocity and mutual support.” This ‘sense-making’ versus ‘meaning-making’ in the context of chronic illness and finding a ‘new normal’ has also been described in the HCI literature (e.g Burgess et al., 2019; O’Kane, Park, Mentis, & Blandford, 2016), in which people are shown to work through distinct but overlapping ‘information work’ phases. A similar shift in women’s management of the information and support work involved in becoming a new parent can also be described by self-determination theory and the current study highlights an additional mechanism by which we might understand and design for perinatal wellbeing. In late pregnancy, women prioritised personal autonomy, particularly in relation to birth choices, preparation and proactive disengagement from resources other than those meeting immediate needs. This taking of control was acknowledged as an important part of managing worry. However, postnatally, women explicitly yielded control in their search for directive advice and relational support. Women attributed early postnatal positive wellbeing to feelings of competence and support rather than being in control.

Secondly, previous research has largely described perinatal women’s usage of online resources for information and support as prolific and ubiquitous (Plantin & Daneback, 2009b; Prescott et al., 2017; Sayakhot & Carolan-Olah, 2016; Slomian et al., 2017). Research has also described women’s dissatisfaction with quality and continuity of information (Olander et al., 2019), the feasibility of online programmes to improve
parenting skills and reduce pregnancy-specific worry (Hamilton et al., 2016; Nieuwoer et al., 2013; Slomian et al., 2018) and the lack of guidance on digital resources from perinatal healthcare providers (Dalton et al., 2014; Hundley, van Teijlingen, & Luce, 2015). These themes are all represented in the findings from this study. However, this study provides a more nuanced understanding of women’s engagement with perinatal resources than has previously been described. Participants in this study highlighted that they were more likely to proactively disengage with many perinatal digital resources as part of managing pregnancy-related worry and meeting increasingly narrow information needs. In addition, there were clear preferences for information provided by credible professionals antenatally which shifted to just-in-time medical and support needs being met postnatally by a combination of professionals and similar peers. Women were unable to identify a digital resource that had a key positive impact on their perinatal experience and described the importance of just-in-time information filling in gaps in community care or facilitating face to face postnatal interaction with local peers.

Thirdly, this study adds weight to the call for wellbeing measures to be context-specific (Alderdice et al., 2013, 2017; Linton et al., 2016b). Previous research shows that existing measures such as the Edinburgh Postnatal Distress Scale or the Whooley questions used in the clinical consultation are insufficient in identifying women at risk of poor wellbeing because of their narrow focus on clinically significant psychological distress rather than sub-clinical, pregnancy-specific worry (Darwin, McGowan, & Edozien, 2016). Participants in the current study reported high levels of pregnancy-specific worry across a number of domains including housing, relationships and money which perhaps challenge assumptions around what middle class, educated women with routine pregnancies ‘worry about’. In addition, women
described their worries about issues not addressed by the validated measures such as previous experiences of miscarriage and their concerns about the community care they may or may not receive. Participants in this study described that they were willing to discuss their concerns with healthcare providers and that midwives play an important role in managing wellbeing. The critical role of the midwife in supporting perinatal wellbeing has been described (Higgins, Health, Downes, Carroll 2018; Lagan, Sinclair, & Kernohan, 2011; Rollans et al., 2013; Seefat-van Teeffelen et al., 2011). However, the way in which women are invited to talk about their worries during pregnancy is an area that still requires exploration.

Fourth, this was the first study to use EMA methods to gather real-time data from perinatal women regarding their self-reported wellbeing and usage of digital resources during the transition to first time motherhood. This gap in the perinatal literature has been highlighted in recent research (Doherty et al., 2018) as a unique opportunity to examine the feasibility of collecting real-time versus retrospective data. Whilst the perinatal participants in Doherty et al. (2018) hypothesised that they would complete EMA reports ‘more often and with greater honesty’, this was not necessarily the case in the current study: some participants frequently missed, ignored or delayed responding to notifications and, crucially, were explicit in exit interviews about answering measures in a socially desirable manner. Biases associated with momentary reports, such as reactivity, habituation and defensive strategies such as social desirability and positive self-presentation are acknowledged in the EMA literature (Doherty & Doherty, 2018). Problems with the functionality of EMA systems similar to those described by current study participants are also described in the literature (van Berkel, Ferreira, & Kostakos, 2017; Kini, 2013), in particular the triggering of notifications and the complexity of multi-platform compatibility. While
EMA data collection methods were perceived to be acceptable (and offer significant benefits over reliance on diary studies, retrospective accounts or think aloud protocols), study design is of particular importance, especially in the context of a sensitive life transition.

10.6.2 Strengths

To my knowledge, this was the first study to use EMA methods to gather real-time data from perinatal women regarding their self-reported wellbeing and usage of digital resources during the transition to first time motherhood. The methods used were appropriate in answering the specific research objectives (section 10.3). The measures used in the study were selected based on prior evidence from examination of the multidisciplinary literature (reviewed in Chapter 4) and in-depth qualitative work with target users of perinatal digital resources (reported in Chapter 5). Usage of the prototype varied but the content, tone and design were described by participants as acceptable and useful. Entry and exit interviews provided rich, contextual data which supplemented the usage data and wellbeing data collected using EMA methods. The EMA data collection methods were acceptable and the automatic recording of the data in real-time minimised participant burden. No participants dropped out or were lost to follow-up. The study provided initial evidence that curated content relating to birth, practical baby care, and the facilitation of face to face contact with local peers and professionals is acceptable and useful to women in late pregnancy and early motherhood. In addition, it is acceptable to participants to gather data about the wellbeing and usage of digital resources in this manner.
10.6.3 Limitations

The study was conceptualised as being wholly ‘in-the-wild’. Participants were provided with a prototype and invited to use it as little or as often as desired. They were also encouraged to answer the EMA notifications as desired. As a result of such a ‘light touch’ approach - which was motivated by the intention to minimise participant burden - some participants hardly used the prototype or ignored notifications, leading to large amounts of missing data. The study may have benefitted from taking a more structured approach using design features shown to be effective in ehealth interventions (Morrison, Yardley, Powell, & Michie, 2012) such as regular reminders to complete measures and invitations to use all aspects of the website (particularly postnatally). In addition, future studies might employ both time- and event-prompted EMAs, inviting users to respond to a few questions about their engagement with the prototype immediately after having engaged with it, rather than asking them to do so retrospectively. This would need to be piloted carefully to minimise participant burden.

10.6.4 Conclusion

This study illustrated the complexity and diversity of the perinatal experience even in routine pregnancy and provided a nuanced understanding of how perinatal women use digital resources to meet their information and support needs. The study provided an understanding of what content is desired at the point of transition from the third to the fourth trimester, and how such content should be presented and by whom. Novel methods of real-time data collection are feasible in the transition to motherhood and wellbeing measures which explore pregnancy-specific worry are sensitive, appropriate and preferable to those which focus on the identification of psychological distress.
This was the final empirical study of the thesis. Chapter 11 brings together key findings from the narrative synthesis and the five empirical studies conducted as part of this thesis, and highlights implications for research, policy and practice, in addition to avenues for future research.
Part 4: Synthesis
Chapter 11 General Discussion

By drawing on best practice from the fields of HCI and behavioural science, this thesis took an interdisciplinary approach to study the way in which digital resources might be developed and evaluated with the aim of supporting maternal wellbeing in the transition to motherhood. Chapters 4-10 reported the results of six linked studies: a systematic narrative synthesis of available literature and five empirical studies that employed a range of methods to address the following research objectives:

1. To identify and synthesise the evidence regarding digital wellbeing interventions for women in uncomplicated first-time pregnancy;

2. To develop a digital prototype resource which is acceptable to the target population, is likely to have good uptake and use, and which contains active ingredients and theoretical underpinning that are likely to effectively address the tractable problems identified above;

3. To explore the usability, uptake, acceptability and perceived impact of the prototype in the target population in a real-life context.

In this final chapter, the key findings are discussed in relation to the thesis objectives. The following sections provide a reflective overview of the general strengths and limitations of the key findings and research process so as not to replicate the detail provided at the end of each chapter. This is followed by reflections on the implications for further research, policy and practice and a set of recommendations regarding the
development, evaluation and usage of digital resources for use during the transition to motherhood is proposed.

11.1 Summary and interpretation of key findings

11.1.1 Objective 1: To identify and synthesise the evidence regarding digital wellbeing interventions for women in uncomplicated first-time pregnancy.

Understanding the nature of perinatal women’s wellbeing needs is crucial if we want to develop effective, useful and engaging digital resources. Previous conceptualisations have been limited by a lack of qualitative evidence (Allan et al., 2013) and have largely described perinatal wellbeing as an undefined subjective experience or an absence of affective symptoms. The need for context-specific definitions of wellbeing is acknowledged (Linton et al., 2016b). In parallel, there has been a marked shift towards holistic conceptualisations which acknowledge the role of positive emotions on health and wellbeing (Alderdice et al., 2013). Through the systematic synthesis of multidisciplinary academic literatures (Chapters 2 and 4) and in-depth interviews with perinatal women (Chapter 5), a definition of perinatal wellbeing was developed which proposed that perinatal wellbeing was a woman’s subjective appraisal of the balance between her psychological, social and emotional challenges and resources during late pregnancy and the first year following birth. Following exploration of which aspects of perinatal wellbeing might be tractable (Chapter 5), this was refined at the stage of operationalisation (Chapter 7), to focus
on a strengthening of resources during the transition to the fourth trimester rather than minimising the challenges of new motherhood.

Digital wellbeing resources for use in the perinatal period have been dominated by commercial products which have tracked or digitally mirrored the pregnancy process for a homogenous group of consumers. Furthermore, academic digital resources have largely been developed with the primary aim of treating postnatal affective disorders. Both harness the knowledge that the majority of perinatal women are ubiquitous users of a wide range of digital tools and that they are actively seeking information on multiple topics at a time of low knowledge and high anxiety. However, synthesis of the multidisciplinary academic literatures specific to DHIs demonstrated methodological heterogeneity and limitations regarding intervention complexity and a lack of theoretical underpinning, user involvement and meaningful evaluation. However, the literature also identified an unmet need amongst the low-risk majority. This identified a key opportunity to harness best practice from the disciplines of eHealth and HCI in the systematic, multidisciplinary development and evaluation of a novel DHI.

The next step was therefore to interrogate this with potential users and determine i) was there appetite for a novel digital resource, and if so, ii) what user goals should it prioritise. The contextual interviews (Chapter 5) confirmed existing descriptive literature regarding ubiquitous and highly diverse use. However, a detailed understanding of the ebb and flow of the perinatal digital lifestyle emerged: the ‘typical’ perinatal experience does not exist and women do not consider their pregnancies to be ‘routine’, even when low-risk and clinically uncomplicated.
Numerous digital resources were accessed and discarded, often in response to perceived support and information gaps and women described a desire for positively-framed information, and content which connected them to other people in their local area. A theoretical lens was applied to the data and supported the proposal that a wellbeing resource could be developed by operationalising key factors relating to the constructs of self-determination theory.

Synthesis of diverse forms of evidence is recognised as challenging, particularly in the development of digital resources (Danaher et al., 2015) as it requires transformations of abstractions such as participant quotations into ‘something’ that can be evaluated. However, the systematic steps of gathering and synthesising the evidence into evidence statements and then into a logic model and a set of candidate design hypotheses (Chapter 6) increased confidence in the development process and provided a solid foundation for examination in the next stage of development.

11.1.2 Objective 2: To develop a digital prototype resource which is acceptable to the target population, is likely to have good uptake and use, and which contains active ingredients and theoretical underpinning that are likely to effectively address the tractable problems identified by meeting the first objective.

The process of developing a digital prototype involved multiple, iterative collaborations with target users, subject experts, a developer and usability experts. Firstly, the practical utility of the synthesised evidence relating to the user requirements and outcomes was systematically interrogated in a design workshop
(Chapter 7) and refined as a result. Core user goals were clarified, and three design hypotheses were rejected (direct access to healthcare professionals, an interactive forum, a self-monitoring facility). Critically, the definition of perinatal wellbeing was refined to reflect women’s explicit desire to feel that their resources outweigh their challenges. This was incorporated into subsequent design to focus on a strengthening of resources during the transition to the fourth trimester rather than minimising the challenges of new motherhood.

The narrative synthesis (Chapter 4) identified that evaluation of DHIs is often poorly described or limited to self-report questionnaires which interrogate hypothetical acceptability (Sekhon et al., 2017) through the examination of brief or de-contextualised usage of a ‘finished’ resource by users who may not be the target audience. A process of cooperative evaluation of a functioning prototype using qualitative methods (Chapter 8) was therefore the first step in determining how well the prototype might fit into women’s existing information ecologies (Peyton et al., 2014) and established that the clickable prototype was acceptable to naïve users in terms of its functionality, navigational coherence and interaction framework. In addition, the exercise provided critical feedback regarding the feasibility of proposed wellbeing, social media and face to face features. This feedback was interrogated using the same systematic approach applied in Chapter 6, by which user preferences are individually considered and evaluated according to the criteria of relevance, existing availability and ease of implementation (Curtis et al., 2015).

Design hypotheses stating that the prototype would be built on features including i) facilitated local face to face meetings and ii) social media functionality were rejected
as being out of scope of the project and replicating existing resources. The wellbeing toolkit was completely revised. This process served as a useful reminder of the difficulty of designing a resource considered acceptable by all users but also underlined the importance of minimising resource complexity and developing resources that fitted into antenatal women’s lives rather than adding burden (eg it was suggested that heavily pregnant women who were still working and attending weekly parenting classes would not be likely to want to attend further face to face meetings).

Iteration of the prototype had been thus far governed by a focus on function and meeting user needs. The next stage of the development process sought to address questions of form (Chapter 9) and was critically important in optimising design and establishing that the prototype was robust enough to be used in the wild independently by naïve users.

11.1.3 Objective 3: To explore the usability, uptake, acceptability and perceived impact of the prototype in the target population in a real-life context.

The narrative synthesis (Chapter 4) highlighted the critical importance of meaningful evaluation of digital resources. Previous research has not examined the way that usage of digital resource changes over the course of pregnancy and the motivations behind proactive engagement and disengagement. It was therefore imperative that the bump2bump prototype should be evaluated contextually during the transition to the fourth trimester in order to better understand discrepancies between hypothetical and actual use. Lay experts in the final usability study (Chapter 9) had provided
valuable information regarding how the prototype might be used in the wild and had offered important signposting regarding how it might be appraised, with certain features (e.g. the wellbeing toolkit) receiving mixed responses.

At the time of writing, this was the first study to explore the relationship between pregnant women’s wellbeing and their real-time usage of digital resources in the transition to motherhood. A mixed methods approach was taken with the intention of balancing depth of data with minimising participant burden: in-depth interviews, think aloud methods and EMA-based delivery of brief wellbeing measures specific to perinatal wellbeing were combined in an effort to gather as much data about what women were doing online, how and why, and how their use of bump2bump might fit within that ecology. The study illustrated the complexity and diversity of the perinatal experience, even within a relatively small sample of women. In addition, it highlighted the complexity of how perinatal women use digital resources to meet their wellbeing and information needs. The prototype was acceptable, although usage was relatively low. Arguably, the study suffered from being too ‘in the wild’ and may have benefitted from taking a more structured approach, such as using prompts and reminders to encourage use (Haga et al., 2013; Hamilton et al., 2016; Morrison et al., 2014; Yardley et al., 2016). Such prompts may have been important for delivering proximal outcomes, such as repeated interaction with the prototype and re-engagement with the content (Klasnja et al., 2017), which had been hypothesised to be an important part of the information retention loop (Chapter 6). However, the study was conceived of as trying to imitate real life usage so any conclusions regarding prompted use and improving proximal measures are speculative.
Certain design hypotheses were supported: women valued credible, specific, practical information relating to care of a newborn and, in particular, breastfeeding; women valued information that facilitated face to face interaction with local, similar others; women valued experiential information presented by real people and which told positive and negative stories. Tone of content was important, as was accessibility via smartphone. The wellbeing toolkit was rejected, even by those participants who had expressed strong interest and is proposed to be due to a combination of factors: evidence from the biomedical literature suggests that preventative work can be difficult and unappealing due to its inherently abstract nature (McSharry, McGowan, Farmer, & French, 2016) and this is supported in the perinatal literature (Cornsweet Barber et al., 2013). However, those participants who did access the toolkit, provided strong feedback regarding the toolkit’s usability and tone, indicating their intention to engage with it was superseded by their dislike of it.

Previous perinatal wellbeing research has used a wide variety of self-report measures (Chapter 4) and although response rates were inconsistent, this study demonstrated that the measures used were acceptable, not burdensome, perceived as relevant and that, critically, they picked up potentially distressing levels of worry in some women. Pregnancy-specific worry has been consistently identified as a key risk factor in subsequent development of postnatal affective disorders (Glover, 2014), yet none of the women in the study had discussed their concerns with their midwives. Delivery of the measures using an EMA approach was generally acceptable but the technology itself was not optimal, demonstrating some of the issues regarding delivery of notifications identified in previous research (Kini, 2013).
bump2bump had been developed using self-determination theory as a theoretical framework. The use of qualitative methods (Chapter 5) supported the hypothesis that the transition to new motherhood might compromise all of the theory’s constructs of autonomy, relatedness and competence and antenatal women talked throughout the research about the importance of feeling in control of the process, feeling competent in caring for their baby and in connecting with other people and maintaining existing relationships. The prototype was developed accordingly (Chapter 6) with a distinction made between proximal and distal outcomes. The use of SDT as a thinking tool was particularly valuable when it came to interpretation of the results of the final study, which unexpectedly highlighted a distinct shift from an antenatal focus on autonomy towards postnatal competence and relatedness. Pregnant women had effectively managed their anxiety through enacting control: birth plans, purchasing baby items, proactively disengaging with digital resources. However, new mums described wanting to be told what to do in order to feel more competent at caring for their baby and more connected to others. This suggests that efficacy of DHIs might be improved by encouraging antenatal engagement with features which support competence and relatedness rather than autonomy.

11.2 Strengths

This thesis has several strengths, particularly methodological. A range of qualitative methods were used throughout the thesis and combined in the final study with quantitative methods to address the same research question. Moreover, this thesis prioritised the interdisciplinary examination of how the paradigms of behavioural science and HCI have been applied to the development and evaluation of digital wellbeing resources in the context of pregnancy and motherhood. As a result, the
research question was examined through multiple lenses which provided richer insight and encouraged a wider range of research methods to be used. Contextual limitations notwithstanding, the use of novel methods examining real-time rather than hypothetical or retrospective engagement with a digital resource and association with the user’s perinatal wellbeing (e.g. the EMA technology used in the final study) constitutes a key strength. In addition, this was the first instance of the application of SDT as a thinking tool in the development of perinatal digital resources. Its practical utility was considerable and supported the proposition that there is an opportunity to develop DHIs which leverage the theory’s constructs (section 11.4.1).

This thesis was based on work with a targeted sample of women. This sample was selected based on evidence of unmet need and allowed for a far deeper understanding of what might work, how and why in the context of meeting their digital wellbeing needs. Thirty perinatal women and 8 usability experts provided over 65 hours of in-depth, qualitative data and this lends support to the call for information power rather than arbitrary numbers of ‘adequate’ sample size (Malterud et al., 2016).

11.3 Limitations

This thesis focused on perinatal wellbeing as a whole: rather than focusing on one aspect such as breastfeeding or peer support, these and many other areas considered to be important to meeting wellbeing needs were covered. More work is clearly needed to address how we can provide better signposting to crucial postnatal service - to breastfeeding support in particular - in light of continued cuts to service delivery. Due to the difficulty of gaining access, the views of healthcare professionals
were not sought. Given the importance placed by participants on the role of the midwife in particular in steering women towards good resources of all types, this is an avenue for further work. Evidence in this area is mixed with regard to midwives’ willingness to engage with digital resources in the context of the consultation (Dalton et al., 2014; Hundley et al., 2015; Lagan et al., 2011; Seefat-van Teeffelen et al., 2011). However, it is clear from the data in this thesis that midwives play a crucial role in guiding women to information and support services, particularly to important alternatives when statutory community services may be absent. The sample of women included in this work might be considered a limitation in terms of size and demographics and subsequent transferability. However, as described above, a targeted approach was taken in order to gain deep, rich data from a subset of women with unmet needs.

11.4 Implications for research, policy and practice

An integrated framework of recommendations is proposed that could be used to support the design and development of future digital perinatal wellbeing resources. The working definition of perinatal wellbeing used throughout this thesis has been based on Dodge et al.’s conceptual model of balance between resources and challenges, with particular focus on supporting the perception of one’s resources rather than minimising the reality of the (unavoidable) challenges of new motherhood. The model focuses on an individual’s biopsychosocial perception of their subjective wellbeing. I propose the addition of a digital dimension to the model (Figure 11.1), which is relevant to all wellbeing contexts and relates directly to the question posed in Chapter 2 of how digital health feels. The knowledge that the experience of interacting with digital resources can be positive or negative is not in itself novel;
however, this has not been applied directly to a holistic model of subjective wellbeing. The specific relevance of the update to the perinatal context is described further below.

![Diagram of the balance model of subjective wellbeing with digital resources highlighted.](image)

*Figure 11.1 Proposed update to the balance model of subjective wellbeing.*

### 11.4.1 Research

Engagement with digital resources is an ubiquitous part of daily life for many people. Evidence points towards the harm that digital devices may do (Kushlev & Dunn, 2015) as well as to their potential as tools to promote deeper meaning and happiness (Calvo & Peters, 2014). Holistic models are emerging which encourage the operationalisation of design strategies that foster sustained engagement, behaviour change and wellbeing and the basic psychological needs shown to mediate these outcomes (e.g. the Motivation, Engagement and Thriving in User Experience model or METUX, (Peters et al., 2018)). This is a valuable step forward but speaks largely to a motivated, HCI audience. In order to harness best practice from the eHealth and HCI paradigms, evidence from this thesis points towards the following recommendations in the development and evaluation of DHIIs for use in the transition to first time motherhood (Table 11.1).
### Recommendations for research

| How might the development of perinatal DHIs be improved? | (i) Systematically synthesise multidisciplinary academic and primary data to determine the target user group and the specific goals to be met through engaging with the DHI.  
(ii) Identify an appropriate theory to underpin the development process; use full theories rather than cherry-picking constructs from across multiple theories.  
(iii) Develop a logic model in order to state the problem, the proposed mechanisms of action and the intended goals.  
(iv) Operationalise the evidence according to evidence-based features.  
(v) Keep checking in with representatives of the target user group to ensure fidelity to user goals and preferences.  
(vi) Think big, start small and scale up. Keep intervention components to a minimum. |
| How might the evaluation of perinatal DHIs be improved? | (i) Incorporate evaluation into the research from the outset.  
(ii) Conduct multiple, structured, formative evaluations with target users.  
(iii) Evaluate using mixed methods and in the wild - people need to use the resource not because they are taking part in research but because it fits within their existing digital ecology.  
(iv) Proximal goals such as repeated engagement with the resource need to be considered alongside quantifiable distal goals. |

*Table 11.1 Recommendations for research.*
11.4.2 Policy

The results from this thesis have implications for digital health policy. The prevailing narrative is that digital tools hold great potential for supporting patient empowerment and self-care (Topol, 2019). However, the reality is that very few women involved in the research described in this thesis had ever spoken to a healthcare professional at all about digital resources during their pregnancies. Midwives were consistently identified by women as a key individual in navigating the perinatal journey and are clearly in a strong position to provide signposting to trustworthy digital resources, especially in the context of reduced community services. However, evidence suggests that personal attitudes towards digital health are more influential in guiding healthcare professionals’ introduction of digital resources into the consultation than policy (Hundley et al., 2015). Clarity around how perinatal women use digital resources in the transition to first time motherhood and what kinds of information might be more useful and when can be used to help healthcare professionals and policy-makers determine what kinds of evidence-based resources to recommend. Indeed, the negative impact of seeing multiple midwives over the course of a pregnancy might be mitigated by being signposted to evidence-based, useful online resources. The UK’s National Health Service’s App Library endorses behaviour change applications that meet certain criteria and is likely to include other web resources in time. The NHS website and other services were consistently raised by participants as being trusted to provide up to date information and there is an obvious opportunity for it to include signposting to digital resources beyond those focused on behaviour change.
Recommendations for policy

| How might policy regarding perinatal DHIs be improved? | (i) Midwives should be supported so that they feel comfortable asking women about what they are looking at online. Structured guidelines for how and what to ask and signpost to are required.  
(ii) Many women are confused about what they read online but are uncomfortable about raising it in the consultation.  
(iii) Healthcare professionals should be aware that women’s use of digital resources changes over the course of their pregnancy and narrows significantly as they approach the birth. This means that they might need more encouragement to use resources that focus on parenting matters other than birth. Women who have actively engaged with parenting classes describe how important it is to read and watch ‘refresher’ information or even learn new tips.  
(iv) Women can be encouraged to proactively disengage with resources that do not support them or which worry them in some way.  
(v) Women could be signposted in particular to the antenatal use of resources which focus on new born care and facilitation of face to face meetings with local, similar others.  
(vi) Midwives can signpost women to resources which include information about key professional support services for the fourth trimester. |

*Table 11.2 Recommendations for policy.*
11.4.3 Practice

Usability and HCI experts have a critical role to play in the multidisciplinary development of perinatal DHIs. Women choose to engage with commercial digital resources largely as a result of persuasive design features and ease of use. Aesthetics and usability are critically important but must be combined with evidence rather than used as a hook for engagement alone. Findings from this thesis point to the importance of including certain types of information in DHIs used at the transition to motherhood and that this information is best presented in particular ways.

<table>
<thead>
<tr>
<th>Recommendations for practice</th>
<th>How might usability and acceptability of perinatal DHIs be improved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Perinatal DHIs are best developed in collaboration with healthcare professionals and target users.</td>
<td></td>
</tr>
<tr>
<td>(ii) Perinatal DHIs are best developed for extensive use on an individual’s smartphone.</td>
<td></td>
</tr>
<tr>
<td>(iii) The resource should be clean and simple and free from advertising - not too many interacting parts.</td>
<td></td>
</tr>
<tr>
<td>(iv) The resource needs to be grounded in clearly articulated user needs and goals.</td>
<td></td>
</tr>
<tr>
<td>(v) Developers and users need to be able to articulate how they will know if goals have been met.</td>
<td></td>
</tr>
<tr>
<td>(vi) Proximal goals such as repeated engagement with the resource need to be considered alongside quantifiable distal goals.</td>
<td></td>
</tr>
<tr>
<td>(vii) Provide information and content relevant to the stage of pregnancy.</td>
<td></td>
</tr>
<tr>
<td>(viii) Content should be modular, browsable and searchable.</td>
<td></td>
</tr>
<tr>
<td>(ix) Content should be perceived as being credible.</td>
<td></td>
</tr>
<tr>
<td>(x) Content should include brief, just in time, practical information around baby care and breastfeeding in particular.</td>
<td></td>
</tr>
<tr>
<td>(xi) Content should be delivered by real people (not actors).</td>
<td></td>
</tr>
</tbody>
</table>
(xii) If possible, provide interactive and ‘hedonic’ content such as quizzes and printable lists, or information in alternative formats.
(xiii) Include accurate, up to date signposting to professional support.
(xiv) Provide accurate, up to date information about local resources relevant to perinatal users within a clearly defined, narrow geographical area; if possible, provide information that has been recommended by other local mothers.
(xv) Provide content in a truthful, non-judgmental, positive and encouraging tone.
(xi) If users are required to log in, ensure this information is not used to send anything other than information or content that target users have confirmed is useful.

<table>
<thead>
<tr>
<th>Table 11.3 Recommendations for practice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5 Unanswered questions and opportunities for future research</td>
</tr>
<tr>
<td>Since the work presented in this thesis began, there has been significant increased research interest in the topic of perinatal wellbeing. Preventative interventions have been developed and evaluated, showing promise (Corno et al., 2018; Forsell et al., 2017), but largely still focused on maternal mental health, postnatal affective outcomes and a reliance on professionals for their delivery. Research consistently demonstrates that few interventions are being tailored for the perinatal period, despite extensive evidence showing that tailored interventions are more likely to be perceived positively and used. This was evident in participants’ responses to the wellbeing toolkit used in the evaluation of bump2bump: wellbeing resources which are developed and evaluated without meaningful user input are likely to fall short of</td>
</tr>
</tbody>
</table>
meeting women’s expectations and may indeed put them off using future resources of this type. In addition, interventions remain overly complex and lack clear evaluation of what worked, how and for whom (Haga, Drozd, Lisøy, Wentzel-larsen, & Slinning, 2018). This is a distinct challenge for the future development and evaluation of DHIs: either minimise intervention components or utilise alternative, more nuanced evaluation methods (e.g. micro-randomised trials (Klasnja et al., 2015)) in order to prevent the replication of interventions which ultimately are not helpful to participants and which may increase burden at a time of significant life stress.

However, there is some evidence of simple digital resources being used to address the unmet needs of the low-risk majority through the provision of targeted, practical information (Munro et al., 2017). Munro et al. used qualitative methods to explore the feasibility of delivering key antenatal information via text message to a sample of Canadian women with low-risk pregnancies. This was acceptable and is worthy of exploration in different populations. Moreover, the minimisation of participant burden has been considered through the application of EMA methods. EMA methods have been combined with in-depth qualitative interviews and utilised for the collection of longitudinal data (Doherty et al., 2018) in the context of monitoring perinatal mood. This is a welcome advance and offers researchers the opportunity to gather contextual, real time data, while minimising burden on participants. Future research might incorporate more opportunities for women to provide real-time qualitative data using such tools rather than limiting their use to collection of quantitative measures.

This thesis highlighted an opportunity to measure the extent to which the proposition generated by this research holds true with regard to self-determination theory: that
the antenatal focus on autonomy shifts or is replaced by a postnatal focus on competence and relatedness. Previous work on the application of the theory (Gustafson et al., 2002) has suggested that wellbeing is not only achieved through equilibrium between all three SDT constructs but that the focus may shift between them at important points; this echoes Dodge et al.’s balance theory of wellbeing and confirmation of this would have important implications for design of DHIs.

Findings from this thesis also beg the question of how to engage women in resources at a time of attentional bias. The tension between preparation for the abstraction of new parenthood while managing the anxiety of imminent childbirth was raised by the majority of participants as an insurmountable task. This should be explored in future research, with particular focus on what are the key ‘hooks’ that could be leveraged in order to encourage women to engage with DHIs containing specific content around postnatal self-care and care of a newborn.

11.6 Conclusions

Developing and evaluating digital perinatal wellbeing resources to support pregnant women and new mothers is extremely challenging. This thesis aimed to gain a better understanding of how the wellbeing needs of perinatal women might be better met through the application of a systematic, multidisciplinary approach, utilising qualitative and quantitative methods. Synthesis of academic evidence and primary data supported the refinement of the working definition of perinatal wellbeing and how this might be operationalised in the development of a novel digital resource: a new focus was placed on how a digital resource might improve women’s subjective perception of their resources rather than minimising their challenges as new mothers. Responses from a design workshop, one-to-one evaluations, focus groups and a
longitudinal, in the wild study showed that features which provide credible, brief, just-in-time, practical parenting information and facilitate face to face interaction with similar others in the local community are important for promoting wellbeing in early motherhood and antenatal engagement with such resources might be an important factor. Healthcare professionals are well placed to champion such resources and provide guidance. These findings can be used to inform the development and evaluation of new digital perinatal wellbeing resources.
References


Archer, C., & Kao, K. T. (2018). Mother, baby and Facebook makes three: does social media provide social support for new mothers?. *Media International Australia*, 168(1), 122-139.


the Internet Help or Hinder? *Journal of the American Psychiatric Nurses Association*, 22(6), 475–482.


Research in organizational change and development (pp. 81-142). Emerald Publishing Limited.


Activity, 9(52).


behaviour therapy for antenatal depression: A randomised controlled trial. 

*Journal of Affective Disorders, 221*(June), 56–64.


Jensen, T., & Tyler, I. (2012). Austerity Parenting: new economies of parent-


Randomized Controlled Trial. *JMIR Research Protocols*, 5(2).


Research (4th ed.). SAGE Publications.


...


Practical Technique, i, 1–12.


Newhouse, N., & Blandford, A. (2016). ‘My Facebook is a bit of a multiple personality at the minute’: Social Media and the Transition to New Motherhood. NordiCHI ’16, Gothenburg, Sweden. (Workshop)


Books.


Ogden, J. (2016). Celebrating variability and a call to limit systematisation: the


Peyton, T., Poole, E., Reddy, M., Kraschnewski, J., & Chuang, C. (2014). “Every pregnancy is different”: Designing mHealth interventions for the pregnancy


Prescott, J., & Mackie, L. (2017). "You Sort of Go Down a Rabbit Hole... You’re Just


Appendix 1 Chapter 4

Search strategy - Medline, PsycInfo & MDIRS (Ovid)

1. wellbeing.ti, ab,sh.
2. well-being.ti,ab,sh.
4. “life satisfaction”.ti,ab,sh.
5. stress.ti,sh.
6. depression.ti,sh.
7. anxiety.ti,sh.
8. worry.ti,sh.
9. hassle.ti,ab,sh.
10. 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9
11. pregnan*.ti,ab,sh.
12. antenatal.ti,sh.
13. prenatal.ti,sh.
14. perinatal.ti,ab,sh.
15. matern*.ti,ab,sh.
16. 10 OR 11 OR 12 OR 13 OR 14
17. online.ti,sh.
18. web*.ti,sh.
19. digital.ti,sh.
20. smartphone.ti,sh.
21. cellphone.ti,sh.
22. mobile.ti,sh.
23. internet.ti,sh.
24. computer.ti,sh.
25. technolog*.ti,sh.
26. mhealth.ti,sh.
27. 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26
28. 10 AND 16 AND 27
Search strategy – Web of Science

TOPIC: ((wellbeing OR well-being OR quality of life OR life satisfaction OR stress OR depression OR anxiety OR worry OR hassle)) AND TITLE:((pregnan* OR antenatal OR prenatal OR perinatal OR matern*)) AND TITLE: ((online OR web OR digital OR smartphone OR cellphone OR mobile OR internet OR computer OR technolog* OR mhealth))

Search strategy – Science Direct

(TITLE-ABSTR-TITLE (wellbeing OR well-being OR quality of life OR life satisfaction OR stress OR depression OR anxiety OR worry OR hassle)) AND (TITLE (online OR web OR digital OR smartphone OR cellphone OR mobile OR internet OR computer OR technolog* OR mhealth)) AND (TITLE (pregnan* OR antenatal OR prenatal OR perinatal OR matern*))

Search strategy – ACM

(wellbeing OR well-being OR quality of life OR life satisfaction OR stress OR depression OR anxiety OR worry OR hassle) AND (pregnan* OR antenatal OR prenatal OR perinatal OR matern*)

Search strategy – HCIBIB

pregnant OR pregnancy; wellbeing AND pregnancy; mother*
## Characteristics of included studies

<table>
<thead>
<tr>
<th>Authors (Year)</th>
<th>Country</th>
<th>Study aim</th>
<th>Population</th>
<th>Technology</th>
<th>Participant characteristics</th>
<th>Study design</th>
<th>Wellbeing measures</th>
<th>Data collection method</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] Ashford et al. (2016)</td>
<td>UK</td>
<td>To provide a first overview of computer- or web-based interventions for women's perinatal mental health issues by systematically identifying and reviewing their characteristics and efficacy.</td>
<td>Perinatal women</td>
<td>Computer- or web-based</td>
<td>N/A</td>
<td>Systematic review; narrative synthesis</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>[2] Barrera et al. (2015)</td>
<td>US</td>
<td>To describe the characteristics of pregnant users of the preventative intervention site, and to obtain preliminary data on the efficacy of the intervention to reduce the risk of PND.</td>
<td>Pregnant women</td>
<td>Tunnelled website; Mothers and Babies Course/Curso Mamás y Bebés</td>
<td>N=111; Spanish speaking (82.9%); mean age (SD)= 30.19 (5.57); from 23 countries</td>
<td>Pilot RCT</td>
<td>CES-D; EPDS; MDE Screener; intervention acceptability (Likert)</td>
<td>Questionnaires (email); usage data</td>
</tr>
<tr>
<td>[3] Cornsweet Barber et al. (2013)</td>
<td>New Zealand</td>
<td>Examination of effects of a computerised relaxation and mindfulness programme.</td>
<td>Pregnant women</td>
<td>Computer-based, 15-step self-help programme</td>
<td>N=9; pregnant; 2/9 pregnant with a first child</td>
<td>Pre-post intervention, no control group</td>
<td>PSS-10; EPDS; STAI; CSES; MAAS</td>
<td>Questionnaires and exit interview (both face to face)</td>
</tr>
<tr>
<td>Study Reference</td>
<td>Country</td>
<td>Objective</td>
<td>Target Population</td>
<td>Intervention</td>
<td>Sample Size</td>
<td>Study Type</td>
<td>Assessment Methods</td>
<td>Additional Notes</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------</td>
<td>-----------</td>
<td>-------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>------------</td>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>[4] Drozd (2013)</td>
<td>Norway</td>
<td>To test the efficacy of Mamma Mia.</td>
<td>Pregnant women &amp;/or partner</td>
<td>Tunneled website; <em>Mamma Mia</em></td>
<td>N/A</td>
<td>Protocol registration for RCT (ongoing)</td>
<td>EPDS; SWLS; anxiety subscale of EPDS; 10 secondary outcome measures, including relationship satisfaction, social support, parenting self-efficacy, emotional reactivity</td>
<td>N/A</td>
</tr>
<tr>
<td>[5] Drozd et al. (2015)</td>
<td>Norway</td>
<td>To provide a description of the intervention rationale and the development of Mamma Mia.</td>
<td>Pregnant women &amp;/or partner</td>
<td>Tunneled website; <em>Mamma Mia</em></td>
<td>N/A</td>
<td>Retrospective application of the Intervention Mapping framework</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>[6] Evans et al. (2012)</td>
<td>US</td>
<td>To assess the efficacy of a text messaging campaign.</td>
<td>Pregnant women</td>
<td>Text messaging system; <em>text4baby</em></td>
<td>N=123; Hispanic (79.7%); mean age=27.6</td>
<td>Pilot RCT</td>
<td>Questionnaires (telephone)</td>
<td>N/A</td>
</tr>
<tr>
<td>[7] Gao et al. (2014)</td>
<td>US</td>
<td>To present the development and formative evaluation of a prototype application.</td>
<td>Pregnant women &amp; partners</td>
<td>Wristband with sensors, with application; <em>Nuwa</em></td>
<td>N=unclear; 131 responses to questionnaire; qualitative participants unspecified</td>
<td>N/A</td>
<td>Questionnaires (online) and interviews (face to face)</td>
<td>N/A</td>
</tr>
<tr>
<td>Reference</td>
<td>Country</td>
<td>Purpose</td>
<td>Population</td>
<td>Website/Platform</td>
<td>Sample Size</td>
<td>Measures</td>
<td>Data Collection Method</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>[8] Haga et al.</td>
<td>Norway</td>
<td>To pilot test the intervention in order to assess feasibility and acceptance among program users.</td>
<td>Pregnant women &amp;/or partner</td>
<td>Tunneled website; Mamma Mia</td>
<td>N=103; % female=82.5; 4 interview participants (male=1)</td>
<td>Cohort</td>
<td>Unspecified measures of perceived usefulness, ease of use, credibility and unobtrusiveness</td>
<td>Questionnaires (web-based); face to face interviews</td>
</tr>
<tr>
<td>(2013)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[9] Hamilton et</td>
<td>Australia</td>
<td>To compare the efficacy of two versions of Baby Steps.</td>
<td>First time pregnant mother-father couples</td>
<td>Online intervention with text-message prompts; Baby Steps</td>
<td>N/A</td>
<td>Protocol for RCT (ongoing)</td>
<td>AQol-8D; EDPS; Couples Satisfaction Index; Social Support Survey; non-validated measures assessing parenting self-efficacy, parenting skills and programme satisfaction</td>
<td>Questionnaires (online)</td>
</tr>
<tr>
<td>al. (2016)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[10] Hearn et</td>
<td>Australia</td>
<td>To discuss the development and usage of an online resource to promote healthy lifestyles during the perinatal period.</td>
<td>Perinatal women</td>
<td>Website and app; Healthy You, Healthy Baby</td>
<td>N=196 (interviews with pregnant women=53; focus groups with postnatal mothers=67; interviews with healthcare professionals= 76)</td>
<td>Qualitative</td>
<td>N/A</td>
<td>Face to face focus groups and interviews; usage data</td>
</tr>
<tr>
<td>al. (2014)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>Country</td>
<td>Objective</td>
<td>Population</td>
<td>Website Details</td>
<td>Sample Size</td>
<td>Study Design</td>
<td>Measures</td>
<td>Data Collection</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>-----------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------</td>
<td>----------------</td>
</tr>
<tr>
<td>[11] Herman et al. (2005)</td>
<td>US</td>
<td>To examine the feasibility and usage pattern of a social support website.</td>
<td>Low-income, first-time pregnant African American women</td>
<td>Website: Healthy Pregnancy</td>
<td>N=19; mean age (SD)=20.5 years (4.01); % unemployed=74; % living with baby's father=11; % married=0</td>
<td>Cohort</td>
<td>N/A</td>
<td>Usage data; content analysis of email communication and discussion board.</td>
</tr>
<tr>
<td>[12] Kuo et al. (2009)</td>
<td>Taiwan</td>
<td>To evaluate an Internet education programme.</td>
<td>First time pregnant women</td>
<td>Website</td>
<td>N=118; mean age of intervention group (SD)=29.7(3.9)</td>
<td>RCT</td>
<td>Newborn-Care Knowledge Tool; NPI-II; Interpersonal Support Evaluation List; Maternal Confidence Questionnaire</td>
<td>Questionnaires (paper and email)</td>
</tr>
<tr>
<td>[13] Lee et al. (2016)</td>
<td>UK</td>
<td>To systematically review web-based interventions for the prevention and treatment of mood disorders in the perinatal period.</td>
<td>Perinatal women</td>
<td>Web-based</td>
<td>N=1274</td>
<td>Systematic review; narrative synthesis</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>[14] Mauriello et al. (2011)</td>
<td>US</td>
<td>To test a computer-tailored intervention designed to promote positive health behaviours during pregnancy.</td>
<td>Low-income pregnant women</td>
<td>Computer-based programme; Healthy Pregnancy: Step by Step</td>
<td>N=87; mean age (SD)=24.44 (5.28); % first time mothers=39</td>
<td>Cohort</td>
<td>Unspecified measures of acceptability.</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>[15] Muuraiskangas et al. (2015)</td>
<td>Finland</td>
<td>To report the user experiences of mobile mental well-being intervention.</td>
<td>Pregnant women</td>
<td>Mobile phone; Oiva</td>
<td>N=29; mean age=33; % first time mothers=82</td>
<td>Cohort</td>
<td>Unspecified measures of acceptability.</td>
<td>Questionnaire, usage data, interview</td>
</tr>
<tr>
<td>[16] Nieuwbower et al. (2013)</td>
<td>The Netherlands</td>
<td>To synthesise the experimental outcomes of web-based parenting resources for parental competencies and children's development.</td>
<td>N/A</td>
<td>Web-based</td>
<td>N/A</td>
<td>Systematic review; meta-analysis</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>[17] Peyton et al. (2014)</td>
<td>US</td>
<td>To develop a set of design requirements for designing mobile health (mHealth) interventions related to healthy pregnancies.</td>
<td>Pregnant women and mothers</td>
<td>N/A</td>
<td>N/A</td>
<td>Qualitative</td>
<td>N/A</td>
<td>Face to face focus groups and interviews</td>
</tr>
<tr>
<td>[18] Sajjad &amp; Shahid (2016)</td>
<td>Pakistan</td>
<td>To describe the development and formative evaluation of a mobile application.</td>
<td>Pregnant women</td>
<td>Smartphone application; Baby+</td>
<td>N in development phase=12; mean age=33; N in evaluation phase=14; mean age=26</td>
<td>Qualitative</td>
<td>N/A</td>
<td>Questionnaire; face to face interview</td>
</tr>
<tr>
<td>[19] Salonen et al. (2008)</td>
<td>Finland</td>
<td>To describe the development of an internet-based intervention for parents with infants.</td>
<td>Pregnant women &amp;/or partner</td>
<td>Online intervention; vauvankaa</td>
<td>N=1388; %female=62; mean age (SD) =30.2(5)</td>
<td>Cohort</td>
<td>Multiple: self-concept; EDPS; perception of infant, health, family functioning, social support; Subscale WPBL-R; PSE scale</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>Reference</td>
<td>Country</td>
<td>Study Objective</td>
<td>Target Population</td>
<td>Intervention</td>
<td>Sample Size</td>
<td>Data Collection Methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>----------------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[20] Salonen et al. (2011)</td>
<td>Finland</td>
<td>To evaluate the effectiveness of an internet-based intervention to support mothers’ and fathers’ parenting satisfaction and parenting self-efficacy.</td>
<td>Pregnant women &amp;/or partner</td>
<td>Online intervention; vauvankaa</td>
<td>N=742; % female=66; mean age mothers (SD)= 30.6(4.6); mean age fathers (SD)=31.7(5.1)</td>
<td>Cohort</td>
<td>Subscale WPBL-R; PSE scale devised by authors; EPDS; computer use and skills; FAFHES</td>
<td></td>
</tr>
<tr>
<td>[21] van Zutphen et al. (2008)</td>
<td>The Netherlands</td>
<td>To determine reach, attrition and program engagement and their associations with user characteristics for an online healthy lifestyle program.</td>
<td>Pregnant women</td>
<td>Website and email quizzes; Hello World</td>
<td>N=488; mean age (SD)= 31(6); % first time mothers= 60</td>
<td>Cohort</td>
<td>N/A</td>
<td>Usage data</td>
</tr>
<tr>
<td>[22] Wenger et al. (2014)</td>
<td>US</td>
<td>To describe the development and formative evaluation of a prototype application.</td>
<td>Pregnant women</td>
<td>Smartphone application: Bloom</td>
<td>N=51</td>
<td>N/A</td>
<td>N/A</td>
<td>Survey; face to face interview; questionnaire</td>
</tr>
<tr>
<td>[23] Whittaker et al. (2012)</td>
<td>US</td>
<td>To describe the development of the text messages and N/A</td>
<td>Text messaging system; text4baby</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Text message</td>
<td></td>
</tr>
</tbody>
</table>
national launch of the service.

[24] Wierckx et al. (2014) To describe the development and formative evaluation of a prototype application First-time pregnant women Smartphone application; Babywijzer N=total unclear N/A Unspecified measures of acceptability. Face to face interviews; questionnaire

Example of study commentaries

<table>
<thead>
<tr>
<th>Authors (Year)</th>
<th>Study commentary</th>
<th>Quality Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashford et al. (2016)</td>
<td>A systematic review by Ashford et al. (2016) found that computer- or web-based interventions targeted at improving mental health, especially existing depression, may be effective. For pregnancy, interventions were developed for depression, stress and anxiety and mental health of women diagnosed with preterm labour. Postpartum interventions largely targeted depression. 4/9 were designed to prevent the development of mental health issues through stress management and by promoting mental wellbeing. 7/9 were web-based, 2/9 were computer-based. 2/9 were for couples following pregnancy loss. Some sort of therapist contact was included in the majority of the programmes; the interventions employed a variety of therapeutic approaches (not stated on 1) but theoretical underpinning</td>
<td>High</td>
</tr>
</tbody>
</table>
was not evaluated. Approaches included: CBT (5/9); behavioural activation (1/9); relaxation, biofeedback and mindfulness (1/9); relaxation and stress management (1/9). Findings for depression were predominately positive; negative findings for anxiety and stress are hypothesised to be due to the fact that 4 interventions were of a preventative nature rather than being designed to reduce existing symptoms. The authors propose that preventive interventions therefore might not be as effective as those targeted at reducing an existing mental health issue. However, they acknowledge that much of the sampling relied on self-report rather than completion of diagnostic tools, confounding the findings somewhat. Most studies were limited by their recruitment strategy, indicating possible sampling bias.

**Barrera et al. (2015)**

A pilot RCT by Barrera, Wickham, & Muñoz (2015) tested the efficacy and acceptability of a website adapted from an effective face to face intervention, designed for use in pregnancy, to prevent PND. Recruitment via Google ads. Guiding theoretical principles include CBT, social learning theory, reality management training, attachment theory and 'socio-cultural issues relevant to culturally diverse populations'. Adaptation of the intervention is described as being based on user feedback but is not documented (symposium talk only referenced). The online version comprised sequential completion of 8 'lessons' + worksheets; logins, total time on site and last lesson viewed were logged. Participants were asked to complete monthly follow-up assessments using clinical measures of depression and up to 6 monthly postpartum assessments. Acceptability was determined by Likert scale responses (useful/easy to understand/helpful). The authors report substantial dropout at every stage from eligibility (n=5,071) to final analysis (intervention n=57; control n=54). 33/57 intervention arm participants logged in once. The authors failed to demonstrate a significant reduction in PND incidence as a function of the e-MB intervention but did find a significant reduction in PND risk for women with the greatest severity of prenatal depression symptoms if they engaged with the intervention. Engagement levels are on a par with Haga et al. and may demonstrate international interest in the option of engaging with an online preventive resource.

Medium: sampling strategy and analysis numbers; high attrition and low engagement were not explored appropriately; inadequate description of population in terms of stage of pregnancy.
Example of sub-group synthesis

Target users

All of the studies in this review described interventions developed for pregnant women. Four of the 16 studies targeted pregnant women and/or their (heterosexual) partners; 4 studies explicitly targeted women who were pregnant for the first time (although women who were pregnant for the first time were described by all studies as being the primary users of the intervention being reported). Six studies target women identified as falling within a subgroup, eg low-income, although the recruitment and usage of such resources is often complicated by being used/evaluated by women not belonging (strictly) to the target group. Three studies targeted low-income women and another study described by Evans et al. (2012) and Whittaker et al. (2012) was developed for medically underserved women; however, full demographics of actual users were unavailable, making intended versus actual reach unclear. Several studies (Cornsweet Barber et al.(2013), Drozd et al. (2013;2015), Kuo et al. (2013), Sajjad & Shaihid (2016), Wierckx et al. (2014)) grounded their rationale in acknowledging information and support gaps in low-risk, routine pregnancy and the opportunity afforded by digital health to act as a holistic, low-threshold, preventative tool. This was in contrast to those aiming to meet needs of niche groups such as underserved women (and where the efficacy of doing so was unclear, often because the intervention was used in reality by a broader range of women). The women targeted by the interventions varied widely in terms of gestation, age, nationality, income level, socio-economic status and number of children. Background data for participants was often unknown or unreported. For example, 4 studies describe the development and evaluation of a prototype or outline the process taken to develop a set of design requirements and describe recruitment of pregnant women and mothers but do not provide full information regarding sample size and background, recruitment rationale or evidence that selective sampling was avoided. In addition, recruitment for some studies (eg van Zutphen et al. 2008) was conducted by those involved in developing the intervention, suggesting sampling bias. Previous syntheses highlight the development of tools almost exclusively for postnatal women in the context of preventing or treating affective disorders and state that postnatal use of a web-based intervention may be effective but there is limited evidence for their preventative power. However, studies are reported as being heterogenous and limited in quality and so all conclusions are tentative.
PARTICIPANT INFORMATION SHEET

We would like to invite you to take part in a research study. This information sheet explains why the research is being conducted and what it will involve if you decide to take part. Please take the time to read the information in this leaflet carefully and talk to others about the study if you wish.

What is the purpose of this study?
The purpose of this study is to find out whether using online resources (apps and websites) during pregnancy helps women to feel more supported as they prepare for birth and beyond. We want to know more about what kinds of digital resources pregnant women use and what they find useful.

By conducting this study we hope to learn:
- More about how women use digital resources and the internet during pregnancy and in early motherhood;
- Whether information is more useful if it is presented in a particular way;
- If women have a preference as to how information and support are provided online.

How many people will be involved?
We are aiming to recruit 15 participants in order to collect enough information to obtain reliable results.

Am I eligible to take part?
For this study we want to recruit:
- Women (aged 18+) who are resident in England and are pregnant
- Women (aged 18+) who are resident in England and have given birth within the past 5 months

Do I have to take part?
No. Your participation in this study is entirely voluntary. If, having read this leaflet you decide that you do not want to take part you do not need to respond. If you do agree to take part you are free to withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights.

Further information about participating in research projects can be found at www.invo.org.uk

What will I have to do if I take part?
In this study, we want to talk to women about their attitudes to using digital resources during pregnancy and in early motherhood. This interview will be conducted by a researcher who will visit you at your home, or another suitable location.
What are the benefits or risks to taking part?
We cannot guarantee that you will personally benefit from participation in this study but you will be contributing to important research. You will receive a £20 high street voucher in thanks for your time. We do not foresee any risks to taking part but if talking to the researcher causes you concern about your health please contact your GP or call NHS Direct on 0845 4647.

Why do I need to sign a consent form?
As part of your inclusion in the study you will be asked to sign a consent form to confirm that you understand what the study is about and what it involves for you. This is required in order to protect your rights. If you decide you no longer wish to participate in the study you can withdraw at any time without providing a reason.

Why do I need to provide the research team with my contact details?
You will be asked to provide us with your contact details so that we can email or telephone you if need be. We will want to contact you with information about the study and to arrange a convenient time to meet and speak with you. Your contact details will be held securely by the University of London in accordance with the Data Protection Act 1998 and only authorised personnel will have access to this information.

Will you contact my GP?
We will not contact your GP and your participation in this research will have no impact on the quality or type of care you receive from them.

What if there is a problem?
Given the nature of this study, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the course of this study, you should contact Louise Gaynor at l.gaynor@ucl.ac.uk

What will happen if I don’t want to carry on?
If you no longer wish to participate in the study you can withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights. Any data that you have already provided will be used in the study unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk.

Will my taking part be kept confidential?
The information you provide during the interview will be made anonymous so you cannot be identified from it by anyone other than selected members of the research team. All information collected at interview will be stored in a permanent and secure archive at the University of London.

What happens at the end of the study?
Once we have completed our analysis of the interview data, we will use this information to help guide the next stage of our research. The results will also be published in a scientific journal, through reports and conference presentations.

Who has reviewed the study?
All research in the NHS is reviewed by an independent group of people called a Research Ethics Committee (REC), to ensure your safety, rights, wellbeing and dignity are protected. This study has been reviewed and given a favourable opinion by the UCL/C Research Ethics Committee, reference UCL/C/12/13/015 on 3/4/13.

Thank you for taking the time to read this information sheet.
If you wish to take part or have any further questions, please email the lead researcher
Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk
bump2bump
Digital resources and wellbeing in first time pregnancy

Participant Details

Please provide the following information. If you prefer not to answer any questions, please leave them blank.

Name: ________________________________________________________________

Age: ____________________________

Relationship status: single □ married □ civil partnership □ divorced/separated □ widowed □
prefer not to say □

If pregnant, what is your due date? ________________________________

If you have given birth, how old is your baby? __________________________

Level of education: ________________________________________________

Employment status: full time □ part time □ caring □ unemployed/not in paid employment □ retired □
self-employed □

Occupation: ________________________________________________________
Ethnicity (Please circle the number that best describes your ethnic group or background):

White
1. English / Welsh / Scottish / Northern Irish / British
2. Irish
3. Gypsy or Irish Traveller
4. Any other White background, please describe

Mixed / Multiple ethnic groups
5. White and Black Caribbean
6. White and Black African
7. White and Asian
8. Any other Mixed / Multiple ethnic background, please describe

Asian / Asian British
9. Indian
10. Pakistani
11. Bangladeshi
12. Chinese
13. Any other Asian background, please describe

Black / African / Caribbean / Black British
14. African
15. Caribbean
16. Any other Black / African / Caribbean background, please describe

Other ethnic group
17. Arab
18. Any other ethnic group, please describe

Sexuality: Straight ☐ gay ☐ Lesbian ☐ bisexual ☐ other ☐ prefer not to say ☐

Disability: Do you have a longstanding (more than 6 months) illness, disability or impairment which causes substantial difficulty with day to day activities? Yes ☐ No ☐

On a scale of 0-10, with 0 being 'not at all', how confident are you in your ability to use the internet? ........

How many digital devices do you own? e.g smartphone, laptop, tablet, smart TV ............

Which one/s do you use the most and what for?

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

hump/hump Study Interview Demographics Form Version 2 Oct 2013
Office Committee Ref: U316/31/18/015
bump2bump
Digital resources and wellbeing in first time pregnancy

INTERVIEW CONSENT FORM

Title of Project: bump2bump Study
Name of Researcher: Nikki Newhouse

Please initial all boxes

1. I confirm that I have read and understand the information sheet dated Jan 2010 (version 2) regarding taking part in an interview. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I consent to having my interview recorded on audio devices on the understanding that I can refuse recording of some parts.

3. I agree that information collected during the interview may be looked at by authorised personnel from the research team, University College London or regulatory authorities for the purpose of audit and monitoring.

4. I understand that information collected during the interview is confidential, and that no material which could identify me will be used without my explicit consent.

5. I understand I can later withdraw from the interview or ask for the recordings or parts of them to be deleted without giving a reason and this will not adversely effect me in any way.

I agree to take part in this interview.

Name of Participant (please PRINT) ____________________________ Date ______ Signature ____________________________

Name of Researcher (please PRINT) ____________________________ Date ______ Signature ____________________________

bump2bump Study Interview Consent Form Version 2 June 2010
Ethics Committee Ref: UCL/G/1213/015
Interview schedule

1. Opening narrative question

I am interested in finding out more about how women use digital tools like the internet, apps, blogs and forums as they move from pregnancy and into motherhood for the first time. There are no right or wrong answers, your experiences are what I'm interested in.

Antenatal: Can we start with you telling me whatever comes to mind, whatever seems important about how you are getting ready for motherhood, practically and emotionally?

Postnatal: Can we start with you telling me whatever comes to mind, whatever seems important about what it’s like to be a new mum?

2. Wellbeing and support

We hear a lot about the importance of personal wellbeing these days – what does the term wellbeing mean to you? What about wellbeing as a new mum?

Antenatal: Tell me about life after your baby is born. What does it look like? Who’s around?

What kind of support do you think you'll need and want after your baby is born?

Postnatal: Tell me about what kinds of support you have around you now that your baby is born? Is it the kind of support you thought you’d need? Is it the kind of support that you want?

On a scale of 0-10, how supported have you felt this week? Tell me about that. What does X mean for you? What would X look like?

Some of the academic literature says that support from your partner or family members is the best kind of social support when you’re pregnant / a new mum. What do you think about that?

3. Life online

This study is focusing on how women like you use digital tools like the internet, apps, blogs and forums you they move from pregnancy and into motherhood for the first time.

Tell me about which device or devices do you use to access the internet?
Tell me all about how you use your smartphone/tablet/computer (typical day of use) – when do you first check your smartphone/tablet/computer, how often etc

What social media platforms do you use?

Antenatal: Tell me about how the way you’ve used the internet has changed while you’ve been pregnant
Postnatal: Tell me about how the way you use the internet has changed since giving birth

Can you tell me about a specific time you had a particularly strong reaction to a pregnancy app or website etc, positive or negative.

Tell me about the apps or websites or forums etc you use [Participant invited to walk researcher through typical usage; probe use about functionality, appeal, gaps etc]

Where do you go for information if you have a specific question about your pregnancy/baby/postnatal concern?

What other sources of information would you use? (people, websites, books…)

Antenatal: How have your information and support needs changed over the course of your pregnancy?
Postnatal: How have your information and support needs changed since you gave birth?

Some women say that nothing can prepare you for the reality of the first month with a newborn. What do you think?

What would (have) encourage(d) you to plan for new parenthood as much as you are preparing (prepared) for birth?

Have any of the health professionals involved in your care ever recommended or talked to you about online resources?

Has using these digital resources changed the way you interact with health professionals?

Has using these digital resources changed the way you interact with friends and family?

4. User requirements

Tell me about the perfect online resource for heavily pregnant women and new parents. Let your imagination run wild – no budget, anything is possible.
Now, in reality and thinking about budgets, what would you dump from what you’ve just said and what would you keep?

What should it not have on it?

Who should be involved in designing a resource like that?

Would you be interested in getting involved?

What do you want to tell other first-time mums about pregnancy/life with a new baby?

Is there anything that you think we haven’t covered or anything you would like to add?
Appendix 3 Chapter 6

bump2bump
Digital resources and wellbeing in first time pregnancy

PARTICIPANT INFORMATION SHEET
DESIGN WORKSHOP

We would like to invite you to take part in a design workshop. This information sheet explains why the workshop is being conducted and what it will involve if you decide to take part. Please take the time to read the information in this leaflet carefully and talk to others about the workshop if you wish.

What is the purpose of this workshop?
This workshop is part of a PhD project exploring how women use online resources during and after pregnancy. We are developing an online resource and we want mums to help us. This will make sure that what we design is useful and acceptable to future users.

How many people will be involved?
We are aiming to recruit 6-8 participants.

Am I eligible to take part?
For this workshop we want to recruit:
- Women (aged 18+) who are resident in England, who have given birth within the past 6 months and whose pregnancy was clinically routine

Do I have to take part?
No. Your participation in this workshop is entirely voluntary. If, having read this leaflet you decide that you do not want to take part you do not need to respond. If you do agree to take part you are free to withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights. Further information about participating in research projects can be found at www.hno.org.uk

What will I have to do if I take part?
The workshop is intended to be relaxed and will take the form of small group conversations about the design and content of a digital resource for use during pregnancy and in early parenthood. You will be asked to think and talk about how your experiences of pregnancy and early motherhood might be useful in helping a design team develop a website. We will ask you your opinion about design ideas and invite you to contribute ideas of your own.

What are the benefits or risks to taking part?
We cannot guarantee that you will personally benefit from participation in this workshop but you will be contributing to important research. You will receive a £10 high street voucher in thanks for your participation.

Ethics Committee Ref: UCL/12/3/619.
time. We do not foresee any risks to taking part but if talking to the researcher causes you concern about your health please contact your GP or call NHS Direct on 0845 4647.

Why do I need to sign a consent form?
As part of your inclusion in the workshop you will be asked to sign a consent form to confirm that you understand what the workshop is about and what it involves for you. This is required in order to protect your rights. If you decide you no longer wish to participate in the workshop you can withdraw at any time without providing a reason.

Why do I need to provide the research team with my contact details?
You will be asked to provide us with your contact details so that we can email or telephone you if need be. We will want to contact you with information about the workshop and to arrange a convenient time to meet and speak with you. Your contact details will be held securely by the University of London in accordance with the Data Protection Act 1998 and only authorised personnel will have access to this information.

Will you contact my GP?
We will not contact your GP and your participation in this research will have no impact on the quality or type of care you receive from them.

What if there is a problem?
Given the nature of this workshop, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the course of this workshop, you should contact Professor Ann Blandford at blandford@ucl.ac.uk

What will happen if I don’t want to carry on?
If you no longer wish to participate in the workshop you can withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights. Any data that you have already provided will be used in the workshop unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk.

Will my taking part be kept confidential?
The information you provide during the interview will be made anonymous so you cannot be identified from it by anyone other than selected members of the research team. All information collected at interview will be stored in a permanent and secure archive at the University of London.

What happens at the end of the workshop?
Once we have completed our analysis of the interview data, we will use this information to help guide the next stage of our research. The results will also be published in a scientific journal, through reports and conference presentations.

Who has reviewed the workshop?
All research in the NHS is reviewed by an independent group of people called a Research Ethics Committee (REC), to ensure your safety, rights, wellbeing and dignity are protected. This workshop has been reviewed and given a favourable opinion by the UCLIC Research Ethics Committee, reference UCLIC/1213/015 on 24/6/13.

Thank you for taking the time to read this information sheet.
If you wish to take part or have any further questions, please email the lead researcher
Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk

bump2bump Workshop Information Sheet Version 1 July 2015
Ethics Committee Ref: UCLIC/1213015.
bump2bump
Digital resources and wellbeing in first time pregnancy

bump2bump Design Workshop, 28th July 2016

AGENDA

Where: Donnington Doorstep Children’s Centre, Townsend Square, Oxford OX4 4BB
When: Thursday 28th July, 10am-12pm
Why: We want to explore your experiences and ideas about digital resources in pregnancy and early motherhood, we will introduce the bump2bump model and ask you to help us decide on some of its content and style.

Problems on the day? Please contact lead researcher Nikki Newhouse on 07801424040

***

10am – Introductions, housekeeping, aims for the session
10.10am – Thinking about apples 😊
10.30am – Activity 1: People like you
10.45am – Activity 2: A day in the life
11.00am – Activity 3: Solutions to everyday problems
11.15am – Activity 4: Using the solution
11.30am – Activity 5: Information sorting
11.45 – Roundup
12pm – Thank you and close
Appendix 4 Chapter 8

PARTICIPANT INFORMATION SHEET
EVALUATION OF A PROTOTYPE WEBSITE

We would like to invite you to take part in the evaluation of a basic website. This information sheet explains why the evaluation is being conducted and what it will involve if you decide to take part. Please take the time to read the information in this leaflet carefully and talk to others about the evaluation if you wish.

What is the purpose of this evaluation?
This evaluation is part of a PhD project exploring how women use online resources during and after pregnancy. We are developing an online resource and we want mums to help us. This will make sure that what we design is useful and acceptable to future users.

How many people will be involved?
We are aiming to recruit 6 participants.

Am I eligible to take part?
For this evaluation we want to recruit women (aged 18+) who are resident in Oxford, have given birth to their first child within the past 6 months and whose pregnancy was clinically routine.

Do I have to take part?
No. Your participation in this evaluation is entirely voluntary. If you do agree to take part you are free to withdraw at any time without giving a reason. Further information about participating in research projects can be found at www.invo.org.uk

What will I have to do if I take part?
The evaluation will involve the researcher visiting you at your home and showing you a basic website designed for use during pregnancy and in early parenthood. You will be asked to provide feedback about how the website looks and works and will be asked to do a short series of simple tasks to test the way the website works. We will ask you your opinion about design and content and invite you to contribute ideas of your own. Your conversation with the researcher will be audio-recorded.

What are the benefits or risks to taking part? 
There is no immediate benefit from taking part in this evaluation but you will be contributing to important research. You will receive a £20 high street voucher in thanks for your time. We do not foresee any risks to taking part but if talking to the researcher causes you concern about your health please contact your GP or call NHS Direct on 0845 4047.

bump2bump Co-design Group Sheet Version: 1 November 2016
Ethics Committee Ref: UCL/12/13015.
Why do I need to sign a consent form?  
As part of taking part, you will be asked to sign a consent form to confirm that you understand what the evaluation is about and what it involves for you. This is required in order to protect your rights. If you decide you no longer wish to participate in the evaluation you can withdraw at any time without providing a reason.

Why do I need to provide the research team with my contact details?  
You will be asked to provide us with your contact details so that we can email or telephone you if need be. We will want to contact you with information about the evaluation and to arrange a convenient time to meet and speak with you. Your contact details will be held securely by the University of London in accordance with the Data Protection Act 1998 and only authorised personnel will have access to this information.

Will you contact my GP?  
We will not contact your GP and your participation in this research will have no impact on the quality or type of care you receive from them.

What if there is a problem?  
Given the nature of this evaluation, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the course of this evaluation, you should contact Professor Ann Blandford at a.blandford@ucl.ac.uk

What will happen if I don’t want to carry on?  
If you no longer wish to participate in the evaluation you can withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights. Any data that you have already provided will be used in the evaluation unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk

Will my taking part be kept confidential?  
The information you provide during the evaluation will be made anonymous so you cannot be identified from it by anyone other than selected members of the research team. All information collected at interview will be stored in a permanent and secure archive at the University of London.

What happens at the end of the evaluation?  
Once we have completed our analysis of the evaluation data, we will use this information to help guide the next stage of our research. The results will also be published in a scientific journal, through reports and conference presentations.

Who has reviewed the evaluation?  
All research in this project has been reviewed by an independent group of people called a Research Ethics Committee (REC), to ensure your safety, rights, wellbeing and dignity are protected. This evaluation has been reviewed and given a favourable opinion by the UCLIC Research Ethics Committee, reference UCLIC/1213/015 on 24/6/13.

Thank you for taking the time to read this information sheet.
If you wish to take part or have any further questions, please email the lead researcher
Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk
Pre-evaluation interview
1. Tell me about how you might use apps or websites over the course of a typical day.
2. You mentioned [...]. Why do you think that you use it?
3. [If appropriate] You mentioned [social media platform/s]. How do you use [social media platform/s] as a new mum?
4. What do you think a website for new mothers should have on it or be able to do?

Cooperative evaluation
“Today we are going to look at a website called bump2bump. bump2bump is aimed at women in the Oxford area who are pregnant with their first baby, who are in mid to late pregnancy and who are starting to think about and plan for life after birth. bump2bump includes parenting and wellbeing information and resources in the form of videos and worksheets; you can also choose to connect with other local women through face to face meetup groups or through recommended social media resources. There is also a section which features local resources, recommended by real women.

The aim of today is to identify any problems with the site and brainstorm ideas about how it might be improved. I’m going to ask you to do a few activities on the site and to think out loud as you do them, basically to give me a running commentary of what you are thinking and what you are doing. If you get stuck or don’t know what to do, just ask for advice. I want you to voice any thoughts you have about things which you feel are difficult to use or poorly designed. I’ll ask you questions as we go along, and I’ll also make some notes. There are no right or wrong answers here, please feel free to say whatever you think about the website and the tasks you're given. We’ll start off with a practice task, just to warm up. I would like you to search for a pushchair on this website while telling me what’s on your mind as you do so.”
**Tasks**
1. I would like you to imagine that you are at home and are browsing online. You click on a link that brings you to the bump2bump homepage. I would like you to tell me your first impressions of the page and the content on it before registering with the site.

2. Please register. You are now on this landing page. Tell me what you think of this page and the content on it before watching any video you like from the section titled Birth.

3. Imagine you can’t watch the video right now and want to read a transcript of the video instead. How would you do that?

4. Now save the video so that you can watch it later.

5. Please go to the wellbeing section and watch one of the videos.

6. Please go to the local resources section and read a review of a local parent-baby class.

7. This review reminds you of a good class you attended with [baby’s name] and you decide to add it to bump2bump. Please add a listing to the site.

8. Please go to the section on local meet-ups. Find and register for one of the sessions.

9. Please log out of the site.

**Post-session interview**
1. I noticed that you mentioned that you thought that […] was ...

Can you tell me a bit more about that?

2. What else could we add to the parenting information on the website?

3. What else could we add to the wellbeing toolkit on the website?

4. How do you think bump2bump would fit into your daily routine?

5. How do you think bump2bump compares with other digital resources for new mums that you’ve accessed?

6. What do you think is the best/worst thing about the prototype?

7. What do you think most needs changing?
Screenshots of main pages used in the cooperative evaluation
Local Resources

Welcome to the local resources listings. Here you’ll find information about antenatal and postnatal groups, classes, events and services in Oxfordshire. Resources are rated and recommended by people who have used them – please feel free to suggest a listing or leave a review of your own.

Clubs and Classes

The antenatal and postnatal resources listed here are usually informal sessions run by voluntary members of the community or a charity. Postnatal groups usually involve free play with maybe a story, music or a craft session. Most groups offer refreshments and the chance for pregnant ladies and new mums to chat and enjoy a coffee.

Little Sharks

For children age 0-4 years. Kitchen and toys. £1.50 per child. Mainly mums, but also attracts some dads and grandparents.

Ad: Saints Church Hall, new High Street, Headington, Oxford, OX3 9JU.

Monday 9.30am - 12.30pm

NCT Bumps and Babies

Suggest a Listing

What it is called? 

What does it sell/do/provide? 

Where is it? 

When is it open? 

What are the contact details? 

Meet Ups

A support network of other new parents can be a valuable thing. These informal meet ups are in your local area, for mums and partners and are facilitated by a parenting expert. Sign up and suggest topics to talk about.

- Thursday 19th January 2023, 6pm
- Friday 20th January 2023, 6pm
- Thursday 26th January 2023, 6pm
- Friday 27th January 2023, 6pm
Appendix 5 Chapter 9
Usability experts

PARTICIPANT INFORMATION SHEET
EVALUATION OF A DIGITAL PROTOTYPE

bump2bump
Digital resources and wellbeing in first time pregnancy

We would like to invite you to take part in the evaluation of a website called bump2bump. This information sheet explains why the evaluation is being conducted and what it will involve if you decide to take part. Please take the time to read this information carefully and talk to others about it if you wish.

What is the purpose of this evaluation?
This evaluation is part of a PhD project exploring how women use online resources during and after first time pregnancy. We have developed an online resource called bump2bump which is designed to be used by women in low risk, first time pregnancy. We want to know what experts in human computer interaction and design think about the resource - this will help us to develop digital resources that meet women’s needs as they become mums for the first time.

How many people will be involved?
We are aiming to recruit 0 HCI and design experts.

Am I eligible to take part?
You can take part in this workshop if you meet the following requirements:

✓ experience of designing websites
✓ experience of critical evaluation of web resources from an HCI perspective
✓ comfortable with small group work

What will I have to do if I take part?
The 90-minute workshop will take place at UCLIC. Large screen shots of the user journey through the bump2bump prototype will be displayed on the walls. The group will be asked to explore the designs with a critical perspective and asked to write down every issue they see on a sticky note and place the note near to the design issue in question. Critique can be done in collaboration with others or solo. Participants will be asked to consider the following, in order to prompt reflection:

bump2bump CDS HCI Evaluation Consent Form Version 1 June 2016
Ethics Committee Ref: UCLIC/121/2015.
• When you look at the screen, do you understand its fundamental purpose?
• What jumps out at you?
• Do you know what you would click on to advance to the next step?
• What questions do you have about the information and functionality that you’re seeing?
• Are you satisfied that this is a reasonable number of steps?
• Is there anything that feels too complicated or cumbersome?
• Is there any language that doesn’t make sense? Instructions? Labels?

When the group has completed the critique process, they will be invited to look at each other’s notes with the purpose of looking for themes and priority issues. These priority issues will then be synthesised and discussed as a group and recorded (on a flip chart and on an audio recorder). The discussion will close with an evaluation of what works well in the designs and the co-construction of a list of what needs to be changed as a matter of priority. All data will be anonymised and no real names will be used in the transcriptions.

**What are the benefits or risks to taking part?**

We cannot guarantee that you will personally benefit from participation in this study but you will be contributing to important research. Given the nature of this study, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the course of this workshop, you should contact Professor Ann Blandford at ablandford@ucl.ac.uk

**Why do I need to sign a consent form?**

As part of your inclusion in the study you will be asked to sign a consent form to confirm that you understand what the study is about and what it involves for you. This is required in order to protect your rights. If you decide you no longer wish to participate in the study you can withdraw at any time without providing a reason.

**What will happen if I don’t want to carry on?**

If you no longer wish to participate in the study you can withdraw at any time without giving a reason. Any data that you have already provided will be used unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk

**What happens at the end of the study?**

Once we have completed our analysis of the data, we will use this information to help guide the next stage of our research. The results will be published in the lead researcher’s doctoral thesis, academic journals, through reports and conference presentations.

**Who has reviewed the study?**

All research conducted by University College London staff is reviewed by an independent group of people called a Research Ethics Committee (REC), to ensure your safety, rights, wellbeing and dignity are protected. This study has been reviewed and given a favourable opinion by the UCLIC Research Ethics Committee, reference UCLIC/12116/15

Thank you for taking the time to read this information sheet.

If you wish to take part or have any further questions, please email the lead researcher

Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk

bump2jump ©201 HDI Evaluation Current Form Version 1 June 2015
Ethics Committee Ref: UCLIC/12130/15.
Digital resources and wellbeing in first time pregnancy

- When you look at the screen, do you understand its basic purpose?
- What jumps out at you?
- Do you know what you would click on to advance to the next step?
- What questions do you have about the information and functionality that you're seeing?
- Are you satisfied that this is a reasonable number of steps?
- Is there anything that feels too complicated or cumbersome?
- Is there any language that doesn't make sense? Instructions? Labels?
Lay experts
What are the benefits or risks to taking part?
We cannot guarantee that you will personally benefit from participation in this study but you will be contributing to important research. You will receive a £10 high street voucher in thanks for your time. We do not foresee any risks to taking part but if taking part causes you concern please contact your GP.

Why do I need to sign a consent form?
As part of your inclusion in the study you will be asked to sign a consent form to confirm that you understand what the study is about and what it involves for you. This is required in order to protect your rights. If you decide you no longer wish to participate in the study you can withdraw at any time without providing a reason.

What information will I need to provide?
You will be asked to provide us with some basic information such as your age and how old your baby is, which will help us design better online resources. This information will be held securely by the University of London in accordance with the Data Protection Act 1998 and only authorised personnel will have access to this information.

What if there is a problem?
Given the nature of this study, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the evaluation, you should contact Professor Ann Blandford at a.blandford@ucl.ac.uk

What will happen if I don’t want to carry on?
If you no longer wish to participate in the study you can withdraw at any time without giving a reason. Any data that you have already provided will be used unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk

Will my taking part be kept confidential?
The information you provide will be made anonymous so you cannot be identified from it by anyone other than selected members of the research team. All information collected at interview will be stored in a secure archive at the University of London.

What happens at the end of the study?
Once we have completed our analysis of the data, we will use this information to help guide the next stage of our research. The results will be published in the lead researcher’s doctoral thesis, academic journals, through reports and conference presentations.

Thank you for taking the time to read this information sheet.
If you have any further questions, please email the lead researcher

Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk
HOW TO GET STARTED

1. Go to: https://eyp.11114.com (NB: enter exactly as shown, do not enter www.)

2. And click the ‘Register’ button.

3. On the registration page enter your details. Keep a note of the email and password you enter as you will need this next time you login. You will be asked to enter your one off code.

Your code is: trial-eyp2017

Once you have entered all your details, click the ‘Submit Registration’ button.

PLEASE NOTE: Next time you visit the site login with the email address and password you set up during registration. You do not need to enter your code again - this is only a one off code for registration.

Error Reporting
Problems Logging in? Please email support@firecross.com
- A screenshot of your problem or error message.
- The email address you registered with
- The code you are using or have been provided
- What action you expected and what actually happened.

Copyright Fire Ares Resources Ltd. Used under licence www.firecross.com
Appendix 6 Chapter 10

This appendix includes:

(i) the participant information sheet;

(ii) the onboarding pack provided to support download of Paco and entry into the study;

(iii) information provided to participants about how to access the wellbeing toolkit;

(iv) 'just in case' information;

(v) schedules for the semi-structured entry and exit interviews.
bump2bump
Digital resources and wellbeing in first time pregnancy

PARTICIPANT INFORMATION SHEET
EVALUATION OF A DIGITAL PROTOTYPE

We would like to invite you to take part in the evaluation of a website called bump2bump. This information sheet explains why the evaluation is being conducted and what it will involve if you decide to take part. Please take the time to read this information carefully and talk to others about it if you wish.

What is the purpose of this evaluation?
This evaluation is part of a PhD project exploring how women use online resources during and after pregnancy. We have developed an online resource called bump2bump which is designed to be used by women in low risk, first time pregnancy. We want to know what women think about the resource - this will help us to develop digital resources that meet women’s needs as they become mums for the first time.

How many people will be involved?
We are aiming to recruit 10 women.

Am I eligible to take part?
You can take part in this study if you meet the following requirements:

- first time mother
- aged over 18 years
- resident in the Oxfordshire area
- between 34-37 weeks’ pregnant
- own a smartphone
- have access to a laptop / desktop computer / tablet computer which is connected to the internet
- have not participated in previous bump2bump research
Do I have to take part?
No. Your participation in this study is entirely voluntary. If, having read this information sheet, you decide that you do not want to take part you do not need to respond. If you do want to take part, you are free to withdraw at any time without giving a reason. Further information about participating in research projects can be found at www.invo.org.uk

What will I have to do if I take part?
This is approximately a 10-week study, during which you will be asked to use a digital resource as much or as little as you like before you have your baby and for a month after you have had your baby. Firstly, the researcher will come to your home, introduce the study and answer any questions you might have; she will show you the bump2bump website and ask you some questions about your first impressions of the website. You will also be asked to download an application called Paco to your smartphone. The researcher can help you to do this. The application will be used to contact you during the study and ask you brief questions about how you are feeling and what you think about the website (if you have used it). You can delay answering these questions if you want to or ignore them completely! At the end of the study (about 4 weeks after you have had your baby), the researcher will visit you again at home and ask you about the bump2bump website and what it was like to take part in the study. The researcher will also help you to uninstall Paco from your smartphone.

What are the benefits or risks to taking part?
We cannot guarantee that you will personally benefit from participation in this study but you will be contributing to important research. You will receive a £100 high street voucher in thanks for your time, following the second interview. We do not foresee any risks to taking part but if taking part causes you concern about your health please contact your GP.

Why do I need to sign a consent form?
As part of your inclusion in the study you will be asked to sign a consent form to confirm that you understand what the study is about and what it involves for you.  This is required in order to protect your rights.  If you decide you no longer wish to participate in the study you can withdraw at any time without providing a reason.

Why do I need to provide the research team with my contact details?
You will be asked to provide us with your contact details so that we can email or telephone you if need be.  We will want to contact you with information about the study and to arrange a convenient time to meet and speak with you.  Your contact details will be held securely by the University of London in accordance with the Data Protection Act 1998 and only authorised personnel will have access to this information.

Will you contact my GP?
We will not contact your GP and your participation in this research will have no impact on the quality or type of care you receive from them.
What if there is a problem?
Given the nature of this study, it is highly unlikely that you will suffer harm by taking part. However, if you wish to complain about any aspect of the way in which you have been approached or treated during the course of this workshop, you should contact Professor Ann Blandford at a.blandford@ucl.ac.uk

What will happen if I don't want to carry on?
If you no longer wish to participate in the study you can withdraw at any time without giving a reason. This will not affect the standard of care or treatment you receive from your GP or other health care providers, or affect your legal rights. Any data that you have already provided will be used unless you request that it is deleted. You can request that your data is deleted by emailing nikki.newhouse.14@ucl.ac.uk

Will my taking part be kept confidential?
The information you provide will be made anonymous so you cannot be identified from it by anyone other than selected members of the research team. All information collected at interview will be stored in a secure archive at the University of London.

What happens at the end of the study?
Once we have completed our analysis of the data, we will use this information to help guide the next stage of our research. The results will be published in the lead researcher’s doctoral thesis, academic journals, through reports and conference presentations. We will also provide all participants with a summary of our findings.

Who has reviewed this study?
All research conducted by University College London staff is reviewed by an independent group of people called a Research Ethics Committee (REC), to ensure your safety, rights, wellbeing and dignity are protected. This study has been reviewed and given a favourable opinion by the UCLIC Research Ethics Committee, reference 8657/002.

Thank you for taking the time to read this information sheet.
If you wish to take part or have any further questions, please email the lead researcher

Nikki Newhouse at nikki.newhouse.14@ucl.ac.uk
bump2bump evaluation

1. Installing Paco
2. Joining the study
3. Participating in the study
bump2bump evaluation

1. Installing Paco
These instructions use an iPhone for visual reference but the process is the same for Android phones.
Locate the App Store app on your phone and tap on it.
Tap on the search icon
Type ‘paco’ and tap *Search*
Tap *Get* next to the Paco app (the one with a dog icon)
Tap Install
Wait for Paco to install.

Next you’ll learn how to sign into Paco and join the experiment.
bump2bump evaluation

2. Joining the study
After Paco finishes installing, tap Open.

If you left the App Store, open Paco by tapping the Paco app on your home screen.
If prompted, tap OK

It’s necessary to allow notifications for this study.

If you accidentally tap “Don’t Allow,” go to the Settings app, tap Notifications, tap on the Paco app (scroll down until you find it), then turn on “Allow Notifications.”
Sign in with the Google email account provided during your entry interview.

Then tap Next
Enter your password provided for your bump2bump Google email and tap *Sign In*
Tap *Accept*. This allows us to match your responses to an email address.
You should now see Paco’s main screen
Tap *Find My Experiment*

You should see the UCL bump2bump maternal wellbeing study
Tap Join this Experiment
Tap I Consent
Depending on which model of phone you are using, you may be invited to change the notification schedule.

Currently, Paco will send you notifications at 8pm every Wednesday and Saturday.

If you want to change the time that you receive the notifications, tap *Running Experiments* and follow the prompts.

Please only change the time, not the day!
bump2bump evaluation

2. Participating in the study
Twice per week, Paco will ‘bark’ and send you a notification.

That means it’s time to participate.

Please respond as soon as you are able to.

Answering the questions should only take a few minutes.
Some questions will invite you to enter text, as if you are typing a text or WhatsApp message.

After entering text, please make sure you tap *Done*.

Please continue answering questions before you press *Submit*
You can also check to see if you have missed any notifications by tapping on *Running Experiments* and tapping on the study name.
...and reviewing your response rate.
If you have to miss a notification to participate, you can voluntarily submit your answers at another time.

Just tap *Participate* to submit your responses.
That’s it!

Remember:

• You will receive 2 notifications per week for the duration of the study
• Please try and respond to every notification
• If you must miss a notification, you can volunteer one later by tapping Participate
• Once you have registered on the bump2bump website, you may want to use the wellbeing toolkit.

• The following screenshots provide information on how to register with the wellbeing toolkit

Click here to access the wellbeing toolkit from bump2bump

This page will open in a new tab. Click the register button
You will then see this page. Please register, using your own personal details.

Please ignore this box

Your access code is EYPUCL17
**HOW TO GET STARTED**

1. Go to: eyp.ltt4f.com (NB: enter exactly as shown, do not enter www.)
   And click the ‘Register’ button

2. On the registration page enter your details. Keep a note of the email and password you enter as you will need this next time you login. You will be asked to enter your one off code.

   **Your code is:** EYPUC17

3. Once you have entered all your details. Click the ‘Submit Registration’ button.

   **PLEASE NOTE:** Next time you visit the site login with the email address and password you set up during registration. You do not need to enter your code again – this is only a one off code for registration.

---

**Error Reporting**

Problems Logging in? Please email support@fiveareas.com
- A screen shot of your problem or error message
- The email address you registered with
- The code you are using or have been provided
- What action you expected and what actually happened
Thank you for agreeing to take part in the evaluation of the bump2bump website

PLEASE READ THE INFORMATION BELOW!

Some ‘just in case’ information:

• If you need to re-enter the website address in your browser:
  http://www.jcdclients.co.uk/bump2bump/

  PLEASE DO NOT SHARE THIS WEBSITE ADDRESS WITH ANYONE OUTSIDE THE STUDY

• The wellbeing toolkit is provided by an external provider and will open in a separate tab to the bump2bump website. If you wish to use the toolkit, please register on the toolkit page, using the code EYPUCL17
  More information is provided on the attached sheet.
  If you have problems with registration/logging into the wellbeing toolkit, please let Nikki know in the first instance.

• Twice per week, you will receive a notification from the application you installed on your phone, requesting that you answer some questions.
  If you DON’T receive these notifications, please let Nikki know as soon as possible.

• Nikki will follow up with you approximately 1 month after you have had your baby.
  She will need to visit you again to talk to you about your experience of using/not using the website, to help you uninstall the data collection application from your mobile phone and to give you the £100 participation voucher.

• If you have any problems or questions during the study, please do not hesitate to get in touch with Nikki at nikki.newhouse.14@ucl.ac.uk
SEMI-STRUCTURED ENTRY INTERVIEW

Part 1: digital resources and wellbeing in pregnancy

General use:
1. So why don’t’ we start with you telling me about how you might use apps or websites over the course of a typical day.
2. Tell me about the websites, the apps, the forums that you have used during your pregnancy. Probe: likes/dislikes; similarities and differences between resources mentioned; general usage
3. Have you used forums during your pregnancy? Probe: why/why not
4. Have you used social media such as Facebook, Instagram or Twitter? Probe: why/why not?
5. Are there any particular resources that you use now in later pregnancy that you didn’t use before or vice versa, have you stopped using anything that you did use earlier?
6. How have you found out about the resources you use? Probe: HCP/friends etc; what makes it good information; trustworthiness
7. What other online information have you used apart from X?

Engagement:
8. What do you think you get from using X,Y,Z?
9. Is there anything about the resources you’ve used that you don’t like or that you think is missing?
10. Did you read anything for example that scared or worried you?
11. What makes you go back to a resource?
12. Some women say that they only want to hear positive stories, what do you think about that?
13. What do you need from a digital resource at this stage in your pregnancy?
14. How can people like me who are building support resources for people like you, get you to think beyond labour?

**Wellbeing**

15. On a scale of 0-10 with 0 being not great and 10 being really good, what would you rate your wellbeing as now?

16. What does X mean?

17. What would it take to get you to a 10?

18. What do you think your wellbeing will depend on as a new mum?

19. In terms of support, what kind of support do you have in place for when you come home with baby?

20. How might a digital resource support you when you come home?

**Participation**

21. What are you hoping to get out of taking part in this study?

22. Is there anything we haven’t talked about that you’d like to discuss?

**Part 2: immediate impressions of bump2bump**

1. I would like you to imagine that you are at home and are just browsing online. You click on a link that brings you to the bump2bump homepage. I would like you to tell me your first impressions of the page and the content on it before registering with the site.

Probe: encourage think-aloud while participant browses and follow up as necessary

2. How do you think you might use this site over the coming few weeks? When do you think you might use it?

3. Is there anything we haven’t talked about that you’d like to discuss?

4. Do you have any questions about the study?
SEMI-STRUCTURED EXIT INTERVIEW

Opening narrative question
1. So how are things?
2. What’s going well?

Wellbeing
3. When I was last here, you rated your wellbeing as X - what would you rate it as now?
   What’s that based on?
   How is that different from when you came home?
   What would it take to get you to a 10?
4. When I was last here, you talked about having X here to support you when you came home?
   How was that?
   Was that the kind of support you needed?
5. Thinking about how things have been over the past X weeks, what would you say has been the most valuable source of information and support?

General use of digital resources:
6. When I was last here, you talked about using websites/apps/etc - what have you been using since X was born?
   Probe: what for/when/differences to antenatal usage etc.

bump2bump
7. Tell me what you thought of the bump2bump website
8. Which aspects of the website did you like/ dislike?
9. What did you think about the type of information provided?
10. What did you think about the way the information was presented?
11. How relevant was the information to you, personally?
12. Was there too much of anything? / was anything missing?
13. Did the website give you any cause for concern/worry you in any way?
14. How did it compare to other digital resources you used?
15. Did using the site have any effect on your parenting skills or self-confidence?
16. What do you think is the best/worst thing about the prototype?
17. What modifications would you suggest?

**Participation**

17. When I was last here, you told me that you had hoped to get X out of taking part. If so/not, how/ why?
18. Tell me about using the Paco application.

Is there anything we haven’t talked about that you’d like to discuss?