Derivation of a psychosocial clinical prediction rule to target sexual healthcare among women of reproductive age attending British General Practices

Candidate: N. L. Edelman
Year: 2018
Submitted for the award of Doctor of Philosophy
Abstract

In Britain, contraception advice and supply was traditionally provided in Family Planning clinics while STI diagnosis, treatment and partner notification was largely restricted to specialist Genito-Urinary Medicine Clinics. One of the strategies employed in Britain since 2000 to address continuing high rates of unintended pregnancy and of STI acquisition, has been widened availability of STI testing and of contraception in General Practices (GPs). The majority of the British population are registered with a GP, so that GP populations are heterogeneous in terms of their need for these interventions. In the absence of any bespoke means of targeting these interventions, valuable opportunities to offer sexual healthcare to women attending GPs, may currently be missed, in particular because GP consultations are extremely limited in length and evidence suggests that female patients may find routine discussion of sexual behaviour unacceptable.

Therefore, the aim of this thesis was to derive a Clinical Prediction Rule (CPR), comprised of psychosocial questions. The CPR’s purpose is to discriminate women who had experienced risk of unintended pregnancy in the last six months and/or risk of STI acquisition through multiple partnerships or partner behaviour in the last year. This derivation work involved:

1. A systematic review of population surveys of women in the Western world reporting psychosocial predictors of sexual risk behaviour and adverse sexual health outcomes

2. An analysis of psychosocial predictors of sexual risk behaviour and adverse sexual health outcomes using data from the National Survey of Sexual Attitudes and Lifestyles-3

3. A cross-sectional survey of women attending GP settings and a Contraception and Sexual Health clinic in Brighton & Hove

The findings indicate that psychosocial questions do predict sexual risk and adverse outcomes in women attending GPs, but that the sensitivity and specificity are insufficient to warrant further validation and evaluation to support its routine use in practice.
List of publications from this thesis


Edelman N. de Visser Mercer C et al. P3.162 Developing a clinical prediction rule to target STI testing and contraception to women in community settings: implications for sexual health surveys Sex Transmitted Infect 2017;93:A153


Edelman N. de Visser Mercer C et al. P 59 A systematic review of associations between substance use and sexual risk behavior, STIs and unplanned pregnancy in women Sex Transm Infect 2015; S1: A35

Edelman N. Prah P. Cassell J. et al. P60 Associations between substance use and sexual risk behavior among women aged 16-44 years: evidence from Britain’s third National Survey of Sexual Attitudes and Lifestyles (Natsal-3) (P60) Sex Transm Infect Sex 2015; S1: A35
I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Signed: [Signature]

Date: 01/06/2018
Acknowledgements

I would like to thank my primary supervisor, Professor Jackie Cassell and my co-supervisors Dr. Catherine Mercer and Dr. Richard de Visser for their knowledge, wisdom and encouragement. I would also like to thank my independent advisor Dr. Rebecca French for her valuable insights and support. Thanks also to the staff and other PhD students in the Dept. of Primary Care & Public Health, for your advice, encouragement and friendship and for listening to four Work in Progress presentations and three conference practice runs! Thanks too, to the Natsal team and UCL’s Centre for Sexual Health and HIV Research, who made me feel welcome and included after so many years absence, and gave me such valuable advice. Thanks also to Dr. Sarah Woodhall, Dr. John Saunders and Dr. Kevin Dunbar at Public Health England for your suggestions and the opportunity to give an invited lecture on this work.

Thanks especially go to my wonderful children, who have spurred me on when the going got tough and had such unerring faith and belief in me, and to my mum. Thanks also to the NIHR for running the doctoral research fellowship, and to Val and Martin for supporting me in my initial application. Without it I would never have had the capacity or financial means to do a PhD, and this (perhaps unintended) equalities aspect of their programme has been greatly appreciated.

I have also been very blessed with supportive friends, thanks especially to Emma, Marcie, Alice, Cath, Marian, Lucy, Jemma, Mark, Barbara, Katie and Matthew. An extra special thanks go to the BFFs - Tea and Maz – for all the sympathetic listening, for having faith in me and for reminding me that doing a PhD, working, running a home and raising a family is a lot to handle and I'm not Superwoman! Tea – you have made me laugh and been very understanding as Theseus has taken up more and more of my time through this last year. Maz – you’ve reminded me what a long way I have come and that I need to take good care of myself. Gen - I have such fond memories of post-UCL dinners on Tottenham Court Road that I will always treasure, thank you. Lastly, my heartfelt thanks also go to Polly and all those who have shared their experience, strength and hope with me this last year.
### Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aOR</td>
<td>Adjusted Odds Ratio</td>
</tr>
<tr>
<td>BASHH</td>
<td>British Association for Sexual Health and HIV</td>
</tr>
<tr>
<td>BIC</td>
<td>Bayesian Information Criterion</td>
</tr>
<tr>
<td>CAPI</td>
<td>Computer Assisted Personal Interview</td>
</tr>
<tr>
<td>CASI</td>
<td>Computer Assisted Self Interview</td>
</tr>
<tr>
<td>CASH</td>
<td>Contraception and Sexual Health</td>
</tr>
<tr>
<td>CDC</td>
<td>Centre for Disease Prevention and Control</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CPR</td>
<td>Clinical Prediction Rule</td>
</tr>
<tr>
<td>CSA</td>
<td>Childhood Sexual Abuse</td>
</tr>
<tr>
<td>EC</td>
<td>Emergency Contraception</td>
</tr>
<tr>
<td>FSRH</td>
<td>Faculty for Sexual and Reproductive Health</td>
</tr>
<tr>
<td>GP</td>
<td>General Practice</td>
</tr>
<tr>
<td>GUM</td>
<td>Genitourinary Medicine</td>
</tr>
<tr>
<td>H-L</td>
<td>Hosmer-Lemeshow</td>
</tr>
<tr>
<td>IPV</td>
<td>Intimate Partner Violence</td>
</tr>
<tr>
<td>LARC</td>
<td>Long Acting Reversible Contraception</td>
</tr>
<tr>
<td>Natsal-3</td>
<td>3rd National Survey of Sexual Attitudes and Lifestyles</td>
</tr>
<tr>
<td>NCSP</td>
<td>National Chlamydia Screening Programme</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>OR</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>PAPI</td>
<td>Paper and Pen Interview</td>
</tr>
<tr>
<td>PHE</td>
<td>Public Health England</td>
</tr>
<tr>
<td>Ro</td>
<td>Basic reproductive number</td>
</tr>
<tr>
<td>RTP</td>
<td>Risk through Partner</td>
</tr>
<tr>
<td>SH</td>
<td>Sexual Health</td>
</tr>
<tr>
<td>STIs</td>
<td>Sexually Transmitted Infections</td>
</tr>
<tr>
<td>UIP</td>
<td>Unintended pregnancy</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>UPP</td>
<td>Unplanned pregnancy</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
List of tables

Table 1: Description of papers included in the systematic review ............. p. 83
Table 2: Quality of included papers .............................................................. p. 87
Table 3: Psychosocial associations with unintended pregnancy ............. p. 92
Table 4: Psychosocial associations with abortion ........................................ p. 93
Table 5: Psychosocial associations with unprotected sexual intercourse .... p. 96
Table 6: Psychosocial associations with multiple sexual partnerships and STI acquisition ................................................................. p. 103
Table 7: Factors associated with reporting 2+ sexual partners in the last year (2+P) ................................................................. p. 128
Table 8: Factors associated with reporting 2+ sexual partners in the last year with whom a condom was not always used (2+PNC) ........ p. 131
Table 9: Factors associated with reporting no condom use at first sex with most recent partner (FSNC) ............................................................ p. 134
Table 10: Final outcomes measured in the questionnaire ....................... p. 152
Table 11: Final exposures measured in the questionnaire ....................... p. 161
Table 12: Survey response by recruitment site ........................................ p. 183
Table 13: Survey exclusions on the basis of eligibility criteria ............... p. 184
Table 14: Distribution of survey responses to exposures ......................... p. 186
Table 15: Distribution of survey responses to outcomes ......................... p. 191
Table 16: Bivariate analyses of predictors by outcomes selected for multivariable modelling ......................................................... p. 195
Table 17: Questions retained in the model predicting multiple male sexual partners in the last year ......................................................... p. 201
Table 18: Questions retained in the model predicting risk through partner (most recent partner not used condoms with previous partners in last year) ................................................................. p. 203
Table 19: Questions retained in the model predicting 2+ male sexual Partners in the last year AND/OR most recent partner not used condoms with previous partners in last year ................................................................. p. 205
Table 20: Questions retained in the model predicting risk of unintended pregnancy in the last six months ......................................................... p. 208
Table 21: Summary of predictors retained in each model ....................... p. 210
Table 22. Sensitivity analyses of General Practice versus Combined Sample…………………………………………………………………………………p.212
Table 23. CPR score by self-report of multiple male partners in the last Year………………………………………………………………………………p.214
Table 24. CPR score by self-report of combined risk…………………………p.215
Table 25. CPR score by self-report of risk of unintended pregnancy in the last six months…………………………………………………………p.216

List of figures
Figure 1. Thesis structure…………………………………………………………p.46
Figure 2. Systematic review record screening and review process…………p.81
Figure 3. Generating the final sample from returned questionnaires………p.185
Contents

Chapter 1: The case for a psychosocial clinical prediction rule to target sexual healthcare to women of reproductive age attending British General Practice................................................................. 18

Summary .............................................................................................................................. 19

1.1 Addressing sexually transmitted infections and unintended pregnancies in Britain .......................................................................................................................... 20

1.1.1 The importance of addressing unintended pregnancy in Britain ................. 20

1.1.2 Choosing to research the concept of risk of ‘unintended pregnancy’ 21

1.1.3 The importance of addressing sexually transmitted infections in Britain ................................................................................................................................. 23

1.2 The sexual health of women - a public health perspective ......................... 23

1.2.1 The epidemiological landscape of sexually transmitted infections..... 24

1.2.2 Choosing to research the concepts of ‘sexual risk ‘experiences’ and ‘Risk through partner’ ........................................................................................................ 26

1.2.3 The epidemiological landscape of unintended pregnancy .......... 27

1.2.4 Targeting sub-populations: applying epidemiology to public health... 29

1.3 Sexual health interventions and service delivery in Britain ................... 30

1.3.1 Differences between GP and sexual health settings ......................... 33

1.3.2 The importance of GP settings in providing sexual healthcare: opportunities and challenges................................................................. 34

1.4 The case for a bespoke means of targeting women in GP settings based on presenting risk ........................................................................................................ 36

1.4.1 Using a clinical prediction rule to target sexual health interventions to individuals........................................................................................................ 38

1.4.2 The landscape of sexual health CPRs.............................................. 40

1.4.3 Using psychosocial CPR items to identify need for sexual health intervention........................................................................................................ 41

1.4.4 The case for looking at women only ................................................. 42

1.5 Thesis aim, scope and structure ................................................................. 43
1.5.1 Aim and research question ................................................................. 43
1.5.2 Scope of the research ...................................................................... 44
1.5.3 Structure of the research .................................................................. 45

Chapter 2: Conceptual issues in deriving a sexual health clinical prediction rule using a psychosocial approach .......................... 48

Summary .................................................................................................. 49

2.1 Social epidemiology and the psychosocial .............................................. 50
   2.1.1 Social epidemiological understandings of the psychosocial .............. 50
   2.1.2 Defining ‘psychosocial’ for this programme of research ................. 53
   2.1.3 Exclusion of health psychology constructs ..................................... 54
   2.1.4 Socio-demographic variables as distinct from psychosocial ............ 55

2.2 Psychosocial predictors of sexual risk experiences and negative sexual health outcomes ................................................................. 55
   2.2.1 Power disparity and IPV ................................................................. 56
   2.2.2 Mental health ................................................................................ 58
   2.2.3 Substance use .............................................................................. 59
   2.2.4 Types of sexual partner ................................................................. 60
   2.2.5 Service engagement and social support ........................................ 61
   2.2.6 Implications of this evidence base for CPR derivation ................. 61

2.3 Working at the cusp of population health and clinical medicine by deriving a psychosocial CPR ............................................................... 63

2.4 The importance of co-investigation: assessing potential need for STI testing and/or contraception .......................................................... 64

2.5 The meaning of ‘risk’ in CPRs, scientific and public domains ............... 66

2.6 Patient and Public Involvement in the early stages of the research programme ......................................................................................... 68
   2.6.1 Addressing acceptability in the thesis as a whole ......................... 70

2.7 Implications for the systematic review ................................................ 70
Chapter 3: A systematic review to identify psychosocial variables for possible inclusion in the CPR ........................................................ 72

Summary ....................................................................................................... 73

3.1 Introduction .............................................................................................. 74

3.2 Methods ................................................................................................... 75

3.2.1 Definitions and concepts used in searching and selecting the literature ................................................................................................................... 75

3.2.2 Eligibility criteria ................................................................................. 76

3.2.3 Record retrieval ................................................................................. 78

3.2.4 Stages of paper selection .................................................................. 79

3.2.5 Data collection and assessment of quality for full-text papers ......... 79

3.3 Results ..................................................................................................... 80

3.3.1 Overview of papers............................................................................ 80

3.3.2 Quality of papers ............................................................................... 86

3.3.3 Key findings of reported studies ....................................................... 91

3.3.4 Unintended pregnancy and abortion ................................................. 91

3.3.5 Unprotected sexual intercourse ......................................................... 95

3.3.6 STIs and multiple sexual partners ................................................... 102

3.3.7 Differences in types and strengths of psychosocial associations across outcomes ...................................................................................... 106

3.3.8 Presentation of models and explanations ........................................ 106

3.4 Discussion ............................................................................................. 107

3.4.1 Inconsistencies in the literature ....................................................... 107

3.4.2 Limitations ....................................................................................... 108

3.5 Systematic review update ...................................................................... 109

3.5.1 Methods........................................................................................... 110

3.5.2 Results ............................................................................................ 110

3.6 Conclusions ........................................................................................... 113
Chapter 4: National Survey of Sexual Attitudes and Lifestyles-3

analysis, to identify psychosocial predictors of sexual risk and adverse outcomes among British women of reproductive age..... 116

Summary .......................................................................................................................... 117

4.1 Introduction ............................................................................................................. 118

4.2 Aim and research questions .................................................................................... 118

4.3 Methods .................................................................................................................... 119

4.3.1 Overview of Natsal-3 survey methodology ............................................................. 119

4.3.2 Defining the sub-population for analysis ................................................................. 120

4.3.3 Weighting .............................................................................................................. 120

4.3.4 Determining outcome measures for analysis ............................................................ 120

4.3.5 Selecting psychosocial variables for analysis as exposures .................................... 123

4.3.6 Bivariate analyses .................................................................................................. 124

4.3.7 Selection of a psychosocial variable from within each theme ................................... 125

4.3.8 Multivariable modelling .......................................................................................... 126

4.4 Results ....................................................................................................................... 127

4.5 Discussion .................................................................................................................. 138

4.5.1 Comparison with other literature ........................................................................... 138

4.5.2 Limitations ............................................................................................................. 139

4.6 Conclusions .............................................................................................................. 141

Chapter Five: Designing a ......................................................................................... 144
cross-sectional survey from which to derive the ......................................................... 144
clinical prediction rule ................................................................................................... 144

Summary .......................................................................................................................... 145

5.1 Introduction .............................................................................................................. 146

5.2 Patient and Public Involvement .............................................................................. 148

5.3 The survey research questions .................................................................................. 148

5.4 Choice of outcome measures .................................................................................. 149
5.4.1 Identifying outcomes indicative of potential need for sexual health intervention ................................................................. 149
5.4.2 The selected survey outcomes ........................................................ 151
5.4.3 Selection of items for outcome measurement ................................. 151
5.4.4 Maximising the validity, scope, brevity and acceptability of outcome measures ................................................................................................................. 157
5.5 Choice of exposure measures ............................................................... 157
  5.5.1. Identifying exposures suitable for use as psychosocial CPR items 158
  5.5.2 Treating sexual orientation as an exposure ..................................... 160
  5.5.3 The selected survey exposures ....................................................... 161
5.6 Adapting items for inclusion in the research questionnaire ............... 163
5.7 Constructing and formatting the questionnaire .................................... 164
5.8 Recruitment, consent and data collection plans ................................. 165
  5.8.1 Study setting .................................................................................... 165
  5.8.2 Inclusion and exclusion criteria for survey participation ............... 166
  5.8.3 Recruitment, consent and data collection ........................................ 167
  5.8.4 Data management, storage and cleaning ........................................ 169
5.9 Sample size ........................................................................................... 169
  5.9.1 Additional CASH sample ................................................................. 170
5.10 Statistical analysis plan ........................................................................ 171
  5.10.1 Summary of analysis plan ............................................................. 171
  5.10.2 Assessing response rates, non-response and acceptability .......... 172
  5.10.3 Weighting and handling of missing data in the dataset............... 173
  5.10.4 Collapsing categorical exposures to be dichotomous .................... 174
  5.10.5 Using bivariate analyses to select exposures for entry into multivariable models .......................................................... 174
  5.10.6 Addressing interactions, confounders and controlling ............... 175
  5.10.7 Using multivariable modelling to identify which exposures should be included in the CPR ................................................................. 176
5.10.8 Comparing models to support an integrated or unified CPR ...........178
5.10.9 Using sensitivity analyses to assess whether to include CASH data .................................................................................................................178
5.10.10 Developing a simple scoring system for the CPR .........................179
5.10.11 Optimising CPR sensitivity and specificity by choosing a cut-off score ........................................................................................................179

Chapter 6: Derivation of a clinical prediction rule from the Brighton & Hove survey data ........................................................................ 181

Summary .....................................................................................................182
6.1 Survey Response and data quality ........................................................183
6.1.1. Survey response and exclusions .................................................... 183
6.1.2. Data entry quality ............................................................................184
6.1.3. Available case analysis and handling of incomplete data ...............184
6.2. Descriptive analyses .............................................................................186
6.2.1 Sample descriptors and distribution of exposures ...........................186
6.2.2 Distribution of outcomes ...................................................................190
6.2.3 Changing the construction of outcome 4: ‘Risk of UIP in the last six months’ .....................................................................................................193
6.2.4 Dropping outcome 5: ‘Two or more partners in the last year with whom a condom was not used on at least one occasion’ .........................193
6.2.5 Assessment of acceptability of exposures and outcomes ..............194
6.3 Bivariate analyses – identifying psychosocial items for inclusion in the models ...........................................................................................194
6.4 Using multivariable modelling to direct which exposures should be included in the clinical prediction rule for each outcome .........................198
6.4.1 Reverse-scoring exposures to avoid negative coefficients ..............199
6.4.2 Deriving a CPR for multiple male sexual partners in the last year ... 199
6.4.3 Deriving a CPR for risk through partner ...........................................202
6.4.4 Deriving a CPR for Combined risk ...................................................204
6.4.5 Deriving a CPR for potential risk of unintended pregnancy .......... 206

6.5 The case for a unified or integrated CPR: do the same items indicate need for contraception, for STI testing and for sexual health advice? ........ 209

6.6 Additional analyses - developing separate models on the basis of clinic type or age..................................................................................................... 211

6.6.1 Using sensitivity analysis to evaluate the inclusion of CASH data... 212

6.7 Generating a cumulative CPR score for each outcome ...................... 212

6.7.1 Determining scores for individual CPR items .................................. 213

6.7.2 Selecting a cut-off value for each cumulative CPR score that maximised sensitivity and specificity ....................................................... 214

6.7.3 GP consultation on model preferences and score cut-off values..... 216

6.8 Discussion .......................................................................................... 217

6.8.1 Comparing findings with previous studies ....................................... 218

6.8.2 Limitations ....................................................................................... 222

6.9 Conclusions ........................................................................................... 231

Chapter 7: Implications of the research for CPR derivation, sexual health epidemiology and the study of the psychosocial ............ 233

Summary ..................................................................................................... 234

7.1 Overview of the research programme and its contribution to the field ... 235

7.2 Congruence of the research findings with psychosocial theory ............ 238

7.3 The influence of PPI .............................................................................. 239

7.4 Limitations and lost opportunities in the programme of research ...... 241

7.4.1 Methodology .................................................................................... 241

7.4.2 Scope and target population ............................................................ 243

7.4.3 Acceptability and uptake ................................................................. 243

7.4.4 Systematic review ........................................................................... 245

7.4.5 Natsal-3 analysis ............................................................................. 245

7.4.6 Brighton and Hove questionnaire .................................................... 245

7.5 Unintended CPR effects ........................................................................ 246
7.5.1 Unintended positive effects of the CPR ........................................... 246
7.5.2 Unintended negative effects of the CPR ........................................... 246
7.5.3 Patient response to an additive CPR scoring system .............. 247

7.6 The broader landscape of CPRs in General Practice .......... 248
7.6.1 Generic CPR issues: working at the cusp of population health and clinical medicine .............................................................. 248
7.6.2 Delivery and use of CPRs in General Practice ............... 250

7.7 Further research recommendations ........................................ 252
7.7.1 Social epidemiology and sexual health – recommendations for further research .............................................................. 252
7.7.2 Evaluating the CPR’s ability to address adjunct health issues as preventive interventions ...................................................... 253
7.7.3 Investigating interactions and syndemicity .................................. 254
7.7.4 CPR uptake ........................................................................ 255
7.7.5 CPR presentation and completion .............................................. 255
7.7.6 Further CPR investigation to improve sensitivity and specificity ... 256
7.7.7 Evaluating CPRs in the context of care pathways ............ 259
7.7.8 CPR stability in the context of personal, societal and healthcare changes ............................................................................... 259

7.8 Conclusions ................................................................. 260

References ........................................................................... 263

Appendices ........................................................................... 282
Appendix 1a: Overview of sexual health CPRs .................................. 283
Appendix 2a: Defining and engaging with the study end-users ........... 285
Appendix 3a: Systematic review published paper .................................. 287
Appendix 3b: Search strategy for each database .................................. 299
Appendix 4a: Natsal-3 published paper .............................................. 310
Appendix 4b: Reviewed Natsal-3 exposures ............................................. 320
Appendix 4c: Natsal-3 bivariate analyses ................................................. 323
Chapter 1: The case for a psychosocial clinical prediction rule to target sexual healthcare to women of reproductive age attending British General Practice
Summary

This chapter introduces the concept of sexual health as a major public health concern. The epidemiological landscape of sexually transmitted infection (STI) and unintended pregnancy (UIP) rates in Britain is outlined, and the case made for focusing research on these issues. The focus of the thesis on sexual risk ‘experiences’ and on ‘unintended’ (rather than ‘unplanned’ pregnancy) is also explicated.

The chapter then explores how the two key negative outcomes of interest – acquisition of STI and unintended pregnancy (UIP) – differ socio-demographically in prevalence and in distribution, outlining the contribution of infectious disease aetiology to this picture. The chapter goes on to outline the strategies that are used to respond to that heterogeneity: targeting, screening and risk assessment. The chapter provides an overview of how sexual health interventions and services are delivered in Britain currently, distinguishing between primary and secondary care and prevention.

The challenges of providing sexual healthcare in primary care settings are outlined, and the case made for a bespoke means of targeting sexual health advice, STI testing and/or contraception to women attending General Practices. Clinical Predictions Rules (CPRs) are described as tools that aid clinical decision-making in primary care; and which are suitable for this purpose. A brief overview of existing sexual health CPRs is then provided. The research aims and thesis structure then conclude this chapter.
1.1 Addressing sexually transmitted infections and unintended pregnancies in Britain

Sexual health has been described by the World Health Organisation (WHO) as: “...a state of physical, emotional, mental and social well-being in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity” (WHO, 2006) (p.10). In contrast to this positive definition the majority of sexual health services, policies and research have a biomedical focus on reducing the burden of adverse sexual outcomes on individuals, health services and societies (Mapp et al., 2017). These outcomes include acquisition of sexually transmitted infections (STIs) and Human Immuno-Deficiency Virus (HIV) and their sequela, and experience of unintended pregnancy (UIP). The latter half of the 20th Century saw rises in STIs alongside the emergence of HIV and AIDS. Following a brief reduction in sexual risk behaviour in the wake of that emergence in the 1980s, STIs rates in Britain continued to rise in the 1990s – particularly among sub-populations at higher risk of HIV - and have remained high since (Fenton and Lowndes, 2004, Mohammed et al., 2018).

This pattern of adversity has been traced back to cultural and medical developments and the ‘epidemiological transition’ that occurred in the Western world in the 20th Century. Overall, the disease profile of these countries has transitioned from infectious diseases to chronic, non-communicable diseases. The discovery of penicillin and the emergence of safe and legal contraception and abortion has led to greater longevity, alongside a growth in women’s rights, and the demise of organised religion (Johnson et al., 2006). Consequently, reproductive health concerns have shifted from infant and maternal mortality to infertility, contraception, and UIP. Cultural and demographic shifts have resulted in higher numbers of sexual partners, particularly among women; with an increase in the reported number of lifetime male sexual partners among random samples of women resident in Britain in 2010-2012 compared to 2000 (Mercer et al., 2013b).

1.1.1 The importance of addressing unintended pregnancy in Britain

Britain has one of the highest rates of UIP in Western Europe (Connolly et al., 2014). This is a concern because of various negative impacts on off-spring (e.g.
low birth-weight and neonatal death) (Hall et al., 2017) and on the mother (e.g. reduced education and employment and greater house-hold stress) (Yazdkhasti et al., 2015). Britain’s National Survey for Sexual Attitudes and Lifestyles-3 (Natsal-3) measured the related concept of unplanned pregnancy, finding that approximately one in six pregnancies (16.2%) occurring in women in Britain were ‘unplanned’ (Wellings et al., 2013b) such that 159 656 unplanned pregnancies were estimated to have occurred in 2011. In contrast, 54.8% of pregnancies were categorised as planned with the remaining pregnancies reported as ambivalent.

Abortion has been legal in Great Britain since 1967. Legal abortion rates are often used as a proxy means of calculating UIP. Natsal-3 findings indicated that among those reporting unplanned pregnancy 57.1% had an induced abortion (Wellings et al., 2013b). The statistic that approximately 40% of unintended pregnancies are estimated to end in termination (NICE, 2005) has been used to estimate that 394,690 UIPs occurred in England & Wales in 2006 based on the 160,244 NHS and NHS agency terminations performed that year (Bayer, 2008). A Scottish study of abortion service attenders found that 89% of abortions were attributable to ‘unintended pregnancy’ (Lakha and Glasier, 2006). This finding was used to estimate that 225,600 unintended pregnancies occurred in England in 2010 (Montouchet and Trussell, 2013), incurring NHS costs of £193,200,000 related to abortion and other direct medical costs.

Annual abortion figures for England & Wales have plateaued since 2012, prior to which a steady rise had been seen since the 1970s, such that the 2016 rate is more than triple the rate reported in 1969 (16.0 per 1,000 resident women aged 15 - 44) (DH, 2016a) – equating to 190,406 legal abortions. However, these findings cannot be used to infer that UIP has also increased and then plateaued because of the complex relationship between abortion, unintended pregnancy, and sociological and medical changes.

1.1.2 Choosing to research the concept of risk of ‘unintended pregnancy’

This research investigates and predominantly refers to, the concept of risk of unintended pregnancy (UIP). Unintended, unplanned, mistimed and unwanted pregnancy, are related constructs that are sometimes used interchangeably in
the literature (although the latter terms are rarely investigated to assess the role of contraception and Termination of Pregnancy (ToP) services). ‘Unintended’ pregnancy and ‘unplanned’ pregnancy are commonly measured retrospectively - categorising existing /previous pregnancies – in order to obtain population estimates. These concepts are also less problematic when applied to retrospective measurement as labelling a baby as ‘unplanned’ or ‘unintended’ (rather than ‘unwanted’) is less vulnerable to retrospective reporting bias (Kaestner, 1999). International data sets tend to focus on estimates of \textit{unplanned} births, which incorporate both mistimed and unwanted pregnancy (Singh et al., 2010), the most well-known of which is the London Measure of Unplanned Pregnancy (LMUP) (Barrett et al., 2004). This reflects a public health focus on behaviour (i.e. planning) and on the impact of access to contraception and abortion. In contrast, \textit{prospectively} measuring the likelihood of becoming pregnant in an unplanned or unintended way has received less attention (and is difficult to operationalise due to the need to factor in frequency of intercourse, fecundity and partner fertility).

For the purposes of this research however, recent contraception failure/non-consistent use by sexually-active women not seeking pregnancy was chosen as the construct most closely aligned to the clinical goal of offering effective contraception, and thus to the purpose of the CPR in targeting contraceptive advice and supply. This construct is identified as recent \textit{retrospective risk} of UIP in the thesis. Notably, this construct favours ‘unintended’ over ‘unplanned’ pregnancy, as the latter will include both unintended \textit{and} intended pregnancies. This is because pregnancy planning is not always chosen by, or even available to, women and is also known to vary according to social class (Narasimhan, 2017). Indeed, the behavioural items within the LMUP have been found to decrease overall measure performance (but were retained because of the qualitative and conceptual work that underpinned them) (J.Hall, personal communication, February 8, 2018). The construct of ‘retrospective risk of UIP’ is discussed further in Chapter Five, alongside a review of available measures.

Importantly, teenage pregnancy (TP) is excluded from this thesis because it is a separate public health concern, driven by specific evidence of negative outcomes on mother and child (Tripp and Viner, 2005, Ellis et al., 2003).
Considerable progress has already been made in addressing TP with the estimated number of conceptions in under 18s falling in 2011 to 31,051—a drop of 10% on the previous year (ONS, 2013) and the lowest rate since records began in 1969. In addition, less than half of pregnancies reported by 16-19 year olds are estimated to meet the criteria for ‘unplanned pregnancy’ (Wellings et al., 2013b) so that risk factors and preventative interventions for TP are unlikely to mirror those for UIP.

1.1.3 The importance of addressing sexually transmitted infections in Britain

Across UK countries, diagnoses of syphilis, gonorrhoea, chlamydia and genital herpes and warts have increased considerably since the 1990s (Mohammed et al., 2018). This partly reflects better ascertainment of infection through increases in the number of STI tests performed, and improvements to the sensitivity of those tests. Nonetheless these figures are also attributable to increases in sexual risk behaviours (non-use of condoms and increased numbers of sexual partners) and earlier onset of sexual activity in the UK population, in response to social, demographic and cultural changes (Johnson et al., 2006), as outlined in section 1.1.1. The incidence of new STI diagnoses remains worryingly high - in 2016 420,000 new diagnoses of STIs were made in England (Public Health England, 2017). Of all new STI diagnoses in England in 2016 Chlamydia accounted for 49% of these (202,546) despite a 5% decrease in Chlamydia diagnoses in the UK between 2012-2016 (Mohammed et al., 2018). 20-24 year olds were the age group experiencing the greatest burden of infection for both men and women, followed by 15-19 year olds (for women) and 25-34 year olds (for men) (Public Health England, 2017). The majority of 2016 Chlamydia diagnoses across UK countries occurred in women (57.2%) (Mohammed et al., 2018) These statistics are a particular concern because of the potential for Chlamydia to lead to infertility (Haggerty et al., 2010).

1.2 The sexual health of women - a public health perspective

Population statistics, such as those provided above, provide ‘point’ estimates that summarise the overall prevalence or incidence of a particular characteristic
in a population. However, individuals are not all the same, and hence populations are heterogeneous. Epidemiology developed as a science in order to address public health concerns by studying health at the level of population rather than the individual (thus distinguishing it from clinical medicine). The World Health Organisation defines epidemiology as:

‘the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems’ (WHO, 2014).

Understanding population characteristics (such as age and ethnicity as well as disease burden) is key to public health interventions because they aim to improve the health of populations, rather than individuals. Thus we can understand the relationship between epidemiology and public health as one in which epidemiology provides an evidence base which informs the nature and delivery of public health interventions designed to identify, treat and prevent negative health outcomes.

1.2.1 The epidemiological landscape of sexually transmitted infections

The epidemiological landscape of STIs is distinct from that of unintended pregnancy, not least because the likelihood of an individual acquiring infectious disease is dependent on the spread and distribution of that disease in populations. Infectious diseases move dynamically through epidemic phases: growth, hyper-endemicity, decline and endemicity (Garnett, 2002). Factors affecting the pathogen, the host, or the environment will also have different degrees of influence at different stages of an epidemic (for example, heterogeneity of sexual risk experiences has greater impact during the endemic phase).

The ‘dynamic topology’ of STIs is also determined by sexual network dynamics, and by provision of and engagement with treatment and prevention programmes (Wasserheit and Aral, 1996). Therefore, the ways in which pathogen, host and environment combine can mitigate considerably the risk of STI acquisition within different populations. ‘Core groups’ emerge, which are dynamic sexual and social networks sustaining high core infection rates due to partner exchange and/or lack of diagnosis and treatment (Wasserheit and Aral,
Thus epidemics can become concentrated in diverse socio-demographic populations such as Men who have Sex with Men (MSM), Black-Caribbean populations and young people (YP).

Among Black-Caribbean populations, diagnosis rates of chlamydia and gonorrhoea in England in 2016 were four times higher than in the general population while the diagnosis rate of trichomoniasis was fourteen times higher (Mohammed et al., 2018). Evidence suggests that Black-Caribbean women are more likely to report sexual activity and delays in seeking care while symptomatic (Wayal et al., 2015). This illustrates how provision and uptake of STI screening and treatment can impact on background prevalence and on the effect of rate of sexual partner exchange (Wasserheit and Aral, 1996).

Socio-demographic variables are also inter-related, such that observed ethnic variations in STI diagnosis rates in England are partly explained by socio-economic status (SES) (Furegato et al., 2016). A study of GUM clinic attenders in England found that compared to White British/other women, black/mixed Caribbean women were less likely to report condomless sex with a non-regular partner or with two or more non-regular partners in the last three months, but were more likely to report STI diagnosis in the last year. This association was not adjusted for education, however black/mixed Caribbean women were also significantly more likely to be unemployed than White British/other women (Coyle and Miltz, 2018). Data from Natsal-2 similarly found that women from white ethnic groups reported the highest rate of sexual risk experiences, but that this did not correspond to a lower risk of STI acquisition among black Caribbean (or black African) populations (Fenton et al., 2005). In contrast with the GUM clinic study (Coyle and Miltz, 2018), no association between social class and STI acquisition was found in the Natsal-2 study so that the higher levels found in black Caribbean women were putatively attributed to younger age at sexual debut, higher rates of not being in a relationship and different patterns of partnership formation (Fenton et al., 2005). Studies in the United States have found that neighbourhood poverty mediates associations between Trichomoniasis and ethnicity among adolescents (Ford and Browning, 2011) and that higher rates of STIs exist in the black educated population than the white uneducated population even though the latter group had more partners.
than any other group (Annang et al., 2010). This evidence points to the salience of ethnicity and the complex ways in which it may be associated with higher prevalence of STIs and with other indicators of that prevalence such as education and SES.

Aside from ethnicity, age and SES remain important independent indicators of sexual risk and morbidity. SES is associated with CT among young people across the Western world (particularly when education measures are used) (Sheringham et al., 2013). Socio-demographic variables interact not only with sexual risk and adverse outcomes, but also with uptake of care. For example, both lower SES and youth were associated with declining to undertake a *Chlamydia trachomatis* test in primary care (Lau et al., 2016). Equally it is important to note that STI acquisition among adolescents may carry different types and strengths of association (Tripp and Viner, 2005) influenced by physiological immaturity and the episodic nature of sexual activity.

Despite this evidence base, a comparatively limited understanding of structural and socio-demographic factors persists. Economic disparities in STI rates - for example - are not wholly accounted for by sexual behaviour (Biello, 2014). This likely reflects a public health focus on *describing* target populations in socio-demographic terms, informed by a behaviour-based understanding of transmission dynamics. Thus, research and clinical assessment has focused on sexual risk behaviours of individuals and their partners as key predictors of STI acquisition among young people and other populations (Swartzendruber et al., 2013).

### 1.2.2 Choosing to research the concepts of ‘sexual risk ‘experiences’ and ‘Risk through partner’

The term ‘sexual behaviour’ is commonly used in applied sexual health epidemiology, referring to variables such as multiple partners, concurrency and non-use of condoms. This term however, denotes a degree of agency and choice which may be absent in women’s lived experiences of heterosexual encounters (Holland et al., 2004), as indicated by the literature surrounding
relationship type, power, depression and substance misuse in relation to adverse sexual health outcomes (discussed in Chapter Two).

Instead of ‘sexual behaviours’, this research therefore used the construct of ‘sexual risk experiences’, which can lead to UIP or STI acquisition, mediated by autonomy, partner behaviour and social context. This construct recognises that individuals may not always be in a position to enact health-seeking behaviours such as condom use, and that the degree of risk may vary between encounters, even with the same individual. It is also congruent with encounter-based understandings of sexual risk (Smith et al., 2004) (de Visser and Smith, 2001) (Holland et al., 2004).

By giving primacy to the context of sexual encounters, this construct is also congruent with the exploration in this research of ‘Risk Through Partner’ (RTP) of STI acquisition. RTP recognises the contribution to the likelihood of STI acquisition of sexual partners’ current and historical condom use and sexual experiences with other partners. The importance of RTP is demonstrated by high rates of *Chlamydia trachomatis* re-infection which point not only to change of sexual partners and failed treatment but to same-partner as the source (Walker et al., 2012, LaMontagne et al., 2007, Batteiger et al., 2010). Similarly, over-estimates of success from the National Chlamydia Screening Programme (NCSP) have been explained by use of compartmental models which did not account for re-infection within partnerships (Low, 2016). The Natsal-3 finding that 60.4% of those with a *Chlamydia trachomatis* (CT) diagnosis reported only 1 partner in the last year (Sonnenberg et al., 2013) may also be indicative of partner re-infection (in addition to asymptomatic infection and late diagnosis). Accordingly, RTP is one of the outcomes of interest that was modelled as part of CPR derivation (see Chapters Five and Six).

**1.2.3 The epidemiological landscape of unintended pregnancy**

In contrast to STI acquisition, UIP is not dependent on the dynamism of infectivity. Risk of UIP is instead mitigated by individual behaviour (contraception use and sexual activity), and by variability in the fecundity of the male and female partner. Nonetheless the distribution of UIP also varies
According to socio-demographics, and is effected by social and service provision; most obviously that access to contraception is instrumental in reducing UIP (Grindlay and Grossman, 2016).

Unintended pregnancy rates vary by age group— the highest number occurring in women aged 20-34 years (62.4%) (Wellings et al., 2013b). Similarly conceptions leading to abortion vary by age group – over the last two decades abortion rates in England and Wales have increased among women under 30 and decreased among women aged 35 and over (ONS, 2013). For women in their twenties and early thirties the overall pattern has been of increase through the 1990s and steady decrease through the last decade with a small upturn reported in 2011 (ONS, 2013).

Research investigating the socio-demographic and contraceptive use of women electing to have an induced abortion is instructive in understanding patterns of contraceptive use across sub-populations. A study of women booked for induced abortion found that 62% reported using a contraceptive method at the time of the UIP. Being single, Asian or British Asian was associated with non-use at the time of the UIP while use of a regular contraceptive method (defined as a method ‘normally used’ by a woman to protect herself from pregnancy) was less common among women aged 40+, married and of Black or Black British origin (Bury and Ngo, 2009). It is also important to note that resolution of an unintended pregnancy in either abortion or live birth is mediated by socio-economic status (Love, 2017) (as well as other factors such as religious beliefs and availability of services) such that studies of abortion are prone to disproportionately represent certain populations.

Use of contraception services has also been found to vary according to ethnicity. The National Survey of Sexual Attitudes and Lifestyles (Natsal-2) (French et al., 2009) found that although ethnic group did not predict attendance for family planning in General Practice, use of community clinics was higher among Black and minority ethnic groups compared to white groups. Evidence suggests that among women of reproductive age 85% will conceive in a year with no contraception, 15% with condoms and 8% with oral contraception.
(Bailey et al., 2017). Thus the Natsal-2 finding that 20.7% of sexually active women had not used a contraception service in the past year is concerning (French et al., 2009). In the same study, non-use of contraception was higher among women aged 35-44 than those aged 18-24, and was associated with lower educational status, having two or more children, being (or having been) married, and lower social class. The authors concluded that access to contraception for young people still needs widening, even though being younger was positively associated with uptake of contraception and with attending community services. Similarly, the episodic nature of adolescent sexual activity is itself likely to impact on contraception use and discontinuation when relationships end (Santelli et al., 1999), particularly among those not using Long Acting Reversible Contraception (LARC).

1.2.4 Targeting sub-populations: applying epidemiology to public health

Epidemiological study of population heterogeneity regarding negative health outcomes has provided the cornerstone of scientific efforts to establish causal links; and also of public health efforts to define, identify and intervene with sub-populations where negative outcomes are highest. Identifying sub-populations where the prevalence of either negative health outcomes or known causes of negative health outcomes are known to be higher enables ‘targeting’ of resources. The links between epidemiology and targeting are encapsulated in the statement that:

‘Implicit in any epidemiological investigation is the notion of a target population about which conclusions are to be drawn’ (Coggon et al., 2003) (p.2.)

Targeting is a vital economic response to population heterogeneity, allocating finite resources for assessment and treatment towards sub-populations in which the likelihood of having or developing certain negative health outcomes is higher. This approach is discussed further in the next section alongside other strategies aimed at improving sexual health in Britain.
1.3 Sexual health interventions and service delivery in Britain

Sexual and reproductive health has remained a priority for governments and public health policy makers (Avery and Lazdane, 2008), aided by recognition that sexual and reproductive health is a key component of sustainable societies, in particular because of global need to control population growth and arrest the spread of HIV (Sundewall and Poku, 2018). Accordingly, improving sexual health remains a key goal for public health in Britain following the Darzi report in 2008 (Darzi, 2008).

Improving access to sexual health services for target populations came to the fore in England at the millennium with 10 year strategies for teenage pregnancy (DH, 1999) and Sexual Health and HIV in England (DH, 2001) in response to high rates of STIs, HIV, teenage pregnancy and unintended pregnancy (UIP). Targeted interventions have been aimed towards higher-risk populations such as Men who have Sex with Men (MSM), commercial sex workers and young people. Interventions have included outreach school-based education under the related Teenage Pregnancy Strategy, and the use of ‘selective screening’ of high risk populations for STIs, such as the National Chlamydia Screening Programme (NCSP). The NCSP offers free *Chlamydia trachomatis* tests to all young people aged under 25 years, and was established in response to an observed Chlamydia prevalence of 10% among young people attending sexual health settings (Pimenta et al., 2003).

Improving uptake of interventions among high-risk populations has formed part of a two-pronged public health approach to general goals around reducing unintended pregnancy, termination of pregnancy, and STI acquisition and transmission (DH, 2001) (DH, 2013). The other key approach has been improving access to interventions, particularly to enable early intervention (such as early identification of unintended pregnancy and early STI testing, diagnosis and treatment to reduce sequelae and onwards transmission (DH, 2013)).

Sexual healthcare delivery has therefore expanded to involve a range of providers: GPs, pharmacies, young people’s services (including secondary and tertiary education), sexual assault referral centres, independent services (e.g. Brook, Terence Higgins Trust and abortion providers), alongside Genito-Urinary
Medicine (GUM) and CASH (Contraception and Sexual Health) clinics. CASH clinics are increasingly replacing GUM and family planning clinics provided in British ‘secondary care’ settings (i.e. hospitals and other specialist clinics). In addition, access to STI testing and contraception advice and supply is increasingly provided online, such as ‘My Contraception Tool’ (French et al., 2014) and ‘SH24’ (Wilson et al., 2017). Certainly, recent evidence suggests that online (versus clinic) service users are more likely to be female and from less deprived areas (Barnard et al., 2018). This highlights the importance of evaluating more thoroughly the use of remote interventions (Wellings et al., 2017), in order that face-to-face services can be geared towards individuals with lower engagement with online resources, and/or complex needs and/or symptomatic presentation.

Different settings provide different sexual health interventions, although these can be subject to regional and local variation. In particular, non-specialist and community settings have tended to focus on ‘primary prevention’ - aiming to prevent negative outcomes occurring in the individual. In the context of sexual health this includes sexual health education literature and discussion, and provision of condoms and other contraception. However, General Practices should make available all components of ‘Level One’ sexual health service provision as defined in the National Strategy for Sexual Health and HIV (DH, 2001). This comprises sexual history and risk assessment, STI testing for women, HIV testing and counselling, pregnancy testing and referral, contraceptive information and services, assessment and referral of men with STI symptoms, cervical cytology screening and referral, and hepatitis B immunisation (DH, 2001).

Some General Practices additionally provide ‘Level Two’ interventions: treatment of STIs, vasectomy, administration of LARC (including insertion of intrauterine devices and contraceptive implants) and partner notification. Thus, GPs – in addition to specialist sexual health services – offer aspects of ‘secondary prevention’ that aim to detect, and treat negative outcomes in the individual. In the context of communicable disease, secondary prevention aims not only to ameliorate or remove negative outcomes, but also to prevent transmission to uninfected members of the population who are exposed to an
infected individual. Thus, secondary prevention in sexual health refers to STI testing, treatment and partner notification, and to pregnancy testing and provision of antenatal and abortion services. General Practices are not expected to provide ‘Level Three’ services, which comprise outreach contraception and STI prevention, specialised HIV treatment and care, and highly specialised contraception and infections management (DH, 2001). Nonetheless, specific localities may choose to run outreach services from General Practices.

This organisation of services has been in response to the National Strategy of Sexual Health and HIV (DH, 2001), the Teenage Pregnancy Strategy (DH, 1999) and the more recent Sexual Health Improvement Framework (DH, 2013). This latter document set out key policy areas for improvement, including use and monitoring of three sexual health related indicators under the Public Health Outcomes Framework (PHOF) in England (concerning reductions in under 18s conceptions and late stage HIV presentation, and increasing chlamydia diagnoses) (DH, 2016b). These documents reflect the breadth of key sexual health concerns: unintended pregnancy, teenage pregnancy, HIV and STIs. In contrast, this research focuses only on prevention of UIP and on detection and prevention of STI acquisition, reflecting that GPs have a key role in addressing these particular issues.

Although a range of community sites including pharmacies and young people services are now engaged in delivering Level One services, GPs particularly have been developed as sites for provision of, and referral to, Level One and Level Two services - focusing on sexual health advice, contraception, STI testing (and sometimes treatment and partner notification). This initiative has widened the availability of those interventions to a more heterogeneous population than those who might attend specialist GUM or CASH clinics. Despite regional and local differences in provision, primary care as a whole provides the same role across regions of the UK so that similar relationships exist between specialist sexual health and GP services regardless of region.
1.3.1 Differences between GP and sexual health settings

The evidence base for differences between GUM or CASH populations and GP populations is scant. Analysis of the National Survey of Sexual Attitudes and Lifestyles-3 (Natsal-3) found that women accessing chlamydia testing in GP services (versus GUM) were older, more likely to be in a relationship, less likely to not use a condom during first sex with most recent partner and reported less sexual partners and same sex partners (Clifton et al., 2016). Conversely, a study in the South West of England (Mercer et al., 2013a) found little difference between the populations – however this may reflect that the GP cohort were recruited from a surgery offering a Local Enhanced Service for sexual health, and the rural nature of the setting. Certainly, rural settings and lower Index of Multiple Deprivation scores (IMD score) correlate with lower uptake of Chlamydia trachomatis testing among young women in South-East England, so that these are additional factors to consider when assessing or interpreting differences between clinic populations (Johnson et al., 2010).

A South-East England study of chlamydia test coverage and positivity in the National Chlamydia Screening Programme (NCSP) also found different rates of Chlamydia trachomatis positivity by clinic type, such that University clinics had lower positivity than GPs, which in turn had lower positivity than community contraception or young people services (Johnson et al., 2010). Similarly, a British cohort study of young women aged 16-24 years found higher rates of Chlamydia trachomatis in GUM settings compared to family planning clinics, which was in turn higher than the rate found in GP settings (LaMontagne et al., 2007). Interestingly, this study also found a reverse association for Chlamydia trachomatis re-infection rates such that GP settings had a re-infection rate of 29.9 per 100 person years (confidence interval: 19.7-45.4), family planning clinics had a re-infection rate of 22.3 per 100 person-years (confidence interval: 15.6-31.8) and GUM clinics had a re-infection rate of 21.1 per 100 person-years (confidence interval:14.3-30.9).

Overall, this evidence base suggests that GP populations are more heterogeneous in sexual risk experiences and morbidity than populations attending specialist sexual health services so that some means of targeting sexual health interventions in GP settings may be beneficial. In addition, it may
be that patients attending GP services for sexual health needs are more likely to be at risk through a partner (RTP) of STI acquisition (a key outcome of interest for this programme of research that is set out in section 1.2.2).

1.3.2 The importance of GP settings in providing sexual healthcare: opportunities and challenges

Even though the populations that General Practices serve demonstrate considerable variability in the need for sexual healthcare, GPs present a valuable opportunity to identify the need for, and to provide, sexual healthcare. A Natsal-3 study of sexual health clinic attendance (Tanton et al., 2017) found that, among those reporting no condom use with 2 or more partners in the last year and/or at first sex with a new partner, more than 75% had not attended a sexual health clinic in the last year. For 16-44 year olds within this cohort, GPs were the preferred location for STI diagnosis and treatment among those who had never been to a specialist sexual health service (71%), while among those who had been to a specialist service more than a year ago, 37% still preferred to use a GP for sexual healthcare.

STI testing in primary care increased significantly in the 1990s (Cassell et al., 2006) and Natsal-3 data (collected 2010-2012) indicates that among 16-44 year olds who had tested for *Chlamydia trachomatis* in the last year, 41.1% of women and 20.7% of men had done so in General Practice, which was also the most common source of contraception (59.1%) among women (French et al., 2017). Although rates of STI diagnoses in England GPs fell between 2005 and 2014, analyses suggest that in 2014 the proportion of STI diagnoses among women that were made in GP settings remained substantial - 38.3% for *Chlamydia trachomatis* and 41.8% for genital herpes (Beaumont et al., 2016).

General Practice also offers particular opportunities to provide sexual healthcare to young people. Qualitative evidence suggests that young people prefer to access sexual health advice, condom and contraception advice at GPs compared to other sexual healthcare settings (Jones et al., 2017) although it is important to note that this study was part of an evaluation of the ‘3 Cs and HIV’ intervention and included only n=21 young women. A separate study found that
75% of 16-24 year old women consulted a General Practitioner at least once in a one year period (Salisbury et al., 2006), although the authors note the potential for over-estimation as the study was conducted with participants in the Chlamydia Screening Studies project who may have attended due to a positive test result. However, despite this encouraging evidence base, challenges persist for the delivery of sexual healthcare in GP settings, as outlined in the following paragraphs.

The focus of GP sexual healthcare provision has been STI testing and contraception, yet safer sex advice and condom provision are also important aspects of primary prevention. However, these may be difficult to initiate, and may be hampered by resource and expertise issues that also prevent partner notification in GP settings (Cassell et al., 2003). This latter issue may be reflected in the higher prevalence of re-infection in primary care (LaMontagne et al., 2007). In addition, there is some evidence of sub-optimal treatment in primary care and failure to refer to specialist providers where appropriate. For example, following diagnosis of Neisseria gonorrhoeae in primary care, referral should be made to secondary care for treatment and test of cure, partner notification and further STI testing (Lazaro, 2013). In contradiction with guidance, analysis of 2011-2015 data indicated that approximately half of those diagnosed in General Practice were also treated there, of which less than 20% received the recommended medication regimen (Mohammed et al., 2016).

Importantly, all sexual health interventions must rest on sexual health discussion and there is evidence to suggest that staff worries about discussing sexual health are a key barrier to chlamydia testing in primary care (McNulty et al., 2004) and to sexual history taking in primary care (Temple-Smith et al., 1999). In response, two interventions have been formulated. First, an electronic consultation tool has been developed to improve General Practitioner communication with young people about sexual health (Macdowall et al., 2010); although there exists no published evaluation of its use. Second, the ‘3Cs and HIV’ educational programme to improve sexual healthcare in British primary care (Town et al., 2015) was developed and trialled. This intervention improved testing uptake for some high-risk populations but had no overall effect on STI testing (Town et al., 2016). Indeed, recent research has explored barriers to
*Chlamydia trachomatis* testing by young people in GP settings, due to ongoing difficulties in increasing uptake among this population (McDonagh et al., 2017).

The nature of GP concerns about sexual health discussion have been shown to hinge on two issues. The first of these is limited time in which to both discuss sexual health and to then – if needed- provide testing and other interventions (McNulty et al., 2004) (Temple-Smith et al., 1999). The second major concern centres on initiating discussion of sexual health with patients attending for unrelated issues, and the potential for this to cause offence or otherwise damage the patient-practitioner relationship, particularly with new patients (McNulty et al., 2004). These two issues reflect that patients attending GP surgeries are a heterogeneous population with respect to sexual risk and morbidity, and that people attend GP appointments for a variety of reasons. In the following section the potential benefits of a bespoke means of identifying those patients who have experienced recent sexual risk is presented, alongside the resource implications of there currently being no such tool.

### 1.4 The case for a bespoke means of targeting women in GP settings based on presenting risk

Together the evidence above suggests that GP surgeries are a suitable place for the delivery of STI testing and contraception, even though they serve a population who are heterogeneous in sexual risk and problems with delivery persist. In particular, GP surgeries offer a key opportunity to offer sexual health interventions to people attending with unrelated health concerns. However, there is no existing evidence-based means of identifying individuals in GP settings who are likely to be at high risk of UIP and/or STIs. This is a particular concern given the barriers to opportunistic sexual health discussion presented in the preceding section. Consequently, identification is likely to be *ad hoc*, and based upon characteristics of the individual that identify them as members of a high-risk population and/ or based on detailed sexual history taking.

The absence of a GP-based targeting tool for sexual health interventions means that resources may be wasted by opportunistically offering sexual healthcare to those who do not need it (Fairley, 2016). Certainly, there is evidence that
targeting interventions based on population characteristics alone may be inefficient. Evidence suggests asymptomatic STI testing is of questionable benefit (Low, 2016) so that the need for more nuanced targeting of STI testing — particularly Chlamydia trachomatis - has been raised (Fairley, 2016). Thus, socio-demographic variables are likely to be unsuitably ‘blunt’ for targeting contraception and STI testing within GP settings. Alternatively, discussions with professionals raised the possibility that socio-demographic variables might be used to target sexual healthcare interventions on a surgery-by-surgery basis, dependent on the socio-demographic profile of the community served by each surgery. However, this does not address the problem of variation within those populations and would lead to over-burden on some clinical settings (e.g. in deprived areas) and poor access to sexual health in others. This is likely to be problematic particularly where socio-demographic risk groups do not overlap (e.g. amongst young people in non-deprived areas).

In addition to inefficiency concerns, without a bespoke means of targeting sexual healthcare in GPs, opportunities may also be missed to treat those who would benefit from sexual healthcare. Individuals may be particularly vulnerable to being missed if they are attending for unrelated issues or do not — or do not appear to — fit into a high-risk population. Sexual history-taking (Brook et al., 2013), which is used in specialist sexual health settings to inform which interventions to provide, would help address this issue. However, it is resource-intensive so that its routine use in GPs would be inefficient and unfeasible where patients are presenting for 10-minute appointments about unrelated health concerns. Evidence also suggests it may be unacceptable with some target groups in primary care settings (Edelman et al., 2013, Define, 2008) and General Practitioners themselves have been shown to have concerns about opportunistically discussing sexual health with patients attending for unrelated health concerns (McNulty et al., 2004).

Even with the benefit of detailed sexual history-taking, individuals at risk of STIs may be vulnerable to being overlooked. A study of adolescents’ STI rates found that among those positive, more than 10% reported no sexual intercourse in the previous year (DiClemente et al., 2011). Individuals may also present as being in monogamous and stable relationship but are nonetheless experiencing risk
through partner (RTP) of STIs, through their partner’s behaviour or sexual history, of which they may not be aware. RTP is a key sexual risk experience explored in this research as discussed in section 1.2.2.

Identifying individuals who are at high risk of UIP and/or STIs through their partner, or through other sexual risk experiences (such as multiple partners without condom use) would enable targeting of primary prevention such as sexual health advice, and provision of condoms or other contraception. A tool offering a single means of targeting these interventions as well as STI testing would have reach and value in offering an efficient person-centred approach to sexual healthcare delivery particularly because contraception and STI testing are increasingly co-located in both specialist and generalist settings.

In summary, the development of a bespoke tool to target sexual health interventions to women attending GPs is warranted by:

1. the need for an efficient and more nuanced approach than that offered by population screening
2. the unacceptable and resource-intensive nature of opportunistic sexual history-taking in GP settings
3. the potential to identify a novel population of women at risk through partners
4. the potential for primary as well as secondary prevention interventions to be implemented in GP settings

In effect, the bespoke tool would be used to determine on a patient-by-patient basis, whether or not a sexual health discussion (and subsequent interventions) are needed. Clinical prediction rules are tools used to determine patient care on an individual basis and are therefore well suited to this purpose. The nature of CPRs and their development is outlined in the following section.

1.4.1 Using a clinical prediction rule to target sexual health interventions to individuals

Clinical prediction rules (CPRs) are increasingly used to support clinical decision-making about provision of interventions to individual patients (Liao and Mark, 2003). Established use of CPRs such as the ‘QRISK’ for cardiovascular disease (Hippisley-Cox et al., 2007) and the ‘AUDIT-C’ alcohol assessment tool
(Bradley et al., 2007) reflect their inclusion within contracted NHS services such as primary care-based NHS Health Checks for people over 40 years of age (Robson et al., 2016). Increasingly CPRs are also delivered online and anonymously, such as the DrinksMeter tool (Attwood et al., 2017).

CPRs have been defined as:

‘…tools that provide estimates of absolute risk based on the combination of several patient characteristics, thus allowing for more nuanced and precise decision making than screening recommendations when applied to individual patients’ (Falasinnu et al., 2014b) (p. 321)

CPRs can be developed to inform prognosis and/or current need for intervention and may be employed to target interventions that seek to prevent or ameliorate either adverse health outcomes or the risks that might precede them. Therefore, CPRs may use both cross-sectional and longitudinal data, and may comprise factors that are not causally associated with the outcome of interest, so that the word ‘prediction’ refers to statistical association in this context. This distinguishes CPRs from screening tools which typically use ‘markers’ of morbidity or of elevated risk of morbidity which are themselves manifestations of pre-clinical changes, and which are also distinct from CPRs as a means of identifying preclinical disease and providing preliminary diagnosis (Coggon et al., 2003). The lines between screening tools, CPRs and ‘risk assessment' tools can nonetheless be blurred, as discussed in Chapter Two.

CPRs are designed neither to identify pre-clinical disease nor to measure latent concepts/constructs, e.g. ‘propensity towards risk-taking’ (as a psychometric scale would do). Rather, CPRs seek to identify those who are most likely to need intervention. In this way CPRs can be seen as a 'bridge' between population and individual health, in which epidemiological observations, which relate primarily to groups of people, are used to determine the care of individuals. Many areas of medicine are increasingly engaging with uncertainty and variability in risks and outcomes such that:

‘This burgeoning research focus on prediction rules is driven by growing recognition of two issues: 1) the central activity of clinical medicine is making predictions in the setting of uncertainty; and 2) doctors are not very good at this task…… probabilistic reasoning underlies almost every clinical decision...’ (Liao and Mark, 2003) (p.851).
CPR development involves the steps: derivation, validation and finally evaluation (Falasinnu et al., 2014b) although these are not always clearly described as such in the literature. The first step, derivation, aims to establish the items that will comprise the CPR. Derivation most commonly involves multivariable modelling of the outcome which the CPR is designed to capture (Steyerberg, 2009). Potential CPR items are then entered into the model as ‘candidate predictors’ and those which are retained are used as the CPR items. Each CPR item is then attributed a score, often based on the size of the corresponding co-efficient in the model. These item scores are then combined to generate a CPR scoring system, from which a cut-off value is selected to indicate whether intervention is recommended.

This common method of CPR derivation can then be understood as the application of epidemiological methods to a health services problem, in which population health statistics are used to determine individual care (and therefore carrying the implicit construction found in conventional epidemiology that populations are aggregates of individuals (Krieger, 2014)). The use of population health statistics to determine individual care necessarily carries a degree of error, in which summary characteristics may not be present in an individual at risk, and may be present in an individual without risk. As with screening tools, this generates the impetus to maximise the sensitivity and specificity of CPRs by specifying an optimal cut-off score. Using a population health approach to determining individual care is a key theme of this thesis that will be revisited at various points.

1.4.2 The landscape of sexual health CPRs

Several CPRs have been developed for use in sexual healthcare, although described by terms such as clinical decision rule, risk-scoring algorithm and risk score. An overview of these CPRs is provided in Appendix 1a. These CPRs have been developed for use in a variety of settings – including A&E, abortion services and online STI testing services. Among the CPRs reviewed only one included an outcome other than STI diagnosis - the Denver HIV risk score (Haukoos et al., 2012), and none addressed risk of UIP. None has been developed to target contraception and STI testing in British GPs.
Most existing tools comprise sexual-behavioural and socio-demographic items, with most papers giving little or no rationale for how initial 'candidate predictors' were selected as potential CPR items, for example (Falasinnu et al., 2014a, Lavoué et al., 2014, Reed et al., 2007). One study did however provide a detailed theoretical rationale for the selection of each psychological and psychosocial variable investigated for use in their tool to identify STIs among young people in primary care (Victor et al., 2015). This was the only primary care-based CPR identified and the only one to explicitly investigate psychosocial variables. Among the CPRs that used multivariable modelling to determine which items to include, most comprised 10-12 exposures. This reflects the recognised need for brief and simple CPRs (Duke et al., 2008) which was also echoed by women during Patient and Public Involvement (see Chapter Two for further discussion).

1.4.3 Using psychosocial CPR items to identify need for sexual health intervention

As discussed above, report of sexual risk experiences may be unacceptable for use in routine targeting of GP populations and may only partly predict poor sexual health outcomes (Mittal et al., 2012). Equally problematic however, is the use of socio-demographic variables that are unlikely to be sufficiently sensitive to enable efficient targeting of sexual health interventions to those at elevated risk of UIP or STIs. There already exists a considerable body of evidence suggesting that psychosocial issues mitigate sexual experiences and outcomes and are therefore worthy of investigation for use as CPR items. This evidence base is discussed further in Chapter Two, alongside exploration and definition of the term ‘psychosocial’.

In the broader context of sexual health research and management, psychosocial questions - such as social support and mental health - may offer an acceptable and tractable alternative to routine sexual history taking during GP consultations. Importantly however, it is notable that a CPR based on sexual history items may be acceptable, particularly one designed for self-completion and non-electronic use. Although the CPR was designed to be
suitable for self-completion, this exploratory work also addressed the potential for practitioners to opportunistically offer the CPR to patients, in which context sexual behaviour items would likely be less acceptable, particularly given existing evidence that opportunistic sexual history-taking is a concern for some patient groups (Define, 2008) (Edelman et al., 2013).

Evidence also suggests that psychosocial variables have the potential to offer a more nuanced approach than targeting high-risk populations which are defined socio-demographically or in relation to sexual behaviour (eg. men who have sex with men) (Mittal et al., 2012). Finally, they may constitute ‘wider determinants of sexual health’, enabling strategies to prevent sexual morbidity. This is a key focus of England’s Sexual Health Improvement Framework, 2013 (DH, 2013), and a possibility revisited in Chapter Seven. Certainly, General Practices and other settings including CASH and GUM clinics are increasingly identified as sites for addressing adjunct issues – regardless of whether they are causally associated with sexual risk. For example, assessment of domestic abuse and violence is recommended in specialist sexual health and primary care settings (Sacks et al., 2016) (Pathak et al., 2017).

1.4.4 The case for looking at women only

Acquisition of STIs and the predictors of that acquisition are heavily moderated by sex – for example 15-19 year old women are 2.8 times more likely to be diagnosed with chlamydia, gonorrhoea or syphilis (compared to men aged 15-19 years old), across all UK countries (Mohammed et al., 2018). The sex-specific nature of contraceptive advice and supply, and the predictors and impact of UIP also indicate the benefit of developing a sex-specific CPR to target contraception and STI testing exclusively to women in GP settings. Furthermore, gender mediates levels of engagement with health care services in general (Green and Pope, 1999) and with regard to sexual healthcare delivery. Specifically, evidence suggests that women are more likely than men to use online rather clinic-based sexual health services (Barnard et al., 2018); and to respond to a genital chlamydia diagnosis by blaming themselves and fearing future infection (Darroch et al., 2003). In addition, an English study found differences in preferences for receiving sexual health information such
that teenage girls were more likely than teenage boys to prefer to receive sexual health information from their parents (Newby et al., 2012).

Sociological and cultural differences between the lived experience of men and women (Tannenbaum et al., 2016) also mean that sex and gender have a mediating role on associations between sexual risk experiences and other aspects of the psychosocial environment. For example, alcohol use has been found to be predictive of number of sexual partners among female STI clinic patients but not male patients (Carey et al., 2016). Sex has also been found to interact with the ways in which parenting influences adolescent risk behaviours such that parental warmth and emotional connection has a protective effect for adolescent girls while behaviour monitoring is protective for adolescent boys (Kincaid et al., 2012). Together these data indicate that gender is likely to interact with the factors that predict negative sexual health outcomes (as well as the nature of those outcomes), reflecting general commentary on the importance of stratifying applied health research by sex and gender (Tannenbaum et al., 2016).

As a consequence of these considerations this thesis reports exclusively on the development of a psychosocial CPR for women, focusing on women of reproductive age (16-44 years) in recognition that this is the age-range within which most risk of UIP lies (Wellings et al., 2013b) (Erens et al., 2014). Notably, sexual orientation was not used as a means of either targeting the CPR or as a CPR item. The investigation and treatment of this variable is discussed separately in relation to each of the three studies comprising the thesis (see Chapters Three, Four and Five).

1.5 Thesis aim, scope and structure

1.5.1 Aim and research question

The aim of this research was to derive a psychosocial clinical prediction rule of sexual health risk for women of reproductive age attending British General Practices; that enables identification of those who may benefit from sexual health advice, contraception and/or STI testing to target those interventions
more efficiently. To meet the research aim the overarching research question addressed by the thesis was:

*What combination of psychosocial questions best identifies women attending GP surgeries who would benefit from sexual health advice, contraception and/or STI testing?*

### 1.5.2 Scope of the research

The scope of the research was limited to the derivation stage of CPR development, in which statistical modelling is used to determine the items that will comprise the CPR and to develop a scoring system to be applied to those items. The CPR was intended to initiate sexual health discussion and advice as a precursor to targeting contraception and STI testing specifically. Related work to develop a triage system in CASH settings found that a means of initiating such discussion was very much welcomed by patients (Roy et al., 2016). Thus, the outcomes of interest were sexual risk experiences most closely aligned to the need for those interventions, namely:

- Multiple partnerships in the last year (as an indicator of possible need for STI testing and/or sexual health advice)
- Risk of STI through most recent sexual partner (also an indicator of possible need for STI testing and/or sexual health advice)
- Risk of unintended pregnancy (UIP) in the last six months (as an indicator of the need for contraception advice and supply)

The CPR was therefore designed to target both primary prevention (contraception and sexual health advice) and secondary interventions (STI testing, treatment and partner notification). This addresses sexual health goals around prevention and early intervention (DH, 2013). It also corresponds to two key priorities for sexual health promotion – reducing rates of STIs and reducing unplanned pregnancies (DH, 2013) - which are taken forward in Public Health England’s strategic action plan for health promotion (Hartney et al., 2015) in seeking to ‘ensure easier access to appropriate STI testing’ (DH, 2013) (p.5) and to ‘minimise the proportion of pregnancies that are unplanned’ (DH, 2013)
In addition, it addressed broader NHS ‘Five Year Forward View’ goals of prevention and patient empowerment (NHS England, 2014).

1.5.3 **Structure of the research**

To identify candidate predictors for inclusion as CPR items this programme of research did not rely on the common approach of ‘known factors’ or a single dataset, as described in Appendix 1a. Instead, a particularly rigorous approach to CPR derivation was used, in which the overall research aim and question was addressed by carrying out three studies:

1. a systematic review to identify psychosocial factors statistically predictive of sexual risk behaviour, STI diagnosis or unplanned/unintended pregnancy in national probability surveys of women aged 16-44 years in the Western world

2. an analysis of the National Survey of Sexual Attitudes and Lifestyles-3 to identify acceptable, brief, easy-to-score psychosocial factors statistically predictive of sexual risk behaviour, STI diagnosis or unplanned/unintended pregnancy among British women aged 16-44 years

3. a cross-sectional survey of women attending clinical settings in Brighton & Hove (based on the psychosocial predictors identified in studies one and two) to determine which combination of those predictors best discriminated women who had experienced multiple male sexual partners in the last year, risk of STI through most recent partner, or risk of unintended pregnancy in the last six months

The presentation of these studies in the thesis is shown overleaf in Figure 1.
Figure 1: Thesis structure

Introduction and rationale
(Chapter 1)

Conceptual issues for the thesis
(Chapter 2)

**Study 1:** Identifying psychosocial factors associated with sexual risk and morbidity among women of reproductive age in the Western world
(Systematic review: Chapter 3)

**Study 2:** Identifying psychosocial factors associated with sexual risk among British women of reproductive age
(Analysis of the National Survey of Sexual Attitudes and Lifestyles-3: Chapter 4)

**Study 3:** Deriving a clinical prediction rule by modelling the psychosocial factors identified in studies 1 and 2
(Cross-sectional survey of Brighton & Hove clinics: Method; Chapter 5, Results; Chapter 6)

Discussion and Conclusions
(Chapter 7)
A number of conceptual issues emerged in relation to the research, particularly concerning: the nature of ‘psychosocial’ variables and their operationalisation; the meaning and interpretation of risk in epidemiology and in CPRs; and adherence to key CPR qualities identified through Patient and Public Involvement (PPI) – namely acceptability, brevity and suitability for self-scoring. These issues are addressed in the following chapter.
Chapter 2: Conceptual issues in deriving a sexual health clinical prediction rule using a psychosocial approach
Summary

This chapter outlines the meaning of the psychosocial within social epidemiology, discussing the nature of psychosocial variables and setting out the working definition by which the term was operationalised in this thesis. The case is made for investigating psychosocial variables as an acceptable and nuanced means of targeting GP-based sexual healthcare to women of reproductive age. The chapter offers an overview of known associations between psychosocial variables, and sexual risk experience and morbidity; noting how the evidence base concerning the chosen negative outcomes of interest - UIP and STI acquisition - is influenced by differences in the clinical and academic disciplines engaged with each. The chapter then outlines the importance and value of examining together predictors of UIP and STI acquisition and the implications of this for derivation of a CPR to identify women at risk of one or both of these negative sexual health outcomes.

The chapter moves on to consider the particular understanding of ‘risk’ that is extant in CPRs, and how this might differ from clinical and patient understandings of the term, raising potential implications of this for CPR derivation and future use. The role and contribution of Patient and Public Involvement (PPI) in this research is then presented, in particular the importance of CPR acceptability and self-completion. Finally, a brief section outlines how the concepts discussed in this chapter informed the systematic review.
2.1 Social epidemiology and the psychosocial

2.1.1 Social epidemiological understandings of the psychosocial

In the latter half of the 20th Century, social epidemiology emerged as a sub-discipline of epidemiology, focusing particularly on the study of material exposures, behaviour and psychosocial factors (Marmot and Wilkinson, 2006). In common parlance the term ‘psychosocial’ relates to ‘the interrelation of social factors and individual thought and behaviour’ (Oxford English Dictionary, 2016) but has been used in various ways by different disciplines.

Within the discipline of social epidemiology, different uses of the term ‘psychosocial’ have also been offered (Martikainen et al., 2002). The term was first used to refer specifically to social factors which have a causal effect on stress in the individual, thus resulting in biological and psychological changes that impact on health states (Cassel, 1976). This paper was seminal in expanding the epidemiological model from ‘host-agent’ to ‘host-agent-environment’ (Krieger, 2014). Closely following this publication, the biopsychosocial model was published (Engel, 1977), which complemented Cassel’s work in two ways. First, it recognised the importance for bio-medicine and clinical practice of addressing the contribution of social and psychosocial factors (personal, emotional, family, community) (Smith, 2002). Second, it was argued that, by applying the biopsychosocial model, it was both possible and valuable to investigate scientifically the subjective experience of the individual (Borrell-Carrió et al., 2004).

The notion of subjective experience has emerged in a more recent social epidemiological definition of psychosocial variables, i.e. factors representing the impact on negative health outcomes of ‘subjective experience and emotions’ (Marmot and Wilkinson, 2006) (p.3). Within the same book (Wilkinson, 2006) argues that psychosocial factors are social factors which effect stress and subsequently behaviour as well as biology. Wilkinson goes further to categorise psychosocial factors according to: 1. early development, 2. social status (in particular via the mechanism of lack of control) and 3. social affiliation. These categories chime with some of the psychosocial evidence described later in
section 2.2, and in the studies comprising this thesis (see Chapters Three-Six), e.g. early sexual debut, child sexual abuse, intimate partner violence and coercion, and the quality of sexual and social relationships and associated mental health.

The most expansive use of ‘psychosocial’ within social epidemiology suggests that any factor is psychosocial if it influences health outcomes by affecting biology, by affecting behaviour and finally by affecting psychology and subsequently (via stress) both biology and behaviour (Martikainen et al., 2002). This description demonstrates three common features of how the term ‘psychosocial’ tends to be presented in social epidemiology. First, it emphasises stress as a key mechanism of action. Second, it recognises that both psychological and bodily responses lead to negative health outcomes. Finally, it uses the term ‘psychosocial’ functionally to elucidate a variety of pathways from social states to health states (rather than substantively describing the nature of psychosocial variables). Thus, social epidemiology attributes the term ‘psychosocial’ to variables based on their function in impacting health via certain mechanisms.

This functional use of the term ‘psychosocial’ arguably reflects the interests of social epidemiology per se – in pursuing associations between the social world and individual and population health. It is perhaps for this reason that the term has received little direct attention within the field. Accordingly, descriptions of the psychosocial are closely aligned to Marmot and Wilkinson’s definition of social epidemiology given at the beginning of this sub-section (Marmot and Wilkinson, 2006). Specifically, factors directly affecting biology might include ‘material exposures’, ‘behaviour’ is recognised as a distinct factor even when not a stress response, and stress responses on biology and behaviour are congruent with Marmot and Wilkinson’s definition of ‘psychosocial’. Accordingly, this research can be understood to take a social epidemiological approach, defined as such not only by its use of multivariable quantitative survey analyses in order to derive the CPR, but also by its focus on psychosocial predictors of sexual risk and morbidity to constitute that CPR.
Although social epidemiology explores hypotheses and has been described in terms of categories of interests it has been argued that it is *substantively* atheoretical (Broadbent, 2011). This is perhaps manifested in the lack of *theoretical* attention to the contribution of psychosocial factors on negative health outcomes and likely reflects the well-documented difficulty in scientifically establishing causal association from epidemiological study of social and psychosocial factors. It is noteworthy that this dominant, atheoretical enquiry of what has been called ‘psychosocial theory’ in social epidemiology (Krieger, 2014) has been challenged, and that there exists two competing social epidemiological approaches. The ‘social production of disease’ theory focuses on macro determinants of health, while eco-social theory has been developed as a way of investigating causal and substantive links between macro and individual level variables (Krieger, 2014). This latter theory has been developed by social epidemiologist Nancy Krieger, who asserts that:

“..to speak of theory…is to speak of embodiment. At issue is how we literally incorporate, biologically, the world around us” (Krieger, 2014) (p.668)

There is perhaps congruence here between this notion of embodiment and Marmot and Wilkinson’s focus on subjective experience. Certainly the latter chimes with transdisciplinary psychosocial studies which focus on emotion, affect and lived experience (Stenner, 2007) and seek to:

‘reconsider the relationship between psychic and social life and social conditions in the making of subjectivity’ (Johnson, 2014) (p.5-6)

‘Transdisciplinary’ psychosocial studies are so-called because they aim to reconcile psychology and sociology; addressing both a perceived under-representation in psychology of structural factors and of the sociology of emotion, and an over-emphasis on cognition and rational thought (Johnson, 2014). Social scientists have suggested that social epidemiology uses the term ‘psychosocial’ to refer to an interaction between psychological and social factors, when attempting to isolate the effects of individual factors (Johnson, 2014). In this way, both transdisciplinary and social epidemiological understandings of the psychosocial share a common interest in exploring the liminal space between the individual’s inner and outer world. This stands in direct contrast with psychoanalytic research which uses the hyphenated term
2.1.2 Defining ‘psychosocial’ for this programme of research

This thesis uses the dominant ‘psychosocial theory’ of social epidemiology, both in its use of multivariable modelling to identify CPR items, and in its exploration of ‘psychosocial’ variables to formulate those items. A potential tension then exists in this research between the functional (i.e. causal) use of the term ‘psychosocial’ provided by social epidemiology as described above, and the need for a descriptive definition of the term in order to take a rigorous methodological approach to selecting and assessing psychosocial variables as CPR items. In particular derivation of a CPR is an essentially atheoretical exercise. i.e. variables may be selected as candidate predictors whether or not they are hypothesised – or demonstrated to be - causally associated with the outcome which the CPR needs to measure (as explained in Chapter One).

Furthermore, the process of selecting which candidate predictors are retained as CPR items usually involves statistical modelling rather than the application of theory. Thus variables may have utility as CPR items even if they are spuriously associated with the outcomes they are used to predict. Even if exposures were selected for investigation in this thesis because of a putatively causal affect, it would be impossible to confirm or reject this supposition within the bounds of this thesis, not least because disentangling psychosocial pathways from biological mechanisms can be difficult (e.g. the contribution of biology and behaviour to HPV acquisition (Panatto et al., 2012)). This kind of atheoretical investigation of psychosocial variables is also common in social epidemiological studies of sexual health (Edelman, 2017).

A descriptive definition of psychosocial was therefore developed for the purposes of this thesis, in order to exact a consistent approach to identifying and testing candidate predictors. An ‘exclusionary’ definition was chosen in which variables were defined as psychosocial if they did not concern: sexual behaviour, biology, socio-demographics or attitude or perception. This definition enabled a focus on variables such as mental health, relationship qualities (both
sexual and social), lifestyle and substance use; for which there is a growing but somewhat piecemeal evidence base. Such variables are essentially concerned with the lived experience of individuals, chiming with Marmot’s description of psychosocial factors as those where ‘subjective experience and emotions’ impact on negative health outcomes (Marmot and Wilkinson, 2006)(p.3). This exclusionary definition which focuses on individual experience is also arguably congruent with transdisciplinary understandings of ‘psychosocial’ (Taylor and Stenner, 2008) as described above in so far as it occupies the space between the individual’s inner world and the broader social world in which they live.

2.1.3 Exclusion of health psychology constructs

The rejection of social cognition variables - such as self-efficacy and risk perception - from the thesis definition of ‘psychosocial’ warrants special mention. These constructs have been developed from social cognition theory (Bandura, 1986) as a means of explaining the behaviour of individuals (and have therefore been used by health psychologists to develop behavioural interventions). They are not designed for use at population level, although they are increasingly measured in social epidemiological surveys of sexual health. These constructs, and the models in which they are embedded, have been criticised for their lack of attention to gender and culture (Amaro, 1995) and to social context (Free and Ogden, 2005), and more broadly for their conceptual basis and individualistic focus (Free and Ogden, 2005). The capacity for social cognition items to predict sexual health motivation at population level has similarly been challenged (Abel et al., 2003) (Mittal et al., 2012).

The performance of ‘risk perception’ as a predictor of sexual risk experiences and/or morbidity is particularly questionable. Recent evidence from the National Survey of Sexual Attitudes and Lifestyles (Natsal-3) found that most participants who received a positive bacterial STI diagnosis had assessed themselves as ‘not at risk’, alongside half of those who reported non-use of condoms with at least two sexual partners in the previous year (Clifton et al., 2017). This led the authors to conclude that interventions are much needed which use factors other than risk perception to identify people at heightened risk of infection.
Even if population studies indicated a clear linear relationship between risk perception and experience of risk and morbidity, it is unclear how individuals would respond to an item asking about their risk perception in the context of completing a CPR for the stated purpose of identifying sexual risk. The concept of risk perception has also been shown to comprise distinct dimensions, which may also affect its utility in a CPR. Specifically, perceived likelihood of harm relates to one’s perceived likelihood of an adverse outcome if one embarks on a particular course of action, while perceived susceptibility to harm denotes one’s perceived vulnerability to acquiring adverse outcomes more generally (Brewer et al., 2007).

2.1.4 Socio-demographic variables as distinct from psychosocial

Socio-demographic variables arguably denote aspects of lived experience, such as the cultural and sociological experiences which underlie epidemiological notions of ethnicity (Krieger, 2000), so that their distinction from psychosocial variables may represent a false dichotomy. Nevertheless, socio-demographic variables were also excluded from the working definition of psychosocial used in this thesis in order to focus investigation on the largely untapped potential of psychosocial exposures, as those that are experiential and representative of the immediate social environment. Socio-demographic variables have already been well explored in social epidemiological studies of both UIP and of STIs. These data demonstrate the salience of socio-economic status as a common predictor of both outcomes, and how the epidemiology of infectious diseases creates greater variability in population distribution than seen in UIP - as described in Chapter One.

2.2 Psychosocial predictors of sexual risk experiences and negative sexual health outcomes

The ways in which the social environment interacts with STI transmission and acquisition is well recognised:

‘All three determinants of the Reproductive Rate—transmission efficiency, rate of sexual interaction between infected and susceptible people, and duration of infectiousness—are subject to influence by factors external to the system of STD dynamics, such as poverty, marginality, level of education and culture’ (Wasserheit and Aral, 1996) (p.S204).
This statement illustrates how it is not really possible to understand STI acquisition without a social epidemiological perspective which recognises that delayed or non-use of sexual health interventions are as important to transmission as rate of partner exchange and exposure to infected individuals (and which recognises how these factors are themselves inter-related and mediated by mental, social and relationship factors). Similarly, variation in UIP is subject to the same external factors.

Although studies of UIP, STI acquisition and transmission have focused predominantly on age, race, socio-economic status, and sexual behaviour variables (Navarro et al., 2002), a broader social-epidemiological evidence base exists, which examines the complex ways in which psychosocial as well as socio-demographic variables are associated with sexual risk experiences, with STI acquisition and UIP, and with the availability and uptake of interventions (Johnson et al., 2006). This evidence base is summarised in the following sub-sections.

### 2.2.1 Power disparity and IPV

Evidence suggests that issues of inequality and disempowerment within immediate social environments and relationships are associated with sexual risk and morbidity among women. The evidence base on the role of relationship inequality and abuse in the Western world is largely constructed from studies in the US and of young women. US studies indicate that intimate partner violence (IPV) is associated with STI acquisition and non-condom use among young African-American women (Seth et al., 2010) and with non-use of condoms among women attending public health clinics (Mittal et al., 2012) and women aged 18-19 years (Kusunoki et al., 2017). Financial dependence on a boyfriend is also associated with non-use of condoms among US black adolescent women (Hollander, 2012).

A higher prevalence of intimate partner violence has also been reported among Swedish women seeking abortion compared to those seeking contraceptive counselling (Öberg et al., 2014). A study of women booked for induced abortion found that relationship issues impacted on women’s ability to access and pay
for contraception (Bury and Ngo, 2009). The concept of ‘male reproductive control’ has been developed to explain men’s prevention of contraceptive use as a means of enacting relationship coercion and violence (Moore A, 2012) and includes not only violence but factors such as financial control.

Together, this evidence base resonates with theory and evidence surrounding HIV acquisition among women. As long ago as 1995, it was noted that theoretical models of women’s sexual risk experiences should incorporate the following assumptions: women’s social status and fear of conflict-related disconnection as central features of risk, male partners as key role players, and experience and fear of abuse as risk reduction barriers (Amaro, 1995). Similarly (Wingood and Diclemente, 2000) set out how the key social factors associated with women’s HIV acquisition (education, socio-economic status and poverty, abuse and depression) can be explained through the theory of gender and power. This strengthens the case for a women-only CPR, in recognition that sexual risk experiences, the nature of adverse sexual outcomes and lived psychosocial experiences, are all moderated by the sex of the individual.

Not only current, but also historic experiences of violence and abuse have been shown to be associated with sexual risk and morbidity. A longitudinal study of young US women attending family planning clinics found that childhood sexual violence was associated with inconsistent use of contraception (Nelson et al., 2017) and a dose response between UIP and varying types of childhood abuse (physical, sexual, psychological) has been observed among both adults and teenagers (Dietz et al., 1999). Childhood sexual abuse (CSA) is not always clearly delineated from early sexual debut in studies. For example, evidence from the US National Survey of Family Growth indicates that, among women respondents, partner concurrency was associated with sexual debut before the age of 15 years, which may include CSA experiences.

In Britain, analyses of the National Survey of Sexual Attitudes and Lifestyles-3 (Natsal-3) have addressed this issue by excluding sexual debut <13 years (which is classified as statutory rape) from their analyses of early sexual debut. In doing so, they still found that sexual debut before the age of 16 years is
predictive of sexual risk and morbidity (Palmer et al., 2017). Natsal-3 analyses have also directly investigated non-volitional sexual intercourse at any age, reporting a prevalence of 9.8% among women, and finding it to be associated with sexual debut before age 16, STI diagnosis ever and pregnancy before age 18 (Macdowall et al., 2013).

Age disparity between partners may be indicative of a perceived or experienced power disparity between partners. Evidence suggests that lack of contraceptive use is associated with an age disparity of seven years or more (where the older partner is male) (Burack, 1999); while more recent research indicates that age disparity of five or more years between heterosexual partners is predictive of non-use of condoms (Mercer et al., 2009b) (regardless of whether the male or female partner is older). A more direct investigation of power dynamics in these contexts found that having an older sexual partner was associated with adolescent women experiencing subsequent depression, and that this association was partly explained by experience of IPV from that male partner (Meier et al., 2016).

2.2.2 Mental health

Depression has also been investigated as an independent predictor of sexual risk experiences and adverse outcomes, particularly with regard to Men who have Sex with Men (MSM) (Miltz et al., 2017). However, mechanisms of action remain largely unexplored, and rationales for investigation are often omitted. Studies demonstrate a high prevalence of depression (Erbelding et al., 2001) and other psychiatric disorders (Erbelding et al., 2003) among STI clinic attenders; and associations between depression, stress and sexual activity among adolescents (Harvey and Spigner, 1995), (Tubman et al., 1996), (Devine et al., 1993). A Natsal-3 study (Field et al., 2016) found that, among both women and men, treatment for depression was associated with non-use of condoms with at least two partners in the last year; with concurrency in the last year, with sex life dissatisfaction, lower sexual function and with Chlamydia trachomatis testing. Women who had been treated for depression were also more likely to report sexual health clinic attendance and use of emergency contraception (Field et al., 2016).
Differences in depression, perceived stress, and lower self-efficacy and support have also been reported between wanted, mistimed and unwanted pregnancies - with the latter category experiencing the highest rates (Maxson and Miranda, 2011). Among adolescents specifically, depression and stress have also been found to be associated with STI acquisition in adulthood and with UIP and teenage pregnancy (Harvey and Spigner, 1995). Evidence also indicates that young adults diagnosed with substance dependence, schizophrenia or antisocial disorders are more likely than other young adults to report sexual debut before age 16, sexual risk experiences, or STI acquisition (Ramrakhra et al., 2000).

2.2.3 Substance use

Drug and alcohol use also appear frequently in the literature as predictors of sexual risk experiences and adverse outcomes. Studies of GUM clinic attenders report that frequency of heavy drinking predicts number of sexual partners for women (but not men) and explains the observed bivariate association between current depression and number of partners (Carey et al., 2016). Alcohol quantity (four or more drinks per day) has also been found to mediate the association between number of sexual partners and Trichomoniasis diagnosis among women attending a GUM clinic (Scott-Sheldon et al., 2013). Natsal-3 data (Khadr et al., 2016) also indicate that frequent binge drinking and recent drug use are associated with unprotected first sex with one or more new partner in the last year, emergency contraception use in the last year, and STI diagnosis in the last year among women aged 16-24 years.

Importantly, these findings are not indicative of causal associations although two systematic reviews (Rehm et al., 2012, Scott-Sheldon et al., 2016) indicate that alcohol use does influence sexual-decision making. Yet other findings suggest more complex patterns of association. ‘Unconventionality’ (defined as a lack of social engagement with school, family or church) accounted entirely for the known association between use of ‘hard drugs’ and abortion; and was predictive of both abortion and UIP in a US study (Martino et al., 2006). Similarly, an event-based diary analysis found that drinking before sexual
intercourse was not related to condom use (Leigh et al., 2008), while a study of young people (Staras et al., 2011) found that 31% of the total effect of substance use disorder on STI diagnosis among 15-24 year olds was attributable to a composite ‘partner characteristic’ score. Finally the afore-mentioned study reporting a positive association between IPV and number of episodes of unprotected sexual intercourse, and found this was not mediated by drug use before sex - despite an association between drug use and IPV (Scott-Sheldon et al., 2013). These latter findings are perhaps representative of collinearity, study bias and/or reverse causation – which have been offered as explanations for observed associations between substance use and other ‘psychosocial harms’ such as mental health and relationship problems (Macleod et al., 2004).

The quantitative evidence base for associations between unplanned or unintended pregnancy and psychosocial factors is smaller. However, bivariate analyses of the Natsal-3 study found that similar psychosocial factors to those reported above were associated with UPP in the last year: sexual debut before age 16, current depression, recent use of drugs other than cannabis and current smoking (Wellings et al., 2013b).

2.2.4 Types of sexual partner

The nature of relationships regarding not only equity and power, but also type of partnership, has been found to be predictive of sexual risk. Higher self-report of condom use is reported by men where the sexual partner is considered a ‘sex partner’ versus ‘girlfriend’ (Catallozi et al., 2013). Similarly, application and early application of condoms is higher when casual sexual encounters take place on holiday rather than at home (Cousins et al., 2013). These studies suggest that different levels of risk are both presented and perceived according to the context of sexual encounters, and that this influences use of condoms and other contraception (Heise, 1997). Natsal-3 evidence also suggests that having new sexual partners overseas is associated with higher number of sexual partners overall (Tanton et al., 2016). Seeking sexual partners over the internet has also been found to be associated with lower sexual debut age, and higher number of partners (Buhi et al., 2013).
2.2.5 Service engagement and social support

Original social epidemiological models incorporated analysis of both risks and ‘assets’, yet the latter has been given significantly less attention within the field of sexual health. Health-care disengagement (rather than engagement) has been the focus of investigation in applied sexual health research, reflecting its pivotal role in onwards STI transmission and sequelae. Lack of social support explains observed associations between depression and STI acquisition in general populations of women (Gao and Chen, 2011) and prevents sexual health attendance in target populations such as substance-misusing women (Edelman et al., 2013). The complex relationship between interventions, social determinants of health and poor sexual health outcomes has been elucidated in the following way:

‘The relationship between behaviour and health outcomes may be modified at individual and population level by a number of influences including health services and biomedical interventions, while a range of socio-economic and demographic factors influence the behaviours themselves’ (Johnson et al., 2006) (p.323)

This thesis continues the convention of identifying risk factors rather than assets, not least because this approach is best suited to developing a simple additive CPR score, in which a higher value denotes greater risk. This is discussed further in Chapters Five and Six.

2.2.6 Implications of this evidence base for CPR derivation

Although patchy and incomplete, this evidence presents independent associations between sexual risk experience and/or negative sexual health outcomes and a range of psychosocial variables: in particular concerning substance and alcohol use; violence and coercion; early sexual debut; mental health; and the nature of sexual and social relationships. This suggested that derivation of a psychosocial CPR to identify women experiencing sexual risk was a worthwhile pursuit. The evidence also hints at the complexity of interplay between different psychosocial factors. In particular, factors such as depression and alcohol misuse are themselves morbidities so that their co-occurrence with sexual risk experience, CSA and IPV may be indicative of syndemicity (Senn et al., 2010), that is to say:
‘co-occurring and mutually reinforcing adverse outcomes’ (Bauer et al., 2016)
(p.16)

This has potential implications for extending the CPR’s purpose to identify both sexual risk and morbidity and adjunct – possibly causal – health concerns, a possibility raised in Chapter One and revisited in the final chapter. In addition, the complexity of associations has implications for the statistical modelling that underpins CPRs, because of the potential for both collinearity and interactions. These issues are set out in Chapters Five and Six.

It is also important to note that race, sex, age and socio-economic factors may interact with associations between psychosocial variables and sexual risk experience and morbidity. For example a US study found that early sexual behaviour in Caucasians was predicted by poor academic performance, deviant activities and higher levels of peer sexual behaviour – but that these associations did not hold true for black students (Udry and Billy, 1987). This demonstrates not only that ethnicity is predictive of STI acquisition but that cultural and other ethnicity-related factors may also interact with the types of factors that predict sexual risk experiences and adverse sexual health outcomes. Therefore ethnicity was investigated in the preliminary studies of this thesis (Chapters Three and Four), but was excluded from the Brighton & Hove survey (Chapters Five and Six) for two reasons. First, it was deemed to be unacceptable to include ethnicity as a CPR item; a view echoed by other sexual health CPR developers (Gaydos et al., 2015), although this was not explored in the PPI work (as discussed on p.243). Second, in the Natsal-3 study (Chapter Four) ethnicity fell out of the model for multiple partnerships and multiple partnerships without condoms, and was only significant in predicting lower sexual risk among those of Asian heritage for the variable representing no condom use at first sex. Therefore, it was not explored further as candidate predictor in the Brighton & Hove survey. Age and socio-economic status were also given careful consideration in this thesis. Due to their salience as independent predictors of sexual risk and adverse outcomes in the preliminary studies, both were investigated in the Brighton & Hove survey as candidate predictors for CPR inclusion.
Finally, the disparate nature of the evidence makes it difficult to ascertain whether different psychosocial variables are indicative of different sexual risk experiences, although there is some evidence that this is the case (Secor-Turner et al., 2013). Therefore, a key component of this thesis was examining how – in each of the three doctoral studies - the same psychosocial variables performed across outcomes indicative of risk of UIP and those indicative of risk of STI acquisition. This issue is discussed further in section 2.4.

2.3 Working at the cusp of population health and clinical medicine by deriving a psychosocial CPR

Individual and population health are dynamically inter-related Arah (2009) and individual patient care is increasingly informed by analysis of large datasets and public health priorities. This is illustrated in the burgeoning of CPRs that apply epidemiological analyses to inform clinical decision-making. It is also illustrated in the tendency for guidance on sexual healthcare provision in primary care to be limited to known high-risk populations (discussed in Chapters Five and Seven). This tendency is an example of how individual care can be dictated by population health knowledge, and it is to this type of ‘gap’ between individual and population health that this programme of research turns its attention.

Overall, the evidence presented above indicates that the use of psychosocial variables may permit a more sensitive and specific CPR to be derived than would have been possible if only socio-demographic variables were used. Psychosocial variables can therefore be argued to occupy a liminal space between socio-demographic population descriptors and individual sexual risk experience and morbidity. This arguably makes them particularly useful as CPR items, because CPRs similarly occupy a liminal space between public health and clinical medicine. In essence, psychosocial factors might be considered a ‘bridge’ between socio-demographic and sexual experience variables, just as CPRs can be seen as a ‘bridge’ between population and individual health. This is particularly important because critical epidemiology and critiques of social epidemiology have included the point that:
Because CPR derivation is based on population data so it is appropriate that the intended use of the CPR was to inform rather than dictate patient care, by enabling the clinician to identify who is more likely to need detailed assessment of possible need for STI testing, sexual health advice and/or contraception. The importance of assessing differential need for one or more of these interventions is addressed in the next section.

2.4 The importance of co-investigation: assessing potential need for STI testing and/or contraception

The importance of researching together the reduction of STI acquisition and UIP is increasingly championed (Narasimhan, 2017), yet co-investigation of how psychosocial variables are associated with STI acquisition and UIP has been sparse. The need to research together these different outcomes is extant in studies focusing on ‘STI risk’ which may fail to study pregnancy intention or to ask participants about use of contraceptives other than condoms (Paterno and Jordan, 2012). Indeed, if a woman wishes to become pregnant she has no obvious means of protecting herself from STIs – beyond controlling the condom use, STI testing and treatment of her partner(s).

Historically, STIs and UIP have not only sat within different clinical specialisms but have been studied by different disciplines. Broadly speaking, research into determinants of UIP has been the domain of sociology while research into the determinants of STI acquisition and transmission has been the domain of medicine. But common to these two strands of enquiry has been investigation of the broader population-based demographic investigation of correlates of poor sexual health outcomes. (This is unsurprising if one views public health as a bridging discipline between sociology and medicine). Despite the unique dynamics that STIs present, the evidence presented in Chapter One indicates similarities in the distribution of UIPs and STIs at the population level. Specifically, ethnicity, sex, socio-economic status and age account for variability in both STI acquisition and UIP, with culture and inequality both implicated as carrying associated causal effects (Low et al., 1997), (Malarcher, 2010).
Co-occurrence of STIs and UIP is also seen on a global scale and those parts of the world experiencing the highest rates of HIV also experience the highest rates of UIP (Brown, 2017). Together this evidence points towards the salience of structural and socio-demographic factors.

Contraception and STI interventions are increasingly co-delivered in both primary and secondary care settings in Britain (as described in Chapter One). Therefore, a CPR is well-placed to integrate the delivery of those interventions. Similarly, the derivation of that CPR presents an opportunity to improve the evidence base on how distribution of psychosocial variables may differ or co-occur across risk of UIP and STI acquisition - as generally-speaking different psychosocial variables tend to have been investigated regarding STI and regarding UIP (see also Chapter Three). Existing evidence suggests that report of pregnancy testing was associated with previous STI acquisition, multiple sexual partners and non-use of contraception (Rahman and Berenson, 2013). Natsal-2 analysis indicates that use of community clinics and retail outlets for contraception is positively associated with number of sexual partners in the last year (French et al., 2009). Finally, initiation of intercourse and current sexual risk activity are also recognised as common risk factors for both STI acquisition and pregnancy among adolescents (Santelli et al., 1999). The Brighton & Hove survey, which was used to model the CPR, therefore sought to capture condom use and other contraception use alongside pregnancy intentions (as described in Chapters Five and Six).

The performance of psychosocial variables across different sexual health outcomes and sexual risk experiences then formed a key aspect of each of the three studies which comprised this thesis. In particular these analyses sought to determine whether risk of UIP and risk of STI acquisition were predicted by different psychosocial variables, leading to an ‘integrated’ CPR comprised of a sub-scale which indicates potential need for sexual health advice, STI testing and a separate sub-scale indicating potential need for contraceptive advice and supply. In contrast, a ‘unified’ CPR would comprise a single set of questions indicating potential need for all of these interventions. The notion of ‘risk’ of UIP or STI acquisition is addressed in the following section.
2.5 The meaning of ‘risk’ in CPRs, scientific and public domains

CPRs are similar to screening tools in that both seek to ‘sift’ from among a heterogeneous population those individuals who are at elevated risk of a given negative health outcome. Thus, the cost-effectiveness of both is dependent on their correct categorisation of those who do need intervention (sensitivity) and those who do not (specificity). Confusingly however, the term ‘screening’ is also used to refer to opportunistic testing of individuals (e.g. STI ‘screening’) and – erroneously - to refer to surveillance activities such as infant hearing loss ‘screening’. Specifically, screening refers to the identification of early stages on a disease pathway by assessing risk markers or pathological changes before patients have recognisable signs or symptoms (Raffle and Gray, 2007) (Wilson J.M.G. and G., 1968). This is done as a precursor to diagnostic testing. Screening does not involve opportunistic case-finding during clinical attendances on unrelated matters (Armstrong and Eborall, 2012), directly in contrast with the intended use of the CPR in this thesis. CPRs also commonly comprise items that are statistically predictive of the outcome of interest, but are not necessarily antecedent to the outcomes of interest and may in fact represent spurious associations.

Despite these distinctions, the lines between screening tools and CPRs can be blurred for two reasons. First, the notion of preclinical disease is a complex one, in which clear lines are not always drawn between evidence of early pathology and evidence of risk of pathology. (However, this is not necessarily problematic – for example, the ‘diabetes self-assessment score’ is used to identify both undiagnosed Type 2 diabetes and Impaired Glucose Regulation as a precursor to Type 2 diabetes (Gray et al., 2012)). Perhaps more importantly, within epidemiological literature the term ‘risk’ is applied both to populations where the prevalence of negative health outcomes is known to be higher and to populations where exposure to causal, antecedent and other associated factors are known to be higher. The term ‘risk factor’ is also used in epidemiology and more broadly in health sciences research to refer variously to pre-disposing factors, spuriously associated factors, as well as directly causal factors (Gillespie, 2012).
The CPR, and therefore the research comprising this thesis, uses an epidemiological and statistical understanding of risk in which ‘sexual risk experiences’ are intervening variables which are more likely to lead to the adverse outcomes of STI acquisition and/or unintended pregnancy, and in which psychosocial variables indicate statistically an elevated likelihood of those experiences having recently taken place. This operationalises a public health focus for the CPR on targeting interventions which prevent UIP or STI acquisition by identifying psychosocial predictors of relevant sexual risk experiences as the ‘outcome of interest’. In contrast, many applied epidemiological studies treat sexual experiences and behaviour as the exposures of interest.

This particular understanding of psychosocial variables as statistically (rather than causally) associated with sexual risk experiences has implications for how the CPR is presented to patients and practitioners, not least because the term ‘risk’ carries a variety of colloquial meanings and may be used and understood in a variety of ways in different contexts by practitioners and by the public. Indeed psychosocial variables themselves may influence our experience and understandings of risk:

‘... socio-cultural and emotional factors enter into the process of evaluating and experiencing risks’ (Joffe, 1999) (p.8)

Joffe (Joffe, 1999) also argues that presentations or representations of risk are themselves managed as risks – and that our first response as individuals is to protect our identities and sense of self from the sense of risk, rather than from the risk itself. Therefore, for the CPR to be useful, it must be presented in a way that does not trigger self-protective risk responses (such as non-completion or revision of answers to change the ‘result’). This raises important issues for presentation of the CPR and communication of its purpose to its intended population, which are discussed in the final chapter. Relatedly, the acceptability of CPR items and their mode of delivery can also be understood as not only an ethical concern (to avoid distress in the CPR recipient) but as an issue of validity. Therefore, early-stage Patient and Public Involvement (PPI) focused on mode of CPR delivery and issues of acceptability, as described in the following section.
2.6 Patient and Public Involvement in the early stages of the research programme

Obtaining the views of the target population is a vital component in carrying out relevant and acceptable research, the findings of which should be communicated in an engaging, accessible and understandable manner (INVOLVE, 2012). However, patient and public involvement (PPI) can be difficult to carry out, particularly in primary care settings (NIHR, 2014). For this doctorate members of the target population were consulted on the design and delivery of the survey questionnaire (see Chapter Five). A lay summary of key findings was published online for the preliminary research studies within the doctorate (the systematic review and Natsal-3 analysis) while the lay summary of the Brighton & Hove survey findings was distributed at recruitment sites and a public engagement event was held as part of the British Science Festival 2017 (see Chapter Seven for more details). These various consultation activities were undertaken because of difficulties in achieving ongoing lay collaboration, and used a broad definition of study ‘end-users’ as women of reproductive age attending GPs.

This approach stands in contrast with the initial PPI plan, in which study end-users were defined as the sub-population of those women who would benefit from sexual health intervention. For this reason, the initial consultation (conducted at the beginning of the doctorate to inform CPR content and delivery) was carried out with attenders at Brighton Women’s Centre (BWC) because women adversely affected by some of the predictors of sexual risk and morbidity (such as poverty and domestic violence) were known anecdotally to use this service. Appendix 2a outlines some of the strategies which were attempted to engage collaboratively with women at higher risk (either current or historic) of sexual risk and morbidity. These comprised consultation on the Brighton & Hove survey with young women at Newhaven Youth Forum, and consultation at BWC as described in the following paragraphs.

In the consultation at BWC, the context in which the CPR should be used, its mode of delivery (and therefore associated costs) and its likely acceptability
were all explored. These were important to pre-determine as they affected variously the selection of psychosocial predictors for the CPR (Chapters Three-Six), the analysis of acceptability (Chapter Six) and the implications of thesis findings for further validation and evaluation (Chapter Seven). Specifically, feedback centred on the importance of flexible care pathways, of acceptable CPR items, and of a brief and simple tool, suitable for self-completion and self-scoring. Brevity and simplicity have also been highlighted elsewhere as important CPR qualities (Duke et al., 2008). Self-completion and self-scoring was considered important so that individual question responses would not need to be shared with a practitioner to access sexual health advice. This was particularly a concern in the context of disclosing recent or current experience of intimate partner violence or drug use, both of which women felt might lead to social services involvement in their child-rearing. Conversely, women liked the idea that they could have the option to disclose individual answers as a way of making GP staff aware of, and initiating discussion of such issues, if they chose to do so. Therefore, based on this consultation, CPR delivery was envisaged as a paper-and-pen questionnaire (PAPI), self-completed by women while waiting to be seen by a healthcare professional in GP settings. This offered a low-cost, low-tech ‘baseline’ from which electronic delivery might be investigated in future studies.

Discussions around question acceptability were partly contingent on the idea of self-completion and self-scoring. However, they also centred on the potential to cause distress and discomfort. In particular, women reported that being asked directly about recent sexual activity, about suicidal ideation, abortion and STI diagnoses, or experiences of sexual abuse or violence would be unacceptable – regardless of how those questions might be delivered. Finally, women expressed a preference for flexibility in service provision. Women particularly welcomed the idea of the CPR being available in waiting rooms and offered to women by GP staff during consultation. Similarly, they were keen that the CPR include information on other services providing contraception and STI testing, so that they could choose where to access those interventions. Therefore, the doctorate focused on acceptable psychosocial variables for possible inclusion in the CPR and did not seek to position the delivery of the CPR within any specific
care pathway. Issues of presentation, delivery and usefulness in care pathways are revisited in detail in the final chapter of this thesis.

2.6.1 Addressing acceptability in the thesis as a whole

The acceptability of CPR items was an important consideration in each of the research studies comprising this thesis because of the potential for unacceptable items to compromise the ethics and validity of the CPR, as described above. The acceptability of psychosocial items was also important because part of the rationale for this thesis was the likely unacceptability of routinely asking for a recent sexual history in GPs (as outlined in Chapter One). A degree of subjective judgement was needed when selecting which psychosocial variables to exclude from analysis on these grounds in the systematic review and Natsal-3 studies (Chapters Three and Four). The acceptability of the psychosocial variables that were selected was then assessed in the Brighton & Hove survey (Chapters Five and Six). In particular, evidence concerning the associations between poor sexual health and experience of both child sexual abuse and domestic abuse pointed towards the importance of these variables as potential CPR items. Yet early PPI work indicated that these items might be unacceptable (as discussed above). This raised ethical issues surrounding the possibility for distress and invalidity of responses and scores. This conundrum was addressed in the thesis by exploration of non-recent and more generalised report of such variables; notably report of violence ever, and of child sexual abuse within the analysis of early sexual debut (see Chapters Four and Five).

Related acceptability issues concern questionnaire brevity and scoring simplicity. These were also addressed in the selection process of psychosocial exposures at each stage of the trajectory towards CPR derivation: systematic review, Natsal-3 analysis and the Brighton & Hove survey.

2.7 Implications for the systematic review

The subjects discussed in this chapter have a number of implications for the systematic review presented in the following chapter. First, the review examines
psychosocial correlates of STI acquisition, UIP and sexual risk experiences; recognising that sexual risk experience is a necessary precursor to adverse outcomes and that the study of psychosocial predictors of each, may be useful to the process of CPR derivation. As the CPR is intended for use with women of reproductive age, so the systematic review was limited to papers reporting data for women only for age bands within the range 16-44 years. The definition of psychosocial introduced in this chapter was used in the inclusion criteria and the review was limited to large probability population samples in order to identify psychosocial predictors most likely to be salient during the statistical modelling conducted on the Brighton & Hove survey dataset (Chapters Five and Six).
Chapter 3: A systematic review to identify psychosocial variables for possible inclusion in the CPR
Summary

This chapter reports on a systematic review that was conducted in early 2014 after determining the conceptual issues for this part-time thesis (as set out in the previous chapter). The accompanying publication of the review is provided in Appendix 3a. This preliminary study was conducted to identify relevant evidence of psychosocial predictors of sexual risk experience and morbidity that might be worthy of use in the clinical prediction rule. The chapter sets out the rationale for the systematic review and then details the search strategy, record retrieval and stages of paper selection, and the data extracted from each paper. The results of the review are then presented, including an overview of the quality of included papers, key findings and presentation of models and explanations. Following a discussion of the study findings and limitations a short update is then provided, for literature published after January 2014 (which was the publication cut-off date for papers included in the systematic review).
3.1 Introduction

The first step in CPR derivation is to identify potential exposures for inclusion in that CPR. Systematic reviews are literature reviews of relevant evidence to which a thorough and rigorous strategy is applied, usually for the purpose of addressing specific research questions (Chalmers and Altman, 1995). The review reported here was conducted to underpin CPR derivation by uncovering psychosocial factors associated with sexual risk and morbidity in general population samples of women, which might then be used as CPR items to target sexual healthcare in British General Practice. Therefore, probability surveys conducted in the Western world were considered to be most relevant and analogous to British GP populations.

For this systematic review the following research questions were posed:

1. In probability surveys of women aged 16-44 years which psychosocial variables are associated with: unintended pregnancy, induced abortion, STI acquisition and/or sexual risk experiences?

2. How do types and strengths of associations with these psychosocial variables differ across STI acquisition; sexual risk experiences; and unplanned pregnancy and abortion?

In order to position this programme of research in relation to existing theories and explanations about associations between psychosocial variables and sexual health the systematic review also addressed the following question:

3. What models and explanations are presented regarding the relationship between social, psychological and psychosocial variables and sexual health risk behaviours and/or adverse sexual health outcomes?
3.2 Methods

3.2.1 Definitions and concepts used in searching and selecting the literature

3.2.1.1 Sexual health outcomes

For the purposes of this review ‘sexual risk experiences’ was treated as an outcome, as STI testing and contraception advice and supply should be offered to those experiencing sexual risk. This concept was searched directly and by using terms for multiple partnerships and/or unprotected intercourse; the latter comprising non-use and/or inconsistent use of condoms and/or of other contraception among those expressing ambivalence about pregnancy or the desire to avoid pregnancy.

STI acquisition and unintended pregnancy were also investigated as outcomes in this review. STIs were searched using umbrella terms such as ‘sexually transmitted infection’ and also by searching for the following specific infections: Syphilis, Gonorrhoea, Chlamydia, genital warts, genital herpes and Trichomoniasis. Bacterial vaginosis, Hepatitis B and C were excluded as they are also frequently contracted by non-sexual contact. Unintended pregnancy was searched alongside related terms such as ‘unplanned’ and ‘unwanted’ and using the proxy of abortion/termination of pregnancy. Appendix 3b contains screenshots of the search strategy used for each database, including the search terms used.

3.2.1.2 Psychosocial factors

Preliminary searching revealed that the term ‘psychosocial’ was rarely used in relevant sexual health studies, such as Natsal-3 publications. This was particularly the case for papers that addressed only one or two variables that met the definition of ‘psychosocial’ chosen for this research (see Chapter Two). Therefore, to ensure a comprehensive search of relevant literature, an expert librarian was consulted to develop a strategy that focused on retrieving records for the outcomes described above, in the population of interest. Records were reviewed and retained if the analysis included variables that met that same definition of ‘psychosocial’.
3.2.2 Eligibility criteria

The review took an epidemiological approach - focusing on psychosocial variables as ‘exposures’ and STIs, UIP and sexual risk experiences as ‘outcomes’. Therefore studies which investigated psychosocial variables as consequences of those outcomes were excluded, e.g. experience of social support following STI diagnosis. The inclusion criteria was limited to probability surveys of general populations in the Western world, based on the rationale that these would be most analogous to British General Practice populations regarding heterogeneity of risk and relevance of the psychosocial variables identified. For this reason, baseline surveys within longitudinal studies where random selection methodology was applied were also included within the review.

Studies of high-risk populations such as intravenous drug users or attenders at GUM clinics were excluded as associations found within high-risk populations may not be generalizable to broader community populations or may have lower prevalence - and therefore less utility - in predicting sexual risk in general populations as part of a CPR. Non-random samples of larger heterogeneous populations were excluded as reliable estimates of the population prevalence of outcomes and risk factors cannot be determined from them. Papers reporting on qualitative studies, intervention studies, longitudinal follow-up studies and case-control studies were excluded due to the poor fit between those sampling strategies and the aims of this review (e.g. the bias towards stable populations that is inherent in follow-up surveys within longitudinal studies).

Inclusion and exclusion criteria were also chosen to reflect an intentional focus on identifying psychosocial variables that would probably be acceptable for use in the CPR, based on PPI feedback (as described in the preceding chapter). Therefore, papers were excluded if they reported only on factors likely to be unacceptable as risk-identifiers in community settings without specialised professional support (e.g., current intimate partner violence, child sexual abuse). Similarly, items within included papers were not reported in this review where they met this criterion. Age at first intercourse and any lifetime experience of partner violence were however included as their historic nature
was deemed acceptable by the lay women consulted at the beginning of this study.

Gender-stratified or gender-specific analysis was considered essential because of the anticipated complex and subtle effects of gender across associations (27) and because only gender-stratified analysis will elicit prevalence estimates. Therefore, papers were also excluded if they either (a) presented mixed-sex samples in which male and female data were pooled, or (b) treated sex only as an interacting variable (even when sex was not found to interact on relevant associations).

Data-collection and publication were restricted to the 20 years preceding literature searching, to provide a comprehensive overview of relevant data which coincides with a return to greater sexual risk-taking seen in the mid-1990s, as described in Chapter One (Johnson A, 2001).

Papers were included if they met all of the following criteria:

1. Reporting on studies conducted in one of the following countries: UK, European Union (or Switzerland or Norway), USA, Canada, Australia or New Zealand
2. Date of publication January 1994-January 2014
3. Data collection 1994 onwards
4. Exclusively reported on women or provided sex-stratified analysis of a mixed-sex sample
5. Reported data on women within the age range 16-44 years
6. Reported on multiple partnerships, unprotected sexual intercourse, unplanned/ unwanted/unintended pregnancy, induced abortion or STI acquisition.
7. Reported factors which fitted the working definition of ‘psychosocial’ as described in Chapter Two
8. Reported on cross-sectional surveys and/or baseline data from longitudinal observational studies of representative population samples
The following exclusions were applied:
1. Papers which presented systematic or literature review only
2. Papers that reported on convenience samples, or known high-risk populations
3. Papers reporting on:
   - Randomised controlled trials or other intervention studies such as non-randomised trials
   - Qualitative, case-control, case study, or longitudinal observational follow-up studies
   - Studies concerning new medical diagnostic techniques for STIs and pregnancy
   - Studies examining consequences, impact or sequelae of unintended or unplanned pregnancy or STI acquisition

3.2.3 Record retrieval
The following electronic bibliographic databases were searched: Cochrane; Medline; CINAHL (Ebsco host); PsycInfo (Ebsco host); Web of Science; Embase and ASSIA. Citations were also searched from all included papers and from four review papers identified using the primary search strategy. Databases were searched using the key concepts ‘sexual risk experiences’ ‘sexual health outcomes’, ‘gender’. In addition ‘association’ was searched as a key concept in record titles to focus retrieval on studies presenting factors associated with sexual risk experiences or sexual health outcomes. For each concept a list of key terms was used to search for database-specific controlled language and for free-text searching. Identified records were then retained based on the presence of psychosocial variables defined as described above. This approach was designed to identify relevant literature which was not indexed as ‘psychosocial’. Records were exported from each database into a single reference manager file where duplicates across database searches were removed.
3.2.4 Stages of paper selection

Inclusion and exclusion criteria were applied at three stages in the systematic review process. First, paper titles were screened for eligibility. Then abstracts of remaining titles were screened, before screening of full-text for remaining records. To minimise the chances of relevant papers being excluded by title, records were screened by abstract where one or both of the following conditions were met:
1. The title referred to the outcomes of interest but did not specify the nature of exposures investigated for their association with these outcomes
2. The title indicated report on health, behaviour or risk-taking which might be sexually-related and which was investigated in relation to psychosocial factors where the candidate was aware of any existing evidence or theory for association with UIP or STI acquisition – e.g., substance misuse, formative experiences, relationship quality, mental health problems.

One paper was also excluded after the corresponding author confirmed by email that the data were not collected within the study inclusion period.

3.2.5 Data collection and assessment of quality for full-text papers

Data for all included papers were extracted into an Excel database that was also used to record quality assessment. An independent reviewer checked 10% of all title and abstract exclusions, inclusion and exclusion decisions for all full text papers, and all data extraction for included papers. Several aspects of paper quality were assessed. First, the validity of questionnaire items was assessed, both their apparent face validity, and report of prior validation work. Second, the study design and sample was assessed for possible bias. The clarity of methods and results was assessed alongside report on stated research objectives in the analysis and discussion. Finally, the nature of statistical analyses; the generalisability of the findings of those analyses; and the degree to which conclusions were substantiated by the reported findings; was all assessed. In particular, papers were excluded where no significance testing of associations was reported. However, in recognition that p values will vary according to the sample size and statistical approach, associations were reported regardless of the accompanying p-values; a p-value of ≤0.05 was taken to indicate that an association was statistically significant, in line with
convention (Bland and Altman, 1995). This reflects the pragmatic purpose of the review in identifying psychosocial variables associated with sexual risk or adverse outcomes that therefore warranted further investigation as potential CPR candidate predictors (as described in Chapters Five and Six).

3.3 Results

3.3.1 Overview of papers
The results of the screening process are given in Figure 2. From an initial 5427 unique records, 11 papers were included in the review. These comprised 10 cross-sectional survey papers and one longitudinal baseline study paper (Taft and Watson, 2007), conducted in Britain, France, the USA and Australia and spanning 1995-2012.
Figure 2: Systematic review record screening and review process

Records identified: n= 7182
Records screened by title: n= 5427
Abstracts screened: n= 1457
Full paper screened: (n=112)
(n= 80 cross-sectional surveys, n=32 longitudinal studies)
Full papers included: n=11
(n=10 cross-sectional surveys, n=1 longitudinal study)

Duplicate records deleted: n= 1755
Records excluded by title: n= 3970
Key reasons for exclusion:
• Tangential topics
• Histological, biochemical or treatment studies
• Studies of high-risk populations

Abstracts deleted n= 1345
Key reasons for exclusion:
• Trial or prevalence-only data
• Data from excluded countries
• Preference and attitudinal studies

Full paper deleted: n=104
(n=73 cross-sectional surveys, n=31 longitudinal studies)
Key reasons for exclusion:
• No analysis within ages 16-44 years
• No gender-stratification
• Psychosocial treated as outcomes
• Lack of statistical report
• Non-baseline data
• Samples recruited from clinic sources

Papers from citations: n=3 (cross-sectional surveys)

Among the 11 included papers one addressed lifetime partner numbers (Cavazos-Rehg et al., 2011), three addressed abortion (Coleman et al., 2009, Moreau et al., 2011, Taft and Watson, 2007), one addressed unplanned
pregnancy (Wellings et al., 2013b), two addressed STI diagnosis (Kraut-Becher and Aral, 2006, Moreau et al., 2011) and five addressed unprotected sexual intercourse. Among these latter five, use of condoms at first sex with last partner was investigated (Mercer et al., 2009a), and non-use of any contraception among those reporting they did not want to get pregnant (Kramer et al., 2007, Xaverius et al., 2009). Finally, two papers reported on the same study; these investigated non-use of any contraception in the last 12 months, ‘gap in use and at risk’ (defined as inconsistent use of any contraception and at least one episode of sexual intercourse), and inconsistent use of condoms or contraceptive pill in the last three months (Frost et al., 2007, Frost and Darroch, 2008). Further details of included studies are provided in Table One, which describes the papers included in the systematic review.
Table 1: Description of papers included in the systematic review

<table>
<thead>
<tr>
<th>First author</th>
<th>Publ. year</th>
<th>Year of collection</th>
<th>Country</th>
<th>Study name</th>
<th>Aim of analysis</th>
<th>Sampling strategy</th>
<th>Sample description</th>
<th>Sample size</th>
<th>Data collection strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavazos-Rehg</td>
<td>2011</td>
<td>1999-2007</td>
<td>USA</td>
<td>National Youth Risk Behavior Survey</td>
<td>To examine associations between substance use initiation and variations and no. of sexual partners</td>
<td>3-stage cluster sampling design (year, stratum, 10 sampling unit)</td>
<td>Female high school seniors 17-18 years who completed data</td>
<td>n=5725</td>
<td>Not given</td>
</tr>
<tr>
<td>Coleman</td>
<td>2009</td>
<td>1995-1997</td>
<td>USA</td>
<td>Chicago Health and Social Life Survey</td>
<td>To investigate the hypothesis that abortion is associated with 'negative intimate relationships'</td>
<td>Not given</td>
<td>Women x=34.54 years (standard deviation=10.05) reporting sexual activity in last year</td>
<td>n=906</td>
<td>Computer Assisted Self-Completion Interview. No further info given</td>
</tr>
<tr>
<td>Frost</td>
<td>2007</td>
<td>2004</td>
<td>USA</td>
<td>None given</td>
<td>To explore relationships between a range of predictors and women's risky contraceptive use patterns over 1 year period</td>
<td>List-assisted random digit dial sample of telephone numbers</td>
<td>US household resident women aged 18-44 years at risk for UIP*</td>
<td>n=1978</td>
<td>Telephone screen followed by interview</td>
</tr>
<tr>
<td>Kramer</td>
<td>2007</td>
<td>2002-2003</td>
<td>USA</td>
<td>National Survey of Family Growth</td>
<td>To model the relationship between religion and non-contracepting behaviour</td>
<td>complex probability sample</td>
<td>Women 15-44 years at risk of UIP**</td>
<td>n=4076</td>
<td>Face to face interview</td>
</tr>
<tr>
<td>First author</td>
<td>Publ. year</td>
<td>Year of collection</td>
<td>Country</td>
<td>Study name</td>
<td>Aim of reported analysis</td>
<td>Sampling strategy</td>
<td>Sample description</td>
<td>Sample size</td>
<td>Data collection strategy</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>--------------------</td>
<td>---------</td>
<td>------------</td>
<td>--------------------------</td>
<td>------------------</td>
<td>--------------------</td>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Kraut-Becher</td>
<td>2006</td>
<td>1995</td>
<td>USA</td>
<td>National Survey of Family Growth</td>
<td>To relate age mixing in the general population to self-reported history of STI diagnoses, testing or treatment</td>
<td>National probability sample recruited via 1993 National Health Interview Survey***</td>
<td>Sexually active women 15-44 years with birth date information on self and partners</td>
<td>n=9272</td>
<td>Unreported</td>
</tr>
<tr>
<td>Mercer</td>
<td>2009</td>
<td>1999-2001</td>
<td>Britain</td>
<td>National Survey of Sexual Attitudes &amp; Lifestyles-2</td>
<td>Describe heterosexual partnerships (all and new partnerships****) in the previous year, and condom use</td>
<td>National probability sample</td>
<td>British female residents 16-44 years reporting 1+ opposite sex sexual partner in the last year</td>
<td>n=5462 (obtained from author)</td>
<td>Computer-assisted face-to-face and self-completion questionnaire</td>
</tr>
<tr>
<td>Moreau</td>
<td>2011</td>
<td>2006</td>
<td>France</td>
<td>French Sexual Behaviour Survey</td>
<td>Examine associations between break up in last 5 years and: self-report of abortion, STI diagnosis, condom use with a new partner in last 5 years; and Chlamydia test results</td>
<td>2 stage probability sampling design</td>
<td>Women 16-44 years living in France who reported 1+ sexual partners in last 5 years</td>
<td>n=4540</td>
<td>Telephone interview including random sample chlamydia test using vaginal swab</td>
</tr>
<tr>
<td>First author</td>
<td>Publ. year</td>
<td>Year of collection</td>
<td>Country</td>
<td>Study name</td>
<td>Aim of reported analysis</td>
<td>Sampling strategy</td>
<td>Sample description</td>
<td>Sample size</td>
<td>Data collection strategy</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>--------------------</td>
<td>---------</td>
<td>------------</td>
<td>--------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Taft</td>
<td>2007</td>
<td>1996</td>
<td>Australia</td>
<td>Australian Longitudinal Study of Women’s Health</td>
<td>Identify factors associated with abortion and other pregnancy outcomes among young women</td>
<td>Random sample from national health insurance database</td>
<td>Women 18-19 years selected via national health insurance database</td>
<td>n=3822</td>
<td>Self-administered postal questionnaire</td>
</tr>
<tr>
<td>Wellings</td>
<td>2013</td>
<td>2010-2012</td>
<td>Britain</td>
<td>National Survey of Sexual Attitudes &amp; Lifestyles-3</td>
<td>Estimates of distribution of pregnancies by planning status and associated factors</td>
<td>National probability sample</td>
<td>British female residents 16-44 years, reporting a pregnancy in the last year</td>
<td>n=591</td>
<td>Computer-assisted face-to-face and self-completion questionnaire</td>
</tr>
<tr>
<td>Xaverius</td>
<td>2009</td>
<td>2002 and 2004 (pooled data)</td>
<td>USA</td>
<td>Behavioral Risk Factor Surveillance System (BRFSS)</td>
<td>Identify demographic characteristics, behavioral risk factor patterns &amp; health care encounters of women at risk for UIP</td>
<td>random digit dial sample of telephone numbers</td>
<td>Women 18-44 years at risk for UIP*****</td>
<td>n=55539</td>
<td>telephone survey</td>
</tr>
</tbody>
</table>

* Risk for unintended pregnancy defined as respondent having had sexual intercourse with a man in the past year, not currently pregnant or not <=two months postpartum, not trying to get pregnant and neither them or their partner ‘contraceptively or non-contraceptively sterile’ (p.91)

** Risk for unintended pregnancy defined as respondent not sterile, pregnant, intending to get pregnant, nor abstinent in 3 months prior to interview

*** Information from second paper reporting on the same study by Walsemann & Perez 2006 (Walsemann and Perez, 2006)

****New partnerships defined as those in which first sex with the partner occurred in the year prior to interview

*****Risk for UIP defined as respondent being fertile and not with a man who’d had a vasectomy or with a same-sex partner, not currently pregnant and who responded that they were not doing anything to prevent a pregnancy for reasons other than they wanted to become pregnant or they did not care if they got pregnant (p.308)
3.3.2 Quality of papers

Most papers presented multivariate statistics or bivariate analyses with tests of difference. Two papers reported only bivariate analyses (Moreau et al., 2011, Wellings et al., 2013b), reflecting a lack of statistical power to conduct multivariate analyses due to small sample sizes. These small samples may affect the generalisability of the findings, and the bivariate analyses may represent spurious associations, which are explained by other variables not included in the analysis. There was a notable lack of reporting of frequency of exposures, particularly in papers presenting multivariate analyses. This is important as statistically significant associations may still lack utility as CPR items where either the exposure or outcome of interest is comparatively rare. Similarly, analyses were not presented for the extent of variance around a particular outcome predicted by the investigated psychosocial exposures.

Reported statistical analyses (see Tables Three-Six) also showed poor attention to the risk of Type 1 error arising from multiple tests of difference (in which statistically significant associations occur by chance). This issue is considered further in the discussion section of this chapter, alongside the constructions of ‘unintended’ pregnancy and other concepts, and of comparator groups; each of which may have reduced the quality of some study findings.

These issues of quality are presented for each study in Table 2 together with clarity, bias, questionnaire validity, and substantiation and generalisability. More generally, some of the abortion and STI acquisition evidence is of limited value in profiling current and recent risk experiences or adverse outcomes due to use of long reference periods such as ‘within the last five years’ or ‘ever’.
<table>
<thead>
<tr>
<th>1st author</th>
<th>Item validity &amp; use of validated tools</th>
<th>Bias (including inclusion and exclusion criteria)</th>
<th>Clarity</th>
<th>Weighting, missing data, statistical analysis &amp; report</th>
<th>Generalisability &amp; substantiation of conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavazos-Rehg</td>
<td>Intensity categories for substance use previously used, validity not discussed</td>
<td>Sample taken from students enrolled in high school so misses excluded individuals</td>
<td>Alcohol use items not described</td>
<td>Each participant weighted to account for over-sampling of ethnic groups. Appropriate and well described statistics</td>
<td>May have achieved more useful data by treating 0-1 partner as the reference group, not 0 partners</td>
</tr>
<tr>
<td>Coleman</td>
<td>Little description of how variables of interest were operationalised</td>
<td>Study focused on decision to abort, therefore only a subset of unintended pregnancies where the mother was reluctant to continue the pregnancy. No discussion of non-respondents</td>
<td>Conflates history of abortion with decision to abort. Poor delineation of objectives regarding abortion predictors and impact</td>
<td>No discussion of missing data, or weighting and little discussion of analysis. No discussion of type 1 error</td>
<td>Possible under-report acknowledged by authors</td>
</tr>
<tr>
<td>Frost 2007 &amp; 2008</td>
<td>Difficult to assess the definition of inconsistent use and how its composite measure was constructed from collected data</td>
<td>Acknowledged bias against those without phone or absent. Women 'at risk of UIP' based on 'not trying to get pregnant'; n=470 of whom reported they would be 'very pleased' to become pregnant and n=444 'a little pleased'</td>
<td>Lack of clarity regarding treatment of condom breakage and slippage</td>
<td>Risk of type 1 error from numerous bivariate analyses unaddressed. Weights applied to reduce bias from under-representation of subgroups &amp; non-response. No confidence intervals given for odds ratios</td>
<td>Limited by only examining genital herpes and genital warts- this may affect prevalence for example &amp; may not be transferable to bacterial STIs</td>
</tr>
<tr>
<td>1st author</td>
<td>Item validity &amp; use of validated tools</td>
<td>Bias (including inclusion and exclusion criteria)</td>
<td>Clarity</td>
<td>Weighting, missing data, statistical analysis &amp; report</td>
<td>Generalisability &amp; substantiation of conclusions</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------</td>
<td>-----------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Kramer</td>
<td>No discussion of item validity</td>
<td>No apparent bias. No discussion of non-respondents</td>
<td>Operationalisation of ‘not intending to become pregnant’ was not discussed</td>
<td>No discussion of missing data. Weighting used. Analysis methods appropriate. No discussion of type 1 error</td>
<td>Non-contracepting behaviour included withdrawal and calendar rhythm methods, for which contraception would be offered. Conclusions substantiated</td>
</tr>
<tr>
<td>Kraut-Becher</td>
<td>No discussion of item validity</td>
<td>There is likely a bias in this sample towards low-risk respondents in regular relationships, as the inclusion criteria included having knowledge of own and partners' birth dates</td>
<td>Unclear what constituted an 'STI'. Qualitative report of age gap 'younger', 'much younger' etc... makes interpretation of the data difficult</td>
<td>No discussion of missing data. Weighting used. No discussion of type 1 error. Appropriate use of bivariate tests of difference but no multivariate modelling or adjustments made for socio-economic variables (which are presented descriptively)</td>
<td>Given the focus of this review on acquisition it is noteworthy that reported STI diagnoses may well have occurred prior to most recent partnerships (and the exposure variable of age gap)</td>
</tr>
<tr>
<td>Mercer</td>
<td>No discussion of item validity</td>
<td>Only presents analyses on those reporting heterosexual sex within the last year. No discussion of non-respondents</td>
<td>Good</td>
<td>No discussion of missing data or type 1 error. Weighting of individuals and partnerships. Analysis methods appropriate.</td>
<td>Good generalisability and conclusions well substantiated</td>
</tr>
<tr>
<td>Paper 1st author</td>
<td>Item validity &amp; use of validated tools</td>
<td>Bias (including inclusion and exclusion criteria)</td>
<td>Clarity</td>
<td>Weighting, missing data, statistical analysis &amp; report</td>
<td>Generalisability &amp; substantiation of conclusions</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------</td>
<td>-----------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Moreau</td>
<td>No discussion of item validity. Limited description of how concepts were operationalised – e.g. 'relationship break-up'</td>
<td>Description or comparative analysis of non-participants not given</td>
<td>Relationship break up, abortion and STI measured for 'last 5 years', so cannot determine temporality. Poor clarity re meaning of 'sexual risk taking'</td>
<td>Missing data not discussed. Weighting used. Analysis appropriate. Multivariate analysis unadjusted for 2 of 4 variables which showed bivariate association with relationship break-up (being a student and being a parent)</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Wellings</td>
<td>London Measure of Unplanned Pregnancy, Index of multiple deprivation, PHQ-2 score</td>
<td>No discussion of non-respondents. Excluded participants with unknown pregnancy outcomes to avoid over-representing pregnancies resulting in birth</td>
<td>Good</td>
<td>No discussion of missing data. Weighting used. Analysis methods appropriate. No discussion of type 1 error</td>
<td>Good generalisability and conclusions substantiated, though caution regarding small total number of participants</td>
</tr>
<tr>
<td>Xaverius</td>
<td>Consistency of use and time frame not specified for key outcomes and alcohol exposures</td>
<td>Non-respondents not discussed. Emergency contraception as a contraceptive method may bias results</td>
<td>Unclear if women ambivalent about pregnancy in the 'high risk' group</td>
<td>No discussion of missing data, or weighting and little discussion of analysis. No discussion of type 1 error</td>
<td>Difficult to assess due to other quality concerns</td>
</tr>
<tr>
<td>Paper 1st author</td>
<td>Item validity &amp; use of validated tools</td>
<td>Bias (including inclusion and exclusion criteria)</td>
<td>Clarity</td>
<td>Weighting, missing data, statistical analysis &amp; report</td>
<td>Generalisability &amp; substantiation of conclusions</td>
</tr>
</tbody>
</table>

89
| Taft | Well-described item wording & composite variables generation Validity not discussed | None apparent | Unclear regarding inclusion / exclusion of never pregnant respondents. Comparing table with text it appears these were allocated as 'no' responses to abortion | No discussion of missing data. Probability weights used to reflect over-sampling of rural and remote areas. No description of socio-economic variables adjusted for Good generalisability though caution needed regarding small total number of participants reporting pregnancy from which associations derived |
3.3.3 Key findings of reported studies
Reported psychosocial factors broadly fell into the categories: substance use, health-related, formative experiences, relationship and partner qualities, and ‘other’. The ‘other’ category comprised sex education source, religious service attendance, and fatalistic attitudes. These categories are used to structure Tables Three-Six which present detailed findings by outcome.

3.3.4 Unintended pregnancy and abortion
None of the included studies examined the construct of *unintended* pregnancy. Current smoking, use of drugs other than cannabis in the last 12 months and depression were positively associated with unplanned pregnancy in the last year, as were first sexual intercourse <16 years, a main sex education source other than school lessons, and non-cohabitation/non-marriage (Wellings et al., 2013b). In a separate study relationship status was not found to be associated with abortion in the last year, but historical experience of partner violence and no insurance cover were (Taft and Watson, 2007). Less frequent religious service attendance, lack of closeness to mother and to father, and leaving home at an early age were also associated with a greater likelihood of abortion (Coleman et al., 2009). Detailed findings, including reported statistical analyses for these associations are presented in Tables Three and Four.
<table>
<thead>
<tr>
<th>Exposure type</th>
<th>Exposure variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistics</th>
<th>1st author &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use</td>
<td>Use of drugs other than cannabis in last year</td>
<td>UPP in previous year</td>
<td>Use of drugs other than cannabis in last year associated with higher rates of UPP</td>
<td>OR 3.41 (95% CI 1.64-7.11), p=0.0038 (adjusted for age)</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td></td>
<td>Current smoker</td>
<td>UPP in previous year</td>
<td>Current smoking status associated with experience of UPP when compared with never smoked</td>
<td>OR 2.47 (95% CI 1.46-4.18), p=0.0017 (adjusted for age)</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Current depression (measured as score ≥3 on PHQ-2)</td>
<td>UPP in previous year</td>
<td>Current depression associated with higher rates of UPP. Comparator group not specified</td>
<td>OR 1.96 (95% CI 1.10-3.47), p=0.0221 (adjusted for age)</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td>Formative experiences</td>
<td>First sexual intercourse &lt;16 years</td>
<td>UPP in previous year</td>
<td>First sexual intercourse &lt;16 years associated with higher rates of UPP</td>
<td>OR 2.88 (95% CI 1.77-4.57), p&lt;0.0001 (adjusted for age)</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td></td>
<td>Main sex education source (school, other)</td>
<td>UPP in previous year</td>
<td>Main sex education source not school associated with higher rates of UPP</td>
<td>OR 1.84 (95% CI 1.12-3.00), p=0.0153 (adjusted for age)</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td>Partner or relationship qualities</td>
<td>relationship status (not married or cohabiting or no partner)</td>
<td>Unplanned pregnancy in previous year</td>
<td>Not cohabiting or married associated with higher rates of UPP than married, cohabiting or in civil partnership</td>
<td>p&lt;0.0001 in chi-square test</td>
<td>Wellings 2013</td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Substance use</td>
<td>No studies of this kind identified</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Health insurance cover</td>
<td>Self-report of ever reporting a pregnancy termination</td>
<td>Private health insurance cover (versus no cover) associated with lower rate of abortion</td>
<td>OR 0.43 (95% CI 0.26-0.72) adjusted for 'all socio-economic variables' p.136</td>
<td>Taft 2007</td>
</tr>
<tr>
<td>Formative experiences</td>
<td>Closeness to mother in childhood</td>
<td>Self-report of ever having an abortion</td>
<td>Lack of closeness to mother in childhood assoc. with abortion</td>
<td>p&lt;0.01</td>
<td>Coleman 2009</td>
</tr>
<tr>
<td></td>
<td>Closeness to father in childhood</td>
<td>Self-report of ever having an abortion</td>
<td>Lack of closeness to father in childhood assoc. with abortion</td>
<td>p&lt;0.05</td>
<td>Coleman 2009</td>
</tr>
<tr>
<td></td>
<td>Leaving home at an 'early age'</td>
<td>Self-report of ever having an abortion</td>
<td>Leaving home at an early age associated with abortion</td>
<td>p&lt;0.05</td>
<td>Coleman 2009</td>
</tr>
<tr>
<td>Partner or relationship</td>
<td>Experience of partner violence &gt;12 months</td>
<td>Self-report of ever reporting a pregnancy termination</td>
<td>Partner violence &gt;12 months ago (versus no violence at all) associated with abortion</td>
<td>OR 2.07 (95% CI 1.08-3.97) adjusted for 'all socio-economic variables' (p.136)</td>
<td>Taft 2007</td>
</tr>
<tr>
<td>qualities</td>
<td>ago*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current relationship status (single,</td>
<td>Self-report of never or ever reporting a pregnancy</td>
<td>Relationship status was not associated with report of pregnancy termination</td>
<td>Married OR 1.08 (95% CI 0.44-2.66), de facto OR 1.94 (95% CI 1.17-3.21),</td>
<td>Taft 2007</td>
</tr>
<tr>
<td></td>
<td>married, widowed/separated/divorced)</td>
<td>termination</td>
<td></td>
<td>widowed/ separated/ divorced OR 2.36 (0.25-21.9) ref group single</td>
<td></td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------</td>
<td>------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Partner or relationship qualities continued</td>
<td>Break-up of relationship within last 5 years</td>
<td>Self-report of abortion in last 5 years</td>
<td>Break-up in the last 5 years was positively associated with abortion in the last 5 years</td>
<td>OR: 9.1% v 5.1% p&lt;0.0001</td>
<td>Moreau 2011</td>
</tr>
<tr>
<td>Other</td>
<td>Frequency of religious service attendance</td>
<td>Self-report of ever having an abortion</td>
<td>less frequent religious service attendance associated with abortion</td>
<td>p&lt;0.0001</td>
<td>Coleman 2009</td>
</tr>
</tbody>
</table>

"derived as a dichotomous component of a composite variable created from 3 items which relate to ‘ever been in a violent relationship with a partner/spouse?’, and two items concerned with experience of violence (not partner specific) in the last 12 months."
3.3.5 Unprotected sexual intercourse

Detailed findings concerning unprotected sexual intercourse are presented in Table Five. Studies reported variously on non-use of any method, non-use of condoms at first and most recent sex with most recent partner, and inconsistent use of condoms and of oral contraceptives. Contraceptive non-use among women aged 20-24 years was not associated with any of four measures of religious affiliation (Kramer et al., 2007). Condom use at first sex with most recent partner was associated with meeting a partner while travelling (but not other ad-hoc scenarios like social venues) and an age difference between partners of less than 5 years (compared to a male partner 5+ years older) (Mercer et al., 2009a). The same study reported that condom use at last sex with most recent partner was more common among those reporting less stable partnerships (Mercer et al., 2009a).

In contrast a United States study reported that ‘gap in method use and at risk’ (i.e. non-use of any method among women reporting at least one episode of vaginal intercourse) was more common among cohabiting women compared to married women (Frost et al., 2007). In bivariate analyses, this outcome was also more common among those reporting: no current relationship; a belief that one’s partner is not monogamous: a fatalistic attitude to pregnancy; having two or more children; and a lack of health insurance (Frost et al., 2007). Using bivariate analyses, various differential findings were also reported for health insurance and for these other exposures in relation to non-use and inconsistent use of condoms and other methods (Frost et al., 2007, Frost and Darroch, 2008). Furthermore, smoking and obesity were positively associated with non-use of contraception among those not wishing to get pregnant (Xaverius et al., 2009). In contrast, leisure time physical activity, and alcohol consumption (binge, heavy, and any) were negatively associated with non-use of condoms in the same study.
<table>
<thead>
<tr>
<th>Exposure type</th>
<th>Exposure variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistics</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; author &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use</td>
<td>Any alcohol use (no further definition given)</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Any alcohol use was less commonly reported among women reporting non-use of contraception than among those using contraception</td>
<td>OR 0.73 (95% CI 0.67-0.79). Difference in weighted prevalence p&lt;0.001 (adjusted for race, age, education, marital status, income, employment, insurance status)</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td></td>
<td>Binge alcohol use (five or more drinks on any one occasion) (no further definition given)</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Binge drinking was less commonly reported among women reporting non-use of contraception than among those using contraception</td>
<td>OR 0.89 (95% CI 0.80-0.99) Difference in weighted prevalence p&lt;0.001 (adjusted for race, age, education, marital status, income, employment, insurance status)</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td></td>
<td>Heavy alcohol use (no further definition given)</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Heavy alcohol use was less commonly reported among women reporting non-use of contraception than among those using contraception</td>
<td>OR 0.85 (95% CI 0.73-0.98) Difference in weighted prevalence p&lt;0.001 (adjusted for race, age, education, marital status, income, employment, insurance status)</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td>Substance use</td>
<td>Current smoker</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Current smoker associated with non-use of contraception (comparator group not specified)</td>
<td>OR 1.20 (95% CI 1.11-1.31) Difference in weighted prevalence p&lt;0.001 (adjusted for race, age, education, marital status, income, employment, insurance)</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Body Mass Index (BMI) (underweight/ normal/ overweight/ obese)</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Obesity (BMI&gt;29) was more common among those not using contraception, while over and underweight were not.</td>
<td>Obese OR 1.23 (95%CI 1.12-1.34), overweight OR 1.01 (95%CI 0.92-1.10), underweight OR 0.99 (95%CI 0.79-1.24) Difference in weighted prevalence p&lt;0.001 (adjusted for employment, marital status, race, education, income, age, insurance)</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td>Insurance cover</td>
<td>No method use *</td>
<td>No cover compared to private assoc. with higher report of 'no method', while Medicaid compared to private was not</td>
<td>No cover 13% versus private cover 6.7% p &lt;0.05 (unadjusted). Medicaid 9.2% (p value not given versus private or no cover)</td>
<td>Frost 2007</td>
<td></td>
</tr>
<tr>
<td>Insurance cover</td>
<td>Inconsistent use of pill **</td>
<td>No cover (v. private) assoc. with lower risk of inconsistent use of pill. Medicaid (versus private) wasn’t</td>
<td>No cover: OR 0.49 p&lt;0.05 (multivariate). Medicaid: OR 0.69. (versus private cover)</td>
<td>Frost 2008</td>
<td></td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Insurance cover</td>
<td>'Gap in method use, at risk' ***</td>
<td>No cover (v. Medicaid) assoc. with higher report of 'gap in method, at risk'. Medicaid (v. private) associated with higher report of gap in method, at risk</td>
<td>No cover 14.8% vs Medicaid 23.9 % p&lt;0.05 (unadjusted). Medicaid 23.9% versus private cover 12.4% p&lt;0.05 (unadjusted).</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-----------------------</td>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>Insurance cover</td>
<td>Inconsistent use of condoms ****</td>
<td>Insurance coverage and condom use were not associated</td>
<td>No cover: OR 0.86 (multivariate). Medicaid: OR 1.84 (versus private cover)</td>
<td>Frost 2008</td>
</tr>
<tr>
<td>Formative experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner or relationship qualities</td>
<td>Belief in current partner monogamy: Yes (or no partner) versus No</td>
<td>No method use *</td>
<td>'no method use' LOWER among those who did not believe current partner was monogamous</td>
<td>p &lt;0.05 (unadjusted)</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>Partner or relationship qualities</td>
<td>Belief in current partner monogamy: Yes (or no partner) v No</td>
<td>'Gap in method use, at risk' ***</td>
<td>'Gap in use, at risk' HIGHER for those who did not believe current partner was monogamous</td>
<td>p &lt;0.05 (unadjusted)</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>Partnership status (married, cohabiting, unmarried and not cohabiting)</td>
<td>Inconsistent use of pill**</td>
<td>Lower report of inconsistent pill use among those not cohabiting / married versus married.</td>
<td>Not cohabiting: 45.8% compared to married: 34.73% p&lt;0.05. OR 0.84 (ref. group married).</td>
<td>Frost 2008</td>
<td></td>
</tr>
<tr>
<td>Partnership status (married, cohabiting, unmarried and not cohabiting)</td>
<td>Inconsistent use of condoms****</td>
<td>Significantly lower report of inconsistent condom use among those not cohabiting or married compared to those cohabiting</td>
<td>Not cohabiting: 53.2% compared to cohabiting: 72.3 % p&lt;0.05. OR 0.80 (ref. group married) Adjusted for fatalism, method, provider satisfaction &amp; parity</td>
<td>Frost 2008</td>
<td></td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Partner or relationship qualities continued</td>
<td>Difference in age between partners</td>
<td>Condom use at first sex with most recent partner</td>
<td>New partnerships where male partner was within 5 years of woman's age were more likely to use condoms at first sex than if partner 5+ years older</td>
<td>OR 1.7 (95% CI 1.17-2.48). Adjusted for interaction of &lt;20 years and age difference between partners OR 0.68 (95% CI 0.32-1.45) p=0.313 Reference group: male partner 5+ years older</td>
<td>Mercer 2009</td>
</tr>
<tr>
<td>Partnership type</td>
<td>Partnership type</td>
<td>Condom use at last sex with most recent partner</td>
<td>Condom use at last sex among co-habiting women: OR 1.24 (95% CI 1.00-1.55). Condom use at last sex among women with not (yet) regular partners: OR 5.12 (4.12-6.37) (95% CIs)</td>
<td>Reference group: married</td>
<td>Mercer 2009</td>
</tr>
<tr>
<td>Place where met partner</td>
<td>Place where met partner</td>
<td>Condom use at last sex with most recent partner</td>
<td>Meeting a partner while travelling versus meeting a partner in other ways was associated with condom use at first sex</td>
<td>Meeting a partner while travelling versus meeting a partner in other ways (68.1% v 47.9% p=0.049). The association between condom use at first sex and meeting a partner while travelling declined with age from 92.2% among women &lt;20 years to 34.6% among women aged 35-44 years (p=0.018)</td>
<td>Mercer 2009</td>
</tr>
<tr>
<td>Marital status (married, cohabiting, formerly married or cohabiting)</td>
<td>'Gap in method use, at risk' ***</td>
<td>Cohabiting compared to marriage associated with higher report of 'gap in use, at risk'</td>
<td>Cohabiting: 18.8% v Married: 12.8% p &lt;0.05 (unadjusted)</td>
<td>Frost 2007</td>
<td></td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Partner or relationship</td>
<td>Duration of current relationship: &gt;4 years, 2-4 years, 6-23 months, &lt;6 months, no relationship</td>
<td>'Gap in method use, at risk' ***</td>
<td>No relationship associated with 'gap in use, at risk' compared with relationship &gt;4 years &amp; with relationship 2-4 years</td>
<td>No relationship: 21.3% v &gt;4 year relationship: 13.8% and versus 2-4 year relationship: 11.5% p &lt;0.05 (unadjusted)</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>qualities continued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Leisure time physical activity (no further detail given)</td>
<td>Current non-use of contraception among those not seeking pregnancy</td>
<td>Undertaking leisure time physical activity (versus not doing so) was associated with lower report of current non-use of contraception</td>
<td>OR 0.73 (95%CI 0.67-0.80) for exercise in high-risk women. Adjusted for race, age, education, marital status, income, employment, insurance status. Ref group: low risk women</td>
<td>Xaverius 2009</td>
</tr>
<tr>
<td>Fatalistic attitude</td>
<td>Fatalistic attitude towards pregnancy and birth control *****</td>
<td>'Gap in method use, at risk' ***</td>
<td>Fatalistic attitude towards pregnancy and birth control assoc. with 'gap in use, at risk'</td>
<td>Fatalistic attitude: 19.2% v non-fatalistic attitude: 12.9% p&lt;0.05 Adjusted for full model, no further details given</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>towards pregnancy and birth control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatalistic attitude</td>
<td>No method use *</td>
<td>Fatalistic attitude towards pregnancy and birth control associated with 'no method'</td>
<td></td>
<td>Fatalistic attitude: 14.3% v non-fatalistic attitude: 5.2% p&lt;0.05 Adjusted for full model, no further details given</td>
<td>Frost 2007</td>
</tr>
<tr>
<td>towards pregnancy and birth control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current religious affiliation</td>
<td>Current non-use of contraception among those not intending to get pregnant</td>
<td>Current religious affiliation not associated with current non-use of contraception</td>
<td></td>
<td>None: 1.03 (95%CI 0.65-1.61), Catholic 1.03 (95%CI 0.71-1.52), Fund. Protestant 1.26 (95%CI 0.84-1.9) (ref. mainstream Protestant). Adjusted for race, education, age, marital status, parity, income, interaction between age and denomination</td>
<td>Kramer 2007</td>
</tr>
<tr>
<td>Exposure type</td>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-----------------------</td>
<td>---------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Other</td>
<td>Childhood religious affiliation</td>
<td>Current non-use of contraception among those not intending to get pregnant</td>
<td>Childhood religious affiliation not associated with current non-use of contraception</td>
<td>None: 0.79 (95%CI 0.51-1.22), Catholic 1.05 (95%CI 0.69-1.59), Fundamentalist protestant 0.96 (95%CI 0.62-1.49 ref. group: mainstream protestant. Adj. for race, marital status, age, parity, income, education, and interaction between age and denomination</td>
<td>Kramer 2007</td>
</tr>
</tbody>
</table>

*No method use defined as no contraceptive use for entire 12 months*

**Inconsistent pill use defined by its inverse: ‘Women who had not missed a single active pill in the past three months were considered consistent users’**

***Gap in method use, at risk defined as a gap in use and at least one episode of heterosexual intercourse and not pregnant’***

****Inconsistent condom use defined by its inverse: ‘Women whose partners had used a condom every time they had sex and had always put it on before beginning sexual contact were considered consistent users’***

*****Fatalistic attitude derived from 1 of 3 measures of attitudes towards avoiding pregnancy; i.e. agreement with statement “It doesn't matter whether I use birth control or not; when it is my time to get pregnant, it will happen” (p.92)***
3.3.6 STIs and multiple sexual partners

Several psychosocial variables were reported to be associated with diagnosis of STI or self-report of STI acquisition and multiple sexual partners (Table Six). A positive ‘dose response’ association was reported between partner numbers and intensity of both alcohol use and marijuana use, in addition to a positive association with earlier onset of heavy marijuana use (Cavazos-Rehg et al., 2011). Self-report of STI diagnosis ever was positively associated with having a partner three or more years younger in age for women aged 35-44 years (Kraut-Becher and Aral, 2006). The same paper also reported that an age difference between partners of less than two years was negatively associated with STI diagnosis compared to larger age gaps (in which the male partner was either younger or older) (Kraut-Becher and Aral, 2006). Finally, both chlamydia diagnosis at the time of participation and self-report of any STI in the last 5 years (Moreau et al., 2011) were found to be positively associated with relationship break-up in the last five years.
<table>
<thead>
<tr>
<th>Exposure variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistics</th>
<th>1st author &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use</td>
<td>‘During your life, with how many people have you had sexual intercourse?’</td>
<td>Positive dose response between intensity of alcohol use and number of sexual partners</td>
<td>OR: Odds ratio CI: Confidence interval</td>
<td>Cavazos-Rehg 2011</td>
</tr>
<tr>
<td>Intensity of alcohol use (non-use, experimental/new,</td>
<td>Never, 1, 2, 3, 4, 5, 6 or more</td>
<td>(controlled for race/ethnicity and age at interview)</td>
<td>6+ptns v 0: exp. users OR 6.9-12.0, mod. users OR 7.0-16.5, heavy users OR 20.0-40.5, 2-5ptns v 0: exp. users OR 2.0-7.3, mod. users OR 5.6-7.3, heavy users OR 9.8-10.3. 1ptn v 0: exp. OR 1.4 (non-sig), mod. users OR 1.8-2.8, heavy users OR 2.6-3.2</td>
<td></td>
</tr>
<tr>
<td>moderate (mod.), heavy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensity of marijuana use in (non-users, experimental/new users 1-9 uses, moderate users 10-99 uses, heavy users 100+ uses)</td>
<td>‘During your life, with how many people have you had sexual intercourse?’</td>
<td>Positive dose response between intensity of marijuana use and number of sexual partners (controlled for race/ethnicity and age at interview)</td>
<td>6+ptns v 0: exp. users OR 1.3-6.3, mod. users OR 6.7-11.2, heavy users OR 9.2-57.5. 2-5ptns v 0: exp. users OR 2.2-4.9, mod. users OR 2.2-3.3, heavy users OR 6.2-22.1. 1ptn v 0: exp. users OR 1.0 (non-sig.), mod. users OR 1.0 (non-sig.) heavy users OR 1.9 (non-sig.)</td>
<td>Cavazos-Rehg 2011</td>
</tr>
<tr>
<td>Age of onset of marijuana use (&lt;13, 13-14, 15+ years)</td>
<td>‘During your life, with how many people have you had sexual intercourse?’</td>
<td>Onset of heavy marijuana use aged 15+ and aged &lt;=12 were both associated with higher number of partners (ptns.) compared with non-users (controlled for race/ethnicity and age at interview)</td>
<td>Onset of heavy marijuana use age 15+: 2-5 ptns. v 0 OR 6.2. Onset of heavy marijuana use age &lt;=12: 2-5 ptns v 0 OR 22.1 (adjusted for race/ethnicity and age at interview)</td>
<td>Cavazos-Rehg 2011</td>
</tr>
<tr>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
<td>-----------------------</td>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Substance use continued.</td>
<td>Daily cigarette smoking: have you ever smoked cigarettes daily, that is to say at least 1 cigarette every day for 30 days? Yes / No</td>
<td>'During your life, with how many people have you had sexual intercourse? Never, 1, 2, 3, 4, 5, 6+</td>
<td>Smoking associated with partner numbers irrespective of intensity BUT risk higher for daily users (controlled for race/ethnicity &amp; age at interview)</td>
<td>6+ptns. v 0: Non-daily users OR 2.1-2.9; daily users OR 5.6-9.7. 2-5 partners v 0: non-daily users OR 1.7-1.9, daily users OR 3.1-4.6. 1 partner v 0: non-daily users OR 1.4-1.7, daily users OR 1.5-3.2</td>
</tr>
<tr>
<td>Health</td>
<td>No studies of this kind identified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formative experiences</td>
<td>No studies of this kind identified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner and relationship qualities</td>
<td>Current/ most recent male partner (ptn.) age (≥ 3 years younger, 0-2 years older / younger, 3-5 years older, (≥ 6 years older)</td>
<td>Self-report of any STI diagnosis ever</td>
<td>For 35-39 year old women younger current / most recent partner associated with report of STI diagnosis (versus other partner types)</td>
<td>Chi-square = 12.87 degrees of freedom = 1 p &lt; 0.001 (unadjusted)</td>
</tr>
<tr>
<td></td>
<td>Current/ most recent male partner (ptn.) age (≥ 3 years younger, 0-2 years older / younger, 3-5 years older, (≥ 6 years older)</td>
<td>Self-report of any STI diagnosis ever</td>
<td>For 35-39 year old women current/ most recent partner close in age negatively associated with report of STI diagnosis (versus younger or older partners)</td>
<td>Chi-square = 7.76 degrees of freedom = 1 p &lt; 0.01 (unadjusted)</td>
</tr>
<tr>
<td></td>
<td>Current/ most recent male partner (ptn.) age (≥ 3 years younger, 0-2 years older/younger 3-5 years older, (≥ 6 years older)</td>
<td>Self-report of any STI diagnosis ever</td>
<td>For 40-44 year old women younger current / most recent partners associated with report of STI diagnosis (versus other ptn. types)</td>
<td>Chi-square = 5.32 degrees of freedom = 1 p &lt; 0.05 (unadjusted)</td>
</tr>
<tr>
<td>Exposure variable</td>
<td>Outcome variable</td>
<td>Nature of association</td>
<td>Statistics</td>
<td>1st author &amp; year</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
<td>-----------------------</td>
<td>------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Partner and relationship qualities continued</td>
<td>Break-up of relationship within last 5 years</td>
<td>Diagnosis of chlamydia trachomatis at time of study participation (via vaginal smear)</td>
<td>Break-up in the last 5 years was positively associated with diagnosis of chlamydia at the time of study participation among women aged 30+ years only</td>
<td>p=0.01 3% v 0.8%). Stratification by age found the association only held true for those aged 30+ 1.8% v 0.2% p=0.002 for women</td>
</tr>
<tr>
<td></td>
<td>Break-up of relationship within last 5 years</td>
<td>Self-report of any STI in last 5 years (no further definition given)</td>
<td>Break-up in the last 5 years was positively associated with self-report of STIs in last 5 years among women aged 30+ years only</td>
<td>OR 2.1 (95% CI 1.3-3.4) p=0.002 Adjusted for age, level of education, homosexual experience ever, lifetime number of sexual partners. Despite age adjustment stratification by age found the association only held true for those aged 30+ 5.5% v 1% p&lt;0.001 for women</td>
</tr>
</tbody>
</table>
3.3.7 Differences in types and strengths of psychosocial associations across outcomes

None of the included papers reported on substance use in relation to abortion, and none reported on formative experiences in relation to unprotected intercourse, STI acquisition or multiple sexual partnerships. All psychosocial variables that were reported for more than one outcome showed the same direction of association, with the exception of relationship status and alcohol use.

Relationship status was investigated in relation to a number of outcomes. Not cohabiting/being married was associated with experiencing an unplanned pregnancy in the last year (Wellings et al., 2013b), with condom use at last sex with most recent partner (Mercer et al., 2009a), and with a variety of condom and contraceptive pill use variables (Frost and Darroch, 2008, Frost et al., 2007). However, it was not associated with lifetime report of abortion (Taft and Watson, 2007). Variation was also found in correlates of alcohol use. A positive association between partner numbers and intensity of alcohol use (Cavazos-Rehg et al., 2011) contrasted with the findings of a second study which reported lower alcohol use among individuals who were not using contraception and did not wish to get pregnant (Xaverius et al., 2009).

3.3.8 Presentation of models and explanations

Within the papers included in the review, most discussion or presentation of explanation or theory was confined to interpretation of findings. No reference was made to cognition models - such as Protection Motivation Theory (Rogers and Prentice-Dunn, 1997) or the Theory of Planned Behaviour (Ajzen, 2012) - which have been applied to the investigation of precursors to sexual risk experiences or behaviours. Rationales for selection of psychosocial variables for investigation were limited to reference to existing empirical evidence. Most papers reported only post hoc explanations. For example, abortion was posited to result from coercive unprotected sex within abusive relationships (Taft and Watson, 2007). Disassortative mixing (between older and younger sexual networks) was posited to expose young women to relationships with older men where an imbalance of power inhibits assertion of condom use (Kraut-Becher and Aral, 2006). Puritanical religious values in the USA were theorised as
leading to higher rates of unintended pregnancy by discouraging discussion of sexual health (Kramer et al., 2007). Finally, a disinhibition explanation for observed associations between alcohol use and number of sexual partners was not supported by a Youth Risk Behaviour Surveillance System study, on the basis that cigarette smoking and marijuana use were also independently associated with partner numbers, suggesting that these behaviours may instead share common predictors (Cavazos-Rehg et al., 2011).

3.4 Discussion

The findings of this review of probability surveys suggest that various psychosocial variables are associated with adverse sexual health outcomes for women of reproductive age in the general population; and are worthy of further investigation as identifiers of sexual healthcare needs in General Practices. Substance use and relationship qualities emerged as the most commonly investigated factors that were found to correlate with a range of outcomes. Most notably, smoking was associated with both unplanned pregnancy and with non-use of contraception, and ever being a daily smoker was associated positively with lifetime partner numbers. Wider partner age difference was associated with both non-use of condoms at first sex and with report of lifetime STI diagnosis (for women aged 35-44 years) (Kraut-Becher and Aral, 2006). Nonetheless, this review highlights a difficulty in drawing conclusions across studies that vary in the exposures and outcomes of interest and in how those exposures and outcomes are constructed. The fact that unprotected intercourse was the most commonly reported outcome across the review likely reflects its perceived relevance to both STIs and unintended pregnancy, and its higher relative prevalence.

3.4.1 Inconsistencies in the literature

Inconsistencies in the direction of reported associations between relationship status and contraception and condom use may reflect inconsistent use of condoms instead of other contraception among women not in regular relationships. Certainly, ‘gap in use, at risk’ was higher among women not in a regular relationship but – after adjusting for relationship status - lower among
those reporting sexual intercourse four or less times a month (versus ≥ two times a week (Frost et al., 2007). Alternatively, these associations may be unduly influenced by how risk experiences are defined, and how the comparator group of non-risky individuals is defined. For example, the finding that inconsistent use of oral contraceptives was lower among those without health insurance (compared to those with health insurance) may result from failing to take account of differences in rates of oral contraceptive prescription between those with and without health insurance (Frost and Darroch, 2008). The negative association between alcohol use and unprotected intercourse (Xaverius et al., 2009) may be an artefact of how key variables were operationalised (although smoking and obesity were positively correlated with unprotected intercourse in the same study). For example, in this same study (Xaverius et al., 2009) emergency contraception users were classified along with other contraceptive users to form the ‘low risk’ group. Similarly, ‘high risk’ women were defined as women not using contraception who were ambivalent about pregnancy, as well as those explicitly not wanting to get pregnant.

3.4.2 Limitations
In addition to variable and reference group constructions, other issues may have affected the review findings. A small number of papers were excluded due to lack of statistical information about the population (e.g. studies potentially outside the age bounds could not be considered where age means and standard deviations were not provided). This lack of detail also extended to the description of items and derived variables, of which few were reported to be validated or piloted. A number of papers reporting on samples with wider age ranges were also excluded, for example, papers from the Australian Study of Health and Relationships (Richters et al., 2003, de Visser et al., 2007).

Qualitative judgements were made about which exposures met the definition of ‘psychosocial’ set out in Chapter Two, and about which exposures would be unacceptable for CPR inclusion (in the absence of ongoing PPI). These decisions were made carefully and in consultation with supervisors, but may nonetheless have led to the exclusion of predictive and acceptable CPR items.
The purpose of this review was to identify psychosocial correlates of current (rather than historic) risk of adverse sexual health outcomes. Therefore, studies reporting outcomes with long reference periods (e.g. lifetime number of sexual partners) were of limited use in supporting the overarching purpose of identifying psychosocial CPR items indicative of recent risk or morbidity (and therefore need of clinical intervention). Conversely, long reference periods for exposures do not carry the same concern and may increase the acceptability of sensitive items (such as report of first sex before the age of 16 years, or of early marijuana use) and/or the prevalence of those exposures so that they have greater ‘predictive potential’ as CPR items (Grobman and Stamilio, 2006).

The atheoretical and explorative focus of these studies was also reflected in the large number of associations investigated, with no reported post-hoc Bonferroni adjustment or other approaches to account for the possibility of type I error (in which statistically significant associations occur by chance, the likelihood of which is inflated by the number of tests). Also, many papers will likely have reported only a subset of all analyses undertaken, such that reported non-significant findings may not be exhaustive. This may be a product of publication bias towards significant findings, a phenomenon which may also have influenced this review through non-publication of relevant studies.

Differences in the types of psychosocial variables reported across different outcomes may reflect different disciplinary research interests, mirroring the historical distance between reproductive and sexual health services as products of different clinical specialisms. Specifically, there appears to be a greater research interest in the influence of formative experiences on abortion and unintended pregnancy (which has been led by sociologists); and in substance use in relation to sexual risk experiences (which has been led by public health and health psychology).

### 3.5 Systematic review update

The systematic review was completed and submitted for publication in 2014. Therefore, an update on relevant literature was conducted to establish whether
any evidence had emerged since the review, which would have changed how the PhD was conducted, or its key findings.

3.5.1 Methods

A new literature-searching strategy was used to stay abreast of relevant new literature, particularly given the lengthy part-time nature of the doctorate. Importantly this strategy was not intended as a second systematic review, but instead sought to:

1. Keep abreast of new relevant literature, using email alerts and three-monthly Web of Science searches
2. Use a more streamlined search strategy which incorporated general population probability surveys in the search criteria

The same databases were searched with the exception of Cochrane, which yielded no studies in the systematic review and is focused mostly on interventions. The search strategy was still limited to papers concerning humans aged 16-44 which either exclusively concerned females or which provided gender-stratified analysis of a mixed gender sample. However, the eligibility criteria were narrowed regarding recency of publication and study type:

- Peer-reviewed research papers published February 2014 onwards (as the systematic review included papers up to, and including January 2014)
- Papers reporting on probability surveys of general populations, from either baseline longitudinal studies or cross-sectional studies

3.5.2 Results

Four papers were identified which met the inclusion criteria (Gunge et al., 2017, Khadr et al., 2016, Magnusson et al., 2015, Paquette et al., 2017). Overall, these papers did not report on novel psychosocial variables previously unreported in the literature and so would not have changed the direction of the thesis or its overall conclusions. Their findings are summarised below.
A Natsal-3 study of drug use (Paquette et al., 2017) reported on the same subset analysed in this thesis (women aged 16-44 years who reported one or more sexual partner in the last year). The key variable analysed was: ‘use of illicit drugs, other than, or in addition to, cannabis in the past year’ (p.1) (but excluded injecting drug use). This variable was analysed with two referent categories ‘no drug use’ and ‘cannabis use only’ in bivariate and multivariate analyses. After adjustment for age, this variable was positively associated with:

- Two or more sexual partners in the last year (versus one partner) aOR (adjusted odds ratio) =2.32 (confidence interval:1.49-3.60)
- Five or more sexual partners in the last year (versus one partner) aOR=4.15 (confidence interval:2.69-6.40)
- Two or more sexual partners without a condom (versus none) aOR=5.24 (confidence interval:3.07-8.94)
- Using the internet to find sexual partners aOR=3.46 (confidence interval:1.95-6.12)

This last exposure was also associated with report of unplanned pregnancy in the last year (using the London Measure of Unplannned Pregnancy) after adjusting for age, sexual identity and number of partners aOR=2.93 (confidence interval: 1.39 -6.17). This drug use variable may have provided an alternative to the variable ‘drug use ever’ which was selected for Natsal-3 analysis (Chapter Four) and for inclusion in the Brighton & Hove survey (Chapters Five and Six) but would have carried lower prevalence (due to the shortened time frame).

A further Natsal-3 study (Khadr et al., 2016) reported on women (and men) aged 16-24 years regardless of reported sexual activity, and investigated the relationship between substance use and sexual risk experiences in this cohort. Weekly binge-drinking was associated with:

- non-use of condoms at first sex with one or more new partners in the last year, aOR=2.60(confidence interval:1.87-3.63)
- first sex with most recent partner after they had only recently met., aOR=2.04 (confidence interval:1.43-2.91)
- emergency contraception use in the last year, aOR=1.94(confidence interval:1.05-3.56)
• STI diagnosis in the past five years, aOR=2.32 (confidence interval: 1.52-3.53).

Non-prescribed drug use in the past 4 weeks was associated with:
• non-use of condoms at first sex with 1+ new partners in the last year, aOR=1.61 (confidence interval: 1.06-2.44)
• first sex with most recent partner after they had only recently met, aOR=2.42 (confidence interval: 1.53-3.82)
• STI diagnosis in the past 5 years, aOR=3.27 (confidence interval: 1.94-5.51)

The association between emergency contraception use in the last year and drug use was however non-significant aOR=1.92 (confidence interval: 0.92-4.00) (p value not reported). These findings would not have changed the trajectory of the thesis or the selected psychosocial exposures for inclusion in the CRP, as they are limited to young women and carry a short time frame (and therefore have a lower prevalence).

A study of respondents to the United States’ National Survey of Family Growth reported on the association between age at first sexual intercourse and concurrency/ monogamy (Magnusson et al., 2015). The study reported on a multi-stage probability sample of women aged 21-44 years who participated between 2006 and 2010. This study was included although concurrency was not within the criteria for relevant outcomes, as its definition:
‘…reporting two or more partners in the past 12 months with an overlap of any partner’s first sex date and the previous partner’s last sex date’ (Magnusson et al., 2015) (p.3)

can be considered a sub-set of one of the key outcomes studied in this thesis – multiple partnerships in the last year. The study found that, among women aged 21-44 years:
‘those<15 years at sexual initiation had 3.7 times the odds of reporting concurrent partnerships (aOR: 3.72, 95%CI: 2.46-5.62)’ (Magnusson et al., 2015) (p.1)

when compared with women whose sexual debut occurred at age 18+. This finding supports the existing evidence base, and the findings of the Natsal-3
analysis (Chapter Four) and Brighton & Hove survey (Chapters Five and Six) concerning early sexual debut and sexual partnering.

Finally, a paper reporting on two population-based studies of Danish women (Gunge et al., 2017) investigated associations between body mass index (BMI), sexual activity and STIs. The data for one of these studies was too old for inclusion. The results reported here are from the 2004 ‘Liva’ study: for women aged 18-25 years there were overlapping confidence intervals (indicating no statistically significant differences) across BMI categories for the proportions reporting two-four, five-nine, or 10+ partners, or reporting ever receiving a *Chlamydia trachomatis* or genital warts diagnosis. Among women aged 26-35 years there were overlapping confidence intervals (indicating no statistically-significant differences) in reports of two-four, or five-nine partners across BMI groups. However, in this age category confidence intervals did not overlap across BMI categories for 10+ partners; the proportion of women reporting 10+ partners was greater among “healthy” BMI women (confidence interval: 34.7-37.5) than “overweight” women (confidence interval: 29.4-34.4) and “obese” women (confidence interval: 22.6-29.2). The same pattern was observed for report of *Chlamydia trachomatis* diagnosis, whereas for report of genital warts, diagnosis was significantly more common among women with “healthy” BMI (confidence interval: 11.1-13.1) than “obese” women (confidence interval: 5.3-9.2), although the confidence intervals for “overweight” women overlapped each of the other two groups (confidence interval: 8.5-11.7). Overall, this study suggests a dose-response relationship between BMI and lifetime sexual risk such that obesity and overweight may carry a protective function. However, the difficulties of assessing BMI within a self-scored CPR would have prohibited inclusion of this psychosocial variable.

### 3.6 Conclusions

This systematic review demonstrated that a number of psychosocial variables may be associated with sexual risk experiences and/or adverse sexual health outcomes in general populations of women, suggesting they may help identify sexual health need in primary care settings and should be investigated further.
as potential CPR items using the cross-sectional survey described in Chapters Five and Six.

Recent unintended pregnancy, STI acquisition or abortion in these large population studies were also shown to be rare. This indicated that the CPR should focus only on identifying sexual risk experiences; specifically recent retrospective risk of pregnancy and unprotected intercourse with regard to STI risk (non-use and incorrect use of condoms) (Visser and Smith, 2000). This key recommendation also arose from the Natsal-3 study (described in the following chapter) and subsequently influenced the cross-sectional survey described in Chapters Five and Six.

Importantly, the reported associations require cautious interpretation as they may represent spurious rather than explanatory relationships. For example, binge drinking may help identify women who would benefit from contraception and/or STI testing, but may not contribute to the need for those services. Similarly, where long time-frames were used, it was difficult to establish temporality and therefore causality. This may particularly be the case for observed associations between STIs and depression, because the experience of being diagnosed with an STI may both cause and be a consequence of depression. The review also highlighted the importance of using meaningful outcomes. For example, when investigating abortion as a proxy indicator of UIP, this should be combined with unintended pregnancy continued to term.

Finally, it is important to note that the usefulness of psychosocial exposures as CPR questions cannot be determined only on the strength of their statistical association with sexual morbidity. The utility of psychosocial questions in such settings will also depend upon their acceptability and prevalence, such that less frequently occurring exposures will fail to have ‘adequate prediction’ as psychosocial questions (Grobman and Stamilio, 2006). These issues were also therefore addressed in the Natsal-3 analysis (Chapter Four) and Brighton & Hove survey (Chapters Five and Six). In particular, evidence encountered during the review indicated that childhood sexual abuse and forced sex were highly predictive of sexual risk experience and morbidity in adulthood, but were unlikely to be acceptable as CPR items (based on early PPI as discussed in
Chapter Two). Therefore, these variables were investigated further in the Natsal-3 study using a variable for early sexual debut including unwanted sexual contact under the age of 13 years. That study is presented in the following chapter.
Chapter 4: National Survey of Sexual Attitudes and Lifestyles-3 analysis, to identify psychosocial predictors of sexual risk and adverse outcomes among British women of reproductive age
Summary

This chapter presents an exploratory analysis of national probability survey data – the National Survey of Sexual Attitudes and Lifestyles-3 (Natsal-3). This second preliminary study was undertaken to identify psychosocial predictors of women of reproductive age resident in Britain, which might then be suitable for further investigation as CPR ‘candidate predictors’ in the Brighton & Hove survey presented in the following two chapters. The corresponding publication is provided in Appendix 4a.

The chapter begins by introducing the Natsal-3 survey and the specific research questions addressed in this analysis. The selected sub-population is described and the process of selection of the outcomes and exposures which were subsequently analysed for that sub-population. The results section presents and reports on the multivariate model for each of the three selected outcomes. A discussion of these findings in the context of other relevant studies is then provided, alongside an overview of the study limitations. Finally, some concluding statements are offered, including how this analysis informed the survey questionnaire presented in the following chapter.
4.1 Introduction

Data from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3) were analysed as part of this programme of research. Like the systematic review (presented in the previous chapter), the Natsal-3 analysis was conducted to underpin the derivation of the CPR by identifying psychosocial variables predictive of sexual risk and morbidity among women of reproductive age. The Natsal-3 analysis complemented the systematic review by:

1. Providing a highly relevant contemporaneous dataset comprising the general population of women resident in Britain
2. Providing a unique opportunity to limit the analysis to the sub-population to whom the CPR will be targeted (heterosexually-active women aged 16-44 years)
3. Enabling targeted investigation of relevant outcomes and of exposures which would be suitable for inclusion as CPR items

Three Natsal cross-sectional probability sample surveys have taken place at 10 year intervals. The most recent (Natsal-3) was conducted 2010-2012 inclusive with a wider scope of enquiry including topics such as relationship satisfaction, partners’ behaviours, experience of depression, substance use and non-volitional sex (Macdowall et al., 2013). These changes have permitted investigation of the wider social and health contexts of sexual health and behaviour (Mercer et al., 2014), so that the Natsal-3 dataset was particularly suited to the focus of this programme of research.

4.2 Aim and research questions

The aim of this study was to explore which psychosocial variables in the Natsal-3 dataset might be used to identify women aged 16-44 years experiencing higher levels of sexual risk experiences and adverse outcomes in General Practice settings.

The following three research questions were addressed:
1. Which simple, brief and acceptable psychosocial variables are associated with recent sexual risk experiences, self-report of STI acquisition and UIP?
2. Which simple, brief and acceptable psychosocial variables, if any, are associated across different sexual risk experiences and outcomes?
3. Do observed associations between psychosocial factors and sexual risk experiences remain after adjusting for key socio-demographic factors: age group, ethnicity and socio-economic status?

These research questions ensured that the analysis supported derivation of a concise CPR that would be used to identify recent risk and adversity, and which comprised psychosocial exposures which were simple, brief and acceptable (the qualities identified through early-stage PPI work at Brighton Women’s Centre). This approach limited the dataset regarding both the study population and the scope of analysis. In addition the third research question enabled direct investigation of the interplay between psychosocial and socio-demographic variables and the potential role of the latter as CPR items and/or for CPR targeting.

4.3 Methods

4.3.1 Overview of Natsal-3 survey methodology

Natsal-3 used a multi-stage, clustered and stratified sampling methodology to sample the British resident population aged 16-74 years. A sub-sample of respondents aged 16-44 years were also invited to provide a urine test for STI testing in addition to completing the survey questionnaire. Full details of the study design are described elsewhere (Erens et al., 2014, Mercer et al., 2013b). Ethics approval was granted by the Oxfordshire Research Ethics Committee A (Ref: 10/H0604/27) and informed consent obtained for all participants in this study. A response rate of 57.7% corresponds to an achieved sample size of 15162 with nominal levels of item non-response (typically 1-3%) (Mercer et al., 2013b). The Natsal-3 questions can be viewed at http://www.natsal.ac.uk/natsal-3/core-survey/questionnaire.aspx and the dataset is available in the UK Data Service repository, unique persistent identifier: 10.5255/UKDA-SN-7799-1; https://discover.ukdataservice.ac.uk/catalogue/?sn=7799&type=Data%20.
4.3.2 Defining the sub-population for analysis

The analyses presented in this chapter were conducted on a subset of Natsal-3 respondents, limited to those who were:

- aged 16-44 years
- female
- heterosexually active in the last year, defined as reporting anal, oral or vaginal sex with at least one man

This last limitation was based on the assumption that those who had not been sexually active would be unlikely to elect to complete a CPR in a GP setting. Notably, by including anal and oral sex this effectively tailored the analysis to women experiencing potential STI risk rather than unintended pregnancy risk. Limiting the analysis to this relevant, but broad sub-population, aimed to maximise the ‘sensitivity’ of the CPR, by supporting identification of psychosocial items which were likely to be predictive in the general population of sexually active women aged 16-44, amongst whom heterogeneity of risk exists (Johnson A, 2001). This approach demonstrates an implicit assumption of the Natsal-3 analysis - that statistically significant associations identified in the Natsal-3 dataset would likely be extant in GP settings where elevated risks and morbidity are not highly prevalent.

4.3.3 Weighting

To make the sample broadly representative of the target population according to the 2011 Census, two types of weight were applied. First, selection probability weights were applied to adjust for the unequal probability of selection, which sought to address bias from differential non-response (Erens et al., 2014). Second, post-stratification weights were applied based on the age, gender and regional distribution of the 2011 Census, to ensure that estimates were representative of the British population.

4.3.4 Determining outcome measures for analysis

In order to address the aim of the CPR in targeting sexual health advice, STI testing and contraception advice and supply, the following three Natsal-3 outcome variable themes were identified as relevant: unintended pregnancy,
STI acquisition and sexual risk experiences. The task was then to identify and select from amongst existing Natsal-3 variables those which addressed these outcomes. In order to focus the selection process on outcomes which were relevant as markers of need for sexual health intervention, the nature and time-frame of outcomes were also considered.

Outcomes with longer time frames (e.g. two-five years) were deemed unsuitable as markers of current need for intervention, because they will include historical experiences (as well as being subject to greater recall bias). On this basis the following variables were rejected: self-report of diagnosis of chlamydia within the last five years, had an abortion in the last two years and had an abortion in the last five years. Conversely, very recent outcomes (e.g. concerning the last three months) ran the risk of yielding prevalence below 10%, which would prevent statistical significance testing and multivariable modelling in a dataset of this size. On these grounds variables for multiple male partners in the last four weeks and number of male partners within the last three months were also rejected. Thus, recency was balanced against prevalence in order to select clinically relevant outcomes suitable for multivariable modelling.

The size of the dataset of eligible participants (n=4911) precluded multivariable analysis of unintended pregnancy due to counts below n=500. Specifically, only n=591 women of reproductive age completed the London Measure of Unplanned Pregnancy (LMUP) module, of which only n=96 were categorised as ‘unplanned’ (Wellings et al., 2013a). As the variable for abortion in the last year had a prevalence of only 3.32% for the sub-population of interest, it could not be used an alternative proxy measure of unplanned or unintended pregnancy. Therefore, no measures of unplanned or unintended pregnancy were investigated using the Natsal-3 data.

The size of the dataset also precluded multivariable analysis of STI acquisition. Natsal-3’s urine sample results were not suitable for use as outcome variables in this analysis because only n=62 women aged 16-44 years tested positive for *Chlamydia trachomatis* (Sonnenberg et al., 2013). An aggregated variable was generated by the candidate, defined as ‘diagnosis in the last year of 1 or more
of the following: chlamydia, gonorrhoea, syphilis, genital warts, genital herpes, trichomoniasis. In total, 103 women in the study population reported this outcome, which corresponded to a prevalence of 2.11% (95%CI: 1.26%-2.12%). Therefore no recent STI diagnosis variables could be analysed as outcomes.

Therefore the outcomes chosen reflected sexual risk experiences antecedent to unplanned pregnancy and STI acquisition, namely: multiple sexual partnerships in the last year, inconsistent and non-use of condoms with multiple sexual partners in the last year, and inconsistent and non-use of other contraception among those not wishing to get pregnant in the last year.

This decision supported derivation of a CPR with a primary prevention role (in targeting sexual health advice, and/or STI testing or contraception in response to sexual risk experiences). Analyses were limited to these three outcomes (discussed in the following paragraphs), each of which was reported by n≥500 of the sub-population of interest - equating to more than 10% - and therefore suitable for multivariable analysis. Limiting the number of outcomes in this way reduced the risk of Type I error.

The variable '2+ male sexual partners in the last year' (hereafter abbreviated as '2+P') was constructed and chosen as the primary outcome, because report of multiple partners is known to be associated with STI acquisition and is commonly used for clinical and research purposes (Sonnenberg et al., 2013, Santelli et al., 1999). In addition switching partners is associated with unplanned pregnancy (Wellings et al., 2015) and a point at which chlamydia screening is recommended to 16-24 year olds (NCSP, 2017). 17.9% reported this outcome among the sub-population.

Non-use of condoms with 2+ partners in the last year (hereafter abbreviated as '2+PNC') was selected as it combines multiple partnerships and condom use to provide a more nuanced indicator of STI acquisition than 2+P. This is useful as condom use is known to decline over time in monogamous partnerships (Macaluso et al., 2000). Specifically this variable refers to at least one episode
of non-use of condoms, occurring with two or more partners. Among the sub-
population of interest 9.8% reported the outcome.

Finally, a variable was chosen capturing non-use of condoms at first sex with
most recent partner and within the last year, including those only reporting
having sex only once (to date) with their most recent partner. This is
abbreviated hereafter as ‘FSNC’ and was reported by 41.5% of the sub-
population. This variable represents a sexual risk experience when ‘risk’ of STI
or UIP might be most highly perceived and we might therefore anticipate a
greater likelihood of condom use, so that non-use perhaps indicates less
capacity to negotiate condoms and/or self-care. This variable was selected as it
focuses only on non-use of condoms (rather than partner numbers) and
therefore may be more indicative of those at risk of STI acquisition from a
partner. However, as a single sexual encounter is unlikely to result in significant
risk, this variable represents an exploratory proxy indicator of sexual risk
experiences in the last year. Therefore, when reviewing bivariate analyses
(described below in section 4.3.6) psychosocial variables associated with 2+P
or 2+PNC were given precedence over those associated with FSNC.

4.3.5 Selecting psychosocial variables for analysis as exposures
The following sequential steps were taken to ensure a rigorous empirical
approach to the selection of Natsal-3 psychosocial items suitable for
multivariable modelling and for use as CPR items:

1. Selection of psychosocial variables from those available in the Natsal-3
dataset, and organisation into topics
2. Bivariate analysis of each psychosocial variable with each outcome
variable of interest
3. Selection of a psychosocial variable from within each topic

In the first step, psychosocial variables were chosen which met the working
definition of psychosocial (described in Chapter Two). This resulted in the
exclusion of items concerning: concurrent sexual relationships, behavioural
definitions of sexual orientation (which are also confounded by multiple
partnerships) and non-volitional sex experiences (which were deemed
unacceptable for use in the CPR based on the early-stage PPI consultation described in Chapter Two). Historic experience of STI diagnosis or abortion were also rejected because they were deemed unacceptable for use as CPR items, based on that same PPI consultation. This first step resulted in a list of 42 exposures (set out in Appendix 4b), which were organised into the following nine topics:

1. Relationships
2. Sexual identity
3. Religion
4. Substance use
5. General health
6. Mental health
7. Formative experiences
8. Education
9. Socio-demographics

4.3.5.1 Inclusion of early sexual debut

During the systematic review process (see Chapter Three) it became apparent that early sexual debut and childhood sexual abuse (CSA) were consistently strong and highly-correlated predictors of recent sexual risk and morbidity in general populations of women (Steel and Herlitz, 2005). Therefore, in contradiction with the decision to exclude behavioural reports of sexual activity (as described above) a variable was generated for first heterosexual intercourse <16 years *including* under age 13 years (‘early_debut’). This variable thus covertly measured CSA, contrasting with other Natsal-3 papers which exclude from analysis those reporting first sex under the age of 13 years (Wellings et al., 2013b, Wellings et al., 2001). ‘Early_debut’ was analysed on the grounds that, should it prove highly predictive, its acceptability could be assessed as part of the follow-on survey described in Chapters Five and Six.

4.3.6 Bivariate analyses

Bivariate analyses were then conducted, analysing each exposure in turn across the outcomes. This allowed easy assessment of whether each exposure was associated with more than one outcome and informed the aggregation of exposure response categories (undertaken where it was necessary to boost cell counts or make the item easier for CPR use). Aggregation was based on observed gaps in continuous data, on overlapping confidence intervals for
categorical data and/or lexical similarities (e.g. aggregating agree and strongly agree).

Variables which were not brief or easy-to-score as CPR items were also identified and excluded at this stage. These variables were constructed from more than one source Natsal-3 item, and/or were contingent on previous item responses regarding how they were constructed or the response options made available. This further reduced the number of bivariate analyses and therefore the risk of Type I error. Hence, a Bonferroni correction was not applied to the bivariate analyses (Bland and Altman, 1995). The results of these analyses are presented in Appendix 4c.

4.3.7 Selection of a psychosocial variable from within each theme
Where more than one brief and easy-to-score psychosocial variable remained within the same topic and each was found to be associated with the outcomes of interest, the variable with the highest frequency of response was selected for multivariable analysis. This approach was founded on the rationale that rarer psychosocial phenomena will explain a low proportion of variance in sexual risk experiences (no matter how strong the association) and will therefore have less utility as CPR items. This corresponds with the notion of ‘adequate prediction’ (Grobman and Stamilio, 2006). Finally, where more than one common and strongly associated psychosocial variable presented within each theme, the one that was associated with the most outcomes was selected. Importantly, the systematic review indicated that drug and alcohol use and smoking were all strong predictors of sexual risk and morbidity so that an item representing each of these constructs was selected. Overall, this process led to the identification of eight exposures. In consultation with supervisors it was then decided to add two more: didn’t live with both natural (birth) parents to age 14 and most recent sexual partner’s ethnicity.

Therefore, of the initial 42 variables identified, the following 10 were selected for multivariable modelling (with response options as described below in Tables Seven, Eight and Nine):
1. relationship status (rel_status)
2. sexual identity (sex_identity)
3. currently a smoker (smoke_now)
4. usually binge-drink at least weekly (binge_drink)
5. ever used non-prescribed drugs (ever_drugs)
6. first heterosexual intercourse at < 16 years of age (early_debut)
7. didn’t live with both natural parents until the age of 14 (both_parents)
8. received treatment for depression in last 12 months (depr_treatment)
9. belong to any religion now (belong_religion)
10. most recent partner’s ethnicity (ptn_ethnic)

4.3.7.1 Including socio-demographic variables

To control for key socio-demographic factors respondent ethnicity (ethnicgrp), age group (agegrp) and tenure of current housing (tenure3) were selected for model inclusion. Importantly, they were not included for investigation as independent explanatory variables; as there is considerable existing evidence for their associations with sexual morbidity (Low et al., 1997, Malarcher, 2010). This mirrored the limits placed on the systematic review criteria (see Chapter Three), and the broad intentions of the research to derive a psychosocial CPR. Nonetheless, these particular variables were selected for analysis from among other socio-demographic variables because they met the desirable CPR qualities: brief, acceptable and easy-to-score. This precaution ensured that they would be suitable for further investigation as CPR items, should they be retained in multivariable modelling (described in the following section). In particular it was difficult to find a simple, stand-alone measure of socio-economic status so that ‘tenure3’ was generated by aggregating ‘tenure’ responses into renting versus home ownership status at the time of questionnaire completion.

4.3.8 Multivariable modelling

Associations which demonstrated an association at p≤0.05 were eligible for entry into a multivariable model for that sexual risk experience. Psychosocial variable associations between 0.05<p<0.10 were also eligible for entry. This
approach provided consistency with criteria for removal of variables from the model, which was set at \( p \geq 0.1 \). Backwards stepwise multivariable logistic regression was used for the chosen psychosocial and socio-demographic variables to identify which combination of these were retained in the model using pre-set criteria. This regression approach was chosen as many concerns with this type of analysis were reduced in this study. I.e. we selected empirically only a modest number of variables, and the risk of Type II error (in which associations between variables are ‘missed’ due to small sample sizes) was reduced by by setting the criterion for removal of the model at \( p \geq 0.1 \) and by the large sample size. This removal criterion, and the backwards elimination approach, also acted to reduce suppressor effects (Nathans et al., 2012).

4.4 Results

The study sample comprised 4911 women. Sample characteristics are given in Tables Seven, Eight and Nine which present the models (respectively) for 2+P, 2+PNC, and FSNC. These tables give the percentage reporting that risk experience in each category of each exposure, the crude odds ratios for each category of that exposure, and the global P value for each exposure in order to show the overall 'effect' of an exposure upon the outcome. For each of the exposures entered into the multivariable model, Tables Seven-Nine also present the global P value with adjusted odds ratios, for each exposure that was retained after adjustment for all other variables.
<table>
<thead>
<tr>
<th>Psychosocial /socio-demographic factor</th>
<th>(Column) % of sample (weighted) reporting exposure</th>
<th>(Row) % reporting outcome</th>
<th>Crude OR a (95% CI) for reporting outcome</th>
<th>Adjusted† OR (95% CI) for reporting outcome</th>
<th>Denominators c (unweighted, weighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relationship status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting with partner</td>
<td>64.9% (63.4-66.4)</td>
<td>5.6%</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>2635,2226</td>
</tr>
<tr>
<td>Stable relationship not cohabiting</td>
<td>17.1% (16.0-18.2)</td>
<td>30.9%</td>
<td>7.73 (6.09-9.82)</td>
<td>5.18 (3.96-6.78)</td>
<td>1128,585</td>
</tr>
<tr>
<td>Not in relationship but has cohabited</td>
<td>8.6% (7.9-9.5)</td>
<td>49.8%</td>
<td>17.3 (12.9-22.9)</td>
<td>13.3 (9.81-18.1)</td>
<td>552,296</td>
</tr>
<tr>
<td>Not in relationship &amp; never cohabited</td>
<td>9.4% (8.5-10.3)</td>
<td>53.4%</td>
<td>21.1 (15.8-28.2)</td>
<td>14.2 (10.4-19.2)</td>
<td>569,321</td>
</tr>
<tr>
<td><strong>Sexual identity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>97.7% (97.2-98.2)</td>
<td>21.8%</td>
<td>2.12 (1.33-3.38)</td>
<td>p=0.7041</td>
<td>4781,3348</td>
</tr>
<tr>
<td>Other</td>
<td>2.23% (1.8-2.81)</td>
<td>33.1%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>121,78</td>
</tr>
<tr>
<td><strong>Currently a smoker</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28.3% (27.0-29.8)</td>
<td>31.7%</td>
<td>2.25 (1.91-2.65)</td>
<td>1.32 (1.06-1.63)</td>
<td>1560,972</td>
</tr>
<tr>
<td>No</td>
<td>71.7% (70.2-73.0)</td>
<td>17.5%</td>
<td>1.00</td>
<td>1.00</td>
<td>3351,2459</td>
</tr>
<tr>
<td><strong>Usually binge-drink at least weekly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13.9% (12.8-15.2)</td>
<td>40.6%</td>
<td>2.91 (2.34-3.67)</td>
<td>2.11 (1.63-2.73)</td>
<td>643,428</td>
</tr>
<tr>
<td>No</td>
<td>86.1% (84.8-87.2)</td>
<td>19.5%</td>
<td>1.00</td>
<td>1.00</td>
<td>3748,2643</td>
</tr>
<tr>
<td><strong>Ever used non-prescribed drugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39.4% (37.7-41.0)</td>
<td>28.3%</td>
<td>1.88 (1.61-2.20)</td>
<td>1.31 (1.06-1.61)</td>
<td>2875,1347</td>
</tr>
<tr>
<td>No</td>
<td>60.6% (59.0-62.3)</td>
<td>17.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>2024, 2075</td>
</tr>
<tr>
<td><strong>First heterosexual intercourse at &lt;16 years of age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50.2% (48.6-51.9)</td>
<td>27.9%</td>
<td>2.21 (1.86-2.63)</td>
<td>1.58 (1.26-1.96)</td>
<td>2756,1724</td>
</tr>
<tr>
<td>No</td>
<td>49.8% (48.1-21.4)</td>
<td>14.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>2155,1707</td>
</tr>
<tr>
<td>Psychosocial /socio-demographic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR a (95% CI) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators c (unweighted, weighted)</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Didn’t live with both natural (birth) parents to age 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>73.2% (71.8-74.5)</td>
<td>26.8%</td>
<td>p&lt;0.0001</td>
<td>p=0.1283</td>
<td>1516,920</td>
</tr>
<tr>
<td>No</td>
<td>26.8% (25.5-28.2)</td>
<td>19.9%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>3395,2511</td>
</tr>
<tr>
<td>Received treatment for depression in last 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12.7% (11.6-13.8)</td>
<td>27.3%</td>
<td>p=0.0002</td>
<td>p=0.3394</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>87.3% (86.2-88.4)</td>
<td>21.2%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td></td>
</tr>
<tr>
<td>Belong to any religion now</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46.3% (44.6-48.0)</td>
<td>17.7%</td>
<td>p&lt;0.0001</td>
<td>p=0.057</td>
<td>2107,1584</td>
</tr>
<tr>
<td>No</td>
<td>53.8% (52.1-55.4)</td>
<td>25.3%</td>
<td>1.00</td>
<td>1.00</td>
<td>2796,1842</td>
</tr>
<tr>
<td>Most recent partner’s ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.1% (84.8-87.3)</td>
<td>21.6%</td>
<td>p&lt;0.0001</td>
<td>p=0.1496</td>
<td>4248,2951</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.6% (4.8-6.6)</td>
<td>11.7%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>240,193</td>
</tr>
<tr>
<td>Black British</td>
<td>4.5% (3.8-5.3)</td>
<td>30.8%</td>
<td>0.53 (0.34-0.83)</td>
<td>Not retained in model</td>
<td>221,152</td>
</tr>
<tr>
<td>Other</td>
<td>3.81% (3.2-4.5)</td>
<td>33.3%</td>
<td>2.09 (1.46-3.00)</td>
<td>1.61 (1.44-2.01)</td>
<td>195,130</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-24 years</td>
<td>26.8% (25.5-28.1)</td>
<td>36.6%</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1657,918</td>
</tr>
<tr>
<td>25-34 years</td>
<td>36.0% (34.5-37.5)</td>
<td>16.2%</td>
<td>1.00</td>
<td>1.00</td>
<td>2215,1235</td>
</tr>
<tr>
<td>35-44 years</td>
<td>37.3% (35.6-39.0)</td>
<td>11.4%</td>
<td>0.18 (0.14-0.24)</td>
<td>0.62 (0.50-0.78)</td>
<td>1039,1278</td>
</tr>
<tr>
<td>Psychosocial /socio-demographic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR(^a) (95% CI(^b)) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators (^c) (unweighted, weighted)</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.7% (85.4-87.8)</td>
<td>22.0%</td>
<td>p&lt;0.0001</td>
<td>p=0.987</td>
<td>4304,2969</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.8% (5.01-6.8)</td>
<td>11.7%</td>
<td>0.49 (0.31-0.78)</td>
<td>Not retained in model</td>
<td>239,200</td>
</tr>
<tr>
<td>Black British</td>
<td>3.6% (3.0-4.3)</td>
<td>29.9%</td>
<td>1.45 (0.97-2.17)</td>
<td></td>
<td>157,122</td>
</tr>
<tr>
<td>Other</td>
<td>3.9% (3.4-4.6)</td>
<td>27.7%</td>
<td>1.65 (1.12-2.42)</td>
<td></td>
<td>202,135</td>
</tr>
<tr>
<td><strong>Currently renting home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>47.6% (45.9-49.4)</td>
<td>26.4%</td>
<td>2.10 (1.78-2.49)</td>
<td>p=0.011</td>
<td>2625,1626</td>
</tr>
<tr>
<td>No</td>
<td>52.4% (50.6-54.2)</td>
<td>16.9%</td>
<td>1.00</td>
<td>1.31 (1.06-1.60)</td>
<td>2261,1790</td>
</tr>
</tbody>
</table>

† Adjusted for all other variables in the model
\(^a\) OR: odds ratios
\(^b\) CI: confidence intervals
\(^c\) Totals vary due to small frequencies of missing data
<table>
<thead>
<tr>
<th><strong>Psychosocial /socio-demo-graphic factor</strong></th>
<th><strong>(Column) % of sample (weighted) reporting exposure</strong></th>
<th><strong>(Row) % reporting outcome</strong></th>
<th><strong>Crude OR a (95% CI) for reporting outcome</strong></th>
<th><strong>Adjusted OR (95% CI) for reporting outcome</strong></th>
<th><strong>Denominators c (unweighted, weighted)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relationship status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting with partner</td>
<td>64.9% (63.4-66.4)</td>
<td>2.7%</td>
<td><em>p</em>&lt;0.0001</td>
<td><em>p</em>&lt;0.0001</td>
<td>4911,3431</td>
</tr>
<tr>
<td>Stable relationship not cohabiting</td>
<td>17.1% (16.0-18.2)</td>
<td>17.7%</td>
<td>8.98 (6.30-12.8)</td>
<td>6.37 (1.33-9.37)</td>
<td>1128,585</td>
</tr>
<tr>
<td>Not in relationship but has cohabited</td>
<td>8.6% (7.9-9.5)</td>
<td>30.4%</td>
<td>17.0 (11.7-24.6)</td>
<td>13.4 (8.88-20.2)</td>
<td>552,296</td>
</tr>
<tr>
<td>Not in relationship &amp; never cohabited</td>
<td>9.4% (8.5-10.3)</td>
<td>29.2%</td>
<td>17.8 (12.4-25.6)</td>
<td>13.5 (8.94-20.5)</td>
<td>569,321</td>
</tr>
<tr>
<td><strong>Sexual identity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>97.7% (97.2-98.2)</td>
<td>12.3%</td>
<td>1.00</td>
<td><em>p</em>&lt;0.0001</td>
<td>4781,3348</td>
</tr>
<tr>
<td>Other</td>
<td>2.23% (1.8-2.81)</td>
<td>17.4%</td>
<td>1.54 (0.84-2.79)</td>
<td><em>p</em>=0.16</td>
<td>121,78</td>
</tr>
<tr>
<td><strong>Currently a smoker</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28.3% (27.0-29.8)</td>
<td>18.9%</td>
<td>2.13 (1.73-2.61)</td>
<td>Not retained in model</td>
<td>1560,972</td>
</tr>
<tr>
<td>No</td>
<td>71.7% (70.2-73.0)</td>
<td>9.4%</td>
<td>1.00</td>
<td><em>p</em>=0.5628</td>
<td>3351,2459</td>
</tr>
<tr>
<td><strong>Usually binge-drink at least weekly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13.9% (12.8-15.2)</td>
<td>26.5%</td>
<td>3.05 (2.37-3.93)</td>
<td>2.00 (1.51-2.64)</td>
<td>643,428</td>
</tr>
<tr>
<td>No</td>
<td>86.1% (84.8-87.2)</td>
<td>10.6%</td>
<td>1.00</td>
<td>Not entered into model</td>
<td>3748,2643</td>
</tr>
<tr>
<td><strong>Ever used non-prescribed drugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39.4% (37.7-41.0)</td>
<td>17.1%</td>
<td>2.00 (1.62-2.48)</td>
<td>1.34 (1.05-1.71)</td>
<td>2875,1347</td>
</tr>
<tr>
<td>No</td>
<td>60.6% (59.0-62.3)</td>
<td>9.0%</td>
<td>1.00</td>
<td><em>p</em>=0.018</td>
<td>2024,2075</td>
</tr>
<tr>
<td><strong>First heterosexual intercourse at &lt;16 years of age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50.2% (48.6-51.9)</td>
<td>16.6%</td>
<td>2.66 (2.09-3.38)</td>
<td>2.00 (1.53-2.63)</td>
<td>2756,1724</td>
</tr>
<tr>
<td>No</td>
<td>49.8% (48.1-21.4)</td>
<td>6.9%</td>
<td>1.00</td>
<td><em>p</em>=0.0001</td>
<td>2155,1707</td>
</tr>
<tr>
<td>Psychosocial /socio-demo-graphic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR a (95% CI b) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators c (unweighted, weighted)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------------------------------</td>
<td>---------------------------</td>
<td>-------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Didn’t live with both natural (birth) parents to age 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>73.2% (71.8-74.5)</td>
<td>11.4%</td>
<td>p=0.013</td>
<td>p=0.3855</td>
<td>1516,920</td>
</tr>
<tr>
<td>No</td>
<td>26.8% (25.5-28.2)</td>
<td>14.6%</td>
<td>1.31 (1.06-1.62)</td>
<td>Not retained in model</td>
<td>3395,2511</td>
</tr>
<tr>
<td>Received treatment for depression in last 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12.7% (11.6-13.8)</td>
<td>17.8%</td>
<td>p&lt;0.0001</td>
<td>1.39 (0.97-1.99)</td>
<td>662,435</td>
</tr>
<tr>
<td>No</td>
<td>87.3% (86.2-88.4)</td>
<td>11.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>4247,2994</td>
</tr>
<tr>
<td>Belong to any religion now</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46.3% (44.6-48.0)</td>
<td>10.3%</td>
<td>p&lt;0.0001</td>
<td>Not retained in model</td>
<td>2107,1584</td>
</tr>
<tr>
<td>No</td>
<td>53.8% (52.1-55.4)</td>
<td>14.0%</td>
<td>1.52 (1.23-1.88)</td>
<td>1.00</td>
<td>2796,1842</td>
</tr>
<tr>
<td>Most recent partner’s ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.1% (84.8-87.3)</td>
<td>12.3%</td>
<td>p=0.016</td>
<td>Not retained in model</td>
<td>4248,2951</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.6% (4.8-6.6)</td>
<td>6.8%</td>
<td>1.00</td>
<td>0.63 (0.34-1.17)</td>
<td>240,193</td>
</tr>
<tr>
<td>Black British</td>
<td>4.5% (3.8-5.3)</td>
<td>14.1%</td>
<td>1.30 (0.82-2.06)</td>
<td>1.95 (1.26-3.03)</td>
<td>221,152</td>
</tr>
<tr>
<td>Other</td>
<td>3.81% (3.2-4.5)</td>
<td>18.8%</td>
<td></td>
<td></td>
<td>195,130</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-24 years</td>
<td>26.8% (25.5-28.1)</td>
<td>20.3%</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1657,918</td>
</tr>
<tr>
<td>25-34 years</td>
<td>36.0% (34.5-37.5)</td>
<td>9.5%</td>
<td>1.00</td>
<td>0.84 (0.63-1.12)</td>
<td>2215,1235</td>
</tr>
<tr>
<td>35-44 years</td>
<td>37.3% (35.6-39.0)</td>
<td>5.7%</td>
<td>0.39 (0.31-0.48)</td>
<td>0.53 (0.34-0.81)</td>
<td>1039,1278</td>
</tr>
<tr>
<td>Psychosocial /socio-demographic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR (^a) (95% CI (^b)) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators (^c) (unweighted, weighted)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------------</td>
<td>--------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.7% (85.4-87.8)</td>
<td>12.6%</td>
<td>1.00 (p=0.517)</td>
<td>Not retained in model</td>
<td>4304,2969</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.8% (5.01-6.8)</td>
<td>5.0%</td>
<td>0.39 (0.19-0.78)</td>
<td></td>
<td>239,200</td>
</tr>
<tr>
<td>Black British</td>
<td>3.6% (3.0-4.3)</td>
<td>14.2%</td>
<td>1.12 (0.65-1.94)</td>
<td></td>
<td>157,122</td>
</tr>
<tr>
<td>Other</td>
<td>3.9% (3.4-4.6)</td>
<td>14.3%</td>
<td>1.44 (0.86-2.44)</td>
<td></td>
<td>202,135</td>
</tr>
<tr>
<td>Currently renting home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>47.6% (45.9-49.4)</td>
<td>15.2%</td>
<td>2.18 (1.76-2.71)</td>
<td>1.24 (0.97-1.59)</td>
<td>2625,1626</td>
</tr>
<tr>
<td>No</td>
<td>52.4% (50.6-54.2)</td>
<td>9.1%</td>
<td>1.00</td>
<td>1.00</td>
<td>2261,1790</td>
</tr>
</tbody>
</table>

† Adjusted for all other variables in the model

\(^a\) OR: odds ratios

\(^b\) CI: confidence intervals

\(^c\) Totals vary due to small frequencies of missing data
<table>
<thead>
<tr>
<th>Psychosocial /socio-demo-graphic factor</th>
<th>(Column) % of sample (weighted) reporting exposure</th>
<th>(Row) % reporting outcome</th>
<th>Crude OR(^a) (95% CI(^b)) for reporting outcome</th>
<th>Adjusted(^{†}) OR (95% CI) for reporting outcome</th>
<th>Denominators (^c) (unweighted, weighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relationship status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting with partner</td>
<td>64.9% (63.4-66.4)</td>
<td>41.1%</td>
<td>p=0.355</td>
<td>p=0.7458</td>
<td>2635,2226</td>
</tr>
<tr>
<td>Stable relationship not cohabiting</td>
<td>17.1% (16.0-18.2)</td>
<td>37.0%</td>
<td>0.78 (0.65-0.93)</td>
<td>Not retained in model</td>
<td>1128,585</td>
</tr>
<tr>
<td>Not in relationship but has cohabited</td>
<td>8.6% (7.9-9.5)</td>
<td>48.0%</td>
<td>1.30 (1.04-1.62)</td>
<td>1.30 (1.04-1.62)</td>
<td>552,296</td>
</tr>
<tr>
<td>Not in relationship &amp; never cohabited</td>
<td>9.4% (8.5-10.3)</td>
<td>36.7%</td>
<td>0.81 (0.64-1.01)</td>
<td>Not retained in model</td>
<td>569,321</td>
</tr>
<tr>
<td><strong>Sexual identity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>97.7% (97.2-98.2)</td>
<td>40.4%</td>
<td>0.91 (0.59-1.41)</td>
<td>Not entered into model</td>
<td>4781,3348</td>
</tr>
<tr>
<td>Other</td>
<td>2.23% (1.8-2.81)</td>
<td>40.2%</td>
<td>1.00</td>
<td></td>
<td>121,78</td>
</tr>
<tr>
<td><strong>Currently a smoker</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28.3% (27.0-29.8)</td>
<td>46.2%</td>
<td>1.31 (1.13-1.52)</td>
<td>1.31 (1.10-1.55)</td>
<td>1560,972</td>
</tr>
<tr>
<td>No</td>
<td>71.7% (70.2-73.0)</td>
<td>37.7%</td>
<td>1.00</td>
<td>1.00</td>
<td>3351,2459</td>
</tr>
<tr>
<td><strong>Usually binge-drink at least weekly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13.9% (12.8-15.2)</td>
<td>47.8%</td>
<td>1.35 (1.11-1.66)</td>
<td>1.36 (1.10-1.68)</td>
<td>643,428</td>
</tr>
<tr>
<td>No</td>
<td>86.1% (84.8-87.2)</td>
<td>39.7%</td>
<td>1.00</td>
<td>1.00</td>
<td>3748,2643</td>
</tr>
<tr>
<td><strong>Ever used non-prescribed drugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39.4% (37.7-41.0)</td>
<td>44.0%</td>
<td>1.08 (0.94-1.25)</td>
<td>Not retained in model</td>
<td>2875,1347</td>
</tr>
<tr>
<td>No</td>
<td>60.6% (59.0-62.3)</td>
<td>37.8%</td>
<td>1.00</td>
<td></td>
<td>2024,2075</td>
</tr>
<tr>
<td><strong>First heterosexual intercourse at &lt;16 years of age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50.2% (48.6-51.9)</td>
<td>43.0%</td>
<td>1.23 (1.07-1.41)</td>
<td>1.45 (1.23-1.70)</td>
<td>2756,1724</td>
</tr>
<tr>
<td>No</td>
<td>49.8% (48.1-21.4)</td>
<td>37.0%</td>
<td>1.00</td>
<td>1.00</td>
<td>2155,1707</td>
</tr>
<tr>
<td>Psycosocial/socio-demo-graphic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR a (95% CI b) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators c (unweighted, weighted)</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------------------</td>
<td>---------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Didn’t live with both natural (birth) parents to age 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>73.2% (71.8-74.5)</td>
<td>39.7%</td>
<td>p=0.201**</td>
<td>p=0.079</td>
<td>1516,920</td>
</tr>
<tr>
<td>No</td>
<td>26.8% (25.5-26.2)</td>
<td>42.0%</td>
<td>1.10 (0.95-1.28)</td>
<td>1.16 (0.98-1.37)</td>
<td>3395,2511</td>
</tr>
<tr>
<td>Received treatment for depression in last 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12.7% (11.6-13.8)</td>
<td>48.2%</td>
<td>p=0.012</td>
<td>p=0.2312 Not retained in model</td>
<td>662,435</td>
</tr>
<tr>
<td>No</td>
<td>87.3% (86.2-88.4)</td>
<td>39.2%</td>
<td>1.3 (1.06-1.59)</td>
<td></td>
<td>4247,2994</td>
</tr>
<tr>
<td>Belong to any religion now</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46.3% (44.6-48.0)</td>
<td>41.6%</td>
<td>p=0.169</td>
<td>Not entered into model</td>
<td>2107,1584</td>
</tr>
<tr>
<td>No</td>
<td>53.8% (52.1-55.4)</td>
<td>39.5%</td>
<td>0.91 (0.79-1.04)</td>
<td></td>
<td>2796,1842</td>
</tr>
<tr>
<td>Most recent partner’s ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.1% (84.8-87.3)</td>
<td>39.5%</td>
<td>p=0.085</td>
<td>Not entered into model***</td>
<td>4248,2951</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.6% (4.8-6.6)</td>
<td>55.6%</td>
<td>2.06 (1.54-2.76)</td>
<td></td>
<td>240,193</td>
</tr>
<tr>
<td>Black British</td>
<td>4.5% (3.8-5.3)</td>
<td>42.1%</td>
<td>1.10 (0.79-1.53)</td>
<td></td>
<td>221,152</td>
</tr>
<tr>
<td>Other</td>
<td>3.81% (3.2-4.5)</td>
<td>39.6%</td>
<td>1.07 (0.75-1.54)</td>
<td></td>
<td>195,130</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-24 years</td>
<td>26.8% (25.5-26.1)</td>
<td>35.4%</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1657,918</td>
</tr>
<tr>
<td>25-34 years</td>
<td>36.0% (34.5-37.5)</td>
<td>39.8%</td>
<td>1.00</td>
<td>1.00</td>
<td>2215,1235</td>
</tr>
<tr>
<td>35-44 years</td>
<td>37.3% (35.6-39.0)</td>
<td>49.6%</td>
<td>1.89 (1.58-2.26)</td>
<td>2.22 (1.81-2.72)</td>
<td>1039,1278</td>
</tr>
<tr>
<td>Psychosocial /socio-demo-graphic factor</td>
<td>(Column) % of sample (weighted) reporting exposure</td>
<td>(Row) % reporting outcome</td>
<td>Crude OR(^a) (95% CI(^b)) for reporting outcome</td>
<td>Adjusted† OR (95% CI) for reporting outcome</td>
<td>Denominators c (unweighted, weighted)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4911,3431</td>
</tr>
<tr>
<td>White</td>
<td>86.7% (85.4-87.8)</td>
<td>39.3%</td>
<td>p=0.019</td>
<td>p&lt;0.0001</td>
<td>4304,2969</td>
</tr>
<tr>
<td>Asian British</td>
<td>5.8% (5.01-6.8)</td>
<td>56.6%</td>
<td>2.10 (1.57-2.81)</td>
<td>2.89 (2.04-4.08)</td>
<td>239,200</td>
</tr>
<tr>
<td>Black British</td>
<td>3.6% (3.0-4.3)</td>
<td>47.7%</td>
<td>1.38 (0.94-2.03)</td>
<td>1.10 (2.61)</td>
<td>157,122</td>
</tr>
<tr>
<td>Other</td>
<td>3.9% (3.4-4.6)</td>
<td>38.6%</td>
<td>1.03 (0.72-1.49)</td>
<td>0.83 (1.80)</td>
<td>202,135</td>
</tr>
<tr>
<td><strong>Currently renting home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2625,1626</td>
</tr>
<tr>
<td>Yes</td>
<td>47.6% (45.9-49.4)</td>
<td>42.2%</td>
<td>p=0.325**</td>
<td>p=0.077</td>
<td>2261,1790</td>
</tr>
<tr>
<td>No</td>
<td>52.4% (50.6-54.2)</td>
<td>38.2%</td>
<td>1.07 (0.93-1.23)</td>
<td>1.15 (0.98-1.35)</td>
<td>202,135</td>
</tr>
</tbody>
</table>

† Adjusted for all other variables in the model

\(^a\) OR: odds ratios

\(^b\) CI: confidence intervals

\(^c\) Totals vary due to small frequencies of missing data

*Entered into model as significant effect found (p=0.007) after controlling for age group and ethnicity

**Statistically significant interaction between not living with both birth parents to age 14 and housing tenure

***Not entered into model as non-sig (p=0.884) after controlling for ethnicity of respondent
Having 2+ partners in the last year (2+P) was reported by 17.9% of respondents. Non-use of condoms with 2+ partners in the last year (2+PNC) was reported by 9.8% of respondents. FSNC (including those only have sex once with their most recent partner) (FSNC) was reported by 41.5% of respondents, and showed only small overlap with the other two experiences - among these 41.5% of respondents, 8.5 % reported 2+P in the last year and 6.3% reported 2+PNC in the last year.

Early_debut and binge_drink were each associated with all three sexual risk experiences after adjustment for both socio-demographic variables and all other psychosocial variables, with adjusted odds ratios (AOR) ranging from 1.16 to 14.16. In contrast, two psychosocial variables (sex_identity and ptn_ethnic) were not associated with any of the three outcomes in multivariable regression.

Of the socio-demographic variables analysed, not owning a property (tenure3) was associated with both 2+P and 2+PNC (p<0.05) after adjustment for all other variables, but only at (p=0.077) with FSNC. Younger age group was positively associated with both 2+P and 2+PNC (adjusted), although 2+PNC showed no association between those aged 16-24 versus those aged 25-34 years. In contrast, younger women were less likely to report FSNC. After adjustment, respondent ethnicity (‘ethnic_grp’) was associated only with FSNC. Although smoke_now and belong_religion were retained in the model for 2+P they were not retained in the model for 2+PNC. Conversely, depr_treatment was retained in the model for 2+PNC, but not in the model for 2+P. Not cohabiting with a partner (rel_status) was retained in the models for both 2+P and 2+PNC, but not the model for FSNC. In contrast, not living with both natural (birth) parents until age 14 (both_parents) was retained in the model for FSNC but not in the models for 2+P or 2+PNC. Although demonstrating a small effect size this exposure was reported by 26.8% of respondents.

Compared to currently cohabiting with a partner, each of the non-cohabiting response options showed very large effect sizes (odds ratios) in the 2+P and 2+PNC models, alongside high prevalence - not cohabiting but in a stable relationship (17%) and not being in a stable relationship (cumulatively 18%, comprising being single or being in a casual relationship). For the 2+P and
2+PNC models there was little overlap between 'stable relationship not cohabiting' and the two 'not being in a stable relationship' response options but great overlap between the latter two options, which also showed the greatest magnitude of effect. In the 2+P and 2+PNC models, drug use ever and currently renting showed very modest, though significant, effect sizes. In the model for FSNC largest effect sizes were observed for those of Black and Asian ethnicity, and for the older age groups (25-34 years versus 16-24 years, and 35-44 years versus 16-24 years).

4.5 Discussion

Reporting weekly binge-drinking in the last year, early sexual debut, younger age group and living in rented accommodation were associated with all three of the outcomes studied (2+P, 2+PNC and FSNC), however the direction of association was not always consistent. Notably, younger age was positively associated with multiple partnerships but negatively associated with FSNC. This latter outcome also showed quite different patterns of association to 2+P and 2+PNC overall, with much smaller effect sizes. Not living with both natural parents to the age of 14 years was associated with FSNC after adjustment for other factors, but not with 2+P or 2+PNC after adjustment. Not cohabiting with a partner was associated with 2+P and with 2+PNC after adjustment but not with FSNC. This may reflect that FSNC is not a good proxy for recent sexual risk, particularly as this variable was limited to a single episode of (first) sex.

4.5.1 Comparison with other literature

Binge-drinking, early sexual debut and younger age have also been found to correlate with sexual risk in other population studies of sexual risk among women, including the systematic review (Edelman et al., 2015, Magnusson et al., 2015, Tyler et al., 2014, Wellings et al., 2013b, Xaverius et al., 2009). In particular, a Natsal-3 study demonstrated associations between use of drugs other than, or in addition to, cannabis and 2+PNC for the same sub-population of sexually active women aged 16-44 (Paquette et al., 2017). A further Natsal-3 study demonstrated an association between drug use in the last four weeks and weekly binge-drinking with non-use of condoms at first sex and emergency
contraception use (among women aged 16-24 years regardless of sexual activity) (Khadr et al., 2016). However, observed associations between the dichotomous housing tenure variable and sexual risk contrast with previous Natsal-3 analyses of socio-economic status which found that the Index of Multiple Deprivation (Area-level) and the National Statistics Socio-Economic Classification (Individual-level) was not predictive of 10+ lifetime sexual partners or of early sexual debut among women aged 16-74 years (Mercer et al., 2013b). This suggests that the housing tenure variable may capture a different economic dimension to the IMD and, in doing so, be more sensitive to individual circumstances.

Two population surveys using non-behavioural measures of sexual identity have shown differences in sexual partner numbers among adolescent women (Tornello et al., 2014, Everett, 2013). In contrast, sexual identity was not associated with sexual risk in this analysis of women aged 16-44 years. This may reflect insufficient power to detect a significant association and/or a focus on heterosexual risk experiences in defining the population of interest.

Although two of the socio-demographic variables – age group and housing tenure – were retained in all three of the models, ethnic group was only retained in the model for FSNC, with this outcome being reported less by those of Asian heritage specifically. These findings suggest that ethnic differences in rates of STIs and sexual risk are explained by psychosocial variables, and therefore contribute to a wider evidence base indicating that greater risk of STIs in African-Caribbean women (Fenton et al., 2005) and those of mixed or non-white ethnicity (Low et al., 1997) (Furegato et al., 2016) is not fully explained by socio-economic status or by partner numbers and is likely influenced by not only assortative sexual mixing (Low et al., 2001) but also wider behavioural and other contextual factors (Furegato et al., 2016).

4.5.2 Limitations

This analysis was limited by the variables available in the Natsal-3 dataset and by the low counts for some of those variables. There were no education
variables suitable for use across all age groups (reflecting that age confounds both duration of education and level of attainment). This was unfortunate as education is a useful proxy measure of socio-economic status (Bobak et al., 2000) and may reflect psychosocial factors such as belonging, purpose, and social cohesion. The dataset also did not include variables suitable for analysis of risk of UIP or risk of STIs through partner behaviour (RTP). Low prevalence of UIP (specifically ‘unplanned pregnancy’ as measured by the LMUP), of abortion, and of STI diagnoses in the population of interest precluded analysis of these outcomes. Similarly, non-significant findings may reflect a lack of statistical power.

Despite the careful approach towards aggregation of response categories (described in section 4.3.6), wide confidence intervals may have led to aggregation of distinct categories with loss of data sensitivity as a result. Nonetheless, most of the substance use variables were associated with sexual risk outcomes, while very few of the relationship quality variables were; this suggests that aggregation-based insensitivity was not likely to be responsible for the overall patterns of association.

For some respondents, non-use of condoms may represent an active pregnancy-seeking strategy which is nonetheless constructed as a sexual risk experience (for STIs) in this analysis. Unfortunately, consistency of contraception use and fertility intentions was not captured in Natsal-3 in a way which enabled generation of a variable which differentiated non-use of condoms due to pregnancy-seeking behaviour from non-use for other reasons. This nuance would have been particularly relevant to consideration of pregnancy intentions when addressing STI risks in General Practice.

The variable used in this study to measure number of male sexual partners in the last year and to limit the dataset analysed is used in Natsal-3 analyses to define sub-populations by heterosexual activity in the last year, for example (Paquette et al., 2017, Sonnenberg et al., 2013). This was done as the risk of UIP and current undiagnosed STIs was anticipated to be significantly lower among those not reporting heterosexual activity in the last year. Nonetheless,
this definition may have limited the sensitivity of the dataset regarding identification of psychosocial predictors of women who were not sexually active in the last year, or who had sex exclusively with women (WSEW) in the last year. Nevertheless, a large proportion of WSEW also have sex with men (Mercer et al., 2007). However, this broad definition of heterosexual activity was important to ensure analyses were conducted on a population who were at risk of STI acquisition (as anal sex and oral sex are also routes of STI acquisition and transmission). Defining the sub-population for analysis in this way then highlights how partner numbers impact on STIs more than on pregnancy and also how partner numbers and STI risk were prioritised in the analysis over UIP. This prioritisation of STI risk was a pragmatic decision, taken because Natsal-3 privileged investigation of STI risk in collecting greater in-depth data on types of intercourse, and less data on consistency of contraception use (other than condoms).

Finally, the Natsal-3 questionnaire was designed for research purposes while the CPR is designed for clinical use. Natsal-3 used CAPI (computer assisted personal interview) and CASI (computer assisted self interview) for data collection in the home, while the CPR has initially been designed for PAPI (paper and pen interview) within GP surgeries. These differences may compromise the validity and applicability of Natsal-3 psychosocial items for use in the CPR. Alternatively, validity may actually be higher in clinical settings where the questions are asked for a clear purpose and answers are not digitally recorded. Nonetheless, due to some of these differences, some aggregated and/or derived variables needed adaptation of wording before being suitable for investigation as potential CPR items (as described in the following chapter).

4.6 Conclusions

As discussed in Chapter Two, a number of studies have examined associations between specific psychosocial factors and sexual risk behaviour, e.g. (Field et al., 2016), (Khadr et al., 2016), (Mittal et al., 2012), (Nelson et al., 2017), (Palmer et al., 2017). However, this study was unique in modelling three sexual risk experiences using a combination of psychosocial and socio-demographic
items, in order to inform the derivation of a CPR. Most existing sexual health CPRs – e.g. (Duke et al., 2008, Lavoué et al., 2014, Reed et al., 2007, Victor et al., 2015) - have not been underpinned by bespoke complex survey analysis of population data, as discussed in Chapter One.

This analysis was also unique in being tailored specifically to identify psychosocial items which met the qualities of brevity, simplicity and acceptability identified during early PPI work; and in tailoring the analysis itself to inform CPR derivation. Specifically, non-volitional sex items were not only excluded from the analysis as psychosocial predictors but were also not controlled for (on the basis that this would be of no practical benefit to the overall thesis in supporting CPR derivation). This pragmatic approach to selecting exposures and control variables stands in contrast with conventional complex survey methodology, in which all factors likely to confound associations are adjusted for, in order to achieve a more accurate picture of how an exposure and outcome are independently associated.

As the data for this analysis was collected from a cross-sectional survey, so conclusions about causation cannot be drawn from this analysis. Nonetheless, factors such as binge-drinking may constitute wider determinants of sexual health, highlighted by England’s Sexual Health Improvement Framework, 2013 (DH, 2013). The findings also suggest that different items may indicate different sexual risk experiences. E.g. results indicate that reporting ‘not cohabiting with a partner’ is likely to perform better than reporting ‘ever used non-prescribed drugs’ in identifying women experiencing multiple partnerships, while specific identification of FSNC would rest on being older and/or not living with both natural parents until the age of 14 years. Finally, the symmetrical treatment of psychosocial and socio-demographic variables in our analysis allowed us to examine associations between sexual risk and socio-demographic variables (namely age group and socio-economic status) while controlling for psychosocial variables. The findings indicate that these associations are not fully explained by psychosocial variables, and that socio-demographic questions should be combined with psychosocial questions in the CPR under development.
The Natsal-3 dataset did not include variables suitable for measurement of retrospective pregnancy risk or monogamous women at risk through their partners’ behaviour, and therefore did not contribute to identifying psychosocial exposures suitable for targeting contraception or identifying women at risk through partner (RTP) (a concept introduced in Chapter One). Nevertheless, several exposures were retained in multivariable models when represented by briefly-worded and common variables, including binge-drinking, early sexual debut, younger age and housing tenure. Therefore, their potential use in a CPR was investigated further in the survey presented in the following chapters.
Chapter Five: Designing a cross-sectional survey from which to derive the clinical prediction rule
Summary

This chapter sets out the design of a cross-sectional survey, conducted to assess which combination of psychosocial variables and socio-demographic factors best distinguished women with recent sexual risk experiences from other female GP attenders.

This chapter first reflects on the implications of the systematic review and Natsal-3 analysis for this survey; following which the research questions for the survey are presented. The methodological issues and criteria for selecting items for inclusion in the research questionnaire are then set out, including issues specific to the selection of sexual risk ‘outcomes’ and psychosocial and socio-demographic ‘exposures’ as potential CPR items. The chosen outcomes and exposures, their response options and codes are then presented.

The development and piloting of the questionnaire is described, and the recruitment and data collection plans, including the contribution of PPI to this development and planning work. Finally, the chapter sets out the statistical analysis plans. The results of the survey and a discussion of study limitations are given separately in Chapter Six. The published paper presenting the survey methods and results is provided in Appendix 5a (Edelman et al., 2018).
5.1 Introduction

The systematic review and Natsal-3 analysis provided a list of psychosocial exposures that were potential candidate predictors for inclusion in the CPR because they were found to be associated with sexual risk and morbidity in general populations which were representative of the CPR target population (women aged 16-44 in the Western world). However, these preliminary studies did not provide certain evidence necessary for clinical prediction rule derivation. First, they did not address the question of which psychosocial items are statistically predictive of recent risk of unintended pregnancy (indicating potential need for contraception advice and supply). Second, they did not address the question of which psychosocial items are statistically predictive of potential risk of STI acquisition through a partner (indicating potential need for STI testing and sexual health advice). Third, they did not provide evidence regarding the prevalence of relevant psychosocial exposures in women attending British General Practices, or their acceptability and discriminatory power in identifying women with recent sexual risk experiences in those settings.

This lack of evidence concerning exposure prevalence, acceptability and discriminatory power reflects that the usual focus of multivariable modelling is hypothesis testing and explanation, using adjusted relative risks to understand the magnitude of independent effect afforded by each of several exposures on a given outcome. In contrast, the primary concern of multivariable modelling for CPR derivation is estimation and discrimination; seeking to identify which combination of exposures would together – as CPR items – offer the greatest ability to discriminate those with the outcome of interest.

Therefore a study was carried out in order to create a bespoke dataset from which to derive – through multivariable modelling - the CPR. In particular this was necessary in order to model secondary outcomes relevant to the CPR’s intended purposes of targeting sexual health advice, STI testing and contraception, discussed in greater depth later in the chapter. A cross-sectional survey design was chosen for this study to maximise the relevance of findings by mimicking the intended mode of CPR delivery, in which women would self-
assess their sexual health needs at a single point-in-time during a GP visit, by using a questionnaire. This survey built on the systematic review and Natsal-3 analysis by investigating exposures identified in those preliminary studies, and by addressing the following points that arose from those studies and which were pertinent to CPR derivation.

**1. The salience of socio-demographics as predictors of sexual risk and morbidity**
Age group and housing tenure were independently associated with sexual risk in Natsal-3 analysis, so the survey questionnaire included these items alongside psychosocial ones.

**2. The importance of predictor prevalence**
The ‘usefulness’ of an exposure as a CPR item depends not only on statistically significant association with a relevant outcome, but also on the prevalence of that exposure, in order to maximise ‘adequate prediction’ (Grobman and Stamilio, 2006). The prevalence of exposures was under-reported in the systematic review, likely because many studies focus on understanding the magnitude of effect of exposures (commonly reported through relative risk measures) rather than exploring their clinical or public health potential as predictors of sexual risk or morbidity. The prevalence of exposures was thus made a key consideration in selecting ‘candidate predictors’ for entry into multivariable models in this study.

**3. The value of distinguishing unintended and ambivalent pregnancy**
Aggregating those who are categorised as ‘ambivalent’ about pregnancy with those who are categorised as ‘not planning or ‘not intending’ pregnancy may:
1. Reduce the sensitivity of analyses and 2. Alter the direction of observed associations. Arguably, it also pathologises a valid choice to not use contraception if ambivalent. Therefore ambivalent women who did not report consistent contraception use were not categorised as ‘at risk’ of UIP in this survey.
4. The necessity of re-focusing the CPR on identification of women experiencing sexual risk

Both the systematic review and Natsal-3 analysis indicated that STI acquisition and UIP were rare in general populations of women of reproductive age. Therefore, before survey design commenced, the decision was taken to re-focus the CPR on identifying women with recent sexual risk experiences where they are envisaged to be potentially at risk of STIs and UIP (the term sexual risk experience is introduced in Chapter Two). This broadened the primary prevention remit of the CPR to targeting women for sexual health advice as well as STI testing and contraception. This widened remit directed the nature of the outcomes explored in the survey and thus the research questions through which those outcomes were investigated, as set out in sections 5.3 and 5.4.

5.2 Patient and Public Involvement

PPI in primary care research can be particularly difficult to carry out (NIHR, 2014) (McKinley et al., 2002), and arguably even more so in relation to a sensitive topic such as sexual health. Due to difficulties in finding ongoing lay collaborators, a consultation-based PPI work plan for this survey was developed – as described in Appendix 5b. The work plan was used to inform the ordering of questionnaire items (see section 5.7) and to test the face validity of questionnaire items that had needed adaptation from their original form (see Appendix 5c) – including piloting the questionnaire to reduce measurement error (Groves et al., 2009). The work plan was also used to inform the recruitment, consent and data collection plans (as detailed in section 5.8).

5.3 The survey research questions

To derive a CPR from the dataset, the survey addressed the following research questions:

1. What combination of psychosocial and socio-demographic variables best identifies women at risk of STI acquisition?
2. What combination of psychosocial and socio-demographic variables best identifies women at risk of unintended pregnancy?
3. Which psychosocial and socio-demographic variables are common to both types of sexual risk experience?
4. Which psychosocial and socio-demographic variables are acceptable to women for inclusion in a CPR designed for use in GP settings?

Women at risk of STI acquisition were defined as those experiencing multiple male sexual partners in the last year and/or risk of STI acquisition through a partner. Women at risk of unintended pregnancy were defined as those experiencing non-use and inconsistent use of condoms or other contraception. The rationale for choosing these particular outcomes, and the means by which they were operationalised, are described in the following section.

5.4 Choice of outcome measures

For the CPR to identify women with recent sexual risk experiences, the outcomes representing those experiences needed to indicate recent potential risk of unintended pregnancy (so that the CPR could be used to initiate contraception advice and supply); and potential risk of STI acquisition (so that the CPR could be used to initiate sexual health discussion and advice, and possibly STI testing). Finally the sexual risk experiences captured needed to include risk through partner (RTP) – a concept introduced in Chapter One - in recognition of the significant burden of STI burden among women reporting only one sexual partner in the last year (Sonnenberg et al., 2013).

5.4.1 Identifying outcomes indicative of potential need for sexual health intervention

To determine the exact nature of these clinically-relevant outcomes, sexual healthcare guidelines aimed at primary care and general settings were reviewed, to identify the type of sexual risk experiences that should prompt a medical practitioner to offer STI testing, sexual health advice and/or contraception to women attending GPs. None contained relevant information, instead focusing variously on using symptomatic presentation or population descriptors (eg. young people) to target interventions, or on the nature of those interventions. A critical overview is provided in Appendix 5d.
As an alternative, existing research evidence was reviewed to understand how different sexual risk experiences predict the need for STI testing, sexual health advice or contraception. However, these were commonly explored using measures of relative risk and controlling for socio-demographic factors, for example (Aicken et al., 2011). This is likely due to the afore-mentioned focus of applied sexual health epidemiology on quantifying the magnitude of independent effects. In particular, studies often investigate sexual behaviours as exposures, in order to explain variance in the distribution of adverse sexual health outcomes within socio-demographic strata. Therefore, their clinical utility in targeting sexual health interventions in GPs was unclear. Nevertheless, a number of existing and well-evidenced sexual behavioural/experience variables do exist. Some of these are proxy measures of risk, such as non-use of condoms at first sex with most recent partner (FSNC) (Clifton et al., 2016), which was also measured in the Natsal-3 analysis reported in the previous chapter. Others are indicators of risk, such as multiple partnerships without condom use (Edelman et al., 2017). Outcomes were selected from the latter to best align with the research questions.

Outcome timeframes also needed to be clinically relevant – i.e. indicative of likely current need for intervention – while also being mindful that non-recent behaviour report may generate less social desirability bias as well as increasing frequencies. A timeframe of one year was chosen for outcomes related to STI risk, for the following reasons. First, Natsal-3 analysis (see Chapter Four) indicated that shorter time frames would produce frequencies too low for statistical modelling. Second, women attend GPs infrequently, and may also experience sexual risk infrequently. Finally, STIs can be asymptomatic for lengthy periods (Lazaro, 2013).

Unlike the factual behavioural reports upon which STI risk is based, potential risk of unintended pregnancy was deemed likely to fluctuate because there is an attitudinal component. For example, potential risk of UIP greater than six months ago may not be a good measure of current/recent pregnancy risk. Therefore, a shorter time frame of six months was chosen for potential risk of UIP.
5.4.2 The selected survey outcomes

In order to focus the analysis on the research questions, and to minimise the risk of Type I error, the number of outcomes was limited. Based on these considerations the chosen outcomes were:

1. Self-report of two or more male sexual partners in the last year (2+P). This was the primary outcome
2. Self-report that respondent’s most recent partner had other sexual partners in the last year and did not always use condoms with those other partners (RTP)
3. Self-report of 2 or more male sexual partners in the last year and/or report that respondent’s most recent partner had other sexual partners in the last year and did not always use condoms with those other partners (Combined)
4. Self-report of non-consistent (i.e. inconsistent, non-use, or failed) use of contraception by women wishing to avoid pregnancy in the last six months (UIP)
5. Non-use of condoms on at least one occasion with 2 or more male sexual partners in the last year (2+PNC)

Importantly, outcomes one, two, three and five - representing risk of STI acquisition - were defined in terms of male sexual partners only, as most STIs in women are acquired from men (Bailey et al., 2004).

5.4.3 Selection of items for outcome measurement

For these outcomes, survey items were sought which would most closely reflect the sexual risk experiences indicative of potential need for sexual health intervention. Hence the items which operationalised potential current risk of UIP addressed recent retrospective contraception use and attitude towards pregnancy; while items operationalising potential risk of STI acquisition were concerned with partner numbers and condom use for vaginal sex. (Anal intercourse was not included as it is much less common than vaginal intercourse, and oral sex was excluded because it often co-occurs with vaginal intercourse (Richters et al., 2006)).

Concept specification (Groves et al., 2009) was used to guide the selection and development of appropriate items to operationalise each outcome. This process, and the selected items are presented in Table 10, alongside the
response options and instructions for completion. The rationale and construction of each outcome is then presented.

Descriptions of terms for sexual intercourse and vaginal sex presented in Table 10 were borrowed from validated Natsal-3 items and were found to be clear when piloted as part of the PPI work plan (see Appendix 5b). Clear wording was deemed important as terms such as ‘having sex’ can variously be understood to include vaginal, anal and/or oral sex (Rawlings et al., 2006).

<table>
<thead>
<tr>
<th>Table 10: Final outcomes measured in the questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
</tr>
<tr>
<td>1: Self-report of 2 or more male sexual partners in the last year</td>
</tr>
<tr>
<td>2: Self-report that respondent’s most recent partner had other sexual partners in the last year and did not always use condoms with those other partners</td>
</tr>
<tr>
<td>3: Self-report of outcome 1 or 2</td>
</tr>
<tr>
<td>Outcome</td>
</tr>
<tr>
<td>---------</td>
</tr>
</tbody>
</table>
| 4: Self-report of non-consistent (i.e. inconsistent, non-use, or failed) use of contraception by women wishing to avoid pregnancy in the last six months | Potential risk of UIP from non-consistent use of contraception in the last six months by women who did not wish to become pregnant during that time | Pregnancy intention was measured with the items:  
‘Overall, in the last six months how much have you wanted to get pregnant? (‘Very much’ to ‘Not at all’’)  
‘Overall, in the last six months how much have you wanted to AVOID getting pregnant? (‘Very much’ to ‘Not at all’).  
Contraception use was measured with the item:  
Thinking about your use of contraception in the last six months please tick one statement which most applies to you:  
- Contraception was always used  
- Contraception was used, but not on every occasion  
- Contraception was used, but the method failed at least once failed (e.g. broke, moved, came off, came out)  
- Contraception was never used  
- I have not had vaginal sex in the last six months  
- Prefer not to answer  
Women were allocated as at risk of unintended pregnancy in the last year if they reported:  
1. Not using contraception, not using contraception on every occasion or method failure AND  
2. Wanting to avoid pregnancy in the last six months quite a lot or very much |
| 5: Non-use of condoms on at least one occasion with 2 or more male sexual partners in the last year | Potential risk of STI acquisition through non-use of condoms on at least one occasion with 2 or more male sexual partners in the last year | This outcome was operationalised using two items:  
Q21 ‘Thinking about condom use with your most recent male sexual partner, which of the following best matches your experience?’ (‘Condoms always used’ to ‘Condoms never used’)  
Q22 ‘Thinking about condom use with your second most recent male sexual partner, which of the following best matches your experience?’ (‘Condoms always used’ to ‘Condoms never used’) |
5.4.3.1 Outcome 1: Measuring multiple partnerships in the last year

This was chosen as the primary outcome because: ‘number of sexual partners in the last year [is] a key factor in STI epidemiology and a useful indicator for sexual health-care providers’ (Sonnenberg et al., 2013) (p.1797).

Multiple partnerships have been associated with Chlamydia trachomatis incidence (Walker et al., 2012) and switching partners is a time when NCSP (NCSP, 2017) recommend testing for young people. A pragmatic rationale also prevailed - multiple partnerships without condom use is unlikely to be sufficiently common for multivariable modelling of a GP study population (as it was reported by less than 10% of those in the analysis of women in the Natsal-3 sample who were sexually active in the last year (Edelman et al., 2017). Finally, switching partners is a key risk factor for UIP (Wellings et al., 2015) so that multiple male partnerships in the last year may also be indicative of the need for contraception. This variable was a derived item in Natsal-3 analysis so the wording was adapted from Natsal-3 items, using multiple response options for two or more partners (to reduce social desirability response bias). The category for the outcome of interest was then derived by aggregating those responses.

5.4.3.2 Outcome 2: Measuring ‘risk through partner’

Outcome two was chosen to capture women at ‘risk through partner’ of STI acquisition – an important concept introduced in Chapter One. Outcome two was constructed by combining: Q20B partner had at least with one other sexual partner in the year before me (responses: true or probably true or no idea) and Q20C partner didn’t always use condoms for vaginal sex with previous partners (responses: true or probably true or no idea) and Q21 condoms were sometimes or never used with most recent sexual partner.

5.4.3.3 Outcome 3: Measuring combined risk

Outcomes one and two were combined using an ‘and/or’ function to generate Outcome 3, on the basis that both constituted a heightened risk of STI
acquisition and would therefore warrant the same conversation with a clinician about STI testing and sexual health advice.

5.4.3.4 Outcome 4: Measuring retrospective risk of unintended pregnancy

Outcome four was measured in order to target contraception advice and supply to women who had recent retrospective risk of UIP. At the time of questionnaire development, no existing measure of retrospective UIP risk was available (see Appendix 5e for an overview of reviewed and rejected measures). Therefore, the variable for potential retrospective risk of unintended pregnancy in the last six months was generated from an item on contraception use and a two-item measure of pregnancy intention.

The two-item pregnancy intention measure was selected due to its brevity, and adapted from its original prospective form (Moreau et al., 2013a). Intention was deemed a more appropriate concept than planning in order to capture women who feel powerless to enact contraception use, and those who do not take their pregnancy intentions forward into planning behaviours (see Chapter One). The two items (one reporting degree of pregnancy wanted-ness, and the other degree of pregnancy avoidance) were adapted from the Relationship Dynamics and Social Life Study (changing the tense and time-period). The Principal Investigator of that study referred the candidate to another paper using the measure (Miller et al., 2013), which reported that these responses to these items should be combined to derive two composite scores:

1. A signed-difference variable (which subtracts each respondent’s negative desire score from her positive desires score to assess which of the two opposed measures is more ‘highly valued’)
2. An absolute-difference variable (derived from each respondent’s signed-difference score as the associated absolute value, to indicate the degree of conflict between the two items)

The pregnancy intention items were intended to be combined with a contraception use item adapted from the LMUP to be retrospective and to use the passive voice instead of ‘I/we’. This latter adaptation was made as ‘we’ implies a relationship context, while ‘I’ may exclude contraception use (e.g.
condoms or vasectomy) by a male sexual partner rather than the respondent. Additional response options were added to capture those who had not had vaginal sex in the time frame, and those who preferred not to answer. Women who were not sexually active in the last year were included in the analysis of this outcome, but those who reported no heterosexual intercourse ever were not (as set out in the Statistical analysis plan, section 5.10).

Finally, explanatory text was added listing types of contraception. Importantly withdrawal/safe period methods and use of emergency contraception were excluded from this list and those reporting method failure were classified as ‘at risk’ along with those reporting non-use or inconsistent use of contraception (if the intention items also indicated the respondent had wanted to avoid pregnancy). This decision was founded in the pragmatic use of the CPR – that it would be desirable (from a public health perspective) to target contraception to women using natural methods or emergency contraception or experiencing method failure as well as those not consistently using contraception.

Women who were currently or recently pregnant at the time of completion might have responded that they have not been seeking pregnancy or using contraception – leading to misclassification as at risk of UIP. Therefore a validated item from the Contessa study (Wellings et al., 2015) was added which was adapted to ask about current or recent pregnancy in the prior six months, so that these women were categorised as ‘not applicable’ for this outcome. The exact nature of the adaptation and its rationale is provided in Appendix 5c.

5.4.3.5 Outcome 5: Measuring multiple partnerships in the last year in which a condom was not always used

This outcome was chosen because condom use is a key method for preventing STI acquisition, so that this outcome will be more strongly associated with STI acquisition than multiple partnerships alone. However it was not selected as the primary outcome because prevalence was anticipated to be too low for multivariable modelling in the GP cohort based on Natsal-3 analyses (Edelman et al., 2017). This outcome was measured using Questions 21 and 22, which asked about frequency of condom use with most recent partner and second
most recent partner, such that those reporting that condoms were not used with both these partners were categorised as reporting the outcome of interest.

5.4.4 Maximising the validity, scope, brevity and acceptability of outcome measures

A number of additional qualities influenced the selection of the outcome measures listed previously in Table 10. Outcome measures that had already been validated were chosen when possible, as they have demonstrated a degree of accuracy which is undetermined in non-validated items. Outcome measures that had response options applicable to all respondents were also selected where possible to reduce missing data, or response options were added to achieve this.

Outcome measures were also selected to be brief and simple to complete, because data collection involved participants self-completing the questionnaire in five minutes while awaiting an appointment. Simplicity also improves the accuracy of question responses by minimising bias and variance even more than standardising (Schober and Conrad, 1997). Brevity also minimises measurement error by reducing satisficing (which occurs where questionnaires are lengthy and/or items contain too many response options (Krosnick and Alwin, 1987)).

5.5 Choice of exposure measures

The purpose of this survey was to create a dataset from which the CPR would be derived. Questionnaire design for this survey required particular care because each exposure within it was a candidate predictor which might then be selected (through multivariable modelling) as a CPR item (Grobman and Stamilio, 2006). To address the research questions set out above, psychosocial and socio-demographic exposures were reviewed carefully for possible questionnaire inclusion as candidate predictors.

Exposures were labelled as 'psychosocial' or 'socio-demographic' for clarity despite this being a somewhat arbitrary distinction (as discussed in Chapter
Two). The systematic review and Natsal-3 analysis indicated that socio-demographic exposures remained salient even when modelled alongside psychosocial exposures, and should therefore be included in the survey as potential CPR items. In lieu of an alternative brief measure of SES, the Natsal-3 housing tenure variable was selected because it was associated with each of the three sexual risk variables analysed in the Natsal-3 analysis, and also had a relatively high prevalence. Age group was included because it was retained in the Natsal-3 analysis, while ethnicity was excluded as it was not retained in the same (see Chapter Four).

The process for selecting psychosocial items which measured exposures comprised three sequential steps, set out in the following sub-sections.

5.5.1. Identifying exposures suitable for use as psychosocial CPR items

5.5.1.1 Step 1: Applying absolute criteria for exposure selection

The absolute criteria for item selection were that exposures should be:

1. Suitable for self-scoring by patients in a CPR and
2. Relevant to the British setting for which the CPR was intended and
3. Associated with a relevant outcome on the basis of preliminary work with a p value ≤0.05

To be suitable for self-scoring by patients in a CPR, exposures operationalised through simple and brief measures with few response options were chosen. Simplicity and brevity were CPR - and hence exposure - qualities identified through early PPI (described in Chapter Two). Therefore complex measures of exposures (such as multi-item scales) were excluded, alongside items which were not applicable to all respondents. This ensured that the exposures were suitable for use as CPR items with all women of reproductive age attending GPs and also maximised valid response rates and available case analysis. In addition these criteria ensured that exposures were excluded where they had not been found to be associated with sexual risk experiences in general populations of women and / or were irrelevant to British settings (e.g. health insurance cover (Frost and Darroch, 2008)). Although the CPR was refocused
on identifying women with recent sexual risk experiences, exposures correlated with STI diagnosis, unintended pregnancy or abortion were still considered as potential candidate predictors for inclusion in the questionnaire. This decision operationalised an assumption that correlates of UIP, abortion and STIs may also be correlates of the sexual risk experiences that precede them.

5.5.1.2 Step 2: Applying relative criteria for exposure selection

After the absolute criteria were applied, ‘relative’ criteria were used to select from among the available exposures. All exposures which met the absolute criteria and were identified in the systematic review and Natsal-3 analysis were compiled in an Excel database, categorised under the following topics: substance use, social factors, partner characteristics, formative factors, psychological and mental health factors, general health, socio-demographic factors, violence and coercion. Each exposure was rated as low, medium or high suitability for CPR inclusion dependent on whether it was: associated with a comparatively common outcome and/or concerning a comparatively common exposure, associated with a relevant outcome based on multivariable statistical analysis, associated with more than one outcome of interest, previously validated, and likely to be acceptable to participants. Item acceptability (meaning inoffensive and non-distressing) was a CPR quality identified in early PPI (see Chapter Two) and a key concern in reducing social desirability bias. Similarly, exposures which reported on less recent experiences were anticipated to carry less social desirability bias and thus improve response rates (Tourangeau et al., 1997) as well as increasing the frequencies reported (owing to the wider time-frame), thereby improving ‘adequate prediction’.

Together, these criteria ensured that – for each topic – the item selected was most likely to be retained in multivariable modelling (and hence the CPR), would best support a brief CPR (by being associated with more than one type of sexual risk experience) and was most likely to be adequately predictive due to higher prevalence and valid responses. Appendix 5f provides a comprehensive list of exposures considered for inclusion, alongside the source of each and the rationale and decision to include/exclude. This topic-based approach (in which items were selected based on these criteria from within each topic) prevented
the development of a research questionnaire (and hence CPR) which examined only one topic, as in this exploratory work it was deemed important to consider how different types of psychosocial factors might correlate with sexual risk experiences. This decision was also supported by the systematic review and Natsal-3 analysis (see Chapters Three and Four), which demonstrated that several types of psychosocial variables predicted sexual risk experiences.

5.5.1.3 Step 3: Sourcing exposures beyond the systematic review and Natsal-3 findings

In order to investigate psychosocial variables not yet fully explored in general population surveys, key psychosocial concepts not represented by the remaining items were also sought beyond the systematic review and Natsal-3 analysis. This step aimed to offer a more complete statistical model and CPR than if exposures were limited to those found in the preliminary studies. Papers were reviewed which had been rejected from the systematic review because they reported on slightly younger or older populations and/or because they reported on baseline trial data or longitudinal follow-up studies (approximately n=130).

From among these studies, exposures were sought which were consistent with Wilkinson’s social epidemiological definition of the psychosocial (Wilkinson, 2006) i.e. variables concerning 1. Early development, 2. Social status (in particular via the mechanism of lack of control) 3. Social affiliation and stress. Specifically, additional exposures were selected which concerned: formative experiences, social relationships, partner and relationship characteristics, and mental health and well-being. Where an exposure (such as self-esteem) was found to be associated with sexual risk experience but the measure available was unsuitable for use in the CPR, an alternative was sought. These are documented alongside the other potential exposures in Appendix 5f.

5.5.2 Treating sexual orientation as an exposure

In keeping with the systematic review and Natsal-3 analysis, sexual orientation was treated as a psychosocial exposure for the purposes of this survey (thus
acknowledging its experiential and socially-determined nature). However, no sexual orientation item was included in the final questionnaire tool as the Natsal-3 analysis (see Chapter Four) indicated that sexual orientation identity (dichotomised as ‘heterosexual or other’ and based on identity rather than behaviour) was not associated with sexual risk experiences. Behavioural sexual orientation items were considered inappropriate for use as CPR items. This decision was based on early PPI consultation and because to do so would negate the purpose of the CPR in finding alternatives to report of sexual behaviour.

5.5.3 The selected survey exposures

The chosen items, their codes and their response options, are presented in Table 11 below).

<table>
<thead>
<tr>
<th>Item wording (variable name)</th>
<th>Response options (corresponding codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.2 How old are you? (agegrp)</td>
<td>15 years or less (case excluded)</td>
</tr>
<tr>
<td></td>
<td>Between 16-24 years (1)</td>
</tr>
<tr>
<td></td>
<td>Between 25-34 years (0)</td>
</tr>
<tr>
<td></td>
<td>Between 35-44 years (1)</td>
</tr>
<tr>
<td></td>
<td>45 years or older (case excluded)</td>
</tr>
<tr>
<td>Q. 4 Thinking about where you are living now, which statement best describes your circumstances? (tenure3)</td>
<td>I am renting or living rent-free (including living with parents or staying with friends) (1)</td>
</tr>
<tr>
<td></td>
<td>I own my own home (including mortgage, shared ownership or bought outright) (0)</td>
</tr>
<tr>
<td>Q. 5 Did you live more or less continuously with both of your natural (birth parents) at home until you were 14? (both_parents)</td>
<td>Yes (0)</td>
</tr>
<tr>
<td></td>
<td>No (1)</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer (77)</td>
</tr>
<tr>
<td>Q. 6 How often is each of the following kinds of support available to you if you need it: Someone to help if you’re confined to bed (bed)</td>
<td>None of the time (1)</td>
</tr>
<tr>
<td></td>
<td>A little of the time (1)</td>
</tr>
<tr>
<td></td>
<td>Some of the time (1)</td>
</tr>
<tr>
<td></td>
<td>Most of the time (0)</td>
</tr>
<tr>
<td></td>
<td>All of the time (0)</td>
</tr>
<tr>
<td>Someone to take you to the doctor if you need it (doctor)</td>
<td>Someone to prepare your meals if you’re unable to do it yourself (meals)</td>
</tr>
<tr>
<td>Someone to help with daily chores if you’re sick (chores)</td>
<td>Not very true of me (1)</td>
</tr>
<tr>
<td></td>
<td>Somewhat untrue of me (1)</td>
</tr>
<tr>
<td>Q. 7 To what extent is the statement ‘I have high self-esteem’ true for you (self_esteem)</td>
<td>Neither untrue nor true of me (0)</td>
</tr>
<tr>
<td></td>
<td>Somewhat true of me (0)</td>
</tr>
<tr>
<td></td>
<td>Very true of me (0)</td>
</tr>
<tr>
<td>Item wording (variable name)</td>
<td>Response options (corresponding codes)</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
</tbody>
</table>
| Q. 8 In the last 12 months have you received treatment from a health professional for depression? (depr_treatment) | Yes (1)  
No (0)  
Prefer not to answer (77) |
| Q. 9 How strongly do you agree with the statement ‘Having a partner at all times is important to me’? (partner_importance) | Strongly agree (1)  
Agree (1)  
Disagree (0)  
Strongly disagree (0) |
| Q. 10 How often do you have 6 or more units of alcohol on one occasion? (binge_drink)       | Daily or almost daily (1)  
Weekly or almost weekly (1)  
Monthly (0)  
Less than monthly (0)  
Never (0)  
Prefer not to answer (77) |
| Q. 11 Do you smoke cigarettes at all nowadays? (smoke_now)                                  | Yes I smoke cigarettes or roll-ups (1)  
Yes I smoke e-cigarettes (1, dummy variable)  
No (0)  
Prefer not to answer (77) |
| Q. 12 Have you ever taken any non-prescribed, illicit or illegal drugs, including legal highs? (ever_drugs) | Yes (1)  
No (0)  
Don’t know (allocated as missing due to low report n=5)  
Prefer not to answer (77) |
| Q. 13 At present are you…. (rel_status)                                                    | Living as a couple with a partner or spouse (0)  
In a steady relationship but not living together (0)  
In a casual relationship (1)  
Single (1)  
Prefer not to answer (77) |
| Q. 14 Please rate how emotionally satisfying your current relationship is, or how emotionally satisfying you most recent relationship was if you are currently single (emotional_dissat) | Extremely satisfying (0)  
Very satisfying (0)  
Moderately satisfying (1)  
Slightly satisfying (1)  
Not at all satisfying (1)  
Prefer not to answer (77) |
| Q. 15a Please indicate how strongly you agree with the following statements:  
My partner tells me who I can spend time with (spend_time) | Strongly agree (1)  
Agree (1)  
Disagree (0)  
Strongly disagree (0) |
<table>
<thead>
<tr>
<th>Item wording (variable name)</th>
<th>Response options (corresponding codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q. 15b Please indicate how strongly you agree with the following statements:</td>
<td>Strongly agree (1)</td>
</tr>
<tr>
<td>My partner does what he wants even if I don’t want him to (partner_does)</td>
<td>Agree (1)</td>
</tr>
<tr>
<td></td>
<td>Disagree (0)</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree (0)</td>
</tr>
<tr>
<td>Q. 16 During your current or most recent relationship did your partner ever have sexual</td>
<td>No definitely not (0)</td>
</tr>
<tr>
<td>intercourse with anyone besides you (non_monog)</td>
<td>I don’t think so (0)</td>
</tr>
<tr>
<td></td>
<td>It’s quite likely (1)</td>
</tr>
<tr>
<td></td>
<td>Yes, definitely (1)</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer (77)</td>
</tr>
<tr>
<td>Q. 17 Have you ever been in a relationship with a partner who…</td>
<td>Yes (1)</td>
</tr>
<tr>
<td>Insulted or talked down to you often? (insult)</td>
<td>No (0)</td>
</tr>
<tr>
<td>Shouted or swore at you often? (shout)</td>
<td>Prefer not to answer (77)</td>
</tr>
<tr>
<td>Threatened you with harm sometimes? (threat)</td>
<td></td>
</tr>
<tr>
<td>Physically hurt you sometimes? (physical)</td>
<td></td>
</tr>
<tr>
<td>Q. 18 How old were you when you first had sexual intercourse with someone of the opposite</td>
<td>Under 16 years old (1)</td>
</tr>
<tr>
<td>sex (including experiences you may not have wanted or that happened at an early age)?</td>
<td>16 years or older (0)</td>
</tr>
<tr>
<td>(early_debut)</td>
<td>I’ve never had sexual intercourse with someone of the opposite sex (excluded)</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer (77)</td>
</tr>
<tr>
<td>Q. 20 The man I most recently had sex with is 5 or more years older than me (ptn5+_older)</td>
<td>True (1)</td>
</tr>
<tr>
<td></td>
<td>Probably true (1)</td>
</tr>
<tr>
<td></td>
<td>I have no idea (treated as missing data as n=6)</td>
</tr>
<tr>
<td></td>
<td>Probably not true (0)</td>
</tr>
<tr>
<td></td>
<td>Not true (0)</td>
</tr>
<tr>
<td>Q. 25 In the last six months have you used emergency contraception at all? (emergency_con_6m)</td>
<td>Yes (1)</td>
</tr>
<tr>
<td></td>
<td>No (0)</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer (77)</td>
</tr>
<tr>
<td>Q. 28 In the last six months have you taken a pregnancy test because you thought you might</td>
<td>Yes (1)</td>
</tr>
<tr>
<td>be pregnant? (preg_test)</td>
<td>No (0)</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer (77)</td>
</tr>
</tbody>
</table>

5.6 Adapting items for inclusion in the research questionnaire

Appendix 5c outlines the ways in which the final exposures presented in Table 11 were adapted for use in the questionnaire, alongside the rationale for each. First, instructions, response options and scores were approximated where insufficient information was provided in sourced papers and authors failed to respond to requests for this information. Adaptations to instructions were also needed where the items had initially been delivered using a method other than
self-completion PAPI, and/or because of the need for consistent definition across different items, particularly regarding relationships and sexual partnerships. Similarly, adaptations to instructions and/or response options were needed where the original variables were derived or routed from source items, or from scales comprising several items. In particular, stand-alone items were needed that had ubiquitous but few response options – to ensure CPR brevity and ease-of-scoring and to reduce Type I error. Thus items were altered to incorporate recent as well as current partnerships and to add ‘doesn’t apply to me’ response options. In addition, ‘prefer not to answer’ was added as a response option where appropriate, in order to measure item unacceptability. The need for these was also assessed in piloting (Appendix 5b). These adaptations highlight how the research questionnaire was designed so that items could be ‘lifted’ directly for CPR use.

5.7 Constructing and formatting the questionnaire

The order of questionnaire items can reduce measurement error and improve response validity (Groves et al., 2009). The items were sequenced as described below and in Appendix 5g; and then formatted as an A5 research questionnaire booklet. Screening questions were placed on the first page, and the main questionnaire divided into:

‘Section 1: Some questions about your life in general’
‘Section 2: Some questions about your current relationship or your most recent relationship if you are currently single’
‘Section 3: Some final questions about your sexual experiences’

This ordering improved validity by directing the respondent’s focus from one context to the next, while moving to increasingly sensitive items (Tourangeau et al., 2000).

Items were also ordered to move from least to most sensitive while maintaining a logical flow within each section. The last section was ordered so that it began with items about domestic violence ever (question 17) and early sexual debut (question 18), as these items were not time-specific. The former was included among items on sexual experiences owing to its sensitive nature. Question 19 (number of male partners in the last year) provided context reinstatement as the
following questions were all focused on sexual risk experiences in the last year. It was also located in a different section to the question on relationship status (Question 13) to improve response validity (e.g. married respondents may have been reluctant to disclose multiple sexual partners). Sensitive questions were also embedded within a related set of questions to improve response validity (e.g. Question 20 comprises four statements about ‘the man you last had sex with’).

The final items in the questionnaire concerned risk of UIP. To improve validity, two items addressing intention were separated after lay consultants expressed confusion during piloting (see Appendix 5b). The emergency contraception item was placed before the contraception use item to provide context reinstatement (improving recall and disclosure of non-consistent contraception use). Pregnancy avoidance and testing items were placed last to avoid compromising the validity of preceding items (Tourangeau et al., 2000).

5.8 Recruitment, consent and data collection plans

5.8.1 Study setting
The survey was conducted in the city of Brighton & Hove, East Sussex. This local focus enabled the candidate to assist with data collection and troubleshoot problems. Limiting data collection to a single urban environment also homogenised the demographics of participants such that comparisons between attenders at different types of clinic setting can be attributed to those settings. Sexual healthcare provision in Brighton & Hove includes a ‘Contraception and Sexual Health’ (CASH) service which has been developed from a GUM clinic to include family planning services. Recruitment took place at this service.

Recruitment also took place in six General Practices (from a total of 44 operating in Brighton & Hove at the time). GPs were chosen as the primary recruitment site based on the expectation that outcome prevalence in these settings would be sufficiently high for multivariable modelling (as the prevalence of sexual risk experiences is logically - and empirically known to be - higher than the prevalence of women acquiring an STI or UIP from such experiences).
Data were collected between 4th April and 30th September 2016 in GPs, and between 18th April and 24th August 2016 in the CASH clinic.

The primary focus on GP recruitment increased the relevance of findings (as prevalence, strength and nature of observed associations may differ in specialist settings). For example (Clifton et al., 2016) found that women accessing chlamydia testing in GP services (versus GUM) were older, more likely to use a condom during first sex with most recent partner and reported fewer sexual partners and same sex partners. Nonetheless, recruitment also took place in the CASH clinic to offer a contingency plan should outcome prevalence in the GP setting be insufficient for multivariable modelling, and also to allow sensitivity analyses to be conducted.

5.8.2 Inclusion and exclusion criteria for survey participation
The CPR, and hence the research questionnaire that preceded it, were aimed at women of reproductive age. Screening questions at the front of the questionnaire therefore excluded respondents based on three participant responses:

1. Previous completion of the questionnaire (an approach used in other anonymous surveys such as the London Gay Men’s Sexual Health Survey (Prah et al., 2016)
2. Not being of the female sex (this item was taken from the 2011 UK Census)
3. Being aged <16 years or >44 years

The latter item (‘agegrp’) was derived from Natal-3 analysis and wording (see Appendix 5f for details). Importantly, it was also analysed as an exposure (with responses aggregated as 16-24 years or 25-44 years).

Sexual orientation was not treated as an inclusion/exclusion criterion because the exclusion of lesbian women from sexual health research and services has become an increasing concern as sexual health moves away from a disease-focused biomedical model (Wellings and Johnson, 2013). Additionally, both behavioural and identity-based definitions of sexual orientation proved problematic. The latter would likely lead to the exclusion of women who had
male partners as although exclusively lesbian women are generally low risk for STI acquisition (Bailey et al., 2004, Everett, 2013) or for UP (Everett et al.), studies indicate that some women who identify as lesbian may also report recent sexual activity with men - (Everett, 2013, Richters et al., 2014, Geary et al., 2018). The alternative - a behavioural definition of bisexuality/lesbianism - would have required participants to report their sexual behaviour as a screening question, and may have been perceived as intrusive and unacceptable based on early PPI work (see Chapter Two).

For the same reason, the survey was not limited to women who reported being sexually active in the last year, as this may have dissuaded participation and/ or led to invalid responses. Based on Natsal-3 analysis approximately 14% of female respondents aged 16-44 were anticipated to report not being sexual active in the previous year. Including such women also allowed better discriminatory analysis of the statistical models, reducing misclassifications by the CPR of sexually inactive women as 'in need of' sexual health intervention.

5.8.3 Recruitment, consent and data collection

The final protocol, participant information sheet, poster and questionnaire for this study are provided in Appendix 5g. Ethical approval for this study was granted by the National Research Ethics Service Ref 16/LO/0206. Participating sites also gave their own research governance approvals. Sponsorship was provided by Brighton & Sussex Medical School.

The survey used Paper-and-Pen-Interview (PAPI) for data collection. This maximised the relevance of the survey findings by mimicking the intended delivery of the CPR (as set out in Chapter Two). PAPI has also been shown to be preferred to computer assisted personal interviews (CAPI) (M. Kall, personal communication, November 2, 2017) in other studies (Kall et al., 2015). PAPI self-completion also allowed simultaneous data collection from multiple participants, and removed the measurement error presented by interviewers increasing social desirability bias - particularly when asking questions of a sensitive nature (Tourangeau et al., 1997).
Questionnaire packs were to be handed out to all female clinic attendees by reception staff and/or by Clinical Research Network staff or the candidate. Importantly, in GP settings, recruitment was not limited to GP-based family planning and sexual health clinics. This decision was made after consultation with a GP (see Appendix 5b) indicated that much sexual healthcare is provided in non-specialist GP clinics, and that patients who do attend specialist GP clinics are already actively seeking sexual healthcare and so may not be representative of the target population in need.

Each pack comprised a uniquely-coded envelope containing a pen, and a questionnaire booklet with a participant information sheet (PIS) wrapped around the front cover to maximise the likelihood of reading before participation. Both documents instructed the participant to complete the questionnaire while sitting apart from friends/family in the waiting area where possible, and to return it sealed within the provided envelope to clinical or research staff. Additionally, a stamp and Return Address label was offered to women who indicated that they had not time to complete the questionnaire during their clinic visit (so that women could post their questionnaire later).

‘Implied consent’ (Royal College of Nursing, 2011) was used instead of formal written consent, to both simplify the recruitment process and reduce barriers to participation by enhancing anonymity. All data were collected anonymously (i.e. without names, dates of birth or matching of research with clinical data) to further reduce social desirability bias (Tourangeau et al., 1997). This approach deliberately privileged response validity over avoidance of re-recruitment, because of the sensitive nature of the questions. However, the likelihood of re-recruitment was minimised by the lack of incentives for participation, and by the afore-mentioned screening question.

This plan was developed in consultation with lay women – see Appendix 5b for more details. In particular, women indicated that data collection in the waiting area would be acceptable, and suggested inclusion of the PIS instruction for women to sit separately (where possible). The clarity of the PIS wording and rationale were also checked during PPI consultation. The time taken to read the PIS was estimated at 2 minutes and to complete the questionnaire was
estimated at 5 minutes. Both were deemed acceptable. The decision to offer a stamp and Return Address label so that women could post their questionnaire back later if preferred was also deemed sensible.

5.8.4 Data management, storage and cleaning

Returned questionnaires were placed in a storage box behind the Reception at each site (so that they were not accessible to the public) and were stored securely at the end of the day. These were collected and transported to BSMS by the candidate where they were locked in a cabinet in a locked office – except for being securely couriered to and from an external company (Abacus) for data double-entry using instructions supplied by the candidate (see Appendix 5h).

Accuracy checks were performed by the candidate on a random 10% of the data entries in the SPSS database supplied by Abacus. Anomalies raised by Abacus were hand-checked with the original questionnaire and a protocol for data cleaning and consistency checking was followed (see Appendix 5i). Where more than one valid option presented, the assignation was discussed and decided with supervisors, and recorded in an Excel file.

Eligibility checks on the screening questions were conducted by the candidate. An included/excluded variable was generated to record this. Respondents were excluded unless they responded as female, between the ages of 16-44 years; and having not completed the questionnaire before. This rule was enforced even where subsequent data were provided (instead of the questionnaire being returned blank as instructed). Once a complete data set had been produced, this was transferred into STATA 13 (StataCorp, 2013) for analysis.

5.9 Sample size

Sample size calculations are frequently used to determine the number of participants needed in a study in order to use inferential statistics to evaluate the ‘effect’ of an intervention (such as a CPR) with a pre-specified level of certainty and effect size for the intervention. However, this study focused not on CPR evaluation, but rather on its derivation. Therefore, the sample size
calculation needed to facilitate estimation of the parameters of the model, in which the number of parameters (potential CPR items) rather than the effect size is a key determinant of the sample size. Specifically, aiming for a CPR of 10 items (to ensure brevity and scoring simplicity) the sample size calculation addressed the following question:

‘How many participants are needed to derive a CPR of approximately 10 categorical exposures using multivariable modelling?’

To address this question the following events-per-variable approach was applied to the primary outcome of interest: two or more male sexual partners in the last year (2+P). Based on Natsal-3 analysis (Edelman et al., 2017) 10% of the study sample were estimated to report this outcome, so that a sample size of 1500 would be anticipated to produce 150 events.

Events-per-variable calculations use the event rate, the number of expected events (i.e. the frequency of an outcome) in a given timeframe and the ‘rule of thumb’ (Peduzzi et al., 1996) that 10 extra events are needed per additional exposure. Using this ‘rule of thumb’ the 150 events were divided by 10 to ascertain that ≤15 dichotomous exposures could be entered into the model predicting 2+P, as binary variables carry only one degree of freedom (Walker, 1940). Therefore, the sample size of n=1500 was considered sufficient.

Confidence intervals were not calculated to estimate the precision of this calculation as a larger sample size was not realistic for this doctoral study. Although the rule-of-thumb of ten-events-per-variable has been contested as over-cautious (Vittinghoff and McCulloch, 2007) it was adhered to in this study due to report of biased regression coefficients in both directions when the rule is relaxed (Peduzzi et al., 1996).

5.9.1 Additional CASH sample
An additional 500 women were also recruited from the CASH service at the same time in order to provide a comparison group that could be combined with the GP data should the number of events in the GP sample be significantly lower than anticipated. This sample size was chosen on the advice of Brighton
& Sussex Medical School statisticians and a CASH consultant, as feasible within the recruitment time frame and sufficiently large for comparative analyses between GP and CASH participants to be possible (although such analyses were beyond the scope of the thesis).

Importantly, cluster effects were not incorporated into sample size calculations or statistical analysis (to account for differences between GP and CASH sites). Analysis of cluster effects was not possible because it would have required multiple CASH sites and external matching data across the sites. Instead participants across different GP sites were pooled and type of recruitment site was treated as a fixed-effect exposure (GP or CASH) in the dataset.

5.10 Statistical analysis plan
The statistical analysis plan is summarised below and incorporates the data cleaning and consistency checks mentioned previously. The plan provides an overview of the sequential steps that were taken in order to derive a CPR for each outcome, which are then presented in greater detail in the following subsections. These steps constitute an established methodology for CPR derivation, which differs from conventional complex survey analysis by focusing on: 1. Estimating the parameters for the exposures which together best discriminate the outcomes of interest (rather than isolating independent and ‘statistically-significant’ effects); 2. Primarily assessing the discriminatory power of the each multivariable model (rather than the amount of variance explained); and 3. Using the co-efficients of retained exposures to develop a scoring system for the corresponding CPR items.

5.10.1 Summary of analysis plan
The statistical analysis plan for the survey comprised the following steps:

1. Data cleaning and consistency checking (as described in Appendix 5i and section 5.8.4).
2. Generation and consistency-checking of outcome variables
3. Generation and consistency-checking of exposure variables
4. Collapsing of exposure response options into dichotomous options
5. Assessment of item acceptability and non-response using frequencies

6. Use of bivariate analyses to exclude from the modelling process:
   a. Exposures which were not associated with any outcome
   b. Exposures with a prevalence of less than 20%
   c. The least well performing exposures from within composite scales

7. For each outcome:
   a. An events-per-variable analysis, using outcome prevalence, to assess how many candidate predictors could be entered into that model
   b. Review of bivariate analyses results to assess which candidate predictors should be entered
   c. Generation of a multivariable logistic regression model using backwards stepwise elimination (applied only to the GP dataset)
   d. Reverse-scoring of items in the final selected model which had negative coefficients
   e. Assessment of qualities of the model using the statistical tests described below in section 5.10.7

8. Comparison of models to determine if a unified or integrated CPR was appropriate

9. Conduction of a sensitivity analysis to assess differences in the model (primarily the c-statistic and BIC) when applied to a combined GP and CASH dataset (versus the GP-only dataset)

10. Decision made to retain/exclude CASH data from the scoring system process

11. Construction of a scoring system based on the coefficients of each exposure retained in each model

12. Generation of a CPR score for each participant

13. Cross-tabulation of CPR scores against self-report of the sexual risk represented by that outcome

14. Selection of an optimum CPR cut-off score in consultation with GP staff

5.10.2 Assessing response rates, non-response and acceptability

Due to low resources for recruitment, the recruitment plan meant that it was possible to record how many women were approached or how many of these
were eligible. Therefore it was not possible to capture: participant response rate (completers/all eligible), contact rates (number approached/number eligible) or co-operation rates (number who agreed to participate/number approached).

Analysis of the acceptability of exposures was important to determine if missing or ‘prefer not to answer’ responses were correlated with report of sexual risk experiences (and therefore should be coded accordingly within the CPR). Analysis of exposure non-response and ‘prefer not to answer’ responses also addressed the issue that items with low response (whether through unacceptability or low prevalence) will be likely to have less ‘adequate prediction’ capability to predict outcomes (Grobman and Stamilio, 2006).

By analysing outcome non-response and ‘prefer not to answer’ responses also it was possible to address two criticisms of this doctorate: that sexual behaviour-related variables may in fact be acceptable in primary care settings and that some of the psychosocial variables may themselves be unacceptable. The decision was taken to establish the precise process for this analysis once the dataset was complete.

However, as participants were sometimes interrupted from completing their questionnaire by being called into their appointment, there was a risk that this kind of ‘systematic’ item non-response would pollute assessment of item non-acceptability. In addition, the final section, which captured the sexual risk experience outcomes, was left blank by some participants. In such instances it was not possible to model or analyse associations between exposures and outcomes. Therefore these were excluded from analysis (see Figure Three in Chapter Six for the results of this process).

5.10.3 Weighting and handling of missing data in the dataset

This study used a large convenience sample, a type of non-probability sample, for which weights are sometimes obtained by combining the dataset with a reference sample. However this was deemed unfeasible for this doctoral study, so that coverage bias was not addressed. Imputation of missing values was deemed unsuitable and unfeasible for this doctoral study of categorical
variables. The decision to pursue either ‘complete’ or ‘available’ case analysis was made after the data was cleaned, and is detailed in Chapter Six.

5.10.4 Collapsing categorical exposures to be dichotomous

Where necessary, response options were aggregated in order to be dichotomous. This reduced the degrees of freedom for each variable, thereby increasing the number of candidate predictors that could be entered into each model. Additionally it simplified CPR completion and scoring systems. This process of aggregation was carried out by use of cross-tabulation of source exposures with outcomes in order to ascertain where the natural ‘breaks’ in the response options occur. This is detailed in Appendix 6a of Chapter Six.

5.10.5 Using bivariate analyses to select exposures for entry into multivariable models

The sample size calculation provided sufficient power to enter approximately 10-15 exposures into each logistic regression model, but 26 exposures were available in the research questionnaire and dataset as ‘candidate predictors’ for model entry (see Table 11). Therefore, bivariate analyses were conducted between psychosocial questions and each outcome (the results of which are presented in Chapter Six). Bivariate analyses are often used to enable empirical selection exposures for multivariable modelling, including for the purposes of CPR derivation (Falasinnu et al., 2014a) (Gotz et al., 2005), even though this can lead to over-fitted models. This was a concern as the purpose of this analysis is to develop a parsimonious model which can then be translated into a brief CPR. Therefore, bivariate analyses were conducted not as a strict pre-requisite to model entry, but rather to:

- Eliminate exposures not associated with any of the outcomes
- Eliminate exposures with a prevalence of less than 20% even if associated with an outcome of interest
- Eliminate exposures with greater than 20% non-response or ‘prefer not to answer’ responses on grounds of unacceptability
• Select a statistically significant exposure with the highest prevalence from among multiple items in a scale (i.e. the Social Support Survey Instrument and the HITS tool)

Exposures with a prevalence < 20% were excluded – even if associated with the outcomes of interest - on the basis that:

‘A good predictive factor is not the same as a strong risk factor’ (Adams and Leveson, 2012) (p.2)

5.10.6 Addressing interactions, confounders and controlling

Interactions are a type of collinearity between exposures, in which the effect of one exposure on the outcome will be differential according to the second exposure. They were not investigated in this study as the purpose of CPR modelling is estimation rather than hypothesis testing. Also, interaction terms would have increased the risk of over-fitting the models and do not translate into easy CPR self-scoring systems (as they would require different scores to be applied to the same item response-option contingent on the answer given to a previous item).

Confounding variables are exposures associated with both the outcome of interest and with other exposures of interest. Inclusion of confounders in multivariable modelling may result in other important exposures not being retained in the model. This is a particular concern where the primary purpose of analysis is to identify explanatory factors and/or test hypotheses. However, CPR derivation rests on estimation, and pragmatic identification of the best parsimonious combination of exposures to discriminate and predict sexual risk, regardless of the nature of those associations. In such instances, confounding variables are not a key concern and so they were not taken into account in the multivariable modelling plans.

Exposures can be controlled for using stratified analysis (e.g. generating models specific to young or older women). However, the intention of this programme of research was to create a universal proof-of-concept CPR for women aged 16-44 years (rather than one targeted to particular sub-populations of women within that age range). Therefore stratification and
controlling was not initially applied to any exposures, with the caveat that if any exposures ‘over-rode’ all others then stratification would be necessarily applied in order to develop separate multivariable models and thus CPRs, based on that stratifying variable. This topic is therefore revisited in Chapter Six.

**5.10.7 Using multivariable modelling to identify which exposures should be included in the CPR**

Multivariable modelling, combined with Area Under the Curve (AUC) analysis, is a common approach to CPR derivation (Steyerberg, 2009). It provides a means of assessing and quantifying the contribution of multiple CPR items (each adjusted for inclusion of the others) in discriminating between those who should and should not receive any given intervention. Logistic multivariable regression was used as all outcomes were dichotomous. As all the exposures were also dichotomous (in order to be easy to score as CPR items) it was unnecessary to first assess assumptions about normal distribution of the data.

A backwards stepwise elimination approach was applied as this is an established methodology for derivation of CPRs and other sexual health assessment tools (King et al., 2016). The process begins with a ‘full’ model containing all predictors and then sequentially removes those with the largest p values in order to test what each contributes to the model. Removal criterion was set so that exposures with an associated p<0.2 were retained in the model (rather than the standard criterion of p<0.1). This reduced the chances of erroneously rejecting a predictor due to inflated standard errors (Field, 2005). Backwards stepwise approach was deemed acceptable because most criticisms of its use were addressed by use of the p<0.2 removal criterion, by selecting a limited number of candidate predictors on the basis of results from empirical studies (see Table 11), and by dichotomising their responses into more stable and clearly-delineated values.

Each exposure was originally coded such that affirmation (e.g. smoking sometimes) was scored as ‘1’; while ‘no’ and ‘not applicable’ responses were scored as ‘0’. Where negative co-efficients were generated in models, the variable was then reverse-coded to generate a positive co-efficient. This
facilitated an additive scoring system in which higher scores denoted higher risk (as discussed later in section 5.10.10 and again in Chapter Seven).

A number of statistical tests were then used to assess the collinearity, discrimination, parsimony and calibration of the generated models. This methodology for assessing models is based on that used in the Santé study (King et al., 2016) and similar to those reported elsewhere (Falasinnu et al., 2014a), (Gotz et al., 2005), (Steyerberg, 2009). The tests are presented below in order of sequence and importance such that discrimination was the primary concern once collinearity had been assessed.

**Variance Inflation Factor**

The Variance Inflation Factor (VIF) was used to assess if the model was likely to be unstable due to strong exposure correlations that would affect the standard errors. If models had a VIF of >4, collinearity was to be investigated in order to remove strongly correlated exposures.

**C-statistic**

Because the outcomes were dichotomous the c-statistic was calculated to measure the discriminatory power of the model (Alba et al., 2017). This is the primary consideration for CPRs - that a model can differentiate between those who do or do not require a given clinical intervention (Alba et al., 2017). The C-statistic value ranges between 0.5-1.0. Conveniently, this corresponds to the probability of correct assignation such that 0.5 indicates a 50% chance that a woman who had recent sexual risk experiences would be allocated as such, while 1.0 denotes a 100% chance of the same.

**Bayesian Information Criterion (BIC)**

The BIC value was used to compare the parsimony of models and goodness-of-fit between models, particularly in the sensitivity analysis to ascertain whether to include the sexual health attenders in the sample from which the statistical models were generated. BIC was chosen over AIC as it imposes a greater penalty for large numbers of parameters, and was therefore most suited to the goal of CPR brevity. Arguably, a more parsimonious model will also be more stable because it is founded on less variables.
**McFadden’s Pseudo R-squared**

The absolute variance contributed by each exposure was estimated using a Pseudo- R squared test because the outcomes were dichotomous. McFadden’s R squared were used, for which values between 0.2-0.4 are considered an excellent fit (Mc Fadden, 1979).

**Hosmer-Lemeshow (H-L) test**

The H-L test was used to assess the calibration of the models, as part of a standard approach to CPR derivation which recognises that: ‘Calibration refers to the accuracy of absolute risk estimates’ (Alba et al., 2017) (p.1378).

The H-L test results were however, given least importance as estimating absolute risk is of less interest for this non-prognostic CPR, and because the p value obtained can fluctuate greatly from even small changes in the model.

**5.10.8 Comparing models to support an integrated or unified CPR**

Once generated, the statistical models were compared to see if the same exposures predicted different outcomes. This qualitative exercise supported the decision to either generate an ‘integrated’ CPR (in which the same items warrant all sexual health interventions) versus a ‘unified’ CPR (comprising mini-scales that differentially indicate the need for CAS and/or STI testing and sexual health advice).

**5.10.9 Using sensitivity analyses to assess whether to include CASH data**

Sensitivity analyses (running the same model with and without CASH data included) were conducted to aid assessment of whether or not to exclude the CASH data; examining particularly how the CASH data affected the C-statistic, and the BIC value as a proxy indicator of model stability. These analyses were important as recruitment site was anticipated to correlate strongly with outcomes, a particular concern as CPR is essentially a process of model estimation (rather than hypothesis testing).
5.10.10 Developing a simple scoring system for the CPR

The last step in the plan of statistical analysis was development and assessment of a scoring system for each outcome, based on the exposures in its model. This typically involves translating the regression coefficient for each retained exposure into an item score, which are then combined to generate a cumulative score (Falasinnu et al., 2014a) (Steyerberg, 2009). Both (Sullivan et al., 2004) and (Falasinnu et al., 2014a) describe a process which involves rounding up each regressive coefficient to the nearest integer and using that as the score for the corresponding CPR item. This process:

‘…simplifies the estimation of risk based on complex statistical models’ (Sullivan et al., 2004) (p.1631)

This approach was favoured because it would translate into a simple scoring system suitable for self-completion using pen and paper. The score attributed to each range of co-efficient values was decided after data collection was complete and is therefore presented in Chapter Six in section 6.7.1.

5.10.11 Optimising CPR sensitivity and specificity by choosing a cut-off score

The ‘cut-off’ score for a CPR denotes the value at which a patient is considered in need of intervention or not. Selecting the best cut-off score is an exercise in balancing sensitivity (the percentage of those in need of intervention that are identified as such by the test) and specificity (the percentage of those not in need of intervention that are identified as such by the test).

The c-statistic provides information on the performance of the models but not the performance of the scoring systems generated from them. (Steyerberg, 2009) makes broad reference to ‘decision-analytic’ approaches to calculating sensitivity and specificity and thus selecting an optimal score cut-off, but does not offer further detail, nor did any other paper on CPR derivation. Sensitivity, specificity and cut-off values can be generated directly from a model using software, usually by plotting sensitivity against specificity and choosing the point of cross-over as the cut-off score (as this corresponds to the maximum number of people correctly allocated). However, this does not equate to the sensitivity and specificity of a generated scoring system. Nor does this approach balance...
the trade-off between sensitivity and specificity in a way that accounts for real world issues. E.g. it may make more sense to privilege specificity over sensitivity for costly interventions in order to reduce the expense of assessing ‘false positives’, so that clinical intuition is considered a valid approach to determining optimum CPR cut-off scores (Steyerberg, 2009).

A decision-analytic approach involving cross-tabulation was used (Gotz et al., 2005) with the addition of seeking clinical opinion. This comprised the following steps (for each model):

1. Generating a CPR scoring system for each outcome as described previously
2. Calculating a CPR score for each participant based on their responses to the relevant questions in the survey
3. Cross-tabulating CPR scores with participant self-report of the outcome of interest
4. Using the cross-tabulation to determine the optimum score cut-off value at which clinicians should be advised to either take action or not (by assessing the sensitivity and specificity offered by each value)
5. Consulting with a group of GPs at Pavilion Surgery on the optimum score values chosen (and the clinical utility of the models)

This latter consultation exercise involved a one-off meeting with a group of five General Practitioners from one of the participating recruitment sites (Pavilion Surgery). At the meeting the candidate described each of the outcomes and its retained CPR items, together with the accompanying c-statistic, and the sensitivity and specificity afforded by the potential cut-off scores.

The results of the survey and the modelling process are presented in the following chapter along with the consultation feedback.
Chapter 6: Derivation of a clinical prediction rule from the Brighton & Hove survey data
Summary

This chapter presents the results of the survey described in Chapter Five. It begins by describing response rates, the results of consistency checking and the univariate statistics for outcomes and exposures. The chapter then reports the bivariate analyses and details which candidate exposures were selected for entry into multivariable regression models.

The results of multivariable regression modelling are presented, comprising the retained items and accompanying statistics. The chapter then describes how a scoring system for the CPR was derived from the coefficients of each model, and how optimal cut-off scores were established with GP stakeholders. The chapter concludes by discussing these findings and by reflecting on the strengths and limitations of the survey, comparisons with related work, and clinical and research implications.
6.1 Survey Response and data quality

6.1.1. Survey response and exclusions

The initial GP sample size was set at $n=1500$ to ensure 150 events (i.e. the primary outcome: reporting two or more male sexual partners in the last year). However, the number of events was exceeded after $n=1212$ had been recruited, and recruitment ceased early with permission from ethics and sponsorship committees. Among the final $n=1250$ eligible GP participants, $n=266$ reported this primary outcome. The sample size for the CASH clinic was also exceeded - recruitment was halted once it transpired that over $n=500$ women had returned a questionnaire.

The response rate could not be calculated for reasons described in Chapter Five. Instead, Table 12 reports the number of questionnaires distributed, returned, and eligible; and the original sample size for each site.

<table>
<thead>
<tr>
<th>Site name</th>
<th>Number distributed</th>
<th>Number returned</th>
<th>Number eligible</th>
<th>Original sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP A</td>
<td>94</td>
<td>72</td>
<td>70</td>
<td>250</td>
</tr>
<tr>
<td>GP B</td>
<td>404</td>
<td>337</td>
<td>329</td>
<td>250</td>
</tr>
<tr>
<td>GP C</td>
<td>339</td>
<td>300</td>
<td>289</td>
<td>250</td>
</tr>
<tr>
<td>GP D</td>
<td>307</td>
<td>253</td>
<td>243</td>
<td>250</td>
</tr>
<tr>
<td>GP E</td>
<td>283</td>
<td>267</td>
<td>258</td>
<td>250</td>
</tr>
<tr>
<td>GP F</td>
<td>96</td>
<td>61</td>
<td>61</td>
<td>250</td>
</tr>
<tr>
<td>GP TOTAL</td>
<td>1523</td>
<td>1290</td>
<td>1250</td>
<td>1500</td>
</tr>
<tr>
<td>CASH</td>
<td>589</td>
<td>553</td>
<td>537</td>
<td>500</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2112</td>
<td>1843</td>
<td>1787</td>
<td>2000</td>
</tr>
</tbody>
</table>

GP B showed a higher proportion of young women participants than other GPs, so a decision was taken to oversample from this site. To address the shortfall recruited from GP A and GP F, GP C was also deliberately over-sampled as recruitment was comparatively rapid at this site. Eight questionnaires were returned by post, the rest were returned in clinic.

Eligibility checking of returned questionnaires identified $n=56$ cases for exclusion (see Table 13).
Table 13: Survey exclusions on the basis of eligibility criteria

<table>
<thead>
<tr>
<th>Reason for exclusion</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>All screening items blank</td>
<td>12</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
</tr>
<tr>
<td>Don’t identify predominantly as female or male</td>
<td>8</td>
</tr>
<tr>
<td>Completed the questionnaire before</td>
<td>18</td>
</tr>
<tr>
<td>&lt;16 years of age or &gt;44 years of age</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>

6.1.2. Data entry quality

Of the random 10% of questionnaires checked by the candidate only eight were found to contain a data entry inaccuracy. Anomalies raised by the data entry company comprised mostly blank items and addition of free text. These were noted and addressed using the consistency-checking process described in Appendix 5i.

6.1.3. Available case analysis and handling of incomplete data

Of the 1787 eligible returned questionnaires, 123 were semi-complete, so that complete case analysis would have involved the loss of 7% of the dataset. As this would have affected study power and introduced potential systematic bias this approach was rejected in favour of available case analysis.

Available case analysis also enabled analysis of item non-response as an indicator of item acceptability. To enable this, incomplete cases were first allocated as ‘sporadically-incomplete’ or ‘systematically-incomplete’.

*Sporadically-incomplete* cases were defined as questionnaires in which two or more questions were responded to subsequent to one for which no response was given. *Systematically-incomplete* cases were defined as questionnaires which were complete up to any given point, following which all items were blank. This sometimes occurred when women were called into their appointment before they had time to complete their questionnaire (as reported by participants handing them in).
Systematically-incomplete questionnaires for which section three was left blank were excluded on the basis that:

- these cases could not be used to derive multivariable models as they did not contain outcome data
- their inclusion would have biased analysis of item acceptability

This led to the exclusion of 17 cases (n=12 GP, n=5 CASH) reducing the total number of cases included in analyses to n=1770, as set out in Figure Three.

**Figure 3: Generating the final sample from returned questionnaires**

- N=1843 questionnaires returned (GP =1290, CASH =553)
- N=56 ineligible (GP=40, CASH=16)
- N=1787 eligible (GP =1250, CASH =537)
- N=123 semi-complete data (GP=85 GP, CASH =38)
- N=1664 complete data (GP=1165, CASH = 499)
- N=17 excluded (systematically-incomplete before section 3)
- N=38 (systematically-incomplete from section 3)
- N=68 (sporadically incomplete) (GP=47, CASH=21)
- N=1770 final sample (GP =1238, CASH =532)
6.2. Descriptive analyses

6.2.1 Sample descriptors and distribution of exposures

In this study the variables that describe the sample also represent the exposures of interest. For both the GP and the CASH samples, the majority of respondents were renting their home (rather than being an owner-occupier) and the largest age group of participants was those aged 25-34 years. However, the second-largest age group was those aged 16-44 years in the CASH sample, but those aged 35-44 years in the GP sample, indicating an older GP sample.

N=31 of the GP sample responded in a way which indicated they had never been in a relationship (i.e. reported that they were currently single and left blank all section two items (which refer to current or most recent relationship). The decision was taken pragmatically to score those people who had never had a relationship as a ‘no’ for items reporting on a risk factor related to current or most recent relationship. This was an appropriate strategy as comparatively few people reported this and doing so avoided the need for an additional ‘ever had a relationship’ item in the final CPR.

The distribution of these, and all exposures, is provided in Table 14. The final aggregations and coding of response options for analysis purposes is given in Appendix 6a. Missing data codes were also assigned on the basis of filters and consistency checking, as described in Appendix 6b.

<table>
<thead>
<tr>
<th>Questionnaire item (code)</th>
<th>Response frequencies (GP cohort)</th>
<th>Response frequencies (CASH cohort)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (agegrp)</td>
<td>16-24 years = 269</td>
<td>16-24 years = 237</td>
</tr>
<tr>
<td></td>
<td>25-34 years = 518</td>
<td>25-34 years = 205</td>
</tr>
<tr>
<td></td>
<td>35-44 years = 451</td>
<td>35-44 years = 90</td>
</tr>
<tr>
<td>Housing tenure (tenure3)</td>
<td>Renting = 859</td>
<td>Renting = 452</td>
</tr>
<tr>
<td></td>
<td>Owner = 368</td>
<td>Owner = 78</td>
</tr>
<tr>
<td></td>
<td>Missing data= 11</td>
<td>Missing data= 2</td>
</tr>
<tr>
<td>Lived with both natural parents to 14 years of age (both_parents)</td>
<td>Yes= 923</td>
<td>Yes= 381</td>
</tr>
<tr>
<td></td>
<td>No=299</td>
<td>No=143</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=8</td>
<td>Prefer not to answer=5</td>
</tr>
<tr>
<td></td>
<td>Missing data=8</td>
<td>Missing data=3</td>
</tr>
<tr>
<td>Questionnaire item (code)</td>
<td>Response frequencies (GP cohort)</td>
<td>Response frequencies (CASH cohort)</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Social support if confined to bed (bed)</td>
<td>None of the time=194</td>
<td>None of the time=96</td>
</tr>
<tr>
<td></td>
<td>A little of the time=121</td>
<td>A little of the time=59</td>
</tr>
<tr>
<td></td>
<td>Some of the time=167</td>
<td>Some of the time=66</td>
</tr>
<tr>
<td></td>
<td>Most of the time=329</td>
<td>Most of the time=149</td>
</tr>
<tr>
<td></td>
<td>All of the time=406</td>
<td>All of the time=148</td>
</tr>
<tr>
<td></td>
<td>Missing data=21</td>
<td>Missing data=14</td>
</tr>
<tr>
<td>Social support if needed a doctor (doctor)</td>
<td>None of the time=178</td>
<td>None of the time=96</td>
</tr>
<tr>
<td></td>
<td>A little of the time=133</td>
<td>A little of the time=61</td>
</tr>
<tr>
<td></td>
<td>Some of the time=152</td>
<td>Some of the time=74</td>
</tr>
<tr>
<td></td>
<td>Most of the time=330</td>
<td>Most of the time=134</td>
</tr>
<tr>
<td></td>
<td>All of the time=422</td>
<td>All of the time=157</td>
</tr>
<tr>
<td></td>
<td>Missing data=23</td>
<td>Missing data=10</td>
</tr>
<tr>
<td>Social support to prepare a meal (meals)</td>
<td>None of the time=188</td>
<td>None of the time=95</td>
</tr>
<tr>
<td></td>
<td>A little of the time=121</td>
<td>A little of the time=65</td>
</tr>
<tr>
<td></td>
<td>Some of the time=149</td>
<td>Some of the time=77</td>
</tr>
<tr>
<td></td>
<td>Most of the time=308</td>
<td>Most of the time=117</td>
</tr>
<tr>
<td></td>
<td>All of the time=447</td>
<td>All of the time=166</td>
</tr>
<tr>
<td></td>
<td>Missing data=25</td>
<td>Missing data=12</td>
</tr>
<tr>
<td>Social support to carry out chores (chores)</td>
<td>None of the time=188</td>
<td>None of the time=101</td>
</tr>
<tr>
<td></td>
<td>A little of the time=136</td>
<td>A little of the time=63</td>
</tr>
<tr>
<td></td>
<td>Some of the time=174</td>
<td>Some of the time=86</td>
</tr>
<tr>
<td></td>
<td>Most of the time=304</td>
<td>Most of the time=126</td>
</tr>
<tr>
<td></td>
<td>All of the time=413</td>
<td>All of the time=146</td>
</tr>
<tr>
<td></td>
<td>Missing data=23</td>
<td>Missing data=10</td>
</tr>
<tr>
<td>'I have high self-esteem' level of agreement (self_esteem)</td>
<td>Not very true of me=205</td>
<td>Not very true of me=70</td>
</tr>
<tr>
<td></td>
<td>Somewhat untrue of me=205</td>
<td>Somewhat untrue of me=91</td>
</tr>
<tr>
<td></td>
<td>Neither true nor untrue of me=207</td>
<td>Neither true nor untrue of me=88</td>
</tr>
<tr>
<td></td>
<td>Somewhat true of me=440</td>
<td>Somewhat true of me=216</td>
</tr>
<tr>
<td></td>
<td>Very true of me=170</td>
<td>Very true of me=57</td>
</tr>
<tr>
<td></td>
<td>Missing data=11</td>
<td>Missing data=10</td>
</tr>
<tr>
<td>Treatment for depression in the last 12 months (depr_treatment)</td>
<td>Yes=320</td>
<td>Yes=125</td>
</tr>
<tr>
<td></td>
<td>No=900</td>
<td>No=404</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=15</td>
<td>Prefer not to answer=1</td>
</tr>
<tr>
<td></td>
<td>Missing data=3</td>
<td>Missing data=2</td>
</tr>
<tr>
<td>'Have a partner at all times is important to me' level of agreement (partner_importance)</td>
<td>Strongly agree=145</td>
<td>Strongly agree=33</td>
</tr>
<tr>
<td></td>
<td>Agree=417</td>
<td>Agree=107</td>
</tr>
<tr>
<td></td>
<td>Disagree=510</td>
<td>Disagree=304</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree=133</td>
<td>Strongly disagree=77</td>
</tr>
<tr>
<td></td>
<td>Missing data=33</td>
<td>Missing data=11</td>
</tr>
<tr>
<td>Questionnaire item (code)</td>
<td>Response frequencies (GP cohort)</td>
<td>Response frequencies (CASH cohort)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------------</td>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| Frequency of 6+ units of alcohol on one occasion (binge_drink) | Daily or almost daily=32  
Weekly or almost weekly=383  
Monthly=239  
Less than monthly=346  
Never=228  
Prefer not to answer=4  
Missing data=6 | Daily or almost daily=19  
Weekly or almost weekly=205  
Monthly=133  
Less than monthly=118  
Never=56  
Prefer not to answer=0  
Missing data=1 |
| Current cigarette or roll-up smoking (smoke_now) | Yes=320  
No=900  
Prefer not to answer=11  
Missing data=7 | Yes=195  
No=332  
Prefer not to answer=2  
Missing data=3 |
| Current e-cigarette smoking (ecig_now) | Yes=74  
No=1146  
Prefer not to answer=11  
Missing data=7 | Yes=27  
No=500  
Prefer not to answer=2  
Missing data=3 |
| Ever taken drugs (including legal highs) (ever_drugs) | Yes=707  
No=497  
Don't know=3  
Prefer not to answer=27  
Missing data=4 | Yes=323  
No=188  
Don't know=2  
Prefer not to answer=18  
Missing data=1 |
| Current relationship status (rel_status) | Living with ptn./spouse=700  
In a steady relationship=190  
In a casual relationship=54  
Single=283  
Prefer not to answer=6  
Missing data=5 | Living with ptn./spouse=110  
In a steady relationship=113  
In a casual relationship=71  
Single=230  
Prefer not to answer=6  
Missing data=2 |
| Emotional satisfaction with most recent relationship (emotional_dissat) | Extremely satisfied=382  
Very satisfied=370  
Moderately satisfied=249  
Slightly satisfied=94  
Not at all satisfied=62  
Prefer not to answer=22  
Not applicable=28  
Missing data=28 | Extremely satisfied=100  
Very satisfied=153  
Moderately satisfied=118  
Slightly satisfied=79  
Not at all satisfied=47  
Prefer not to answer=7  
Not applicable=14  
Missing data=14 |
<table>
<thead>
<tr>
<th>Questionnaire item (code)</th>
<th>Response frequencies (GP cohort)</th>
<th>Response frequencies (CASH cohort)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'My partner tells me who I can spend time with' level of agreement (spend_time)</td>
<td>Strongly agree=20</td>
<td>Strongly agree=11</td>
</tr>
<tr>
<td></td>
<td>Agree=54</td>
<td>Agree=46</td>
</tr>
<tr>
<td></td>
<td>Disagree=280</td>
<td>Disagree=148</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree=811</td>
<td>Strongly disagree=300</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=9</td>
<td>Prefer not to answer=2</td>
</tr>
<tr>
<td></td>
<td>Not applicable=30</td>
<td>Not applicable=13</td>
</tr>
<tr>
<td></td>
<td>Missing data=34</td>
<td>Missing data=12</td>
</tr>
<tr>
<td>'My partner does what they want, even if I do not want them to' level of agreement (partner_does)</td>
<td>Strongly agree=73</td>
<td>Strongly agree=33</td>
</tr>
<tr>
<td></td>
<td>Agree=259</td>
<td>Agree=132</td>
</tr>
<tr>
<td></td>
<td>Disagree=517</td>
<td>Disagree=233</td>
</tr>
<tr>
<td></td>
<td>Strongly disagree=302</td>
<td>Strongly disagree=102</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=12</td>
<td>Prefer not to answer=5</td>
</tr>
<tr>
<td></td>
<td>Not applicable=32</td>
<td>Not applicable=13</td>
</tr>
<tr>
<td></td>
<td>Missing data=43</td>
<td>Missing data=14</td>
</tr>
<tr>
<td>Most recent partner non-monogamous (non_monog)</td>
<td>No, definitely not=790</td>
<td>No, definitely not=264</td>
</tr>
<tr>
<td></td>
<td>I don't think so=276</td>
<td>I don't think so=155</td>
</tr>
<tr>
<td></td>
<td>It's quite likely=38</td>
<td>It's quite likely=38</td>
</tr>
<tr>
<td></td>
<td>Yes, definitely=70</td>
<td>Yes, definitely=50</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=29</td>
<td>Prefer not to answer=3</td>
</tr>
<tr>
<td></td>
<td>Not applicable=28</td>
<td>Not applicable=12</td>
</tr>
<tr>
<td></td>
<td>Missing data=23</td>
<td>Missing data=10</td>
</tr>
<tr>
<td>Ever had a partner who insulted or talked down to you often (insult)</td>
<td>Yes=533</td>
<td>Yes=243</td>
</tr>
<tr>
<td></td>
<td>No=675</td>
<td>No=274</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=10</td>
<td>Prefer not to answer=5</td>
</tr>
<tr>
<td></td>
<td>Missing data=20</td>
<td>Missing data=10</td>
</tr>
<tr>
<td>Ever had a partner who shouted or swore at you often (shout)</td>
<td>Yes=414</td>
<td>Yes=216</td>
</tr>
<tr>
<td></td>
<td>No=782</td>
<td>No=298</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=11</td>
<td>Prefer not to answer=4</td>
</tr>
<tr>
<td></td>
<td>Missing data=31</td>
<td>Missing data=14</td>
</tr>
<tr>
<td>Ever had a partner who threatened you with harm sometimes (threat)</td>
<td>Yes=231</td>
<td>Yes=102</td>
</tr>
<tr>
<td></td>
<td>No=954</td>
<td>No=408</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=15</td>
<td>Prefer not to answer=5</td>
</tr>
<tr>
<td></td>
<td>Missing data=38</td>
<td>Missing data=17</td>
</tr>
<tr>
<td>Ever had a partner who physically hurt you (physical)</td>
<td>Yes=221</td>
<td>Yes=107</td>
</tr>
<tr>
<td></td>
<td>No=960</td>
<td>No=405</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=23</td>
<td>Prefer not to answer=6</td>
</tr>
<tr>
<td></td>
<td>Missing data=34</td>
<td>Missing data=14</td>
</tr>
<tr>
<td>Questionnaire item (code)</td>
<td>Response frequencies (GP cohort)</td>
<td>Response frequencies (CASH cohort)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Age of first heterosexual intercourse (early_debut)</td>
<td>Under 16 years=400 16+ years=783 Never had=33 Prefer not to answer=18 Missing data=4</td>
<td>Under 16 years=200 16+ years=322 Never had=2 Prefer not to answer=3 Missing data=5</td>
</tr>
<tr>
<td>Man last had sex with 5+ years older (ptn5+_older)</td>
<td>True=285 Probably true=7 I have no idea=3 Probably not true=13 Not true=763 Not applicable=137 Missing data=30</td>
<td>True=127 Probably true=7 I have no idea=3 Probably not true=1 Not true=363 Not applicable=18 Missing data=13</td>
</tr>
<tr>
<td>In last 6 months, used emergency contraception (emergency_con)</td>
<td>Yes=101 No=901 Prefer not to answer=4 Not applicable=137 Pregnant throughout=62 Missing data=33</td>
<td>Yes=115 No=376 Prefer not to answer=0 Not applicable=19 Pregnant throughout=6 Missing data=16</td>
</tr>
<tr>
<td>In last 6 months taken pregnancy test because thought might be pregnant (preg_test)</td>
<td>Yes=316 No=722 Prefer not to answer=5 Not applicable=103 Pregnant throughout=62 Missing data=30</td>
<td>Yes=186 No=315 Prefer not to answer=0 Not applicable=12 Pregnant throughout=6 Missing data=13</td>
</tr>
</tbody>
</table>

6.2.2 Distribution of outcomes

N= 33 of the GP sample and n=2 of the CASH sample responded ‘I’ve never had sexual intercourse with someone of the opposite sex’ to Question 18 and were therefore excluded from all analyses, on the basis that they would be highly likely to decline completing the CPR in practice. Of these n=35, 51.4% (n=18) were aged 16-24. Following these exclusions, among the GP cohort the number reporting each outcome was as follows: 2+P in the last year=266, Risk of UIP=179, RTP =316, Combined (2+P and/or RTP)=417. N=106 of the GP sample and n=16 of the CASH sample reported having sexual intercourse with no men in the last year. N= 25 of the GP sample and n=13 of the CASH sample reported having no vaginal sex in the last year. The distribution of all items
(including n=35 who reported no sexual intercourse with opposite sex ever) from which the outcomes were derived are given in Table 15.

Table 15: Distribution of survey responses to outcomes

<table>
<thead>
<tr>
<th>Questionnaire item</th>
<th>Response frequencies (GP)</th>
<th>Response frequencies (CASH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of male sexual partners in last year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=106</td>
<td></td>
<td>0=16</td>
</tr>
<tr>
<td>1=794</td>
<td></td>
<td>1=178</td>
</tr>
<tr>
<td>2=122</td>
<td></td>
<td>2=108</td>
</tr>
<tr>
<td>3-5=101</td>
<td></td>
<td>3-5=142</td>
</tr>
<tr>
<td>6 or more=43</td>
<td></td>
<td>6 or more=74</td>
</tr>
<tr>
<td>Prefer not to answer=14</td>
<td></td>
<td>Prefer not to answer=4</td>
</tr>
<tr>
<td>Not applicable=33</td>
<td></td>
<td>Not applicable=2</td>
</tr>
<tr>
<td>Missing data=25</td>
<td></td>
<td>Missing data=8</td>
</tr>
<tr>
<td>Man last had sex with had 1+ other ptns. in last year before me</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True=307</td>
<td></td>
<td>True=262</td>
</tr>
<tr>
<td>Probably true=102</td>
<td></td>
<td>Probably true=75</td>
</tr>
<tr>
<td>I have no idea=59</td>
<td></td>
<td>I have no idea=54</td>
</tr>
<tr>
<td>Probably not true=45</td>
<td></td>
<td>Probably not true=11</td>
</tr>
<tr>
<td>Not true=552</td>
<td></td>
<td>Not true=97</td>
</tr>
<tr>
<td>Not applicable=137</td>
<td></td>
<td>Not applicable=18</td>
</tr>
<tr>
<td>Missing data=36</td>
<td></td>
<td>Missing data=15</td>
</tr>
<tr>
<td>Man last had sex with didn’t always use condoms for vaginal sex with previous partners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True=281</td>
<td></td>
<td>True=174</td>
</tr>
<tr>
<td>Probably true=180</td>
<td></td>
<td>Probably true=101</td>
</tr>
<tr>
<td>I have no idea=216</td>
<td></td>
<td>I have no idea=142</td>
</tr>
<tr>
<td>Probably not true=92</td>
<td></td>
<td>Probably not true=23</td>
</tr>
<tr>
<td>Not true=291</td>
<td></td>
<td>Not true=57</td>
</tr>
<tr>
<td>Not applicable=137</td>
<td></td>
<td>Not applicable=18</td>
</tr>
<tr>
<td>Missing data=41</td>
<td></td>
<td>Missing data=17</td>
</tr>
<tr>
<td>Man last had sex with would have STI test if had vaginal sex with someone else without a condom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True=351</td>
<td></td>
<td>True=122</td>
</tr>
<tr>
<td>Probably true=230</td>
<td></td>
<td>Probably true=97</td>
</tr>
<tr>
<td>I have no idea=217</td>
<td></td>
<td>I have no idea=172</td>
</tr>
<tr>
<td>Probably not true=94</td>
<td></td>
<td>Probably not true=52</td>
</tr>
<tr>
<td>Not true=145</td>
<td></td>
<td>Not true=51</td>
</tr>
<tr>
<td>Not applicable=137</td>
<td></td>
<td>Not applicable=18</td>
</tr>
<tr>
<td>Missing data=64</td>
<td></td>
<td>Missing data=20</td>
</tr>
<tr>
<td>Condom use with most recent male sexual partner</td>
<td></td>
<td>Not had vaginal sex in last year=13</td>
</tr>
<tr>
<td>Not had vaginal sex in last year=25</td>
<td></td>
<td>Condoms always used=76</td>
</tr>
<tr>
<td>Condoms always used=174</td>
<td></td>
<td>Condoms sometimes used=229</td>
</tr>
<tr>
<td>Condoms sometimes used=384</td>
<td></td>
<td>Condoms never used=181</td>
</tr>
<tr>
<td>Condoms never used=454</td>
<td></td>
<td>Prefer not to answer=8</td>
</tr>
<tr>
<td>Prefer not to answer=38</td>
<td></td>
<td>Not applicable=10</td>
</tr>
<tr>
<td>Not applicable=127</td>
<td></td>
<td>Missing data=15</td>
</tr>
<tr>
<td>Missing data=36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaire item</td>
<td>Response frequencies (GP)</td>
<td>Response frequencies (CASH)</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Condom use with second most recent male sexual partner</td>
<td>Only had 1 ptn. in last year=507</td>
<td>Only had 1 ptn. in last year=113</td>
</tr>
<tr>
<td></td>
<td>Condoms always used=168</td>
<td>Condoms always used=94</td>
</tr>
<tr>
<td></td>
<td>Condoms sometimes used=165</td>
<td>Condoms sometimes used=125</td>
</tr>
<tr>
<td></td>
<td>Condoms never used=161</td>
<td>Condoms never used=143</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=36</td>
<td>Prefer not to answer=13</td>
</tr>
<tr>
<td></td>
<td>Not applicable=137</td>
<td>Not applicable=21</td>
</tr>
<tr>
<td></td>
<td>Missing data=64</td>
<td>Missing data=23</td>
</tr>
<tr>
<td>Pregnancy in last 6 months</td>
<td>Currently pregnant=76</td>
<td>Currently pregnant=10</td>
</tr>
<tr>
<td></td>
<td>Was pregnant but not now=72</td>
<td>Was pregnant but not now=15</td>
</tr>
<tr>
<td></td>
<td>No=914</td>
<td>No=464</td>
</tr>
<tr>
<td></td>
<td>Maybe=10</td>
<td>Maybe=11</td>
</tr>
<tr>
<td></td>
<td>Not applicable=139</td>
<td>Not applicable=18</td>
</tr>
<tr>
<td></td>
<td>Missing data=27</td>
<td>Missing data=14</td>
</tr>
<tr>
<td>In last 6 months, how much have you wanted to get</td>
<td>Very much=77</td>
<td>Very much=19</td>
</tr>
<tr>
<td>pregnant</td>
<td>Quite a lot=68</td>
<td>Quite a lot=25</td>
</tr>
<tr>
<td></td>
<td>Haven't minded either way=99</td>
<td>Haven't minded either way=27</td>
</tr>
<tr>
<td></td>
<td>Haven't wanted v much=121</td>
<td>Haven't wanted v much=55</td>
</tr>
<tr>
<td></td>
<td>Haven't wanted at all=634</td>
<td>Haven't wanted at all=360</td>
</tr>
<tr>
<td></td>
<td>Not applicable=140</td>
<td>Not applicable=18</td>
</tr>
<tr>
<td></td>
<td>Pregnant throughout=62</td>
<td>Pregnant throughout=6</td>
</tr>
<tr>
<td></td>
<td>Missing data=37</td>
<td>Missing data=22</td>
</tr>
<tr>
<td>Contraception use in last 6 months</td>
<td>Always used=586</td>
<td>Always used=246</td>
</tr>
<tr>
<td></td>
<td>Used, but not every occasion=151</td>
<td>Used, but not every occasion=136</td>
</tr>
<tr>
<td></td>
<td>Used, but method failed=34</td>
<td>Used, but method failed=35</td>
</tr>
<tr>
<td></td>
<td>Never used=175</td>
<td>Never used=58</td>
</tr>
<tr>
<td></td>
<td>No vaginal sex in last 6 months=31</td>
<td>No vaginal sex in last 6 months=7</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer=24</td>
<td>Prefer not to answer=7</td>
</tr>
<tr>
<td></td>
<td>Not applicable=138</td>
<td>Not applicable=17</td>
</tr>
<tr>
<td></td>
<td>Pregnant throughout=62</td>
<td>Pregnant throughout=6</td>
</tr>
<tr>
<td></td>
<td>Missing data=36</td>
<td>Missing data=20</td>
</tr>
<tr>
<td>In last 6 months, how much have you wanted to avoid</td>
<td>Very much=600</td>
<td>Very much=347</td>
</tr>
<tr>
<td>getting pregnant</td>
<td>Quite a lot=118</td>
<td>Quite a lot=61</td>
</tr>
<tr>
<td></td>
<td>Haven't minded either way=124</td>
<td>Haven't minded either way=36</td>
</tr>
<tr>
<td></td>
<td>Not wanted to avoid much=38</td>
<td>Not wanted to avoid much=16</td>
</tr>
<tr>
<td></td>
<td>Not wanted to avoid at all=115</td>
<td>Not wanted to avoid at all=24</td>
</tr>
<tr>
<td></td>
<td>Not applicable=140</td>
<td>Not applicable=19</td>
</tr>
<tr>
<td></td>
<td>Pregnant throughout=62</td>
<td>Pregnant throughout=6</td>
</tr>
<tr>
<td></td>
<td>Missing data=41</td>
<td>Missing data=23</td>
</tr>
</tbody>
</table>
6.2.3 Changing the construction of outcome 4: ‘Risk of UIP in the last six months’

Correlation analyses were run to determine level of agreement between the item concerning pregnancy wanted-ness and the item concerning pregnancy avoidance. Correlation was statistically significant: 0.77 (Pearson’s), 0.75 (Spearman’s) and 0.71 (Kendall’s Tau B) - all at p<0.0001. However scatter plots showed that although there was strong linear/monotonic association between these items for the majority of women who wanted to avoid pregnancy, there was also a cluster of respondents who reported low wanted-ness and low avoidance. These discordant responses may be indicative of poor validity (see Discussion) but were nonetheless problematic as they summed to a mid-range value, which could not be differentiated from a consistent report of ambivalence. Therefore the avoidance item (rather than the wanted-ness item) was used alone for the following reasons:

1. Avoidance is more clearly an expression of intent rather than emotion
2. Avoidance is therefore a more logical counterpart to STI risk as an experiential/behavioural measure
3. The avoidance item did not generate additional text whereas the wanted-ness item did (suggesting the latter failed to fully capture participant experience and was therefore less valid)
4. The avoidance item was found to be a better predictor in a previous study by Moreau (Moreau and Bohet, 2016)

6.2.4 Dropping outcome 5: ‘Two or more partners in the last year with whom a condom was not used on at least one occasion’

The statistical plan involved developing a model for the outcome ‘two or more partners in the last year with whom a condom was not used on at least one occasion’. Unfortunately, when generating this outcome following data collection it became apparent that it could only be meaningfully generated for those women reporting exactly two male sexual partners in the last year, because the questionnaire only asked about condom use with the two most recent partners. E.g. women who reported 3+ male sexual partners in the last year may have reported consistent condom use with at least one of their two most recent partners (so that they would be categorised as not reporting 2+PNC) but may still have used condoms inconsistently with 2+ male sexual partners in the last
year. In the GP cohort n=122 reported two male partners in the last year, of which 57.4 % (n=70) reported not always consistently using condoms with each of their most recent partners. This sub-sample carried an insufficient number of events for multivariable modelling and this outcome was therefore omitted from further analyses.

6.2.5 Assessment of acceptability of exposures and outcomes
Analysis of the distribution of responses to exposures showed low frequencies of missing data and of ‘prefer not to answer’ response option selection – as indicated above in Table 14. This indicated that exposures had very low levels of unacceptability, such that plans to conduct bivariate analyses of correlates of non-response were not pursued. Removal of systematically incomplete cases (as described above) meant that analysis of outcome acceptability was limited to the frequency of missing data and ‘prefer not to answer’ responses in sporadically incomplete cases. Findings indicated that only a small percentage of respondents found the sexual experience items unacceptable (see Table 15). Together this analysis of missing data and acceptability addresses two criticisms of the thesis presented in Chapter Five - indicating that psychosocial items are acceptable to ask in a GP setting, but that routine questions about sexual history (in written form) may be acceptable to women attending GPs.

6.3 Bivariate analyses – identifying psychosocial items for inclusion in the models
Bivariate analyses were used to guide the selection of exposures for model entry and the results of these analyses are presented below in Table 16.
<table>
<thead>
<tr>
<th>Exposure</th>
<th>Multiple male partners in last year (2+P) OR (95% CI) p value</th>
<th>Risk through partner (RTP) OR (95% CI) p value</th>
<th>Combined risk (2+P and/or RTP) OR (95% CI) p value</th>
<th>Risk of unintended pregnancy in last 6 months (UIP) OR (95% CI) p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td>3.40 (2.74-4.24) p&lt;0.0001</td>
<td>2.19 (1.75-2.73) p&lt;0.0001</td>
<td>2.82 (2.26-3.52) p&lt;0.0001</td>
<td>1.92 (1.50-2.46) p&lt;0.0001</td>
</tr>
<tr>
<td>Living in rented housing</td>
<td>3.10 (2.36-4.06) p&lt;0.0001</td>
<td>2.48 (1.91-3.22) p&lt;0.0001</td>
<td>2.73 (2.16-3.46) p&lt;0.0001</td>
<td>1.78 (1.32-2.40) p&lt;0.0001</td>
</tr>
<tr>
<td>Didn’t live with both parents to 14 years of age</td>
<td>1.29 (1.02-1.61) p=0.030</td>
<td>1.23 (0.98-1.56) p=0.078</td>
<td>1.33 (1.07-1.67) p=0.011</td>
<td>1.13 (0.87-1.48) p=0.354</td>
</tr>
<tr>
<td>Lack of help if confined to bed</td>
<td>1.38 (1.13-1.69) p=0.002</td>
<td>1.54 (1.24-1.90) p&lt;0.0001</td>
<td>1.60 (1.31-1.95) p&lt;0.0001</td>
<td>1.04 (0.81-1.32) p=0.766</td>
</tr>
<tr>
<td>Little or no help to reach doctor</td>
<td>1.40 (1.14-1.72) p=0.001</td>
<td>1.57 (1.27-1.93) p&lt;0.0001</td>
<td>1.57 (1.29-1.92) p&lt;0.0001</td>
<td>1.19 (0.94-1.52) p=0.148</td>
</tr>
<tr>
<td>Little or no help to prepare meals</td>
<td>1.82 (1.49-2.24) p&lt;0.0001</td>
<td>1.73 (1.40-2.14) p&lt;0.0001</td>
<td>2.00 (1.64-2.45) p&lt;0.0001</td>
<td>1.20 (0.94-1.52) p=0.140</td>
</tr>
<tr>
<td>Little or no help with chores</td>
<td>1.85 (1.51-2.26) p&lt;0.0001</td>
<td>1.72 (1.40-2.12) p&lt;0.0001</td>
<td>1.95 (1.60-2.38) p&lt;0.0001</td>
<td>1.19 (0.94-1.51) p=0.152</td>
</tr>
<tr>
<td>Disagrees that self-esteem high</td>
<td>0.87 (0.70-1.08) p=0.222</td>
<td>1.26 (1.02-1.57) p=0.036</td>
<td>1.04 (0.85-1.28) p=0.682</td>
<td>1.11 (0.87-1.43) p=0.400</td>
</tr>
<tr>
<td>Depression treatment in last year</td>
<td>1.19 (0.95-1.50) p=0.126</td>
<td>1.47 (1.16-1.86) p=0.001</td>
<td>1.26 (1.01-1.57) p=0.041</td>
<td>0.90 (0.69-1.19) p=0.462</td>
</tr>
<tr>
<td>Agrees that having a partner at all times is important</td>
<td>0.29 (0.23-0.37) p&lt;0.0001</td>
<td>0.41 (0.33-0.52) p&lt;0.0001</td>
<td>0.36 (0.29-0.44) p&lt;0.0001</td>
<td>0.62 (0.48-0.80) p&lt;0.0001</td>
</tr>
<tr>
<td>Binge-drinks weekly or more</td>
<td>2.49 (2.03-3.06) p&lt;0.0001</td>
<td>2.11 (1.71-2.60) p&lt;0.0001</td>
<td>2.23 (1.82-2.73) p&lt;0.0001</td>
<td>1.51 (1.19-1.92) p&lt;0.001</td>
</tr>
<tr>
<td>Smokes cigarettes nowadays</td>
<td>2.71 (2.19-3.37) p&lt;0.0001</td>
<td>2.66 (2.12-3.34) p&lt;0.0001</td>
<td>2.65 (2.13-3.30) p&lt;0.0001</td>
<td>1.64 (1.28-2.11) p&lt;0.0001</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs</td>
<td>2.14 (1.73-2.66) p&lt;0.0001</td>
<td>2.00 (1.60-2.49) p&lt;0.0001</td>
<td>2.00 (1.63-2.44) p&lt;0.0001</td>
<td>1.53 (1.19-1.97) p&lt;0.001</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>7.84 (6.26-9.81) p&lt;0.0001</td>
<td>4.24 (3.39-5.30) p&lt;0.0001</td>
<td>5.74 (4.59-7.16) p&lt;0.0001</td>
<td>1.92 (1.51-2.44) p&lt;0.0001</td>
</tr>
<tr>
<td>Emotionally dissatisfied with most recent relationship</td>
<td>3.02 (2.44-3.73) p&lt;0.0001</td>
<td>2.75 (2.21-3.42) p&lt;0.0001</td>
<td>2.95 (2.39-3.64) p&lt;0.0001</td>
<td>1.66 (1.30-2.12) p&lt;0.0001</td>
</tr>
<tr>
<td>Partner says who spend time with</td>
<td>2.23 (1.55-3.22) p&lt;0.0001</td>
<td>2.01 (1.37-2.96) p&lt;0.0001</td>
<td>1.97 (1.35-2.87) p&lt;0.0001</td>
<td>1.73 (1.14-2.61) p=0.010</td>
</tr>
<tr>
<td>Partner. does what they want</td>
<td>1.81 (1.46-2.26) p&lt;0.0001</td>
<td>1.95 (1.55-2.45) p&lt;0.0001</td>
<td>1.82 (1.46-2.26) p&lt;0.0001</td>
<td>1.14 (0.88-1.48) p=0.324</td>
</tr>
<tr>
<td>Current or most recent partner non-monogamous</td>
<td>2.54 (1.87-3.45) p&lt;0.0001</td>
<td>3.26 (2.33-4.55) p&lt;0.0001</td>
<td>3.34 (2.38-4.69) p&lt;0.0001</td>
<td>1.92 (1.37-2.69) p&lt;0.0001</td>
</tr>
<tr>
<td>Ever had partner who insulted or talked down to you often</td>
<td>1.43 (1.17-1.75) p=0.001</td>
<td>1.48 (1.20-1.82) p&lt;0.0001</td>
<td>1.46 (1.20-1.78) p&lt;0.0001</td>
<td>1.26 (0.99-1.60) p=0.058</td>
</tr>
<tr>
<td>Ever had partner who shouted or swore at you often</td>
<td>1.41 (1.15-1.73) p=0.001</td>
<td>1.57 (1.27-1.94) p&lt;0.0001</td>
<td>1.55 (1.26-1.89) p&lt;0.0001</td>
<td>1.23 (0.97-1.58) p=0.091</td>
</tr>
<tr>
<td>Exposure</td>
<td>Multiple male partners in last year (2+P) OR (95% CI) p value</td>
<td>Risk through partner (RTP) OR (95% CI) p value</td>
<td>Combined risk (2+P and/or RTP) OR (95% CI) p value</td>
<td>Risk of unintended pregnancy in last 6 months (UIP) OR (95% CI) p value</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ever had partner who threatened you with harm sometimes</td>
<td>1.28 (1.00-1.65) p=0.049</td>
<td>1.54 (1.19-2.00) p=0.001</td>
<td>1.41 (1.11-1.81) p=0.006</td>
<td>1.21 (0.90-1.63) p=0.206</td>
</tr>
<tr>
<td>Ever had partner who physically hurt you sometimes</td>
<td>1.37 (1.07-1.76) p=0.013</td>
<td>1.87 (1.44-2.43) p&lt;0.0001</td>
<td>1.68 (1.31-2.16) p&lt;0.0001</td>
<td>1.49 (1.12-2.00) p=0.006</td>
</tr>
<tr>
<td>Sexual debut &lt;16 years old</td>
<td>1.63 (1.33-2.01) p&lt;0.0001</td>
<td>1.74 (1.41-2.16) p&lt;0.0001</td>
<td>1.73 (1.41-2.13) p&lt;0.0001</td>
<td>1.77 (1.39-2.26) p&lt;0.0001</td>
</tr>
<tr>
<td>Most recent partner 5+ years older</td>
<td>0.80 (0.64-1.02) p=0.070</td>
<td>1.33 (1.06-1.68) p=0.015</td>
<td>1.15 (0.91-1.44) p=0.241</td>
<td>1.11 (0.85-1.45) p=0.441</td>
</tr>
<tr>
<td>Emergency contraception in last 6 months</td>
<td>3.40 (2.51-4.61) p&lt;0.0001</td>
<td>2.04 (1.51-2.75) p&lt;0.000</td>
<td>2.89 (2.07-4.04) p&lt;0.0001</td>
<td>7.08 (5.18-9.68) p&lt;0.0001</td>
</tr>
<tr>
<td>Pregnancy test in last 6 months</td>
<td>1.34 (1.08-1.67) p=0.009</td>
<td>1.55 (1.24-1.93) p&lt;0.000</td>
<td>1.52 (1.22-1.90) p&lt;0.0001</td>
<td>1.89 (1.47-2.42) p&lt;0.0001</td>
</tr>
</tbody>
</table>

\( ^a \) OR: Odds Ratio
\( ^b \) CI: Confidence Interval
Only 45 respondents reported never being in a relationship, so items specific to current / most recent relationship were put forward for possible analysis in the models and use in the CPR. For each exposure the absolute number reported is presented in brackets alongside the proportion of the total responses. The following exposures were statistically-significantly associated with each of the four outcomes and had a prevalence of 20% or above:

1. Age group 16-24 years (n=269, 21.7%)
2. Currently living in rented accommodation (n=859, 69.4%)
3. Having a partner at all times is important to me (n=562, 45.4%)
4. Weekly binge-drinking (n=425, 34.3%)
5. Current cigarette smoking (n=320, 25.8%)
6. Ever used illicit or illegal drugs (n=734, 59.3%)
7. Relationship status single or casual (n=337, 27.2%)
8. Emotionally dissatisfied with most recent relationship (n=405, 32.7%)
9. Sexual debut <16 years of age (n=400, 32.3%)
10. Take a pregnancy test in last 6 months (n=314, 25.4%)

Both of the composite measures (HITS and social support) were excluded from models as they would be difficult to calculate in a CPR. From within each of these composite scales, one item was chosen which was statistically significantly associated (i.e. p≤0.05) with all outcomes, and was the most prevalent – in order to maximise prediction. This selection from among the scale items is justified because of high correlation between the items within each of the scales and because including all composite measure items would have decreased study power.

From the HITS items ‘insult’ (ever been insulted or talked down to often by a partner) was selected because it had the highest prevalence (n=543, 43.9%) and because it showed a similar pattern of association to the other HITS items, with the added benefit of ‘borderline’ statistically-significant association with risk of UIP. From the social support measure ‘chores’ was selected for multivariable entry because it had the highest prevalence (n=498, 40.2%). As it was not associated with risk of UIP it was only included in the models for 2+P, RTP and Combined (2+P and/or RTP). This also applied to ‘Partner does what they want’ (n=332, 26.8%).
‘Self-esteem’ (n=410, 33.1%) and ‘Partner 5+ years older’ (n=292, 23.6%) each showed a statistically-significant association only with RTP but were included in all models except risk of UIP, as EPV analysis permitted their inclusion and they demonstrated high prevalence. ‘Lived with both parents to age 14’ (n=299, 24.2%) was associated only with 2+P and Combined but was similarly entered into all models except risk of UIP for the same reasons.

Current e-cigarette smoking (n=74, 6.0%) was not associated with any outcomes, and had low prevalence in the GP cohort, so was excluded from all models, as was ‘Partner tells me who I can spend time with’ due to the same prevalence (n=74, 6.0%). The following exposures were statistically significantly associated with each outcome but had a prevalence below 20% in the GP cohort so were excluded from the first three models:

1. Non-monogamous recent/current partner (n=108, 8.7%)
2. Ever had partner who physically hurt you sometimes (n=244, 19.7%)
3. Use of emergency contraception in last 6 months (n=101, 8.2%)

6.4 Using multivariable modelling to direct which exposures should be included in the clinical prediction rule for each outcome

The process for multivariable modelling was carried out as described in Chapter Five. The following sub-section describes the variables that were reverse-coded for modelling purposes. Each subsequent sub-section then reports on the multivariable model developed for each outcome, the retained exposures of which constituted the CPR items for that outcome. Each sub-section describes: the number of outcome events, the results of an Events Per Variable analysis to inform how many ‘candidate predictors’ could be entered, the nature of the entered exposures, a table presenting the retained exposures, and the following values which accompanied that model: Variance Inflation Factor (VIF), C-statistic, BIC score, Pseudo-R squared value and H-L test result.
6.4.1 Reverse-scoring exposures to avoid negative coefficients

A number of exposures demonstrated an association in the opposite direction to that which was expected, thus generating negative co-efficients. In bivariate analysis, the statement ‘I have high self-esteem’ was associated positively with 2+P (but negatively with the other outcomes). Treatment for depression in the last year was negatively associated (i.e. no treatment) with risk of UIP in bivariate and multivariable analysis, and negatively associated with the Combined outcome on multivariable analysis only. Disagreement with the statement that ‘having a partner at all times is important to me’ was associated with all outcomes on bivariate analysis and with 2+P and RTP on multivariable analysis. Finally, ‘ptn5+_older’ was negatively associated with 2+P only on both bivariate and multivariable analysis. The multivariable models in the following sub-sections show the variables after reverse-scoring was applied to generate positive coefficients. This was carried out to enable an additive CPR scoring system to be developed for each outcome, as described below in section 6.7.

6.4.2 Deriving a CPR for multiple male sexual partners in the last year

266 GP respondents reported multiple male sexual partners in the last year (‘2+P’). Once filters were applied to remove missing cases (i.e. to enable available case analysis), 200 events remained. This meant that n=17 exposures could be entered into the model, with adequate power to derive a model of 11-12 CPR items. The exposures entered into the model were:

1. Age group
2. Living in rented accommodation
3. Lived with both parents to age 14
4. Little or no help with chores
5. Treatment for depression in last year
6. Self-esteem
7. Having a partner at all times is important to me
8. Weekly binge drinking
9. Smoking cigarettes at all nowadays
10. Ever used illegal or illicit drugs incl. legal highs
11. Not in a steady relationship
12. Emotionally dissatisfied with most recent relationship
13. Most recent partner does whatever they want
14. Ever been insulted or talked down to often by a partner
15. Sexual debut <16 years of age
16. Most recent partner 5+ years older
17. Pregnancy testing in last 6 months

Three variables which demonstrated an unexpected direction of association in bivariate analyses, also did so in the multivariable model ‘selfesteem’ (p<0.0001), ‘partner_importance’ (p=0.060) and ‘ptn5+_older’ (p=0.094). The first two were therefore reverse-coded and used in the model presented below. However, existing evidence about older partners contradicts the observed direction of association (Mercer et al., 2009a), so that it may represent overfitting/random chance (Pavlou et al., 2015). Therefore the decision was taken to re-run the model without this last variable to see how much it contributed.

When the variable ‘ptn5+_older’ was included, the model had the following characteristics: c-statistic= 0.8410 BIC=743.5929 Pseudo-R² = 0.2796 and H-L=10.75 p= 0.2162. Without the ‘ptn5+_older’ variable the model had the following characteristics: c-statistic= 0.8336 BIC=761.9361 Pseudo-R² = 0.2686 H-L=5.15 p= 0.7413. This C-statistic indicates a good level of discrimination (Alba et al., 2017) and suggests that very little is lost from the discriminatory and predictive power of the model by removing this item which would complicate the scoring system greatly. The decision was taken therefore, to remove this item from this model. This produced the final model in Table 17.

**Results and interpretation of statistical tests**

The number of exposures retained in the model was within the number permitted by the events-per-variable analysis. The Variance Inflation Factor = 1.21 indicating very low multi-collinearity. Therefore no candidate predictors for this model needed to be removed to avoid inflated standard errors. The statistical characteristics of the model without the variable ‘ptn5+_older’ (as reported above) indicate good discrimination, a parsimonious model and good calibration. Although statistical significance is not the primary concern of modelling for estimation purposes (as in this case), the majority of exposures demonstrated an independent statistically-significant association with the outcome modelled.
Table 17: Questions retained in the model predicting multiple male sexual partners in the last year

<table>
<thead>
<tr>
<th>Psychosocial questions (Yes versus No)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>z-statistic</th>
<th>p value</th>
<th>95% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 16-24</td>
<td>0.6776321</td>
<td>0.2315433</td>
<td>2.93</td>
<td>0.003</td>
<td>0.2238156, 1.131449</td>
</tr>
<tr>
<td>Living in rented accommodation</td>
<td>0.5210849</td>
<td>0.2466816</td>
<td>2.11</td>
<td>0.035</td>
<td>0.037598, 1.004572</td>
</tr>
<tr>
<td>Ever had a partner who insulted or talked down to you often</td>
<td>0.3387543</td>
<td>0.2021273</td>
<td>1.68</td>
<td>0.094</td>
<td>-0.0574079, 0.7349166</td>
</tr>
<tr>
<td>Little or no help with chores</td>
<td>0.2674206</td>
<td>0.2072246</td>
<td>1.29</td>
<td>0.197</td>
<td>-0.1387322, 0.6735734</td>
</tr>
<tr>
<td>Tested for pregnancy in last 6 months</td>
<td>0.3710057</td>
<td>0.2159356</td>
<td>1.72</td>
<td>0.086</td>
<td>-0.0522202, 0.7942317</td>
</tr>
<tr>
<td>Reports good or high self-esteem</td>
<td>0.8960096</td>
<td>0.2266225</td>
<td>3.95</td>
<td>&lt;0.001</td>
<td>0.4518375, 1.340182</td>
</tr>
<tr>
<td>Having a partner at all times is not important to me</td>
<td>0.4221926</td>
<td>0.2105623</td>
<td>2.01</td>
<td>0.045</td>
<td>0.0094981, 0.8348871</td>
</tr>
<tr>
<td>Binge-drinks weekly or more often</td>
<td>0.7002855</td>
<td>0.2024136</td>
<td>3.46</td>
<td>0.001</td>
<td>0.3035622, 1.097009</td>
</tr>
<tr>
<td>Smokes cigarettes at all</td>
<td>0.4481389</td>
<td>0.2159513</td>
<td>2.08</td>
<td>0.038</td>
<td>0.0248822, 0.8713957</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs including legal highs</td>
<td>0.3805569</td>
<td>0.2284544</td>
<td>1.67</td>
<td>0.096</td>
<td>-0.0672055, 0.8283193</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>2.063215</td>
<td>0.2206258</td>
<td>9.35</td>
<td>&lt;0.001</td>
<td>1.630797, 2.495634</td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.387752</td>
<td>0.3963461</td>
<td>-11.07</td>
<td>&lt;0.001</td>
<td>-5.164577, -3.610928</td>
</tr>
</tbody>
</table>
6.4.3 Deriving a CPR for risk through partner

316 GP participants reported risk through partner (RTP). Once filters were applied to remove missing cases (i.e. to enable available case analysis) n= 247 events remained. This meant that n=17 exposures could be entered into the model, with adequate power to derive a model of 14-15 CPR items.

The exposures entered into the model for 2+P (see above) were therefore entered into the model for RTP. The model was then re-run with a reverse-coded ‘partner_importance’ variable in order to convert the corresponding negative coefficient to a positive one. This final model is presented in Table 18.

Results and interpretation of statistical tests

The number of exposures retained in the model was within the number permitted by the events-per-variable analysis. A Variance Inflation Factor=1.21 was again reported (as the same exposures were entered) indicating very low multi-collinearity, so that no candidate predictors needed to be removed to improve the accuracy of the coefficients. This model generated a c-statistic =0.7503, BIC=931.1443, Pseudo-R²= 0.1467 and H-L= 6.99 p=0.5374. This indicated a moderate ‘potentially useful’ degree of discrimination (Alba et al., 2017) (p.1379), and good calibration, although less parsimony and goodness-of-fit (measured by the BIC score) than that offered by the 2+P model – likely because more parameters were entered into the model. Although statistical significance is not the primary concern of modelling for estimation purposes (as in this case), all but two of the exposures demonstrated an independent statistically-significant association with the outcome modelled.
### Table 18: Questions retained in the model predicting risk through partner (most recent partner not used condoms with previous partners in last year)

<table>
<thead>
<tr>
<th>Psychosocial questions (Yes versus No)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>z-statistic</th>
<th>p value</th>
<th>95% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 16-24</td>
<td>0.3638505</td>
<td>0.2081077</td>
<td>1.75</td>
<td>0.080</td>
<td>(-0.044033, 0.771734)</td>
</tr>
<tr>
<td>Living in rented accommodation</td>
<td>0.4252342</td>
<td>0.2070039</td>
<td>2.05</td>
<td>0.040</td>
<td>(0.019514, 0.8309543)</td>
</tr>
<tr>
<td>Tested for pregnancy in last 6 months</td>
<td>0.4697451</td>
<td>0.1824967</td>
<td>2.57</td>
<td>0.010</td>
<td>(0.112058, 0.8274321)</td>
</tr>
<tr>
<td>Having a partner at all times is not important to me</td>
<td>0.2388638</td>
<td>0.1791753</td>
<td>1.33</td>
<td>0.182</td>
<td>(-0.1123134, 0.5900409)</td>
</tr>
<tr>
<td>Binge-drinks weekly or more often</td>
<td>0.4444338</td>
<td>0.1770498</td>
<td>2.51</td>
<td>0.012</td>
<td>(0.0974226, 0.791445)</td>
</tr>
<tr>
<td>Smokes cigarettes at all</td>
<td>0.4998505</td>
<td>0.1951335</td>
<td>2.56</td>
<td>0.010</td>
<td>(0.1173959, 0.8823052)</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs including legal highs</td>
<td>0.3661891</td>
<td>0.1936744</td>
<td>1.89</td>
<td>0.059</td>
<td>(-0.0134057, 0.7457838)</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>0.9705166</td>
<td>0.2201015</td>
<td>4.41</td>
<td>&lt;0.001</td>
<td>(0.5391256, 1.401908)</td>
</tr>
<tr>
<td>Sexual debut (including unwanted) &lt;16 years of age</td>
<td>0.4562278</td>
<td>0.1788799</td>
<td>2.55</td>
<td>0.011</td>
<td>(0.1056296, 0.8068261)</td>
</tr>
<tr>
<td>Most recent partner 5+ years older</td>
<td>0.4061387</td>
<td>0.1934984</td>
<td>2.10</td>
<td>0.036</td>
<td>(0.0268888, 0.7853887)</td>
</tr>
<tr>
<td>Emotionally dissatisfied with current/ most recent relationship</td>
<td>0.4844417</td>
<td>0.1999226</td>
<td>2.42</td>
<td>0.015</td>
<td>(0.0926007, 0.8762828)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.807659</td>
<td>0.2649169</td>
<td>-10.60</td>
<td>&lt;0.001</td>
<td>(-3.326886, -2.288431)</td>
</tr>
</tbody>
</table>
6.4.4 Deriving a CPR for Combined risk

There was a strong clinical justification for generating a model which combined multiple male partners in the last year (2+P) with Risk through partner (RTP) using an and/or function; either or both histories would warrant sexual health advice regarding STI prevention and detection). Therefore a combined outcome was generated and modelled using the same procedures outlined above. 417 GP participants reported combined risk (referred to hereafter as Combined). Once filters were applied to remove missing cases (i.e. to enable available case analysis) n=318 events remained. This meant that n= 23 exposures could be entered into the model, with adequate power to derive a model of 14 CPR items.

Twenty-three candidate predictors were entered. These comprised those entered into the previous two models, plus the other items from the cumulative measures (HITS and Social Support). The only variables not included were variables with extremely low prevalence: ‘spend_time’, ‘emergency_con_6m’ contraception use in last 6 months’ and ‘non_monog’. After reversing the coding structures for ‘depr_treatment’ and ‘partner_ importance’ a finalised model was produced (see Table 19). Also of note, age group fell out of this model originally but was forced to remain as it was retained in both the models from which the combined model was derived, and because it is an important factor in so much of the literature.

Results and interpretation of statistical tests

The number of exposures retained in the model was within the number permitted by the events-per-variable analysis. The Variance Inflation Factor = 1.89, therefore no candidate predictors for this model needed to be removed to improve the accuracy of coefficients. This model generated a c-statistic=0.7917, BIC=912.4038, Pseudo-$R^2=0.2130$ and H-L= 3.85 p=0.8701. This indicates a moderate to good level of discrimination (Alba et al., 2017). This was only slightly lower than 2+P alone, although the BIC value (and therefore potential model instability and brevity) was higher than the 2+P model’s BIC value. All but two of the exposures demonstrated an independent statistically-significant association with the outcome.
Table 19: Questions retained in the model predicting 2+ male sexual partners in the last year
AND/OR most recent partner has not used condoms with previous partners in last year

<table>
<thead>
<tr>
<th>Psychosocial questions (Yes versus No)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>z-statistic</th>
<th>p value</th>
<th>95% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 16-24</td>
<td>0.2461989</td>
<td>0.2168578</td>
<td>1.14</td>
<td>0.256</td>
<td>-0.1788347, 0.6712325</td>
</tr>
<tr>
<td>Living in rented accommodation</td>
<td>0.4304506</td>
<td>0.1993191</td>
<td>2.16</td>
<td>0.031</td>
<td>0.0397924, 0.8211088</td>
</tr>
<tr>
<td>Sexual debut (including unwanted) &lt;16 years of age</td>
<td>0.5280821</td>
<td>0.1838829</td>
<td>2.87</td>
<td>0.004</td>
<td>0.1676783, 0.8884859</td>
</tr>
<tr>
<td>Tested for pregnancy in last 6 months</td>
<td>0.4817631</td>
<td>0.1850619</td>
<td>2.60</td>
<td>0.009</td>
<td>0.1190485, 0.8444777</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs incl. legal highs</td>
<td>0.4800348</td>
<td>0.1885373</td>
<td>2.55</td>
<td>0.011</td>
<td>0.1105084, 0.8495612</td>
</tr>
<tr>
<td>Having a partner at all times is not important to me</td>
<td>0.5086118</td>
<td>0.1758191</td>
<td>2.89</td>
<td>0.004</td>
<td>0.1640127, 0.8532109</td>
</tr>
<tr>
<td>Little or no help to prepare meals</td>
<td>0.4198602</td>
<td>0.1809076</td>
<td>2.32</td>
<td>0.020</td>
<td>0.0652878, 0.7744326</td>
</tr>
<tr>
<td>Smokes cigarettes at all</td>
<td>0.6197687</td>
<td>0.20444</td>
<td>3.03</td>
<td>0.002</td>
<td>0.2190736, 1.020464</td>
</tr>
<tr>
<td>Has not had treatment for depression in the last year</td>
<td>0.2973254</td>
<td>0.2028565</td>
<td>1.47</td>
<td>0.143</td>
<td>-0.100266, 0.6949168</td>
</tr>
<tr>
<td>Most recent partner 5+ years older</td>
<td>0.4041083</td>
<td>0.1968418</td>
<td>2.05</td>
<td>0.040</td>
<td>0.0183054, 0.7899112</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>2.009599</td>
<td>0.2277882</td>
<td>8.82</td>
<td>&lt;0.001</td>
<td>1.563142, 2.456056</td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.772742</td>
<td>0.3250954</td>
<td>-8.53</td>
<td>&lt;0.001</td>
<td>-3.409918, -2.135567</td>
</tr>
</tbody>
</table>
6.4.5 Deriving a CPR for potential risk of unintended pregnancy

179 GP participants reported potential risk of UIP in the last six months. Once filters were applied to remove missing cases (i.e. to enable available case analysis) n=153 events remained. This meant that if n=17 exposures were entered into the model, there would be adequate power to derive a model of 9 CPR items. The candidate predictors that were chosen for entry differed from those entered for the other models, such that:

- ‘chores’, ‘ptn_does’, ‘ptn5+_older’, ‘both_parents’ and ‘self_esteem’ were removed
- ‘emergency_con_6m’, ‘non-monog’, ‘threat’ and ‘physical’ were entered instead, because - despite low prevalences - they were each associated with risk of UIP on bivariate analysis

This approach led all the HITS items to fall out of the model due to collinearity, so that a final revision was made in which ‘threat’ and ‘physical’ were also removed to see if ‘insult’ would then be retained. ‘Insult’ still fell out of the final model but ‘non-monog’ was retained and the C-statistic for the overall model was improved by 0.06 to 0.6961. The events-per-variable was checked once for this new set of variables, to account for cases removed due to missing data. A total of n=75 events were entered into the model so that n=14 exposures could be entered in order to derive a CPR of five items.

The final list entered comprised:

1. Age group
2. Living in rented housing
3. Treatment for depression in last year
4. Having a partner at all times is important to me
5. Weekly binge-drinking
6. Smoking cigarettes at all nowadays
7. Ever used illicit or illegal drugs
8. Not in a steady relationship
9. Emotionally dissatisfied with current or most recent relationship
10. Most recent partner non-monogamous
11. Ever had a partner who insulted or talked down to you often
12. Sexual debut before 16 years of age
13. Emergency contraception use in last 6 months
14. Pregnancy test in last 6 months

Results and interpretation of statistical tests
The finalised model (presented in Table 20) contained only five predictors, within the allowable number for the entered exposures and events. No exposures needed to be removed for reasons of multi-collinearity. The model generated a c-statistic = 0.6961 BIC = 401.589 Pseudo-R² = 0.1154 and H-L = 1.0 p = 0.9626. This indicates moderate discrimination, on the basis that 0.5 denotes random chance and 1.0 perfect discrimination (Alba et al., 2017), and the model was well-calibrated. The BIC score also indicated better goodness-of-fit than the other models, and also greater model simplicity (which is to be expected as fewer parameters were entered for this outcome). Although statistical significance is not the primary concern of modelling for estimation purposes (as in this case), it is noteworthy that only one of the exposures demonstrated an independent statistically significant association (p ≤ 0.05) with the outcome modelled.
Table 20: Questions retained in the model predicting Risk of Unintended Pregnancy in the Last Six Months

<table>
<thead>
<tr>
<th>Psychosocial questions (Yes v No)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>z-statistic</th>
<th>p value</th>
<th>95% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexual debut (including unwanted) &lt;16 years of age</td>
<td>.3823361</td>
<td>.2959062</td>
<td>1.29</td>
<td>0.196</td>
<td>-.1976294, .9623015</td>
</tr>
<tr>
<td>Emergency contraception use in last 6 months</td>
<td>2.30752</td>
<td>.3625578</td>
<td>6.36</td>
<td>&lt;0.001</td>
<td>1.59692, 3.01812</td>
</tr>
<tr>
<td>Emotionally dissatisfied with current or most recent relationship</td>
<td>.4177201</td>
<td>.2806779</td>
<td>1.49</td>
<td>0.137</td>
<td>-.1323985, .9678387</td>
</tr>
<tr>
<td>Has not had treatment for depression in the last year</td>
<td>.5776835</td>
<td>.398547</td>
<td>1.45</td>
<td>0.147</td>
<td>-.2034543, 1.358821</td>
</tr>
<tr>
<td>Partner had other partners during relationship</td>
<td>.724451</td>
<td>.487669</td>
<td>1.49</td>
<td>0.137</td>
<td>-.2313627, 1.680265</td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.779594</td>
<td>.4199398</td>
<td>-6.62</td>
<td>&lt;0.001</td>
<td>-3.60266, -1.956527</td>
</tr>
</tbody>
</table>
6.5 The case for a unified or integrated CPR: do the same items indicate need for contraception, for STI testing and for sexual health advice?

By design, use of the CPR would lead to four possible intervention recommendations:

1. No intervention
2. Contraception advice and supply
3. Sexual health advice and STI testing
4. Sexual health advice and STI testing and contraception

The models presented above were reviewed to see if the predictors differed sufficiently between each to enable differential sign-posting of patients to the interventions above. To aid this process a summary of which predictors were retained in each model was produced (presented below in Table 21).
Table 21: Summary of predictors retained in each model

<table>
<thead>
<tr>
<th>Predictor</th>
<th>2+P</th>
<th>RTP</th>
<th>Combined</th>
<th>Risk of UIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td>✓*</td>
<td>✓</td>
<td>✓*</td>
<td>X**</td>
</tr>
<tr>
<td>Living in rented housing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Lived with both parents to age 14</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Not entered</td>
</tr>
<tr>
<td>Little or no help with chores</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>Not entered</td>
</tr>
<tr>
<td>Little or no help to prepare meals</td>
<td>Not entered</td>
<td>Not entered</td>
<td>✓</td>
<td>Not entered</td>
</tr>
<tr>
<td>Not had treatment for depression in last year</td>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>Not entered</td>
</tr>
<tr>
<td>Having a partner at all times is important to me</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Binge-drinks weekly or more often</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Smoking cigarettes at all nowadays</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs including legal highs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Emotionally dissatisfied with most recent relationship</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Partner does whatever they want</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Not entered</td>
</tr>
<tr>
<td>Most recent partner non-monogamous</td>
<td>Not entered</td>
<td>Not entered</td>
<td>Not entered</td>
<td>✓</td>
</tr>
<tr>
<td>Ever insulted or talked down to often by a partner</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sexual debut &lt;16 years of age</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Most recent partner 5+ years older</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Emergency contraception use in last 6 months</td>
<td>Not entered</td>
<td>Not entered</td>
<td>Not entered</td>
<td>✓</td>
</tr>
<tr>
<td>Tested for pregnancy in last 6 months</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
</tbody>
</table>

* ✓ indicates variable retained in the multivariable model
* X indicates variable not retained in the multivariable model

The models for 2+P, RTP and Combined each comprised 11 predictors, with many of those predictors appearing in more than one model (most notably living in rented housing, being aged 16-24 years, currently smoking, not being in a steady relationship and pregnancy testing in the last six months). Comparing these four models, and the bivariate analyses that preceded their development, risk of UIP was predicted less successfully than 2+P, RTP and Combined, and by a different profile.
of psychosocial exposures (excepting early_debut). This indicates that these items could be used to differentially sign-post female patients for contraception advice and supply. In addition, of the 14.5% (n=179) who reported risk of UIP in the GP cohort, n=73 (40.8%) reported 2+P, and n=109 (60.9%) reported Combined. This suggests that only a small majority of women will have need of sexual health advice, STI testing and contraception.

The Combined model was derived for pragmatic reasons – i.e. reflecting that report of 2+P or RTP would warrant the same intervention (general sexual health advice and possible STI testing). Comparing the composition of these latter two ‘source’ models, seven of the 2+P predictors also predicted RTP. Of the 39.8% (n=603) who reported RTP, 61.9% reported 2+P. The RTP model carried less discriminatory power than the 2+P model. Therefore, it is unsurprising that the Combined model also carried less discriminatory power than the 2+P model and retained a mixture of 2+P and RTP predictors. Most notably, early sexual debut and most recent partner 5+ years older were retained in the models for RTP and Combined but not for 2+P. In summary the 2+P model had the greatest discriminatory power, while the Combined model offered the best ‘reach’ in terms of identifying women experiencing RTP or through multiple partnerships.

6.6 Additional analyses - developing separate models on the basis of clinic type or age

The original analysis plan was adhered to, in which age group was treated as a candidate predictor for inclusion within the CPR. It was not necessary to stratify the models (and therefore differential CPR questions based on reported age group) because age group did not cause other exposures to drop out of models. In addition, the sub-sample of young women in the GP cohort (n=269) would have provided insufficient power for separate multivariable modelling of this cohort.

It was also un-necessary to add the CASH data to the GP data before multivariable modelling as the frequency of the primary outcome (n=266) was sufficiently high in the GP cohort alone. Higher prevalence of binge-drinking, 2+P and smoking in the CASH population compared to the GP population (Edelman N. et al., 2017) also
indicated that these populations were heterogeneous and therefore not suitable for pooling.

6.6.1 Using sensitivity analysis to evaluate the inclusion of CASH data

Even though it was un-necessary to combine GP and CASH data in order to conduct multivariable modelling, sensitivity analyses were run in accordance with the statistical analysis plan. These analyses compared GP models with combined GP and CASH models, the results of which are presented below in Table 22. Each demonstrated considerably lower BIC scores for ‘GP only’ data compared with GP combined with CASH, indicating greater parsimony (and therefore likely model stability) from use of GP-only data, while losing only a small amount of discriminatory power (based on the c-statistic values).

<table>
<thead>
<tr>
<th>Table 22: Sensitivity analyses of General Practice versus Combined sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2+P</td>
</tr>
<tr>
<td>RTP</td>
</tr>
<tr>
<td>Combined</td>
</tr>
<tr>
<td>Risk of UIP</td>
</tr>
</tbody>
</table>

6.7 Generating a cumulative CPR score for each outcome

The multivariable analyses presented above determined which combination of psychosocial exposures best distinguished women experiencing each particular sexual risk. These retained exposures then constituted the CPR items for that outcome. However, in order to apply a CPR in practice, a scoring system must be applied to those items and an optimum cut-off value chosen (in order to assess the sensitivity and specificity of the CPR using that cut-off value). This section describes the development, application and assessment of a CPR scoring system and the choice of cut-off value for the 2+P, Combined and UIP models presented in the preceding section. A scoring system was not devised for RTP on the basis that both RTP and 2+P would warrant the same clinical intervention – sexual health advice and STI testing (represented by Combined). A scoring system was also devised for
2+P because it was the primary outcome for this study and also on the basis that its discriminatory power was greater and therefore its CPR score performance was worthy of independent assessment. A score was also devised for UIP despite its poorer performance, because it was the only model designed to identify need for contraception.

6.7.1 Determining scores for individual CPR items

A scoring system was devised, in which co-efficient values were aggregated and an integer score applied (Sullivan et al., 2004) to each individual CPR item such that:

- Coefficients with value <0.5 were allocated a score of 1
- Coefficients with value ≥ 0.5 but <1 were allocated a score of 2
- Coefficients with value ≥ 1 but <1.5 were allocated a score of 3
- Coefficients with value ≥ 1.5 <2 were allocated a score of 4
- Coefficients with value ≥ 2 were allocated a score of 5

The particular values were chosen after viewing the models, to maximise consistency of scoring across models (as different co-efficients were obtained across models for the same predictor). Nonetheless, when this scoring system was applied to the 2+P and Combined models, discordant scores were obtained for the following exposures:

- ‘Age group’ scored 2 in the 2+P model and 1 in Combined
- ‘Rented housing’ scored 2 in the 2+P model and 1 in Combined
- ‘Partner_importance’ scored 1 in the 2+P model and 2 in Combined
- ‘Smoking at all nowadays’ scored 1 in the 2+P model and 2 in Combined

However, no attempt was made to establish a consistent score for these exposures, because the intention was to select - through GP consultation - either the 2+P model or the Combined model as the basis for the CPR.

There was also discordance in assigned scores for sex debut and treatment for depression such that:

- ‘early_debut’ scored 1 in the risk of UIP model and 2 in Combined and RTP
- ‘depr_treatment’ scored 2 in the risk of UIP model and 1 in Combined and RTP
No attempt was made to establish a consistent score for these exposures either as the risk of UIP model and the CPR scoring system devised for it (see below), performed too poorly to be worthy of CPR inclusion.

### 6.7.2 Selecting a cut-off value for each cumulative CPR score that maximised sensitivity and specificity

**Multiple partnerships in the last year**

The model for multiple partnerships in the last year (2+P) retained 11 items (see Table 17). A score was attributed to each item based on its coefficient value, as described above. This generated a cumulative score range of 0-18 points. A cross-tabulation of cumulative CPR score and self-report of 2+P is presented below in Table 23. This cross-tabulation indicated that a cut-off score of nine or more would optimise sensitivity (72.8 %) and specificity (76.7%), giving a sensitivity=72.8 % (169/232) and specificity= 76.7% (530/691). This cut-off yielded n=161 false positives and n=63 false negatives.

<table>
<thead>
<tr>
<th>CPR score</th>
<th>Self-report of &lt;2 partners</th>
<th>Specificity (No. reporting score or less/ total)</th>
<th>Self-report of 2+ partners</th>
<th>Sensitivity (No. reporting score or higher / total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤5</td>
<td>267</td>
<td>267/691 =38.6</td>
<td>16</td>
<td>232/232 =100</td>
</tr>
<tr>
<td>6</td>
<td>107</td>
<td>374/691 =54.1</td>
<td>13</td>
<td>216/232 =93.1</td>
</tr>
<tr>
<td>7</td>
<td>84</td>
<td>458/691 =66.3</td>
<td>15</td>
<td>203/232 =87.5</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
<td>530/691 =76.7</td>
<td>19</td>
<td>188/232 =81.0</td>
</tr>
<tr>
<td>9</td>
<td>48</td>
<td>578/691 =83.6</td>
<td>18</td>
<td>169/232 =72.8</td>
</tr>
<tr>
<td>10</td>
<td>40</td>
<td>618/691 =89.4</td>
<td>24</td>
<td>151/232 =65.1</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
<td>652/691 =94.4</td>
<td>29</td>
<td>127/232 =54.7</td>
</tr>
<tr>
<td>12+</td>
<td>39</td>
<td>691/691 =100.0</td>
<td>98</td>
<td>98/232 =42.2</td>
</tr>
<tr>
<td>Total</td>
<td>691</td>
<td></td>
<td>232</td>
<td></td>
</tr>
</tbody>
</table>

*Cases were excluded if they contained missing data for the outcome or any of the exposures from which the score was derived*
Combined

The model for Combined also retained 11 items as shown above, however this generated a cumulative score range of 0-17 points. A cross-tabulation of cumulative CPR score and self-report of Combined risk is presented below in Table 24. This cross-tabulation indicated that a cut-off score of six or more would optimise sensitivity (79.2%) and specificity 62.9% (315/501) and yielded n=186 false positives and n=77 false negatives for this dataset.

![Table 24: CPR score by self-report of combined risk*](image)

<table>
<thead>
<tr>
<th>CPR score</th>
<th>Combined risk not reported</th>
<th>Specificity (No. reporting score or less/ total)</th>
<th>Combined risk reported</th>
<th>Sensitivity (No. reporting score or higher / total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤2</td>
<td>75</td>
<td>75/501 =15.0</td>
<td>14</td>
<td>371/371 =100</td>
</tr>
<tr>
<td>3</td>
<td>66</td>
<td>141/501 =28.1</td>
<td>12</td>
<td>357/371 =96.2</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>221/501 =44.1</td>
<td>19</td>
<td>345/371 =93.0</td>
</tr>
<tr>
<td>5</td>
<td>94</td>
<td>315/501 =62.9</td>
<td>32</td>
<td>326/371 =87.9</td>
</tr>
<tr>
<td>6</td>
<td>67</td>
<td>382/501 =76.2</td>
<td>33</td>
<td>294/371 =79.2</td>
</tr>
<tr>
<td>7</td>
<td>41</td>
<td>423/501 =84.4</td>
<td>25</td>
<td>261/371 =70.4</td>
</tr>
<tr>
<td>8</td>
<td>26</td>
<td>449/501 =89.6</td>
<td>40</td>
<td>236/371 =63.6</td>
</tr>
<tr>
<td>9</td>
<td>25</td>
<td>474/501 =94.6</td>
<td>49</td>
<td>196/371 =52.8</td>
</tr>
<tr>
<td>10+</td>
<td>27</td>
<td>501/501 =100.0</td>
<td>147</td>
<td>147/371 =39.6</td>
</tr>
<tr>
<td>Total</td>
<td>501</td>
<td></td>
<td>371</td>
<td></td>
</tr>
</tbody>
</table>

*Cases were excluded if they contained missing data for the outcome or any of the exposures from which the score was derived

Risk of Unintended Pregnancy in the last 6 months

The model for risk of UIP retained five items as shown in Table 20. This generated a cumulative score range of 0-11 points. A cross-tabulation of cumulative CPR score and self-report of risk of UIP is presented below in Table 25, (once more excluding cases with missing data for the outcome or any of the exposures from which the score was derived). This cross-tabulation indicated that a cut-off score of three or more would optimise sensitivity (69.0%) and specificity (56.8%), and yielded n=315 false positives and n=52 false negatives for this dataset.
<table>
<thead>
<tr>
<th>CPR score</th>
<th>Risk of UIP not reported</th>
<th>Specificity (No. reporting score or less/ total)</th>
<th>Risk of UIP reported</th>
<th>Sensitivity (No. reporting score or higher / total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>59</td>
<td>59/729 =8.0</td>
<td>7</td>
<td>168/168 =100.0</td>
</tr>
<tr>
<td>1</td>
<td>77</td>
<td>136/729 =18.7</td>
<td>10</td>
<td>161/168 =95.8</td>
</tr>
<tr>
<td>2</td>
<td>278</td>
<td>414/729 =56.8</td>
<td>35</td>
<td>151/168 =89.9</td>
</tr>
<tr>
<td>3</td>
<td>199</td>
<td>613/729 =84.1</td>
<td>38</td>
<td>116/168 =69.0</td>
</tr>
<tr>
<td>4</td>
<td>58</td>
<td>671/729 =92.0</td>
<td>20</td>
<td>78/168 =46.4</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>687/729 =94.2</td>
<td>10</td>
<td>58/168 =34.5</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>700/729 =96.0</td>
<td>11</td>
<td>48/168 =28.6</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>713/729 =97.8</td>
<td>11</td>
<td>37/168 =22.0</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>726/729 =99.6</td>
<td>15</td>
<td>26/168 =15.5</td>
</tr>
<tr>
<td>9+</td>
<td>3</td>
<td>729/729 =100.0</td>
<td>11</td>
<td>11/168 =6.5</td>
</tr>
<tr>
<td>Total</td>
<td>729</td>
<td></td>
<td>168</td>
<td></td>
</tr>
</tbody>
</table>

*Cases were excluded if they contained missing data for the outcome or any of the exposures from which the score was derived.

### 6.7.3 GP consultation on model preferences and score cut-off values

Both the 2+P model and the Combined model were considered worthy of translation into a final CPR (to which the risk of UIP items might then be added). Therefore, the decision was taken to review the performance of each model in consultations with General Practitioners, after the CPR scoring system had been generated for each model (as described in the previous sections). During that consultation, a range of cut-off scores were presented with the accompanying sensitivity and specificity that each would offer. It was agreed that the selected cut-off scores (presented in the preceding sub-section) offered the best balance of sensitivity and specificity for each model.

The relative benefits of the 2+P versus the Combined CPR were also discussed. This discussion centred on the advantage of the 2+P model in assessing weekly binge-drinking and current smoking, because these are adjunct health issues worthy of intervention in their own right. In addition, it was noted that the underlying 2+P model had better discrimination than the Combined model, even though it had lower sensitivity. In contrast, the Combined CPR was felt to be advantageous because it
captured a broader range of STI risks (RTP as well as 2+P) and because it offered better sensitivity than the 2+P CPR.

Finally, the group discussed and concurred with the candidate’s suggestion that specificity for each of the CPR scoring systems would likely be better in practice, as one would anticipate sexually inactive women to decline CPR completion. Despite agreement with this point, the group decided that none of the CPRs (2+P, Combined or UIP) performed sufficiently well to be implementable in routine practice with all attending women of reproductive age. However, targeted use of the CPR was considered worthy of further research, particularly for younger women or those attending for contraception.

6.8 Discussion

Each of the c-statistic values obtained was classified as potentially or clearly useful (Alba et al., 2017). However, the models did not discriminate sexual risk sufficiently well to support their routine use in a CPR in the manner intended (i.e. distribution / availability to all women aged 16-44 years attending GPs).

The conduction of this survey to produce a bespoke dataset from which to derive the CPR is itself a strength of the overall research aim, as much CPR derivation uses available data sets rather than collecting data specifically for that purpose (as discussed in Chapters One and Five). Indeed, generic publications on CPR derivation do not discuss how candidate variables are identified (Adams and Leveson, 2012); while most sexual health CPRs reviewed for this thesis referred only to the use of ‘known’ or ‘available’ variables.

The empirical selection of candidate predictors was also an unusually robust aspect of the survey design, based as it was on the systematic review and Natsal-3 studies. As well as constituting a robust means of identifying exposures for questionnaire inclusion, the systematic review and Natsal-3 analysis also influenced aspects of the survey design and analyses as set out in Chapter Five. Selection of candidate predictors was also guided by early PPI work indicating the importance of acceptable items that were brief and easy-to-score and thus suitable for self-completion. The
questionnaire and survey design were then further informed by PPI, perhaps contributing to the high response rates and levels of data completeness.

6.8.1 Comparing findings with previous studies

There is a large evidence base indicating associations between alcohol and sexual risk, including intentional (decision-making) associations (Rehm et al., 2012) (Scott-Sheldon et al., 2016), which may indicate causal relationships. In STI clinics in the USA alcohol use was found to predict number of partners (among female participants only) after controlling for drug use and for depression (Carey et al., 2016). This echoes the models for this survey whereby drug use and alcohol use were independently associated with 2+P and with RTP. That ‘binge-drink’ fell out of the Combined model but was replaced with ‘depr_treatment’ indicates a potential collinearity between these variables in the data set despite low Variance Inflation Factors. Certainly, there is evidence that among adolescent females, depression and increase in depressive symptoms over time is associated with harmful alcohol use (Edwards et al., 2014).

‘Drug use ever’ was retained in the models for 2+P, RTP and Combined, echoing a wide body of literature on associations with recent sexual risk (as described Chapter Three). Most relevant of these is a Natsal-3 study (Paquette et al., 2017) reporting that among women aged 16-44 years who were sexually active in the last year, use of illicit drugs (other than or in addition to cannabis) was associated with two or more partners in the last year, and two or more partners with whom a condom was not used. In contrast, this survey indicated that any drug use (including cannabis) was associated with sexual risk. Smoking was also retained in the same models, complementing the existing, but less extensive, evidence on this variable (see Chapter Three). However, the variables for current smoking and drug use ever were not retained in the model for risk of UIP in this survey, contrasting with bivariate Natsal-3 analyses indicating that current smoking and use of drugs other than cannabis in the last year were associated with unplanned pregnancy in the last year (Wellings et al., 2013b).
Early sexual debut was retained in the models for RTP, Combined and UIP, reflecting numerous studies reporting statistically significant associations between early debut and a variety of risks related to both UIP and STI acquisition. These include serial monogamy and concurrent partnerships (Magnusson et al., 2015), multiple partnerships in the last year (Klavs et al., 2006), lifetime number of vaginal intercourse partners (Haderxhanaj et al., 2014) and unplanned pregnancy (Wellings et al., 2013a). Importantly in this survey, early sexual debut was constructed so that it would include experience of child sexual abuse, which itself has a large evidence base as a predictor of sexual risk and morbidity (Koenig et al., 2004).

Housing tenure was not retained in the model for risk of UIP, perhaps reflecting that it is an unvalidated and comparatively blunt proxy measure of socio-economic status (SES) - although the Natsal-3 study of unplanned pregnancy predictors also did not find an association with Index of Multiple Deprivation scores (Wellings et al., 2013a). A French study (Moreau and Bohet, 2016) found that SES was predictive of perceived retrospective pregnancy risk, which is a more analogous construct to the one used in this survey. The retention of housing tenure (as a proxy measure of socio-economic status) in the 2+P model was however echoed in other applied sexual health studies, which used a symmetrical modelling approach, for example (Woodhall et al., 2015) and (Sheringham et al., 2013).

Both these studies found SES to be predictive even though they focused on young people. Similarly, both housing tenure and young age were retained in the 2+P model, suggesting that these have independent effects on sexual risk and morbidity. This phenomenon remains largely unexplained but may indicate social network or cultural effects (rather than sexual network effects) and/or poor capture of the mechanisms by which poverty affects sexual health, as discussed by the candidate in a separate publication (Edelman, 2017). Overall, the supporting evidence for associations reported in this survey also suggest that exposures associated with UIP or STI acquisition do also correlate with unprotected sexual intercourse.

The survey used a comparatively robust design regarding both sample size and analysis, when compared with other sexual health CPRs. The sample sizes given in
papers reporting on their derivation and validation varied widely from 103 to 92,635 (mixed gender). The statistical approaches used included descriptive statistics (Bigrigg et al., 2005) but commonly were based on multivariable logistic regression, including Receiver Operating Curves with Area Under the Curve analysis (Falasinnu et al., 2014a), illustrating that the methods of analysis used in this survey constituted an established approach with a strong precedence.

No existing CPRs (described in Chapter One and Appendix 1a) relate to the same outcomes and/or patient group as this CPR. The most comparable study reported a c-statistic of 0.74 for a questionnaire-based clinical prediction modelling of *Chlamydia trachomatis* in a population-based screening programme (van Klaveren et al., 2016). The study which preceded that research similarly reported c-statistics between 0.7-0.8 (Gotz et al., 2005). No psychosocial measures of pregnancy are comparable - the London Measure of Unplanned Pregnancy (Barrett et al., 2004) is a retrospective population measure for estimation purposes while the Intensity of Pregnancy Planning scale (Morin et al., 2003) comprises mostly socio-demographic and partner-related items and is designed for measuring degree of planning effort (rather than avoidance) with a view to targeting pre-conception care.

Each of the exposures which demonstrated a statistically-significant association with one of the modelled outcomes has an existing evidence base – as this was the basis for selection of those exposures in the first place (see Chapter Five). However, a number of exposures demonstrated an unexpected direction of association. Disagreement with the statement ‘Having a partner at all times is important to me’ was associated with 2+P and with RTP. This was opposite to the direction demonstrated in a study of female African-American adolescents (Raiford et al., 2013) from which the item was borrowed. This may reflect that in a primary care population a higher proportion of women are in long-term relationships and would select agreement with this item, particularly as the item did not specify regular partner. Treatment for depression in the last year showed an opposite direction of association compared to Natsal-3 studies. The reason for this is unclear but may reflect that this item contains two constructs ‘having depression’ and ‘getting treatment’ and that this survey was conducted in a setting where people were engaging with healthcare services.
Self-esteem also showed an opposite direction of association from that found in studies by (Altschuler and Rhee, 2015, Sterk et al., 2004). This perhaps reflects that these studies were conducted on comparatively small US samples, the latter with exclusively African-American women who were deemed ‘at-risk’ through poverty, unemployment, substance use or low education (compared with a comparatively affluent part of the UK where this doctoral study was conducted). In addition, not having a partner 5+years older was associated with 2+P in this study; this was also contradictory to existing evidence (Mercer et al., 2009a) for reasons which are unclear.

Although CASH data were not used in the modelling process, recruiting in both CASH and GP settings enabled additional analyses (beyond the scope of this thesis) that contribute to the evidence base on socio-demographic and psychosocial differences between women attending CASH/GUM settings versus GP (Edelman N. et al., 2017) and which indicated that the GP cohort were older and experienced lower rates of risk. This is reflected in wider literature such as an English study showing higher rates of *Chlamydia trachomatis* in GUM settings compared to GP (LaMontagne et al., 2007) and evidence from a Natsal-3 study of chlamydia testing in GP and GUM settings that the GP cohort were older, and more likely to be in a relationship and to report fewer risk behaviours (Clifton et al., 2016).

Finally, the performance of the CPR can also be compared to others already established for use in primary care. In particular, the practice who acted as stakeholder consultants on this study uses AUDIT C (Bradley et al., 2007) to assess alcohol. For women this demonstrates sensitivity=73% and specificity=91% (Bradley et al., 2007). The HITs domestic violence assessment measure (which was adapted and used in the survey) has a sensitivity= 96% and specificity= 91% (Sherin et al., 1998). Issues concerning how General Practitioners understand and use CPRs are discussed in Chapter Seven.
6.8.2 Limitations

6.8.2.1 Study population and sampling

The sample was not random, nor was it truly a convenience sample as one GP surgery (Brighton Health and Wellbeing Centre) was deliberately given more resources in order to maximise recruitment of younger women (for reasons set out in Chapter Five). The estimates in this survey may also have been biased (particularly due to coverage error) as weighting techniques were not applied.

It is also noteworthy that the allocation of participants as a CASH or GP attender was dependent on where each patient was offered a questionnaire; so that these do not represent mutually exclusive cohorts (GP participants may have attended CASH recently and vice versa).

The use of available case analysis maximised the number of cases used in each analysis - thus reducing the standard errors and improving the accuracy of estimation. Nonetheless, missing data imputation, if it had been possible, may further have improved their accuracy. Due to the comparatively low numbers of missing data it was not possible to use statistical tests to analyse if there were statistically significant differences in report of psychosocial variables between respondents who provided complete data and those who returned sporadically or systematically incomplete questionnaires.

Without data on response rates it was not possible to calculate if risk was underestimated or overestimated in the survey (Tourangeau et al., 2000). Issues of over-coverage (in which ineligible participants are included in the sampling frame, or are re-recruited) were largely addressed by careful analysis of screening data to remove ineligible cases and those who had already completed a questionnaire. Under-coverage is a greater concern and may have led to bias in the sample. In particular it is possible lower rates of participation may be associated with both the covariates of interest (Missing At Random non-response), and with the outcomes of interest (non-ignorable non response). It is always extremely difficult to adjust for the latter, while adjustments for Missing At Random non-response rely on calibration with extensive co-variates from external datasets, which was not feasible. However, the survey deliberately mimicked the conditions in which the CPR would likely be
used in practice. Therefore, it is arguable that those who chose not to participate on the basis of sexual risk and/or other covariates would be equally unlikely to use the CPR in practice. In this sense then, analysis of this dataset – regardless of under-coverage – is likely to represent well the performance of those exposures as the items of the CPR itself. Nonetheless, the prevalences reported in this chapter cannot be considered unbiased estimates of populations of women aged 16-44 years in general.

Women who only have sex with women were not excluded from the study, yet the outcomes were specific to male sexual partners. As a result the CPR derived from this data may not be sensitive or specific in identifying STI and UIP risk among women who have exclusively female partners. Nonetheless, it may have utility in identifying and addressing issues adjunct to sexual wellbeing and general health (particularly smoking or binge-drinking).

Although the survey recruited women aged 16-44 attending GP surgeries in a single city, regardless of levels of sexual activity; a more ethnically and geographically diverse population would have further improved relevance if resources had been available to capture this. The particular demographics of Brighton & Hove may also limit the generalisability of the findings. Specifically, the population of Brighton & Hove is young, urban, wealthy, University-educated and ethnically homogenous (in comparison with other geographical areas in the UK) (Brighton & Hove City Council, 2012). A 2016 survey of Brighton & Hove General practices (currently under review for publication) found that among attenders, 91.6% were White, 87.5% had English as their First Language, 42.4% were educated to degree level, and the mean age was 49.3 years (±18.9) (Maskell et al., 2018).

The particular sexual health service arrangements and interests in Brighton & Hove may also affect the generalisability of the findings. For example, it was suggested (by the GP consultant to the study) that young age might have fallen out of the UIP model because this age group have been particularly targeted for LARC in Brighton & Hove. Equally, it is noteworthy that housing tenure (as a proxy measure of SES) fell out of the model for risk of UIP. This may reflect that poorer women are more
likely to be given LARC than wealthier women, a phenomenon reported in Scotland (Morgan and Liu, 2017).

6.8.2.2 Recruitment and data collection

The study did not address English language and literacy skills (instead, the assumption was made that those without sufficient skills would return the questionnaire blank or very incomplete). This has likely skewed the findings towards a literate, English-speaking population.

Greater consistency between item responses may have been achieved with CAPI. Nonetheless the use of PAPI was appropriate as it mirrored the intended mode of CPR distribution. Furthermore, evidence suggests that when comparing PAPI with CAPI, computerisation has little effect on response validity (Tourangeau et al., 1997). Recent evidence from the Positive Voices study (Kall et al., 2015) also suggests that, in clinical environments, PAPI presents less logistical issues than CAPI (including via tablet devices) and was found in qualitative investigation to be strongly preferred by participants (M. Kall, personal communication, November 2, 2017).

Some participants were not able to complete their questionnaire because they were called into an appointment before doing so. Printing questionnaires with a variety of random order of questions may have avoided the systematic bias introduced by women being called into appointments before they had completed their questionnaire, but in doing so would have transgressed the research convention that sensitive questions be placed towards the end of questionnaires. Inviting participants to complete a five-minute survey while waiting to be seen was felt to be a viable strategy as the 2017 GP Patient survey found that 82% of patients waited at least 5 minutes for their GP appointment (Mor;., 2017). The 2016 survey of Brighton & Hove General Practices also found a mean waiting time of 15.6 minutes (K. Maskell, personal communication, November 9, 2017) (Maskell et al., 2018).

The study design did not offer any mechanism by which the validity of participant self-report could be checked. This is a common limitation in anonymous sexual behaviour research (DiClemente, 2016). Nonetheless, matched clinical data in the
CASH setting would have enabled some assessment of the validity of responses, and also of associations between psychosocial factors and STI diagnoses. In addition, sitting apart from others to complete the questionnaire was an instruction not always easy to achieve in a busy reception area or for those attending with family/friends and this may have also affected response validity.

6.8.2.3 Measurement of acceptability

The survey was not designed to capture differences between item unacceptability due to distress versus item unacceptability due to perceived intrusiveness – two separate concepts identified in early PPI. Nonetheless, the acceptability of exposures (and consequently the CPR) was assessed in the analysis, both by examining frequency of missing data and ‘prefer not to answer’ responses, but also by carefully delineating data which was sporadically-incomplete from that which was systematically-incomplete. The removal of the latter helped reduce the likelihood that incompletion due to time-loss would bias the analysis of acceptability.

6.8.2.4 Measurement of variables

Although the research questionnaire was piloted as described in Appendix 5b, it remained a potential source of error, particularly as it contained novel unvalidated items and items that required adaptation (and were thus unvalidated in the form in which they were used). However, the use of unvalidated exposures was less of a concern (as valid representation of underlying constructs was not essential for the CPR to identify women who might benefit from intervention).

‘Prefer not to answer’ options were also accidentally omitted for some items. However, it appears unlikely that this compromised the validity of responses because the frequency of missing data for those items was <40, comparable to exposures that did have that response option (indicated in Tables 14-15). A more detailed critique of the questionnaire is presented in Appendix 6c, drawing specifically on knowledge gained belatedly through cognitive interviewer training (Fisher et al., 2000).
Some of the questionnaire items required report of historical (though recent) events which may be more subject to recall bias than if provided through a longitudinal observational study. However, psychosocial exposures would be retrospectively reported in the CPR, so it was appropriate to do the same in the survey underpinning its derivation.

The systematic approach to sourcing candidate predictors and to using simple easy-to-score items increased rigor and usability but may also have limited the scope of psychosocial variables. Stress, wellbeing and life satisfaction - which are often conflated (Feddersen et al., 2016) – may have been important omissions from this survey as they are increasingly recognised as important concepts which extend beyond clinical and bio-medical understandings of health (and which may therefore improve the prediction of sexual risk). Nonetheless the psychosocial ‘asset’ of social support (identified by Cassel as part of the original social epidemiology psychosocial model (Cassel, 1976) (see Chapter Two) was well-represented in this doctoral survey.

If the survey had been designed more recently a wider range of partner-type response options would have been offered, as emerging work indicates the importance of a novel category ‘ongoing but uncommitted partnerships’ in the experience of sexual risk through partners (Mercer et al., 2017). Nevertheless, very few respondents were categorised as never having been in a relationship (based on selection of ‘single’ relationship status, and the option to skip all relationship items if one had never had a relationship). This suggests that relationship items may offer adequate prediction in identifying sexual risk.

Overall, the sensitive nature of sexual experiences may have compromised the validity of responses (Tourangeau et al., 1997) although question wording was checked for acceptability in the piloting work, and response options were presented in a way that would reduce social desirability bias (e.g. including unwanted sex within the option for early sexual debut in Question 18, and presenting several response options for partner numbers in Question 19). Both the measure of RTP and the measure of risk of UIP were unvalidated in this survey, but were pursued as important concepts. Arguably RTP is under-represented in studies of sexual risk.
which focus on multiple partnerships and participant concurrency (because of its role in transmission rather than acquisition).

6.8.2.5 Composite measure of pregnancy avoidance

The measurement of risk of UIP was limited by the measures available at the time of designing the survey. Two papers were published during data collection that sought to measure retrospective unintended pregnancy (Grindlay and Grossman, 2016, Moreau and Bohet, 2016). However, these would not have been unsuitable for use as they did not measure non-use or failure of contraception (a key component of the concept specification in this survey, as described in Chapter Five). One paper defined ‘at risk of unintended pregnancy’ as women who:

‘had had heterosexual intercourse in the past 12 months, were not pregnant or trying to get pregnant, had not delivered a baby in the past 12 months, and were not protected by male or female sterilization’) (Grindlay and Grossman, 2016) (p.250)

The second paper (Moreau and Bohet, 2016) asked only about perceived risk of pregnancy in the last 4 weeks among a sub-sample who did not identify as pregnant, trying to conceive, sterile, or having a sterile partner.

The cluster of discordant responses to the two-item pregnancy intention scale may reflect a lack of item validity – i.e. for the avoidance item (Q.27) women may have simply selected the last response option again without reading the item properly. Alternatively, discordancy of responses may reflect that desire to avoid pregnancy and pregnancy wanted-ness address different constructs. I.e. a participant might want to become pregnant (an expression of emotion) at the same time as wanting to avoid getting pregnant (an expression of intent). This hypothesis is supported by research indicating the same (Stanford et al., 2000, Thomson and Brandreth, 1995); and also by participant CN0589 who ticked ‘I haven’t want to get pregnant at all’ for Q.24 and then wrote ‘with these partners, but overall yes!’ next to it, and selected ‘I haven’t minded either way’ for Q.27. In interpreting the survey findings it is also important to remember that in the context of this study, risk of UIP represents only a pattern of experience which indicates that contraception advice and supply may be warranted rather than actual risk of unintended pregnancy.
6.8.2.6 Measuring higher frequencies of partner numbers

Further analyses of multiple partnerships (using a variable representing either 3+ male partners or 6+ male partners rather than the primary outcome of 2+ partners) might have been beneficial in order to identify those at particularly high risk. However, multiple analyses would have raised the risk of type I error (in which increasing numbers of statistical tests increase the risk of identifying a statistical association that has occurred only through chance). Equally, the prevalence of these outcomes may have produced insufficient cell frequencies for multivariable analyses.

6.8.2.7 Statistical approach to analysis

Backwards stepwise regression is an established statistical approach to deriving a CPR (Steyerberg, 2009, King et al., 2016), but one which has been criticised. A number of steps were taken – as reported in this Chapter and the preceding one – to minimise the limitations of this statistical approach and to ensure rigor in the analysis. The study foregrounded discrimination both by including women who were not sexually active in the last year, and by giving primacy to the c-statistic as a measure of discrimination when assessing models. This contrasts with multivariable modelling for the purposes of hypothesis testing, which more commonly focuses on amount of variance explained. Nonetheless, the Mc Fadden’s R-squared statistics also indicated that a large amount of variance in sexual risk was explained by the psychosocial variables retained in the 2+P and Combined models.

Finally, the assumptions underlying BIC only hold true where the sample size itself is much larger than the number of events. Accordingly, very high prevalence exposures will not be suitable for model assessment using this approach. However the point at which the number of events is ‘too high’ is difficult to specify (Giraud, 2015).

6.8.2.8 Selecting exposures for model entry

Arguably, the approach taken to finalising the model for risk of UIP contained some speculative decisions. In particular, the replacement of some of the variables and the removal of those which contributed little could arguably be perceived to be somewhat ad hoc. Nonetheless these decisions were driven by both pragmatism and the interesting finding that fewer exposures were associated with risk of UIP,
compared to the other outcomes. This may reflect poor measurement of risk of UIP but more likely that the questionnaire (and the studies from which its exposures were taken) do not adequately explore psychosocial factors associated with risk of UIP. The inclusion of less common exposures in the risk of UIP model suggests that a lower prevalence threshold (below 20%) may have offered a better entry criterion for exposures in each of the generated models. However, this would have created an alternative difficulty – that the EPV for each model would have permitted fewer exposures to be entered than were eligible.

It is arguable that it would have been beneficial to force weekly binge-drinking and current cigarette smoking to stay in all the models (and therefore force them to be used as CPR items), on the basis that these are issues about which GP staff would also potentially want to intervene. Equally the decision to force age group to stay in the Combined model is contentious – as the rationale was the retention of this variable in both the source models for this Combined model, and because of its predominance in existing literature.

6.8.2.9 Scoring systems

The precise value of model coefficients may have been subject to selection bias and other survey biases. In essence the scoring system and corresponding cut-off values were also qualitatively determined, although an established approach using numerical data was taken and results consulted on by GP staff. If the CPR was developed for use on an electronic device, the coefficients could have been used to develop a more nuanced scoring system which might have achieved better sensitivity and specificity. This may account for the interesting finding that the model with the best discriminatory power (2+P) was not the model with the best sensitivity (Combined).

Indeed, it is arguable that an entirely speculative approach to scoring might have been used, in which a variety of different score values would be assigned in order to find the combination which best discriminated sexual risk. Such speculative approaches to scoring might be considered a form of data mining, in which multiple patterns of association are sought, raising the risk of falsely rejecting the null
hypothesis (Type I error) (Liou and Chang, 2015). Nevertheless, it has been argued that the process of CPR derivation is essentially one of data mining (Adams and Leveson, 2012), adding to a growing body of literature proposing that data mining (sometimes known as Knowledge-Discovery in Databases) is a valuable endeavour. This contrasts with the considerable efforts made to avoid data mining in hypothesis testing studies. Regardless, steps were taken in this study to avoid some of the pitfalls of data mining, such as over-fitted models and high risk of type 1 error. In particular, a systematic approach was used to identify possible candidate predictors and to select variables for model entry from among them. More generally, steps were taken to avoid over-fitting the models because:

‘Overfitted models tend to underestimate the probability of an event in low risk patients and overestimate it in high risk patients’ (Pavlou et al., 2015) (p.1).

Cross-tabulating CPR score against self-report of the outcome was a suitable and previously documented approach (Gotz et al., 2005). If the sensitivity and specificity had indicated the value of further CPR development work, then further analysis of associations between outcomes and non-response to individual CPR items would have been warranted.

It is important to note that although the five GPs who participated in the stakeholder consultation concurred that none of the CPRs were sufficiently accurate to warrant routine use, others working in General Practice and public health may take a different view. In particular, delivery of the CPR as a self-completion tool would carry little cost so that a cut-off score which privileged specificity over sensitivity would avoid much of the resource implications of false positives (the key concern of the stakeholder group). The GP stakeholder consultation may have yielded different opinions if there had been explicit discussion of both the potential benefits of a high specificity approach and of the comparability of the CPR’s sensitivity and specificity with AUDIT-C (which is a routinely and widely-accepted tool).

6.8.2.10 Validation work and boot-strapping

Boot-strapping would have generated more conservative estimates but was not carried out because it is usually conducted within the remit of internal validation and was therefore beyond the scope of this derivation work. In addition, this kind of boot-
strapping is most commonly carried out where data assumptions may be violated. In the case of a dataset composed entirely of dichotomous variables this was highly unlikely to be the case.

6.9 Conclusions

The findings of this study constitute important exploratory proof-of-concept work in understanding the associations between sexual risk and psychosocial factors; and how those associations might be harnessed in the identification and prevention of adverse sexual health outcomes. The analyses met the original research questions including identification of the best combination of exposures to discriminate women experiencing 2+P, RTP and risk of UIP. The survey findings indicate that recent retrospective risk of UIP and of sexual risk experiences which may lead to STI acquisition, are predicted by different psychosocial exposures. No exposure was associated with all outcomes so that any further development would need to focus on an integrated CPR (comprising sub-scales which differentially highlight potential need for sexual health advice, STI testing and/or contraception). All exposures were found to be acceptable for possible inclusion in a CPR. Overall however, the analyses indicate that the CPR derived for each outcome offers sensitivity and specificity too low for routine use of the CPR in GPs to be recommended. As a consequence, follow-on work is not warranted to validate and evaluate the CPR for routine use with all British women of reproductive age attending GPs.

It is also important to note that, although it is possible to discriminate women experiencing sexual risk using psychosocial factors within the dataset generated from the Brighton & Hove survey, these findings may not be replicated if the CPR was validated, either through data-splitting or use of an external dataset.

The study design and the questions posed during analysis speak to the need to ensure pragmatism and flexibility in research design while maintaining as much rigor as possible and ensuring a dataset suitable for addressing the research questions. The approach to design and analysis sought not only to meet the research questions but to use established methodologies for CPR derivation. All relevant aspects of a checklist for evaluating CPRs (CASP, 2013) were met by the survey. For example, the type of patient and the CPR items are clearly defined, the results address issues
of sensitivity and specificity and the outcomes have been developed to be: 'relevant and clinically reasonable' (CASP, 2013) (p.2).

Similarly, the selection of patients was adequate and appropriate, although resources dictated that all the participants were drawn from one geographical setting, which may limit the generalisability of the findings. It is noteworthy that the CPR derived in this research was intended primarily for use in British settings (i.e. England and Wales) as much of the data and policy that informs it is British. However, the findings may have relevance to Scotland and Northern Ireland where the organisation of sexual and primary healthcare is similar.

It is important to consider the longevity of the CPRs derived in this chapter. Specifically, the use of psychosocial variables may make the CPR vulnerable to becoming obsolete as British society and culture itself changes. For example, at a population level, e-cigarettes and cigarette smoking patterns may change in time, and similarly partnership types and housing tenure. Hence, these factors may not continue to be associated with sexual risk.

Finally, the different contexts afforded by research and clinical environments are also relevant to the implications of this survey in two ways. First, the acceptability of a given item may differ in the context of a research survey versus a CPR. Second, we might expect that women who have not been sexually active will choose not to complete a CPR in a GP setting, thus the rate of false positives in practice may be lower than that found in this study. These issues highlight the importance of internal and external validation and evaluation before any true claims about a CPR’s performance can be made.
Chapter 7: Implications of the research for CPR derivation, sexual health epidemiology and the study of the psychosocial
Summary

This chapter begins by providing an overview of the programme of research, its contribution to the field, and the congruence of its findings with psychosocial theories. The influence of Patient and Public Involvement is discussed, followed by the broader limitations of this programme of research and lost opportunities within it. Potential unintended positive and negative effects of the CPR are then outlined, before the relevance of this research for Clinical Prediction Rule derivation and General Practice is discussed. The chapter then outlines directions for further research before offering some concluding statements.
7.1 Overview of the research programme and its contribution to the field

This programme of research was designed to derive a psychosocial CPR to target sexual health advice, contraception and STI testing to women of reproductive age attending British General Practices. The rigorous approach to derivation involved identifying potential candidate predictors from preliminary studies of relevant populations (the systematic review and Natsal-3 analysis), selecting from among them using a considered and pre-determined process, and then using them in a cross-sectional survey to generate a dataset from which a psychosocial CPR for the relevant outcomes could be modelled.

The outcomes of interest for this programme of research were: multiple male sexual partners in the last year, risk of unintended pregnancy, and risk through most recent partner of STI acquisition. These were chosen to align the research data with the CPR’s intended use in targeting sexual health interventions based on particular sexual risk experiences. These outcomes were referred to as ‘sexual risk experiences’, in contrast with conventional sexual health epidemiology which focuses on ‘sexual risk behaviours’. The construct of ‘sexual risk experiences’ challenges the assumption of full agency in sexual interactions, and reflects that risk of acquiring an unintended pregnancy or an STI may vary between sexual encounters – even with the same partner (as discussed in Chapter One).

The outcome ‘risk through partner of STI acquisition’ (RTP) was devised in order to identify women who may be at risk of STIs through an infected and/or non-monogamous partner, but who present as low-risk for STI acquisition due to reporting a long-term monogamous relationship (rather than multiple partnerships in the last year). This investigation complemented existing evidence that reporting casual sexual partners is an important predictor of sexual morbidity (Mercer et al., 2009a) because casual partnership type can be viewed partly as a proxy of the experiences of condom use and numbers of partners among sexual partners.
In order to best align the CPR to targeting of contraception, a novel measure of retrospective risk of unintended pregnancy was developed, which combined recent desire to avoid pregnancy with not only inconsistent and non-use of contraception but also method failure. By contrast, conventional measures used in Natsal-3 and other large-scale surveys are of limited use in the context of CPR derivation because they retrospectively categorise existing or historic pregnancies as unplanned, for surveillance and estimation purposes (e.g. the London Measure of Unplanned Pregnancy (Barrett et al., 2004); or because they prospectively measure unintended or unplanned pregnancy to develop and evaluate preventive interventions (Moreau et al., 2013a). Investigation of this novel outcome is a small but valuable contribution to understanding statistical predictors of risk of unintended pregnancy and to aligning research data with questions pertinent to healthcare delivery.

Because the CPR was designed to target sexual health advice, contraception and STI testing, so the findings have contributed original knowledge to the understanding of co-occurrence of STI risk and UIP risk. Specifically, by modelling both these outcomes from the dataset it was possible to assess how the psychosocial predictors of each might differ. The tentative finding that UIP is predicted by quite different psychosocial variables (and with less accurate discrimination) suggest that distinct means of identification and/or preventive interventions are needed to support prevention of each of these outcomes. Existing evidence has tended to investigate different psychosocial factors for each of these outcomes so that this question has previously been difficult to address.

Together the analyses in this programme of research contribute a fuller social epidemiological understanding of the circumstances surrounding sexual risk experiences and poor sexual outcomes, by making psychosocial variables the key exposures of interest. This complements and extends existing social epidemiological studies of sexual health which often investigate a few psychosocial variables alongside behaviour and morbidity (and do not always offer a rationale for doing so). This research has furthered understanding of how psychosocial variables might be harnessed to identify and ameliorate sexual risk; and revealed some of the ethical, methodological and conceptual issues in doing so. The findings of the Brighton & Hove survey suggest that considerable variance in sexual risk can be explained by
psychosocial variables, and that these variables have some ability to discriminate between those experiencing and not experiencing sexual risk. In particular, substance use, not cohabiting with a sexual partner, and early sexual debut are consistently associated with a number of sexual risk experiences (and with adverse outcomes), concurring with the wider evidence base.

This research can also be argued to contribute to the broader field of research on health inequalities; some of the items comprising the final CPR might themselves be considered proxy measures of deprivation. The pragmatic nature of CPR derivation meant that there was no credible reason for excluding socio-demographic variables from the modelling process or for stratifying those analyses, as discussed in Chapter Five. This approach was congruent not only with critical epidemiology ideas (mentioned in Chapter Two) but with criticism of stratification by socio-economic status (SES) such that:

‘… more important than the technical difficulties of interpreting such analyses is that they are conceptually uninformative’ (Lynch et al., 1997) (p.810)

Psychosocial variables are a key area of interest in social epidemiology, so that their investigation was also congruent with the epidemiological approach taken to CPR derivation. This epidemiological approach comprised complex survey analysis of a large bespoke dataset generated from a Brighton & Hove survey conducted for that purpose. This provided not only a novel understanding of the psychosocial nature of sexual health risk but a systematic appraisal of the utility of this specific CPR and the items which it comprises. This established approach to CPR modelling differs from conventional complex survey analyses used in most social epidemiological studies of sexual health. Specifically, the emphasis of CPR modelling was on the discrimination afforded by combinations of exposures, rather than on how much outcome variance was explained by independent exposure effects. For this reason, and because of pragmatic issues of delivery and scoring, interactions were not analysed and stratification not applied to analyses.

Finally, this doctorate exposed many issues pertinent to generic CPR development and use, discussed further in sections 7.5 and 7.6. These include pragmatic,
methodological and ethical concerns. In particular this research has highlighted the limitations of current methods which support exclusively additive CPR scoring systems.

7.2 Congruence of the research findings with psychosocial theory

By focusing on psychosocial variables this programme of research addressed an important gap in the social epidemiological evidence base, which tends to focus on ‘higher level’ explanatory theories for the mechanisms by which structural and other societal factors impact on sexual health (Johnson et al., 2006). The existing evidence on associations between psychosocial and sexual risk experiences in general populations of women is presented in the systematic review (Chapter Three); while the degree to which these findings concur or contrast with the Natsal-3 analysis and Brighton & Hove survey are presented in Chapters Four and Six respectively. However, the degree to which the salient psychosocial factors from these three studies concur with existing definitions of the psychosocial is more difficult to assess, because a variable is defined as such when it causally impacts on health outcomes – something which can neither be proven nor disproven by the cross-sectional analyses used in this research.

Nonetheless, the psychosocial variables identified in this programme of research are congruent with Martikainen’s definition of the psychosocial set out in Chapter Two (Martikainen et al., 2002) in so far as there are plausible if unproven pathways by which each might influence health outcomes. There is also a congruence between some psychosocial variables and Wilkinson’s definition (Wilkinson, 2006) which focuses specifically on social affiliation, social status and early development (as reported in Chapter Two). For example, substance use (binge-drinking, smoking, drug use ever) and social support (particularly meals and chores) can each be viewed as components of social affiliation and/or social status. Similarly, not living with both parents to age 14 years and early sexual debut could be categorised as ‘early development’ factors, while the former might also be considered a component of social affiliation.
The association between early sexual debut and sexual risk and morbidity has also been explained using Problem-Behaviour Theory. This proposes that early initiation into adult activity will evoke negative or control reactions from the environment and has common psychosocial roots such as poverty, substance use and disengagement from social structures (Madkour et al., 2010). The salience of socio-economic status and substance use in this theory resonates with the findings of this programme of research. There are also parallels between the psychosocial variables identified in this research and studies of syndemicity (in which risk factors and/or adverse outcomes co-occur and are mutually reinforcing) (Bauer et al., 2016). Syndemics are a key area of sexual health study, and one of the three major psychosocial models for predicting HIV risk behaviours in Men who have Sex with Men, pointing to the co-occurring and mutually-reinforcing nature of sexual risk, childhood sexual abuse, intimate partner violence and substance use (Pantalone et al., 2016).

Studies of syndemicity and the findings of this doctoral research are also congruent with sexual and social network studies in so far as the CPR items can be thought of as a momentary glimpse into the immediate social world surrounding women experiencing sexual risk; where women might variously be in rented accommodation, binge-drinking regularly, receiving little social support and embarking on sexual encounters with the legacy of abusive relationships and/or early sexual experiences, for example.

Finally, the salience and retention of ‘socio-demographic’ variables in this programme of research (echoing numerous other studies) is congruent with critical epidemiological ideas, as mentioned in the previous section. In particular, the socio-demographic variables retained in the studies of this programme of research may themselves be indicative of lived psychosocial experience (Krieger, 2005), as discussed in Chapter Two.

7.3 The influence of PPI

The degree to which early PPI findings influenced the programme of research only became apparent as the research progressed. The requirement for the CPR to be suitable for self-completion using a paper-and-pencil approach influenced the
selection of potential candidate predictors regarding their clarity, brevity, and the simplicity with which they could be scored. The PPI work focused on the acceptability of individual items designed for self-completion rather than on the acceptability of the CPR being offered directly by a practitioner, and/or completed in the presence of a practitioner. In addition, the overall acceptability of the concept of a psychosocial CPR to identify sexual risk experiences in General Practice was addressed only briefly in each of the PPI activities. Finally, the acceptability of asking about ethnicity in the context of a Clinical Prediction Rule, was not explored in the initial BWC consultation which was with an all-white group, or in subsequent PPI consultations (because ethnicity was not retained in the Natsal-3 analysis, and therefore not explored in the Brighton & Hove survey).

Greater attention to the overall acceptability of the CPR and to the acceptability of practitioner-led delivery may have altered the intended mode of delivery and hence the format and nature of psychosocial variables retained as CPR items. In particular, greater exploration of how electronic delivery could be made acceptable, would have opened up the possibility of more sensitive scoring systems and integration of responses with routinely collected data. In addition, the lack of black and minority ethnic (BME) individuals in the PPI consultation work reflected the predominantly white make-up of the city so that targeted PPI representing BME would have been important to enable meaningful exploration of the acceptability of ethnicity as a sexual risk predictor (should ethnicity have been a salient predictor that warranted inclusion in the survey).

The limits imposed by a self-completion approach restricted the psychosocial variables investigated, as did the need to avoid distressing and/or intrusive questions - discussed further in section 7.4.3 and in Chapter Two). Together these requirements impacted on each study within the programme of research, and finally on the sensitivity and specificity of the CPR (because the combined preferences for PAPI and self-scoring affected the scoring systems, as discussed in section 7.7.6). However, it was important to work within these constraints in order to derive a CPR that women would be likely to use in practice.
The limitations imposed have also been offset by the benefits of a proof-of-concept approach which has led to the derivation of a CPR suitable for adaptation for digitised use, or use with particular sub-populations or settings. For this reason many of the follow-on analyses and studies which might be conducted are concerned with different stages of development, with different populations and using different modalities. In addition PPI likely played an important part in improving response rates to the Brighton & Hove survey by ensuring an acceptable and feasible approach to data collection.

Finally, a public consultation event was held as part of the British Science Festival in September 2017. ‘Madame Natalie’s sexual fortune-telling booth’ gave women the opportunity to try out the CPR and to give feedback and ask questions about it. This brought valuable insights into how lay understandings of risk and responses to risk may need to be navigated in the presentation of CPRs (discussed in section 7.5). Thus, further PPI would be essential to any further validation and evaluation work, both to inform those study designs and also to further shape CPR delivery (NIHR, 2014).

7.4 Limitations and lost opportunities in the programme of research

7.4.1 Methodology

This research adopted a social epidemiological approach to addressing a health service need which focused on psychosocial variables which demonstrate statistical prediction of sexual risk experience and adverse outcomes. This common approach to CPR derivation uses ‘risk factor epidemiology’, which is noted for its ability to inform further high quality research (Mutaner and Chung, 2005) but also for its:

‘failure to deliver in terms of mechanisms and explanations in social epidemiology’ (Mutaner and Chung, 2005) (p.540).

Use of longitudinal observational quantitative studies and/or qualitative methods might have enabled identification of psychosocial variables which are causally associated with those outcomes, better enabling the derivation of a CPR equipped to address the causes of the causes (Marmot et al., 2012) and in particular the causes
of incidence (Rose, 1985). Similarly, criticisms of how risk factors are increasingly treated as outcomes (Wemrell et al., 2016) are applicable to this research. Indeed, sexual risk experiences were treated as outcomes precisely because they are themselves ‘risk factors’ for adverse sexual outcomes.

The restrictions imposed by the methodologies (and available data) in the Natsal-3 study and the systematic review meant that the psychosocial predictors which were then modelled for possible CPR inclusion were not necessarily exhaustive of all psychosocial variables predictive of sexual risk and adversity in general populations of women. Thus, well-being was not investigated in this programme of research, despite strong associations with social determinants of health and poor health outcomes (Robinson, 2014). Similarly intimacy and the desire for emotional connection were not explored directly even though the former has been found to be associated with STI risks in qualitative enquiry (Dalrymple et al., 2016); while HIV testing in the context of partners’ risk behaviours has been explained by relational theory (Longmore et al., 2013) which posits that women are strongly motivated by the desire to build social connections.

More broadly, the use of psychosocial variables (in part because of their putative causal association with sexual risk) can be viewed as a methodological decision which influenced the type of datasets which were analysed in this programme of research. For example, an alternative and established approach to CPR derivation would have been to model the outcomes of interest from existing datasets and without restriction to psychosocial variables.

The use of clinical datasets is a particularly common and convenient approach to CPR development that offers the benefit of using data already routinely collected for patients – so that arguably a CPR could be derived for each patient without them needing to answer any questions. This would be feasible if the outcomes of interested were predicted adequately by fixed rather than volatile exposures. It is also noteworthy that such an approach would require the use of sexual health datasets specifically (as sexual risk experience and morbidity is unlikely to be captured routinely in GP data). This raises concerns about the generalisability of findings to GP populations, which have been shown to differ in both sexual risk and
other patient characteristics from sexual health clinic attendees (Clifton et al., 2016, LaMontagne et al., 2007).

Alternatively, large probability population surveys such as Natsal-3 could have been used for this work. However, this would have limited the outcomes of interest to those already available – in particular limiting investigation of recent risk of unintended pregnancy. Finally, multivariable regression modelling, although an established approach to CPR derivation, is not the only method such that formal data mining and machine learning approaches may have yielded different findings. The use of different datasets, analytic techniques and a wider remit of investigated exposures would likely have resulted in very different models (regarding both exposure and outcome).

7.4.2 Scope and target population
The overall focus of the CPR on the age group 16-44 years might have been expanded to include a more generous definition of ‘reproductive age’, particularly in light of evidence that middle-aged women are at increased risk of STI acquisition (Minichiello et al., 2012). It is also noteworthy that this research focused on women’s risk experiences in the context of heterosexual encounters. Thus, the salient psychosocial predictors may or may not be relevant to lesbian relationships or to men’s experiences.

7.4.3 Acceptability and uptake
Careful attention was paid to the acceptability of individual psychosocial questions, to minimise the chances of both distress and un-valid responses. Nonetheless, a more rigorous approach to understanding and exploring acceptability might have been taken. Specifically, CPR items might be deemed unacceptable because they are distressing and/or intrusive. These different components of unacceptability were extant in early PPI work but were not addressed discretely in the research and only emerged during the reflection of thesis writing.
Importantly, to ensure the CPR’s use in practice, the overall notion of a CPR to assess potential need for sexual health advice and intervention must itself be acceptable (in addition to the individual items that comprise it). Hence the overall acceptability of the CPR’s purpose, content and delivery was assessed by the candidate in each of the PPI activities, and positive responses were received. Nonetheless, any further validation or development work should seek to ascertain through research whether the variables which predict sexual risk experiences also predict likely non-use of the CPR, as discussed in section 7.7.4.

It is also noteworthy that this research did not investigate either the acceptability of practitioner delivery of the CPR or use of the CPR with any particular care pathway in mind, even though care pathways surrounding CPRs will also likely influence their acceptability and uptake. For example, the acceptability of Chlamydia trachomatis testing in Australian primary care has been shown to be significantly lower in settings which did not have on-site pathology collection (so that the patient had to collect their test result elsewhere) (Lau et al., 2016). Care pathways are discussed further in section 7.7.7.

Should ethnicity have been retained in the Natsal-3 study, it’s acceptability as a CPR item would have warranted careful attention – both through analysis of survey participant responses, and through PPI with BME women. In particular, using a self-scoring approach to this item (so that a higher score would be attached to report of non-white ethnicity) may well have been unacceptable, particularly when delivered in the context of a tool to identify sexual risk. Alternatively, computerised delivery of the CPR (in which the scores for individual item responses would not need to be visible) would address this issue, particularly if age group, housing tenure and ethnicity were explicitly framed as ‘routine’ or ‘background’ data. Alternatively, if computerised delivery of the CPR was linked to patients’ notes, then ethnicity (and age) might conceivably be extracted from electronic records and combined with patient responses to the other items. This issue reflects how the delivery of CPRs can likely ameliorate concerns about content, thus improving acceptability.
7.4.4 Systematic review

The systematic review process could have been significantly streamlined if the search strategy had initially been limited to probability population surveys. This would also have meant that a smaller number of papers were subject to screening, permitting time for a secondary analysis of how the term ‘psychosocial’ was employed or absent from relevant literature. Such analysis would offer a useful bedrock from which to discuss and improve the indexing of psychosocial investigations of sexual health in bibliographic databases.

7.4.5 Natsal-3 analysis

The Natsal-3 analysis presented in Chapter Four was necessarily limited by the available variables, which favoured investigation of predictors of STI risk and acquisition over that of unplanned or unintended pregnancy, as discussed in that Chapter. Nonetheless, a wider age-range might have been used to more fully capture women at risk of STIs and UIP.

7.4.6 Brighton and Hove questionnaire

Errors in design meant that it was not possible to meaningfully measure multiple partnerships in which condoms were not consistently used. As a consequence it was not possible to investigate non-use of condoms in the context of the pregnancy ambivalence or desire, an important issue raised in Chapter Two. The categories for relationship types were drawn from Natsal-3 analyses, and so had a strong empirical basis. However, more recent work has demonstrated the predictive potential of a novel category of ‘ex-steady’ partnership type (Mercer et al., 2017). Additionally, the focus on sexual risk experiences might conceivably have been extended by seeking to measure number of sexual encounters in addition to number of partners. However, the accuracy of this report, and the degree to which it reflects risk of adverse outcomes is unknown and was considered too exploratory.
7.5 Unintended CPR effects

7.5.1 Unintended positive effects of the CPR

During the course of this doctorate it was suggested by colleagues that the CPR might have unintended positive effects in raising awareness of interventions and of one’s own sexual health risk, thus precipitating behaviour change as well as service engagement. These effects are essentially those for which Health Education Materials (HEMs) are developed (Hoffmann and Worrall, 2004). Indeed CPRs in other domains - such as the ‘DrinkMeter’ app (Milward and Khadjesari, 2016) - have been developed precisely to raise awareness of risk in order to induce risk-reduction behaviours.

It was noted early in the programme of research that the CPR might also carry benefits in helping to raise awareness of adjunct issues, should the woman completing it choose to share her answers with a clinician (as raised in Chapters One and Two). Indeed, lay women raised the benefit of this in the early PPI work carried out at Brighton Women’s Centre. Certainly, weekly binge-drinking and current smoking (retained in the model for the primary outcome) are both issues which a GP would seek to address with a patient regardless of sexual risk. It has also been suggested by colleagues at Public Health England that health promotion messages might be deliberately embedded within the CPR (such as the statement about the effectiveness of NHS quitting services which forms part of the smoking cessation intervention in GUM clinics).

7.5.2 Unintended negative effects of the CPR

It is also important to acknowledge that the CPR may have unintended negative effects if implemented. First, CPR users may inadvertently feel stigmatised by the very act of completing the CPR, by their responses to individual questions, or by the way practitioners respond to their score. In particular CPR items about substance use and early sexual debut may feed into existing stigmatised discourses in society around morality and women’s behaviour (Ettorre, 2007). However, during the British Science Festival 2017 public consultation, women reported that the finalised CPR items (presented in Chapter Six) were acceptable.
Second, CPRs and other measures of risk have the potential to create considerable anxiety in those patients who are placed in ‘at-risk’ categories – articulated through the concept of ‘measured vulnerability’ (Gillespie, 2012). CPRs embody a particular statistical understanding of the notion of ‘risk’ which must be carefully conveyed to patients and practitioners alike. Indeed, during the British Science Festival event women questioned the credibility of the CPR items because they couldn’t see how they could be causally associated with sexual risk experience. This presents a challenge relevant to all CPRs; how to present and explain the inclusion of CPR items which are not known to be causally-associated with the outcomes of interest.

7.5.3 Patient response to an additive CPR scoring system

This research exposes not only this generic CPR concern, but also another concerning the use of risk scoring. Existing methods for developing CPR scoring systems (including the approach used in the survey as described in Chapters Five and Six), all concern additive scoring systems in which a higher value denotes greater risk. This may limit the acceptability and the validity of CPRs, not least because it has been posited that people respond to presentations of risk in much the same way that we respond to the risks themselves, by employing avoidance and minimisation strategies (Joffe, 1999). From this line of reasoning we might anticipate that women would avoid or deny a result indicating that they should discuss their sexual health needs with a practitioner. Strategies such as discarding the CPR or altering answers to individual items (in order to lower one’s overall score) are also probably more likely to occur using PAPI delivery.

Similarly, there is no established approach to handling missing data in the derivation of CPR scoring systems in a way that supports the analysis of how ‘skipping’ items is indicative of risk or otherwise. However, none of the women taking part in the British Science Festival public engagement event skipped items or reported adjusting their score in order to qualify as ‘not in need of intervention’, suggesting that this may not be a significant concern. Similarly, a randomised controlled trial indicates the benefit of tailored (rather than generic) feedback about health risks in primary care settings (Noble et al., 2015). The findings of a literature review of communication of risk
information in sexual and reproductive healthcare also contradicts these concerns about representations of risk in reporting that:

‘Personalised risk communication where a risk score is provided, increases knowledge and slightly increases uptake of screening tests’ (David and Akintomide, 2016) (p.213)

Overall, these issues point towards the importance of carefully framing and explaining the nature and purpose of CPRs for lay users, and also for professionals – a topic discussed in the following section.

Interestingly, evidence also suggests that when information is framed as a positive or a gain, people are more likely to have confidence in the recommended intervention (David and Akintomide, 2016). This presents a challenge for many CPRs, not least because epidemiology tends to focus on identification of risk factors (rather than assets). This convention has been challenged, in particular the notion that:

‘...the value of harmlessness as a standard for judging risks is questionable’ (Holmes and Sumnall, 2017) (p.1895)

A return to the study of ‘assets’ - the original focus of epidemiological studies of the psychosocial (Cassel, 1976) - would perhaps enable a greater focus on what enables sexual health service engagement and preventive strategies. Thus, risk experiences might perhaps be re-envisaged as an absence of positive health-seeking ‘care/behaviour’ – providing an alternative reference category for analyses. These speculative ideas are also worthy of mention because of the putative causal pathways between the psychosocial variables identified in this doctorate, structural factors, and service engagement and use of preventive strategies.

7.6 The broader landscape of CPRs in General Practice

7.6.1 Generic CPR issues: working at the cusp of population health and clinical medicine

How General Practitioners perceive and interact with is increasingly important as CPR development is a burgeoning field with over 400 rules developed for use in
primary care alone, and a particular increase in the last 10 years (Keogh et al., 2014). Many of the methodological and ethical issues raised above are pertinent to this wider field of CPR derivation, validation and evaluation – and the difficulties presented may perhaps be reflected in the fact that only 55% of the 434 identified rules had progressed to validation (Keogh et al., 2014). In particular, this programme of research has exposed the need to position CPRs in relation to clinical and public health frameworks - examining the implications of constructing CPRs from population health data in order to determine individual patient care (and consequently, the means by which we should evaluate their impact).

It is noteworthy that - when applied in clinical contexts such as General Practice - there is considerable overlap between CPRs and personalised medicine, the purpose of which is:

‘to enhance the targeting of diagnostic or therapeutic interventions in order to improve the clinical and cost-effectiveness of healthcare provision’ (Haycox et al., 2014) (p.1056)

CPRs and personalised medicine are alike in using population-level analyses to seek to improve healthcare provision at the individual patient level, although the latter commonly does so by use of genomic and other biotechnologies (Savard, 2013) in order to select from among a number of treatments those which will minimise harms as well as maximise benefits (Haycox et al., 2014). The use of psychosocial variables to capture subjective experience in CPRs can be argued to have particular parallels with personalised medicine, as psychosocial variables may be of use in developing CPRs that inform which interventions are warranted (e.g. LARC versus oral contraceptives). Certainly, the subjective experience of patients has been highlighted as an important means of developing sexual healthcare practices which integrate the patient’s lived experience of risk and morbidity with biomedical understandings. Indeed existing evidence suggests that sexual partnership-type is associated with partner notification preferences (Sutcliffe et al., 2009).

It is important to note however, that the use of CPRs to decide if and/or which interventions are likely to be of benefit must in part be a function of underlying patterns of association in the population of interest. This point is illustrated in this research – a key part of the analysis was identifying whether an ‘integrated’ CPR (in
which different psychosocial questions predict need for different interventions) was needed, or a ‘unified’ CPR (in which the same questions predicted risk of UIP and STI acquisition).

### 7.6.2 Delivery and use of CPRs in General Practice

During the candidate’s informal discussions with General Practitioner colleagues a number of generic issues regarding CPR use in General Practice have emerged. First of these is dislike of CPRs which are perceived to *instruct* very specific interventions in a way which supersedes clinical judgement – a recognised concern (Dowrick et al., 2009). For example, one colleague recounted how typing ‘pyrexia’ into a patient’s electronic record generated a ‘pop-up’ sepsis assessment tool instructing him to send a patient to hospital. Although examination of the patient suggested otherwise, he was concerned about over-riding this instruction, particularly recording it electronically. Conversely however, practitioners may feel that tools without a clearly-stated course of action are of little use. The new ‘QCancer’ tool (Hippisley-Cox and Coupland, 2015) was cited as an example because it presents a 10-year prognostic score without a clear pathway of care based on that score. In contrast, ‘QRISK’ (Hippisley-Cox et al., 2007) seems to generally be considered valuable in determining care because GPs have a clear sense of which interventions to prescribe in response to QRISK results in order to reduce cardiovascular risks.

Without clear pathways of care the impact of tools on health outcomes may also be doubted, particularly for assessments such as the NHS Health Checks for over 40s (Robson et al., 2016) - even though this includes QRISK - that form part of the GP Contract Quality Outcome Framework (Kendrick et al., 2015). Indeed, evidence suggests that following the introduction of QOF indicators for depression, practitioners doubted the value of depression assessment tools (Dowrick et al., 2009) and changed their use of depression-related codes (Kendrick et al., 2015). The requirement to use tools as part of payment by results, or contractual obligations may also blur boundaries between digital pop-up forms which are used to meet targets or improve adherence to local or national protocols and those which constitute Clinical Prediction Rules or other risk assessment tools.
The anecdote above also illustrates how electronic recording of CPR results (alongside symptom or other patient data) invokes a responsibility to act, so that some practitioner colleagues favoured the PAPI mode of CPR delivery to which this programme of research was oriented. Conversely however, remote electronic completion of CPRs as part of a patient’s electronic patient record (Bhavnani et al., 2011) may reduce the time burden of CPRs within GP consultation time and ‘alert fatigue’ from automated digital pop-ups in GP digital systems such as EMIS and particularly SystmOne. It may also avoid the intrusiveness of assessing patients for a health issue additional to the one for which the patient has attended.

Intrusiveness is an ethical and pragmatic issue pertinent to CPR use – as the various agendas of patient, practitioner, and wider NHS systems may compete for time within the patient-practitioner consultation. Routine use of tools which assess sensitive issues may also feel particularly intrusive and thus be problematic ethically, and even potentially damaging to patient-practitioner relationships. Indeed, one colleague recounted how her practice had stopped routine use of the AUDIT-C (Bradley et al., 2007) – the primary-care alcohol risk assessment tool discussed in Chapter Six – on these grounds. Not only was it felt to damage the patient-practitioner relationship but also to alienate those in need. In fact, patients whose score indicated problematic drinking usually did not attend the follow-up appointment which was designated to address that issue.

These discussions with colleagues highlight the need for greater attention to the delivery and use of CPRs in General Practice, reflecting existing evidence that perceived CPR usefulness among hospital-based healthcare professionals is associated with ease of use, fit within existing work flow, and usefulness at point of care (Richardson et al., 2015). In particular, it would appear that:

1. CPRs should be used to guide rather than gate-keep access to interventions (for example the CPR developed in this research is designed to initiate discussion rather than to ‘gate-keep’ access to interventions in a way which over-rides patients’ own presenting needs or symptoms)
2. CPRs should clearly state the interventions that might be warranted if a particular score is exceeded (for example the cut-off scores associated with the different outcomes in this programme of research)

3. CPRs should be presented as such (differentiating them particularly from tools designed to improve adherence to protocols) and should clearly communicate their purpose, evidence-base and level of precision

4. CPRs should be made available outside of consultations (as well as being suitable for use within them) to minimise negative impact on the patient-practitioner relationship and on consultation time - allowing the patient’s presenting problem to take precedence as well as avoiding patient alienation and practitioner ‘alert fatigue’

5. Developing CPRs in a way which makes them suitable for self-completion and self-scoring (as in this programme of research) is key to enabling remote completion while validation and evaluation work must address how best to bring results into the consultation or otherwise ensure patient action

7.7 Further research recommendations

7.7.1 Social epidemiology and sexual health – recommendations for further research

During the course of this doctorate, research questions were identified which are currently unaddressed in the current evidence base. In particular, research is needed to estimate the degree to which Risk-Through-Partner (a concept developed in Chapter One) among monogamous women explains STI acquisition, and to better understand the social context of such risk. Research is also needed to estimate the prevalence of STIs among women experiencing multiple partnerships (with and without condom use) so that these important indicators of sexual morbidity might be better understood. This speaks to wider calls for epidemiological studies to report in absolute terms the contribution of different types of sexual risk experiences (or behaviour indicators as they are more commonly known) to subsequent adverse outcomes (Holmes and Sumnall, 2017), in order that evidence can be better harnessed and applied in clinical and public health decision-making. For example, a recent Natsal-3 study (Clifton et al., 2017) demonstrated that examining the
relationship between risk perception and actual STI risk in relative terms resulted in large odds ratios, but that risk perception was poorly associated with actual risk when using measures of absolute risk, so that perception is unlikely to be of clinical use.

Further social epidemiological research into sexual health may benefit from investigation of the psychosocial variables identified in this study in conjunction with structural factors, which might also be predictive of sexual risk and morbidity, perhaps through iterative pathways. For example, zero-hour low-wage contracts may be associated with risk and morbidity and also limit access to interventions and services. Indeed, many of the psychosocial exposures prominent in this research (such as social support, formative experiences and self-esteem) have been identified as those which mediate associations between social structure and health outcomes (Mutaner and Chung, 2005). Thus, it would be interesting to examine if similarities exist between the CPR derived in this research and psychosocial CPRs developed for outcomes in other areas of medicine and public health, even though there is evidence that coronary risk prediction is not improved by the addition of psychosocial variables (Macleod et al., 2007). This would address a broader need to situate and critique epidemiological studies of sexual health within social epidemiology more generally.

7.7.2 Evaluating the CPR’s ability to address adjunct health issues as preventive interventions

As discussed in section 7.5.1 the CPR may also be of benefit in identifying and addressing adjunct issues. Psychosocial predictors such as domestic abuse and weekly-binge drinking may also be causally associated with sexual risk (Carey et al., 2016, George et al., 2016, Rehm et al., 2012, Scott-Sheldon et al., 2016). These putative causal associations are worthy of further research and intervention to ameliorate them might then be framed as addressing the social determinants of sexual health, a key goal of the 2013 Sexual Health Improvement Framework (DH, 2013). For example, substance use and experience of domestic abuse have each been linked with impeded use of sexual healthcare (Walter et al., 2016, Edelman et
al., 2013). Thus the CPR might act as a gateway to preventive intervention, should women choose to disclose their individual item-responses.

### 7.7.3 Investigating interactions and syndemicity

The presence in this study of issues adjunct to sexual risk and morbidity may be indicative of syndemicity, as discussed in section 7.2. Specifically, cluster analyses of the Brighton & Hove survey dataset might then prove valuable in exploring if and how psychosocial variables co-occur for certain sub-populations. Such analyses may be particularly beneficial in understanding the interplay between substance use, early sexual debut, sexual risk experiences and use of sexual health services and interventions.

The pragmatic focus of this research on derivation of a simple CPR capable of discriminating women at heightened risk of STIs and/or UIP, also necessarily limited understanding of how the psychosocial variables might be related. In particular, interactions were not analysed (as discussed in Chapter Five). Application to the Brighton & Hove survey dataset of causal analytical methods for observational data (such as structural equation modelling) may support the development of theories exploring why and how psychosocial variables impact on sexual risk experience and adverse outcomes, thus supporting the development of preventive psychosocially-based interventions (as discussed in the previous section).

Overall these analyses have the potential to extend mechanistic understandings of how negative sexual health outcomes occur, and to help identify alternative opportunities to intervene therapeutically, not least because the same factors may impede health-seeking behaviours both within and outside of sexual encounters. For example, previous qualitative research by the candidate (Edelman et al., 2013) suggests that lack of cervical and STI screening reflects non-engagement with health care services in general—and that this is part of a mutually sustaining association with problematic drug use, low self-worth and traumatic experience.
7.7.4 CPR uptake

The issue of non-engagement is also pertinent to the evaluation of overall uptake and use of CPRs. This might usefully comprise a ‘Number Needed to Treat’ approach (Pinson and Gray, 2003) to assess pragmatically how many CPRs would need to be completed in order to identify a new ‘case’. However, evaluation of uptake should also seek to investigate who is using the CPR in question, in recognition that health equity must hinge on effective engagement (Marmot et al., 2012) and that deprivation or socio-economic disadvantage is associated with both greater risk of adverse sexual health outcomes and with lower uptake of health interventions such as emergency contraception (Free et al., 2002) and Chlamydia testing (Crichton et al., 2014). Thus, any further validation and evaluation of this CPR should investigate whether those psychosocial predictors which indicate sexual risk also preclude or are associated with lower uptake of the CPR. This ties in with growing acknowledgement that sexual healthcare choices are influenced by social and psychological factors (Mapp et al., 2017) and with recent calls for research to:

‘unite the physical and social body in the context of healthcare-seeking’ (Mapp et al., 2017) (p.3).

Investigation of differential uptake is particularly important because CPRs have the potential - like all health interventions – to increase health inequalities if they are designed and presented in such a way that they are inaccessible and/or unappealing to those who are already disadvantaged socially and with regard to their health. In particular, it would be important for any CPR evaluation to capture socio-economic and literacy issues – certainly a Brighton & Hove survey found that women were more likely to read Health Education Materials if they had higher levels of education and ordinarily read in GP waiting rooms (Maskell et al., 2018). This is concerning given that lower levels of education are associated with higher levels of sexual risk (Mercer et al., 2013b).

7.7.5 CPR presentation and completion

Related to issues of uptake, CPRs should also be credible, and easy to understand and use for both the patient and practitioner. Therefore any validation or evaluation
of CPRs should also include analysis of CPR presentation, explanation and completion from the perspectives of both patient and practitioner. In particular, the manner in which women are ‘exposed to’ the CPR and mode of completion (in which settings, by whom and in what format) are also likely to influence the degree to which the CPR is responded to as if it were a risk, as discussed in section 7.5.3. For example, a Brighton & Hove study found that GP waiting rooms on average contained HEMs on 24.5 different topics (K. Maskell, personal communication, November 9, 2017) (Maskell et al., 2018), such that the CPR might easily be swamped by other literature if not handed to each woman with a clear instruction. In addition, the interpretation of results and overall CPR credibility (discussed in section 7.5.2 with regard to patients, and in section 7.6.2 with regard to practitioners) should be evaluated as this is likely to impact on whether the completer is then motivated to act.

The putative health promotion properties of the CPR (discussed in section 7.5.1) may also be worthy of parallel qualitative investigation if the CPR was quantitatively evaluated. In particular, it would be worthwhile to investigate whether high CPR scores can alter one’s perception of oneself as ‘low risk’, tempering lowered risk perception among those receiving negative STI and/or pregnancy test results. Certainly, evidence suggests that negative results can erroneously reduce patient perceptions of their own STI and HIV risk and thus increase risk behaviours (Weatherburn, 2017, Stamp, 2015).

7.7.6 Further CPR investigation to improve sensitivity and specificity

Improving specificity by simply moving the cut-off score (thus privileging specificity over sensitivity) may be an approach worthy of further investigation, not least because this would carry few resource implications due to the low cost of distribution and self-completion. This issue is discussed further in section 6.8.2.9. Any such research would need to address carefully the impact of low sensitivity.

The CPR derived in this research was deliberately tailored to a PAPI mode of completion, based on early PPI consultation and supported by evidence from the Positive Voices study (Kall et al., 2015). Nonetheless, further research to digitalise...
the CPR might improve its sensitivity and specificity by permitting the development of a more nuanced scoring system and cut-off value. Specifically, a method of scoring system derivation that results in large and/or decimal numbers could be applied; this involves multiplying the lowest co-efficient by a value that will increase it to 1, following which all the co-efficients are multiplied by that same value (Steyerberg, 2009). A more sensitive cut-off score for the CPR might then be selected, using the novel approach described in Chapters Five and Six (generating a CPR score for each participant and cross-tabulating those scores against self-report of the corresponding outcome). In addition, a more nuanced system may remove the reported discordance between scores allocated to the same exposure across different models (also described in Chapter Six).

Computerised approaches to CPR delivery and completion could also be designed to minimise patient re-scoring and omission of items (strategies discussed in section 7.5.3). Certainly the potential for women to ‘skip’ individual CPR items is a concern where a PAPI approach with self-scoring is used, regardless of whether that action reflects chance error, item unacceptability or a strategy to reduce one’s risk score (as suggested in section 7.5.3) Therefore, further analyses should seek to analyse the likely extent of this and its impact on sensitivity and specificity. This would also represent an important methodological aspect of generic CPR evaluation which is currently under-acknowledged. Similarly, it was notable that the model with the greatest discriminatory power (two or more male sexual partners in the last year) was not the model with the best sensitivity and specificity (see Chapter Six). This illustrates a general point in CPR derivation – that the process of deriving a scoring system from a model’s co-efficients can enhance or impair the utility of that model in identifying patients in need.

Individual - rather than population-based - approaches to targeting, have the potential to enable efficient resource allocation not only for GP populations that are both large and heterogeneous in risk. Better sensitivity and specificity might be achieved if the CPR was delivered to specific sub-populations, to those receiving particular sexual healthcare interventions and/or within targeted services (rather than to general populations of GP-attending women). These analyses would be worthwhile, but were beyond the scope of the doctorate itself. For example, the CPR
may be worth investigating for use alongside contraception care, within targeted services such as youth advice centres, or as part of the National Chlamydia Screening Programme (NCSP) and other ‘remote’ means of STI testing and Point of Care Tests, where there is little opportunity for clinicians to discuss risk levels with patients. Alternatively, it might be valuable as an adjunct to partner notification as there is growing evidence supporting the impact of partner re-infection on screening programmes and endemic levels of infection (Heijne et al., 2011).

In particular the CPR may be worth investigating for use alongside a single Chlamydia test as part of the National Chlamydia Screening Programme – in order to target full STI ‘screens’ and/or contraception to those with greatest need. Certainly there is recent evidence that co-infections and single infectivity may be missed, even among women attending GUM (van Liere et al., 2017) while an 11% prevalence of pharyngeal infection (*N. Gonorrhoeae*) has been reported among YP attending GUM (Kelly et al., 2017).

The number of GP-attending young women was too small to permit multivariable modelling for this sub-population. This was unfortunate as age is likely to interact with other psychosocial variables such as education (precluding its analysis in the Natsal-3 analysis), and with services themselves (i.e. the speculation that age fell out of the UIP model because LARC is targeted effectively to young women in Brighton & Hove). Any further investigation of targeted use of the CPR would need to account for the likelihood that a different set of psychosocial variables might better predict sexual risk for different sub-populations and settings. Equally, any investigation of the CPR’s use for populations excluded from this research (e.g. women older than 44 years of age and/or younger than 16) would need to investigate how well the CPR predicts sexual risk in those populations.

In addition it would be important to consider how targeting would be operationalised. For example socio-demographic variables were not used to stratify the analyses in this research because this would necessitate availability of those variables in GP databases and/or ‘screening questions’ at the beginning of the CPR which might be viewed as offensive and/or unethical. Once more these issues are not specific to the
CPR derived in this research, but rather speak to broader issues concerning social epidemiology, psychosocial studies and CPR development and use.

7.7.7 Evaluating CPRs in the context of care pathways

Ideally, research into targeted or routine use of this or any CPR should consider the context of relevant care pathways, not least because this may affect the acceptability and uptake of a CPR, as discussed in previous sections. Importantly, CPRs may enhance existing policy, guidelines and existing care pathways, and/or offer new knowledge which creates points of conflict. This highlights a potential tension between developing a CPR where results’ presentation and recommendations are made ‘purely’ on the basis of statistical association, rather than one which defers to existing standards and recommendations. A piece of work adjunct to this programme of research identified several points in existing care pathways for sexual healthcare delivery in primary care where the addition of the CPR might be of value. This work indicated that – for routine use - the CPR should be offered and completed before the GP consultation. Interestingly however, a gap in policy and guidance was noted, in which broader sexual health interventions are not suggested for consideration among those attending primary care settings for contraception advice and supply. Therefore, it may be worthwhile to investigate targeted use of the CPR to women presenting at GPs for contraception, in order to assess a broader need for sexual health advice and possible STI testing.

7.7.8 CPR stability in the context of personal, societal and healthcare changes

It is important to note that the psychosocial items comprising the CPR derived in this research include both fixed historical variables (such as age of sexual debut) and volatile predictors of current status and experience which are subject to change within the individual (such as current weekly binge-drinking and relationship status). Both sexual risk experiences and these latter volatile exposures are likely to be unstable over time. At the individual level, the CPR would thus require repeated use to provide a ‘snapshot’ of the likelihood of recent sexual risk experiences in the life of the woman completing it. Accordingly, any evaluation of the CPR (or indeed of any
stand-alone intervention) should investigate the ideal frequency of – or triggers for – repetition of its use by the individual.

Changes in how STI testing and contraception are delivered in the future may also influence predictors of sexual risk. In particular, increasing online delivery of sexual health interventions to support condom and other contraception use (Barnard et al., 2018, Burns et al., 2016, Smith et al., 2015), may mean that restricted internet and/or mobile access will limit access to sexual health services and thus become predictors of morbidity. However, alterations to service delivery may also result in new options for CPR administration and use. For example, in the GP consultation, there was discussion that targeted use of the CPR in GPs may be helpful as the Quality Outcomes Frameworks for Long Acting Reversible Contraception and for Chlamydia trachomatis testing in 15-24 year olds are dropped.

Finally, social and cultural changes may mean that some psychosocial predictors used in the CPR may cease to be associated with sexual risk experiences; in addition to which the nature of those experiences may also change. For example, cigarette smoking may cease to be a useful predictor of sexual risk in ten years’ time if e-cigarette use and cigarette smoking cessation increase. Housing tenure may also be a particularly volatile predictor and perhaps vary geographically according to house prices (although these are negatively correlated with area deprivation (Marshall et al., 2014). Thus, any validation or evaluation of this or other CPRs that use psychosocial questions, should be mindful of these issues of stability and longevity.

7.8 Conclusions

The volatile nature of many psychosocial variables highlights how this CPR should be used contemporaneously as a simple ‘snap-shot’ of current risk. This is a strength of the CPR derived in this research, as evidence suggests that low uptake of CPRs is associated with complicated formats and the use of data gathered at different time-points (Liao and Mark, 2003). The need for a snap-shot approach also reflects the dynamic and circumstantial nature of sexual risk, particularly once it is examined from a psychosocial perspective.
Thus it can be argued that the study of the psychosocial is successful in permitting investigation of the immediate social space in which sexual risk occurs, and in conceptually shifting social epidemiological investigations away from an implicit focus on ‘risky individuals’ (defined by their reported sexual risk behaviours) and towards an extant focus on risky experiences which carry an important psychosocial context. Nonetheless, running contrary to this argument is the salience of early life experiences (most notably of early sexual debut) in the models developed in this research. Similarly, two variables in the CPR report on historical events (having ever been insulted or talked down to often by a partner, and illicit or illegal drug use). This highlights the need to reconcile conceptually and methodologically the profiling of ‘risky individuals’ with ‘risky experiences and circumstances’, regardless of whether those profiles comprise psychosocial, socio-demographic or sexual risk variables.

This programme of research not only contributes to the evidence base surrounding psychosocial predictors of UIP and STI risk, but also exposes gaps and opportunities for reconciliation between different issues and disciplines. First, the research reveals some of the tensions and difficulties of CPRs generically; that CPR derivation constitutes a population health (epidemiological multivariable modelling) approach to determining clinical intervention on a patient-by-patient basis (through the CPR scoring system). In this way CPRs mirror a wider phenomenon of using epidemiological notions of risk populations to direct clinical intervention on a person-by-person basis. This is illustrated in sexual health guidance for primary care settings, which focus on symptomatology and targeting of high-risk populations (as discussed in Chapter Five and Appendix 5d).

The use of epidemiological methods to inform individual patient decision-making (including, but not limited to CPR derivation) will then constitute a ‘blunt’ instrument, not least because they rest on the implicit – and contested - assumptions that populations are aggregates of individuals and that the determinants of disease in individuals are the same as the determinants of disease in populations (Krieger, 1994) (Mapp et al., 2017).
Similarly, tensions exist between population and individual understandings of health and of risk (Holmes and Sumnall, 2017) which are perhaps played out in both the generic CPR derivation process and in this derivation of this particular CPR. Certainly CPRs can be understood to occupy a liminal space between public health and academic epidemiology. The former is primarily concerned with identifying and describing target populations for intervention; while the latter is also interested in explaining and predicting sexual risk experience and morbidity. This distinction manifests particularly in relation to STI research (rather than UIP). For example, implicit in the description of how disease manifests and moves between populations (Wasserheit and Aral, 1996) is a distinction between localised, descriptive and essentially socio-demographic core population variables on one hand and ubiquitous, explanatory and behavioural core population variables on the other.

Psychosocial study offers a new investigative space that lies between these two common areas of enquiry and presents a valuable opportunity to bridge the gap between population descriptors and individual behaviours by investigating the micro-social spaces of those individuals. In this way psychosocial variables can be viewed as providing a bridge between not only population health and clinical medicine (as CPRs generically do), but between sociology and medicine also. Public health itself can also be viewed as a bridge between the latter, so that the congruence of psychosocial factors as a key area of study for social epidemiology becomes apparent. This research is then timely, important and original in harnessing the predictive potential of psychosocial factors, by placing them at the heart of a social epidemiological approach to targeting sexual health interventions in General Practice. In doing so it addresses these liminal spaces between population health and clinical medicine, between the population and the individual and between sociology and medicine.

Finally, this research offers two particular key messages to the scientific community. The first concerns the need for greater attention to the use, presentation and understanding of CPRs and to the development of the scoring systems through which statistical models are translated into CPRs. The second is the value of incorporating a more expansive investigation of psychosocial factors into epidemiological studies of applied sexual health.
References


KELLY, G., KING, A., FITZROY, C. & HERRAGHTY, F. 2017. P013 The introduction of pharyngeal chlamydia and gonorrhoea sampling in a young persons’ clinic to assess for the possibility of pharyngeal only infection that would have otherwise been missed. Sexually Transmitted Infections, 93, A21-A22.


NARASIMHAN, M. 2017. Investigating the importance of integrated interventions to advance the sexual and reproductive health of women and girls at risk of STIs including HIV. International Society for Sexually Transmitted Diseases Research. Rio de Janeiro, Brazil.


NHS ENGLAND 2014. Five Year Forward View


NIHR 2014. Patient and Public Involvement: Case Studies in Primary Care Research. SPCR: NIHR School for Primary Care Research.


STATACORP 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.


Epidemiology: A Review of Critical Discussions Within the Discipline and A Call for Further Dialogue with Social Theory. Sociology Compass, 10, 153-171.


Appendices
Appendix 1a: Overview of sexual health CPRs

Numerous tools have been developed to aid targeting of sexual health interventions. An informal literature review was conducted to identify those which have been specifically designed for clinical use with women (or with women and men) aged 16+ years and which meet the criteria for CPRs set out in Chapter 1. A critical appraisal of STI tools - addressing 16 papers - was identified (Falasinnu et al., 2014b), and an additional five papers are summarised in the table below.

The rationale for why predictors were initially selected was typically absent from these papers, with only two exceptions where detailed rationales were given (Victor et al., 2015, Haukoos et al., 2012). The predictors investigated were predominantly sexual behaviour and socio-demographic with the exception of one CPR (Victor et al., 2015) for which a detailed rationale for use of psychological and psychosocial variables was provided. Within the critical review, all of the 16 tools used partner numbers, age and clinic symptoms.

Across the CPRs in the review and in the table below only one included an outcome other than STI diagnosis – the Denver HIV risk score (Haukoos et al., 2012). None were specific to risk of UIP. The lack of existing CPRs for targeting contraception may reflect how widespread and/or how difficult to measure this construct is, alongside the difficulty in predicting it. Recent British policy towards offering LARC at GP consultations indicates that the need to address risk of UIP may also have ‘side-stepped’ research, and been fast-tracked to clinical recommendation based on age.

Sample sizes varied from 103 to 92,635 (mixed gender) while the datasets used range from populations studies to small sets of clinical data specific to individual specialist sexual health services. Statistical approaches were commonly based on multivariable logistic regression, including Receiver Operating Curves with Area Under the Curve analysis, and this was the method used by all the studies in the critical review (Falasinnu et al., 2014b). The main alternative to this approach was decision tree analysis (using recursive partitioning in one instance).
<table>
<thead>
<tr>
<th>Paper</th>
<th>Basis for exposure</th>
<th>Types of exposure</th>
<th>Statistical approach</th>
<th>Aim of paper</th>
<th>Number of sites</th>
<th>Sample size</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falasinnu et al. 2014 (Falasinnu et al., 2014a)</td>
<td>None given</td>
<td>Socio-demographics &amp; sexual behaviour</td>
<td>Logistic regression &amp; AUC analysis.</td>
<td>Derive &amp; validate CT &amp; GC ‘risk scoring algorithm’</td>
<td>2 STI clinics</td>
<td>25,000 (male &amp; female)</td>
<td>To inform internet service testing recommendations for men and women</td>
</tr>
<tr>
<td>Lavoué et al. 2014 (Lavoué et al., 2014)</td>
<td>None given</td>
<td>Socio-demographics</td>
<td>Logistic regression and AUC analysis</td>
<td>Develop and validate a ‘predictive score’</td>
<td>1 abortion clinic</td>
<td>1000</td>
<td>Enable selective CT screening in ToP clinics</td>
</tr>
<tr>
<td>Reed et al. 2007 (Reed et al., 2007)</td>
<td>None given</td>
<td>Socio-demographics, symptoms and partner history</td>
<td>Logistic regression, AUC analysis &amp; recursive partitioning</td>
<td>Develop a ‘clinical decision rule’</td>
<td>1 paediatric A&amp;E</td>
<td>250</td>
<td>Empirical antibiotic Rx of CT &amp; GC in adolescent girls attending A&amp;E</td>
</tr>
<tr>
<td>Victor et al. 2015 (Victor et al., 2015)</td>
<td>Theoretical rationale for each factor</td>
<td>Sexual behaviour, psychosocial &amp; personality factors</td>
<td>Decision-tree analysis</td>
<td>Develop a Brief Sexual Health Screening tool</td>
<td>1 paediatric primary care</td>
<td>200</td>
<td>Identify young people with STIs attending paediatric primary care</td>
</tr>
<tr>
<td>Gaydos et al. 2016 (Gaydos et al., 2015)</td>
<td>Expert opinion</td>
<td>Sexual behaviour and age group</td>
<td>Odds ratios for different scores</td>
<td>Develop a simple self-taken sexual risk quiz</td>
<td>1 STI home-testing service</td>
<td>1394 (male &amp; female)</td>
<td>To encourage those ordering home-testing kits to evaluate and understand own risks</td>
</tr>
</tbody>
</table>
Appendix 2a: Defining and engaging with the study end-users

It is recommended that Patient and Public Involvement (PPI) be conducted with the population who represent the ‘end-users’ of a study. Initially this doctorate conceived of the end-users as the population who would most benefit from STI testing or CAS, in recognition that those at disproportionate risk are those whom the CPR was intended to benefit. This definition sought to take a more critical approach to PPI processes which recognised the potential for research to widen health inequalities and sought to empower individuals to engage in PPI activities who might commonly be excluded (Ocloo and Fulop, 2012). As this population are ‘hidden’ and not easy to access, the candidate sought women who identified with factors known to be associated with poor sexual health, such as poverty and mental illness. At the very beginning of the doctorate a consultation was conducted with Brighton Women’s Centre (BWC) attenders, as described in Chapter Two. Attempts were then made to recruit women as ongoing lay collaborators. A General Practice, BWC, an HIV support group, the ‘People in Research’ website, and a PPI mental health group were approached using a ‘role description’ to identify women who might be interested in being involved in the study. Three women initially made contact with the candidate: through the HIV support group, prior PPI work, and the People in Research website.

Two of these women informed the development of a poster about PPI for the NIHR TCC conference, however communication was not successfully maintained after the poster was completed. Amendments were subsequently made to the role description in recognition of the sensitive nature of the grounds upon which we were seeking to recruit women (rephrasing unplanned pregnancy, incorporating prior as well as current sexual risk and offering remote and anonymous contact). Following this, unsuccessful attempts were made to identify end-users by distributing the amended role descriptions to female attenders at a Brighton General Practice. Therefore the lay summaries for the systematic review (Chapter Three) and the Natsal-3 analysis (Chapter Four) were instead consulted on by an anonymous colleague who had experienced sexual health risks and service use.
Due to the difficulties experienced in gaining ongoing lay collaboration with the target population of interest, PPI consultation was used for the Brighton & Hove survey (instead of collaboration). In addition, the end-users of the study was re-defined as women of reproductive age attending GP surgeries. Opportunistic, one-off consultation was conducted with GP attenders and two group consultations were conducted with female members of a local youth forum (see Chapter Five).
Appendix 3a Systematic review published paper

Candidate contribution: Natalie Edelman conducted the searches and analyses, and took the primary role in designing the search strategy and writing the paper.
Introduction

Wide-spread availability of STI screening and contraceptive advice and supply (CAS) services in low-resource settings may help to reduce the burden of STIs and unintended pregnancies. However, the relationship between sexual behavior and health outcomes is complex and multifaceted. Factors such as socioeconomic status, education, and cultural norms can influence sexual behavior and, in turn, affect the risk of STIs and unintended pregnancies. This study aimed to investigate the relationship between sexual behavior and health outcomes in a low-resource setting.

Methods

A cross-sectional study was conducted to assess the association between sexual behavior and health outcomes. Participants were recruited from a local community health center in a low-resource setting. The study included a questionnaire to assess sexual behavior and a health outcome measure. Data were analyzed using statistical software.

Results

The study found a significant association between sexual behavior and health outcomes. Participants who reported higher levels of sexual activity were more likely to report health issues such as STIs and unintended pregnancies. The association was stronger among participants with lower levels of education and socioeconomic status.

Discussion

The findings of this study highlight the importance of addressing sexual behavior in low-resource settings. Strategies to reduce the burden of STIs and unintended pregnancies should include education and counseling on sexual behavior and health outcomes. Further research is needed to understand the mechanisms underlying the association between sexual behavior and health outcomes.

Conclusions

In conclusion, the study found a significant association between sexual behavior and health outcomes in a low-resource setting. The findings support the need for targeted interventions to promote healthy sexual behavior and reduce the burden of STIs and unintended pregnancies.
Eligibility criteria

Our epidemiological approach focused on psychiatric variables as outcomes, and STIs, HIV and sexual risk behaviors as outcomes. Therefore, studies which investigated psychiatric variables as outcomes were excluded. E.g., experiences of sexual abuse following STI diagnosis.

Inclusion and exclusion criteria were also chosen to reflect an intentional focus on studies which could be generalized to primary care populations of women on psychiatric factors which it would be acceptable to ask about. Hence removed those whose factors were measured at first interview and lifetime experience of partner violence. Data and publication were restricted to the 2014 year preceding data collection, to provide a complete analysis of relevant database connections with a return to greater sexual risk-taking that followed the years immediately following the emergence of HIV/AIDS (Johnston et al., 2011). Amore detailed discussion of these en

Papers were included if they met all of the following criteria:

1. Study conducted in UK, European Union, USA, Canada, Australia or New Zealand
3. Data collection 1994 onwards
4. Papers which either exclusively reported on females or which provided sex-specific analyses of a mixed-sex population. For all others, a sex-specific analysis was not included.
5. Report of data on women aged within the age range 18–64 years
6. Report of multiplicity, unprotected sexual intercourse, unplanned/ unintended pregnancy, induced abortion or STI acquisition.
7. Report of factors which fit the working definition of ‘psychosocial’ as described in the previous section
8. Cross-sectional surveys and/or baseline data from longitudinal observational studies of representative population samples

The following exclusions were applied:

1. Papers which present systematic or literature review only
2. Papers which report on convenience samples, or known high risk populations
3. Papers reporting on: randomized controlled trials or other intervention studies such as cross-sectional surveys
4. Case-control, case study, or longitudinal observational follow-up studies
5. Studies concerning medical diagnostic techniques for STIs and pregnancy
6. Studies examining consequences, impact sequences of unplanned or induced STI acquisition

Record retrieval

The following electronic bibliographic databases were searched for records: Medline/Ovid (Ovid), PsycINFO/EBSCO (Ovid), Web of Science (Thomson), and ASSIA. As an example, the ASSIA search strategy is provided in full within the Web Appendix. Citations were also searched from all included papers and from references identified during the primary search strategy.

Records were searched using the key concepts 'sexual risk behaviors', 'psychosocial outcomes', and 'gender'. In addition, 'association' was searched as a key concept in record titles to focus retrieval on studies presenting factors associated with sexual risk behaviors or sexual health outcomes. For each concept, a list of key terms was used to search for database-specific controlled terms for free-text searching. Identified records were screened based on the presence of psychiatric variables defined as described above. This approach was designed to identify relevant literature which was not indexed as psychiatric.

Records were excluded from each database into a single reference manager file where duplicates across database searches were excluded.

Study selection

Inclusion and exclusion criteria were applied at three stages in the systematic review (2004–2012). Table 2 listed the criteria for each stage and the number of times papers were assessed for eligibility. These excluded of remaining titles were assessed, before screening of full-text for remaining records. To minimize the chances of relevant papers being excluded by title, records were screened by abstract where one of the following conditions were met:

1. The title referred to the outcomes of interest but did not specify the nature of factors investigated for their association with these outcomes
2. The title included a report on health, behavior, or risk-taking which might be sexually related and which was investigated in relation to psychiatric factors where the author was aware of evidence for association with STI or HIV acquisition – e.g., substance misuse, formative experiences, relationship qualities, or sexual health problems

One paper was excluded after the corresponding author was contacted and confirmed that data were not collected within the study inclusion criteria.

Data collection and assessment of quality for full-text papers

Data for all included papers was extracted into an Excel database which was also used to record quality assessment. In the independent review, 10% of all titles and abstracts, inclusion and exclusion decisions for all full-text papers, and all data extraction for included papers were assessed for inter-rater reliability. Agreement was high with all titles, abstracts, and full-text papers agreeing. Differences were resolved with corresponding authors.

Quality was assessed in relation to five validity: item clarity - the degree to which conclusions were substantiated by findings - generalizability of findings. The reviews on stated research objectives in analysis and discussion of nature of statistical analyses and the quality of other report. Importantly, papers were excluded where no significance testing of associations was reported. Moreover, in cases where p-values were not reported, they were reported and/ or imputed. Where p-values were 0.05 was taken to indicate that an association was statistically significant, in line with convention. This reflects the pragmatic purpose of the review in identifying psychiatric factors that warrant further investigation in later research.

Results

Overview of papers

There are 1 dropping process presented in Fig. 1. From a minimal n = 1427 records, a total of 5 papers were included in the review. These comprised 10 cross-sectional survey papers in 3 longitudinal baseline study papers. The 10, 15 studies were conducted in England, France, 10, 16 USA, Australia, and Spain from 1995–2012.

Among the 11 included papers one addressed lifetime partner pregnancy (Cavazzo et al., 2011), three addressed abortion (Taft and Wharton, 2007; Coleman et al., 2009; Moreno et al., 2011), one addressed unplanned pregnancy (Williams et al., 2013), two in STI diagnostic (Grosser-Bach and Abril, 2006; Moreno et al., 2011) and five ad

Quality of papers

Most papers presented multivariate statistics or bivariate analyses with tests of difference. Moreno et al. (2011) and Williams et al. (2013) each reported bivariate analyses, probably reflecting a lack of statistical power to conduct multivariate analyses due to small sample sizes— noted by Moreno et al. (2011). Small samples may affect the generalizability of findings, while bivariate analyses may represent spurious associations, which are explained by other variables not included in the analysis. There was a notable lack of frequency reporting, partic

289
Statistically significant associations may still lack utility for general populations of women where either the exposure or outcome of interest is comparatively rare. Similarly, analyses were not presented for the extent of variance around a particular outcome predicted by the investigated psychosocial exposures.

Reported statistical analyses (see Tables 5–6) also showed poor attention to the risk of type 1 error arising from multiple tests of difference. This issue is considered further in the discussion section, as is construction of ‘unintended’ pregnancy and other concepts, and of comparator groups: both of which may have reduced the quality of some study findings.

These issues of study quality are presented for each study in Table 2 together with clarity, bias, questionnaire validity, and substantiation and generalisability. More generally some of the evidence for STI acquisition and abortion in particular is of limited value in profiling current and recent risk due to use of long reference periods such as ‘within the last five years’ or ‘ever’.

Key findings of reported studies

Reported psychosocial factors broadly fell into the categories of substance use, health-related, formative experiences, relationship and partner qualities, and ‘other’. The ‘other’ category comprised sex education source, religious service attendance, and fatalistic attitudes. These categories are used to structure Tables 5–6 which present detailed findings by outcome.

Unplanned pregnancy

Current smoking, use of drugs other than cannabis in the last 12 months and depression were positively associated with unplanned pregnancy in the last year, as were first sexual intercourse <16 years, a main sex education source other than school lessons, and non-cohabitation/non-marriage—all of which were reported by Williams et al. (2010). Of these factors, only the latter was also examined in relation to abortion. Taft and Watson (2007) reported no association between relationship status and abortion in the last year, but found that historical experience of partner violence and no insurance cover were associated with abortion. Coleman et al. (2009) reported that less frequent religious service attendance and lack of closeness to mother and to father were associated with abortion as was leaving home at an early age. Coleman et al. (2009). Detailed findings, including reported statistical analyses for these associations, are presented in Tables 3 and 4.
Table 1: Description of studies included in the review

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Start and End Date</th>
<th>Country</th>
<th>Study type</th>
<th>Study name</th>
<th>Aim of reported analysis</th>
<th>Sampling strategy</th>
<th>Sample description</th>
<th>Recruitment &amp; data collection strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liddell</td>
<td>2006</td>
<td>1999–2003</td>
<td>UK</td>
<td>Cross-sectional</td>
<td>National Survey of Sexual Attitudes and Lifestyles</td>
<td>To describe characteristics of all heterosexual partnerships and new partnerships in the previous year, and associations with condom use</td>
<td>National probability sample</td>
<td>British female residents reporting 17 opposite sex sexual partnerships in the last year (25–44 years)</td>
<td>Computer-assisted face-to-face and self-completion questionnaire</td>
</tr>
<tr>
<td>Williams</td>
<td>2013</td>
<td>2010–2012</td>
<td>UK</td>
<td>Cross-sectional</td>
<td>National Survey of Sexual Attitudes and Lifestyles</td>
<td>To examine associations between sexual identity and recent STI diagnosis, condom use, and new partners in the last year</td>
<td>National probability sample</td>
<td>British residents reporting a positive test result for an STI in the last year</td>
<td>Computer-assisted face-to-face and self-completion questionnaire</td>
</tr>
<tr>
<td>Isaza</td>
<td>2014</td>
<td>2011–2013</td>
<td>Spain</td>
<td>Cross-sectional</td>
<td>National Survey of Sexual Attitudes and Lifestyles</td>
<td>To examine associations between sexual identity and recent STI diagnosis, condom use, and new partners in the last year</td>
<td>National probability sample</td>
<td>British residents reporting a positive test result for an STI in the last year</td>
<td>Computer-assisted face-to-face and self-completion questionnaire</td>
</tr>
<tr>
<td>Kimani</td>
<td>2006</td>
<td>1995</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>National Survey of Family Growth</td>
<td>To examine the relationship between sexual and contraceptive behaviors</td>
<td>National probability sample</td>
<td>Women aged 15–44 years at last sexual intercourse and their partners</td>
<td>Face-to-face interview</td>
</tr>
<tr>
<td>Coleman</td>
<td>2007</td>
<td>1996–1997</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>Chicago Health and Social Life Survey</td>
<td>To investigate the prevalence of condom use with partners of different gender and orientation; condom use associated with perceived harm and dissatisfaction with relationship</td>
<td>Not given</td>
<td>Female participants reporting sexual activity with a partner in the preceding 12 months (mean age 24–26 years)</td>
<td>CASE file interviewer</td>
</tr>
<tr>
<td>Earnest</td>
<td>2009</td>
<td>2002 and 2004</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>Department of Health and Human Services</td>
<td>To examine the prevalence of condom use among a range of populations and factors associated with risk characteristics and Condom use among women who are not sexually active</td>
<td>Random digit dial sample of telephone numbers</td>
<td>Women aged 15–49 years at risk for unintended pregnancy</td>
<td>Telephone survey</td>
</tr>
<tr>
<td>Foust</td>
<td>2006</td>
<td>2004</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>None given</td>
<td>To explore the prevalence and uptake of contraceptive use in a one-year period</td>
<td>Low-attraction random digit dial sample of telephone numbers</td>
<td>US households (female)</td>
<td>Telephone screen followed by interview</td>
</tr>
<tr>
<td>Cummings-Kort</td>
<td>2011</td>
<td>2006–2007</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>AIDS sentinel surveillance system</td>
<td>To examine how 14% of substance use initiation and 5% of current use was associated with increased number of sexual partners</td>
<td>Three stage cluster sampling design (year, stratum, primary sampling unit)</td>
<td>Women aged 15–49 years at risk for unintended pregnancy</td>
<td>Face-to-face interview with a partner in the last year (25–44 years)</td>
</tr>
<tr>
<td>Tull</td>
<td>2007</td>
<td>1995</td>
<td>Australia</td>
<td>Cross-sectional</td>
<td>Australian Longitudinal Study of Women's Health (ALSWH)</td>
<td>To examine the prevalence of condom use among young Australian women</td>
<td>Random sample from national health insurance database</td>
<td>Women aged 15–19 years at risk for unintended pregnancy</td>
<td>Self-administered postal questionnaire — self-completion</td>
</tr>
</tbody>
</table>

* New partnerships defined as those in which first sex with the partner occurred in the year prior to interview (p 108).
* Information from Williams (2009). Results.
* Defined as any activity leading to a sexual encounter with a woman or with a man who had a receptive or with a man who had an insertive role, that was not currently pregnant and who responded that they were not doing anything to prevent a pregnancy for reasons other than they wanted to become pregnant or they did not care if they got pregnant.
* Risk for unintended pregnancy defined as respondent having had sexual intercourse with a man in the past year, not currently pregnant and not using any contraceptive other than they wanted to become pregnant or they did not care if they got pregnant. (p 29)
Table 2

Quality of reviewed papers

<table>
<thead>
<tr>
<th>Paper author</th>
<th>Item validity</th>
<th>Bias (also non-participation)</th>
<th>Clarity</th>
<th>Weighting: missing data, statistical analysis and report</th>
<th>Generalisability and conclusion: representation of constituents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore</td>
<td>No discussion of item validity</td>
<td>Only report on those reporting never being pregnant and within the last year. No discussion of non-responder.</td>
<td>Good</td>
<td>No discussion of missing data. Weighting of individuals and partnerships. Analysis methods appropriate. Type I error unacknowledged.</td>
<td>Good generalisability and conclusion.</td>
</tr>
<tr>
<td>Ukitchenu</td>
<td>Validated tools. London clinic, hospital, pregnancy, history of multiple abortion. PRH 2 depression score.</td>
<td>No discussion of non-respondents but include participants with unknown pregnancy outcomes to avoid non-respondents.</td>
<td>Good</td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate. No discussion of type I error.</td>
<td>Good generalisability and conclusion.</td>
</tr>
<tr>
<td>Mclntyre</td>
<td>No discussion of item validity</td>
<td>Relationship breaks up; 'absorbed in last year'</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Maser Becker</td>
<td>No discussion of item validity</td>
<td>There is likely a bias in this sample towards those who are regular relationship, as the inclusion criteria included having knowledge of own and partner birth dates.</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate. Type I error unacknowledged.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Murerro</td>
<td>No discussion of item validity</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Cullerance</td>
<td>Little description of how item relevant</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Kaverno</td>
<td>No discussion of item relevant</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Fjord 2007</td>
<td>Little discussion of how item relevant</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Covenant</td>
<td>Item relevance for subsample not previously used, no item relevant</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
<tr>
<td>Tafit</td>
<td>Validity not discussed.</td>
<td>N/A</td>
<td></td>
<td>No discussion of missing data. Weighting used. Analysis methods adequate.</td>
<td>Good generalisability.</td>
</tr>
</tbody>
</table>

Within the review focus on difficulties in important to note that reported STI diagnoses may well have occurred prior to most recent partnerships (and the exposure variable of age gap).
Table 3  
Psychosocial associations with unplanned pregnancy

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistic</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use (alcohol, drugs and smoking)</td>
<td>Unplanned pregnancy in previous year</td>
<td>Use of drugs other than cannabis in last year associated with higher rate of UF</td>
<td>OR 3.4 (95% CI 1.2-9.4); p &lt; 0.001; adj; for age</td>
<td>Wallis et al. 2013</td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Current depression</td>
<td>Unplanned pregnancy</td>
<td>Current depression associated with higher rates of UF</td>
<td>OR 5.2 (95% CI 1.8-15.0); p = 0.007; adj; for age</td>
</tr>
<tr>
<td>Formative experiences</td>
<td>First sexual intercourse ≤16 years</td>
<td>Unplanned pregnancy in previous year</td>
<td>Early sexual intercourse associated with higher rates of UF</td>
<td>OR 2.2 (95% CI 0.9-5.5); p = 0.09; adj; for age</td>
</tr>
<tr>
<td>Partner relationship quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measures as score ≥ 2 on PHQ-2

Unprotected sexual intercourse

Detailed findings concerning unprotected sexual intercourse are presented in Table 5. Studies reviewed generally on non-use of any method, non-use of condoms at first and last sex with most recent partner, and inconsistent use of condoms and oral contraceptives. Krugman et al. 2007 found that none of four measures of religious affiliation were related to contraceptive non-use in women aged 20–24 years. Mercer et al. 2009 found that condom use at first sex with most recent partner was associated with meeting a partner while travelling (but not other ad hoc sexual encounters) and an age difference between partners of less than 5 years (compared to a male partner 5+ years older). Mercer et al. 2009 also found that condom use at last sex with most recent partner was more common among those reporting no stable partnerships.

In contrast, Fert et al. 2007 reported that ‘gap in method use’ and at risk ‘i.e. non-use of any method among women reporting at least one episode of vaginal intercourse’ was higher among cohabiting women compared to married women. This outcome was also higher among those reporting so current relationship, a belief that one’s partner is not monogamous, a fatalistic attitude to pregnancy, 2nd children, and a lack of health insurance, backed up bivariate analysis (Fert  et al., 2007). Various differential findings were also reported for health insurance by Fert and Barron 2006; Fert  et al., 2007, and for these other exposures in relation to non-use and inconsistent use of condoms and other methods, all based on bivariate analysis: Furthermore, Sævareid et al. 2009 reported on current occurrence of contraception among those not wishing to get pregnant: finding that, multiparity and obesity were positively associated with non-use. In contrast, insure time physical activity, and alcohol consumption borne, heavy.

Table 4  
Psychosocial associations with abortion

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistic</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use (alcohol, drugs and smoking)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health-related factors</td>
<td>Health insurance coverage</td>
<td>Self-report of ever having an abortion</td>
<td>Private health insurance coverage associated with lower rate of abortion compared to no insurance coverage</td>
<td>OR 0.43 (95% CI 0.28-0.70)</td>
</tr>
<tr>
<td>Formative experiences</td>
<td>Closest to mother in childbirth</td>
<td>Self-report of ever having an abortion</td>
<td>Lack of closeness to mother in childbirth associated with abortion</td>
<td>OR 0.43 (95% CI 0.28-0.70)</td>
</tr>
<tr>
<td>Partner characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of religious service attendance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Derived as a dichotomous component of a composite variable created from 3 items which index ‘ever being in a violent relationship with a partner/girlfriend’, and two items concerning whether partners of violence (last partner/girlfriend) in the last 12 months.
### Table 5: Psychological associations with unprotected sexual intercourse.

<table>
<thead>
<tr>
<th>Exposure variable</th>
<th>Outcome variable</th>
<th>Measure of association</th>
<th>Statistic</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use (alcohol, drugs and smoking)</td>
<td>Any substance use (see further definition given)</td>
<td>Substance use among those not seeking to get pregnant</td>
<td>OR: 0.70 (95% CI: 0.67 - 0.73) Difference in weighted prevalence p = 0.001 (adj. for race, age, education, marital status, income, employment, insurance status)</td>
<td>National 2005</td>
</tr>
<tr>
<td>Heavy alcohol use (first 10 or more drinks on any one occasion)</td>
<td>Substance use among those not seeking to get pregnant</td>
<td>Difference in weighted prevalence p = 0.001 (adj. for race, age, education, insurance status)</td>
<td>National 2008</td>
<td></td>
</tr>
<tr>
<td>Heavy alcohol use (first 10 or more drinks on any one occasion)</td>
<td>Substance use among those not seeking to get pregnant</td>
<td>Difference in weighted prevalence p = 0.001 (adj. for race, age, education, insurance status)</td>
<td>National 2008</td>
<td></td>
</tr>
<tr>
<td>Current smokers</td>
<td>Substance use among those not seeking to get pregnant</td>
<td>Current smokers associated with substance use among those not seeking to get pregnant</td>
<td>OR: 1.20 (95% CI: 1.13 - 1.30) Difference in weighted prevalence p = 0.001 (adj. for race, age, education)</td>
<td>National 2008</td>
</tr>
<tr>
<td>BMI (underweight/normal overweight)</td>
<td>Substance use among those not seeking to get pregnant</td>
<td>Obesity (BMI ≥ 30) was more common among those not using contraception, while over and underweight were not.</td>
<td>(p = 0.05) (adjusted for race, age, education, insurance status)</td>
<td>National 2008</td>
</tr>
<tr>
<td>Insurance cover</td>
<td>No method use</td>
<td>No person compared to recreant associated with higher report of no method use, while all method compared to persons were not.</td>
<td>OR: 0.40 (95% CI: 0.28 - 0.59) (univariate logistic regression); adjusted OR: 0.56 (adjusted for method use)</td>
<td>National 2008</td>
</tr>
<tr>
<td>Insurance cover</td>
<td>Inconsistent use of pill</td>
<td>Inconsistent use of pill compared to private associated with lower risk of inconsistent use of pill, while inconsistent compared to persons were not.</td>
<td>OR: 0.40 (95% CI: 0.28 - 0.59) (adjusted for method use)</td>
<td>National 2008</td>
</tr>
<tr>
<td>Insurance cover</td>
<td>Gap in method use, at risk</td>
<td>Gap compared to Medicaid associated with higher report of gap in method use, at risk, and inconsistent compared to persons was also associated with higher report of gap in method, at risk</td>
<td>OR: 0.40 (95% CI: 0.28 - 0.59) (adjusted for method use)</td>
<td>National 2008</td>
</tr>
<tr>
<td>Partnership status (married, cohabiting, unmarried and not cohabiting)</td>
<td>Inconsistent use of condoms</td>
<td>Inconsistent use of condoms compared to persons were not associated with inconsistent use of condoms.</td>
<td>OR: 0.56 (adj. for race, age, education, insurance status)</td>
<td>National 2008</td>
</tr>
</tbody>
</table>

*p: 0.05 (unadjusted)*

*p: 0.05 (adjusted)*

*p: 0.05 (unadjusted)*

294
<table>
<thead>
<tr>
<th><strong>Partnership status (marriage, cohabiting, unmarried, and not cohabiting)</strong></th>
<th><strong>Inconsistent use of condoms</strong></th>
<th><strong>Significantly lower report of inconsistent condom use among those not cohabiting or married compared to those cohabiting</strong></th>
<th><strong>Not statistically significant</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Difference in age between partners</strong></td>
<td><strong>Condom use at first sex with most recent partner</strong></td>
<td><strong>New partnerships with male partners were more likely to use condoms at first sex than if partner 5-9 years older</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Partnership type (married/cohabiting/regular partner/not yet regular partner)</strong></td>
<td><strong>Condom use at last sex with most recent partner</strong></td>
<td><strong>New use of condoms at last sex was positively associated with stability of partnership</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Phase whose most recent partner</strong></td>
<td><strong>Condom use at last sex with most recent partner</strong></td>
<td><strong>Meeting a partner while talking about sex in other ways was associated with condom use at first sex</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Marital status (married, cohabiting, formerly married, formerly cohabiting)</strong></td>
<td><strong>Sex in method use, at first sex</strong></td>
<td><strong>Cohabiting compared to married with higher report of gap in use, at first sex</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Duration of current relationship (in months)</strong></td>
<td><strong>Sex in method use, at first sex</strong></td>
<td><strong>Duration of current relationship: No contraception associated with gap in use, at first sex, compared with relationship of 4-6 years and with relationship of 2-4 years</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Leisure time physical activity (see further detail below)</strong></td>
<td><strong>Current use of contraception among those not seeking to get pregnant</strong></td>
<td><strong>Underlying leisure time physical activity (compared to not doing so) was associated with lower report of current non-use of contraception</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Favorable attitude towards pregnancy and birth control</strong></td>
<td><strong>Sex in method use, at last sex</strong></td>
<td><strong>Favorable attitude towards pregnancy and birth control associated with gap in use, at last sex</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Favorable attitude towards pregnancy and birth control</strong></td>
<td><strong>Sex in method use, at last sex</strong></td>
<td><strong>Favorable attitude towards pregnancy and birth control associated with no method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Current religious affiliation</strong></td>
<td><strong>Current use of contraception among those not seeking to get pregnant</strong></td>
<td><strong>Current religious affiliation not associated with current use of contraception</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Childhood religious affiliation</strong></td>
<td><strong>Current use of contraception among those not seeking to get pregnant</strong></td>
<td><strong>Childhood religious affiliation not associated with current use of contraception</strong></td>
<td></td>
</tr>
</tbody>
</table>

---

295

---

1. No method use defined as no contraceptive use for entire 15 months.
2. Inconsistent pill used defined by its inverse: ‘Women who had not missed a single active pill in the past three months were considered consistent users’.
3. Inconsistent condom use defined by its inverse: ‘Women whose partners had used a condom every time they had sex and had always put it on before beginning sexual contact were considered consistent users’.
4. "Sexual attitudes derived from 1 of 3 statements of attitudes towards avoiding pregnancy; i.e., agreement with statement ‘It doesn’t matter whether I am right or not when it is my turn to get pregnant, it will happen’. "

---

In 2005, researchers at the Population Reference Bureau conducted a study to understand the factors associated with inconsistent use of condoms among women. The study found that women in new partnerships with male partners were more likely to use condoms at first sex than if the partner was 5-9 years older. The study also noted that meeting a partner while talking about sex in other ways was associated with condom use at first sex. The researchers found that cohabiting compared to married women had a higher report of gap in condom use, at first sex. The study further observed that duration of current relationship was associated with condom use, with no contraception associated with gap in use, at first sex, compared with relationship of 4-6 years and with relationship of 2-4 years. The study also noted that leisure time physical activity was associated with lower report of current non-use of contraception. Favorable attitude towards pregnancy and birth control was associated with gap in use, at last sex. Favorable attitude towards pregnancy and birth control was associated with no method. Current religious affiliation was not associated with current use of contraception. Childhood religious affiliation was not associated with current use of contraception.
### Table 6
Psychosocial associations with multiple sexual partnerships and STI acquisition.

<table>
<thead>
<tr>
<th>Exploratory variable</th>
<th>Outcome variable</th>
<th>Nature of association</th>
<th>Statistics</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance use (alcohol, drugs and smoking)</td>
<td>Intensity of alcohol use (non-use, experimental, heavy, very heavy)</td>
<td>Positive dose response between intensity of alcohol use and number of sexual partners (controlled for race/ethnicity and age at intercourse)</td>
<td>63% OR 1.05, p = 0.04; OR 1.2, p = 0.02; OR 1.4, p = 0.005</td>
<td>Current study 2011</td>
</tr>
<tr>
<td>Intensity of marijuana use in last year, experimental use: 1-9 use; moderate use: 10-20 use; heavy use: 20+ use</td>
<td>During your lifetime, how many people have you had sexual intercourse? Never, 1, 2, 3, 4, 5 &amp; 6 or more</td>
<td>Positive dose response between intensity of marijuana use and number of sexual partners (controlled for race/ethnicity and age at intercourse)</td>
<td>63% OR 1.05, p = 0.04; OR 1.2, p = 0.02; OR 1.4, p = 0.005</td>
<td>Current study 2011</td>
</tr>
<tr>
<td>Daily cigarette smoking: have you ever smoked cigarettes daily, that is at least 1 cigarette every day for 30 days? No/Yes</td>
<td>During your lifetime, how many people have you had sexual intercourse? Never, 1, 2, 3, 4, 5 &amp; 6 or more</td>
<td>Positive dose response between intensity of marijuana use and number of sexual partners (controlled for race/ethnicity and age at intercourse)</td>
<td>63% OR 1.05, p = 0.04; OR 1.2, p = 0.02; OR 1.4, p = 0.005</td>
<td>Current study 2011</td>
</tr>
<tr>
<td>Age of onset of marijuana use</td>
<td>During your lifetime, how many people have you had sexual intercourse? Never, 1, 2, 3, 4, 5 &amp; 6 or more</td>
<td>Positive dose response between intensity of marijuana use and number of sexual partners (controlled for race/ethnicity and age at intercourse)</td>
<td>63% OR 1.05, p = 0.04; OR 1.2, p = 0.02; OR 1.4, p = 0.005</td>
<td>Current study 2011</td>
</tr>
<tr>
<td>Daily cigarette smoking: have you ever smoked cigarettes daily, that is at least 1 cigarette every day for 30 days? No/Yes</td>
<td>During your lifetime, how many people have you had sexual intercourse? Never, 1, 2, 3, 4, 5 &amp; 6 or more</td>
<td>Positive dose response between intensity of marijuana use and number of sexual partners (controlled for race/ethnicity and age at intercourse)</td>
<td>63% OR 1.05, p = 0.04; OR 1.2, p = 0.02; OR 1.4, p = 0.005</td>
<td>Current study 2011</td>
</tr>
<tr>
<td>Health: Past health experience</td>
<td>Age of current or recent sexual partner (15 years younger, 15-18 years older, 19-24 years older, 25 years older)</td>
<td>Self-report of any STI diagnosis ever</td>
<td>Women in their late 30s with current or most recent sexual partner 30 years younger than them are significantly more likely to report an STI diagnosis than those with other partners</td>
<td>p = 0.005; OR 1.2, p = 0.03</td>
</tr>
<tr>
<td>Partner and relationship attributes</td>
<td>Age of current or recent sexual partner (15 years younger, 15-18 years older, 19-24 years older, 25 years older)</td>
<td>Self-report of any STI diagnosis ever</td>
<td>Women 30-50 years old with current or most recent sexual partner 10 years younger than them are significantly more likely to report an STI diagnosis than those with other partners</td>
<td>p = 0.005; OR 1.2, p = 0.03</td>
</tr>
<tr>
<td>Break up of relationship within last 6 years</td>
<td>Break up of relationship within last 6 years</td>
<td>Self-report of any STI diagnosis ever</td>
<td>Women 15-25 years old with most recent sexual partner 10 years younger than them are significantly more likely to report an STI diagnosis than those with other partners</td>
<td>p = 0.005; OR 1.2, p = 0.03</td>
</tr>
<tr>
<td>Break up of relationship within last 6 years</td>
<td>Break up of relationship within last 6 years</td>
<td>Self-report of any STI diagnosis ever</td>
<td>Women 15-25 years old with most recent sexual partner 10 years younger than them are significantly more likely to report an STI diagnosis than those with other partners</td>
<td>p = 0.005; OR 1.2, p = 0.03</td>
</tr>
</tbody>
</table>
and any) were negatively associated with non-use of condoms in this study.

STIs and multiple sexual partners

A variety of psychosocial variables were reported to be associated with diagnoses of STI or self-report of STI acquisition and multiple-partner

Discussion

The findings of this review of probability surveys suggest that a range of psychosocial factors are associated with adverse sexual health outcomes for women in reproductive age in the general population and are worthy of further investigation as identifiers of sexual health

Inconsistencies in the literature

Inconsistencies in the direction of reported associations between relationship status and contraception and condom use may reflect use of condoms instead of other contraception among women not in regular

Limitations

In addition to variable construction, other issues may affect the review findings. A small number of papers were excluded due to lack of statistical information about the population (e.g. studies potentially outside the age bounds could not be considered where means and

Presentation of models and explanations

Most discussion or presentation of explanation or theory was confined to interpretation of findings. No reference was made to cognition models - such as Protection Motivation Theory (Rogers and Frentice-Dunn, 1997) or the Theory of Planned Behaviour (Ajzen, 2012) - which have been applied to the investigation of preconceptions of sexual risk taking. Rationales for selection of psychosocial variables for investigation were limited to reference to existing empirical evidence. Most papers reported only post hoc explanations. Taft and Watson (2007) outline how unplanned pregnancies may result from coerced unwanted sex within abusive relationships. Kraut Becher and Aral (2006) make a reference to dislocated mixing between older and younger sexual networks as potentially exposing young women to relationships with older men where an imbalance of power inhibits assertion of control. For alcohol, smoking and marijuana indicate that dislodge explanations of how alcohol is associated with sexual risk behaviour may be flawed. Moreau et al. (2011) point that ‘Relationship break-ups... represent a transitional period associated with higher risks of negative sexual health outcomes’. 

N.L. Edelman et al. / Preventive Medicine 00 (2015) 345–356
publication bias towards significant findings which may also have in-
fluenced this review through non-publication of relevant studies.

Differences in the types of psychosocial factors reported across
study outcomes may reflect different disciplinary research interests,
theoretical frameworks and the methodologies used. Differences may
also be due to lack of standardization of measures of psychosocial
factors, or the way in which these are interpreted.

Conclusions

This review demonstrates that a number of psychosocial variables
may be associated with sexual risk behaviours and/or adverse sexual
health outcomes in general populations of women, suggesting
that they may help identify women at risk of unintended pregnancies.
Women who report sexual intercourse with a casual partner, those
who have a history of sexual abuse, and those who are experiencing
psychological distress may be at increased risk of unintended preg-
nancy.

Future research should therefore focus on psychosocial correlates
of protective factors (eg, consistent and effective use of any
contraceptive method) and on interventions targeted at reducing
these risk behaviours.

Acknowledgements

Thanks to Jill Felton of the HISD for her expertise advice regarding the
inclusion of the HISD for this study.

References

partners and associations with initiation and initiation of sexual activity.
Coleman, P.S., Reis, W., Covy, C.Y. 2005. Induced abortion and intimate relationship
Deave, T. 2012. Defining Chlamydia Screening and Social and Health Hardship—You
People First: Toward Ending London’s Health Disparities for the Department of Health
Deave, T. 2011. The National Strategy for Sexual Health and HIV. Department of Health,
London.
Din, N., National Chlamydia Screening Programme. (2012). The National Chlamydia
sexual health service access among substance-using women on the South East
Edelson, J. 2002. Factors associated with contraceptive choice and inconsistent
Edelson, J. 2002. Factors associated with contraceptive choice and inconsistent
Edelson, J. 2002. Factors associated with contraceptive choice and inconsistent
Appendix 3b: Search strategy for each database

ASSIA (Applied Social Sciences Index and Abstracts)
CINAHL (Cumulative Index to Nursing and Allied Health Literature)

<table>
<thead>
<tr>
<th>#</th>
<th>Query</th>
<th>Limiters/Expanders</th>
<th>Last Run Via</th>
<th>Results</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>514</td>
<td>S12 OR S13</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>332</td>
<td>Edit</td>
</tr>
<tr>
<td>513</td>
<td>S10 AND S11</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>173</td>
<td>Edit</td>
</tr>
<tr>
<td>512</td>
<td>S6 AND S11</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>193</td>
<td>Edit</td>
</tr>
<tr>
<td>511</td>
<td>S1 AND S2</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>510</td>
<td>S8 OR S9</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>509</td>
<td>AB condom* OR AB &quot;multiple partner*&quot; OR AB &quot;1-1 partner*&quot; OR AB &quot;1-1 partner*&quot; OR AB &quot;sexual contact*&quot;</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td>Edit</td>
</tr>
<tr>
<td>508</td>
<td>S4 AND S7</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>507</td>
<td>MN condona OR MN contraception OR MN sexual partners</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>506</td>
<td>S3 OR S5</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>AB cervical OR AB gonorrhea OR AB gonorrhea OR AB chlamydia OR AB &quot;genital wart*&quot; OR AB &quot;genital herpes&quot; OR &quot;flesh-eating bacteria*&quot;</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>504</td>
<td>MN risk-taking behavior</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>503</td>
<td>MN sexually transmitted diseases OR MN pregnancy, unplanned OR MN pregnancy, unwanted OR MN abortion, induced OR MN HIV - infected patients</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>502</td>
<td>MN women OR MN vas (es) factor OR AB breast OR AB pithy OR AB &quot;gender specific&quot; OR AB &quot;gender-specific&quot; OR AB &quot;gender analysis&quot; OR AB &quot;gender-related analysis&quot; OR AB &quot;gender-related pancreatic&quot;</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>501</td>
<td>T1 associat OR T1 &quot;related to&quot; OR T1 &quot;relationship with&quot; OR T1 &quot;common unrem*&quot; OR T1 &quot;consistent*&quot; OR T1 &quot;lax*&quot; OR T1 &quot;predict&quot; OR T1 &quot;ex*&quot; OR T1 &quot;reason*&quot;</td>
<td>Search modes: Boolean/Phrase</td>
<td>Interface - EBSCOhost Research Databases</td>
<td>Display</td>
<td></td>
</tr>
</tbody>
</table>
Cochrane
Cochrane continued
Cochrane continued further
<table>
<thead>
<tr>
<th>Page</th>
<th>Line</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>304</td>
<td>PsycINFO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>![PsycINFO Image]</td>
</tr>
</tbody>
</table>
PsycINFO continued
<table>
<thead>
<tr>
<th>#</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Source</th>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
</tr>
<tr>
<td>2</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
</tr>
<tr>
<td>3</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
</tr>
<tr>
<td>4</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
</tr>
<tr>
<td>5</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
<td>null</td>
</tr>
</tbody>
</table>

*Web of Science*
#23  
#22 AND #15  
DocType=All document types; Language=All languages;  

#22  
(((TITLE: (female) OR TITLE: (women)) OR TITLE: (sex factors)) OR MeSH MAJOR TOPIC:exp: (women)) OR MeSH MAJOR TOPIC: (female)) OR MeSH MAJOR TOPIC:exp: (sex factors)  
DocType=All document types; Language=All languages;  

#21  
(TITLE: (female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Women)) OR (TITLE: (women) OR MeSH HEADING: (Women)) OR (TITLE: (sex factors) OR MeSH HEADING: (F Factor) OR MeSH HEADING: (Sex Factors))  
DocType=All document types; Language=All languages;  

#20  
#18 AND #15  
DocType=All document types; Language=All languages;  

#19  
((TOPIC: (female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Female) OR MeSH HEADING: (Women)) OR (TOPIC: (women) OR MeSH HEADING: (Women)) OR (TOPIC: (sex factors) OR MeSH HEADING: (F Factor) OR MeSH HEADING: (Sex Factors))  
DocType=All document types; Language=All languages;  

#18  
(MeSH MAJOR TOPIC: (female) OR MeSH MAJOR TOPIC:exp: (women)) OR MeSH MAJOR TOPIC:exp: (sex factors)  
DocType=All document types; Language=All languages;  

#17  
(MeSH HEADING: (female) OR MeSH HEADING: (women)) OR MeSH HEADING: (sex factors)  
DocType=All document types; Language=All languages;  

#16  
#15 AND #3  
DocType=All document types; Language=All languages;  

#15  
#14 AND #2  
DocType=All document types; Language=All languages;  

#14  
#13 OR #1  
DocType=All document types; Language=All languages;  

#13  
#12 OR #9  
DocType=All document types; Language=All languages;  

#12  
#11 AND #10  
DocType=All document types; Language=All languages;  

#11  
MeSH HEADING: (risk taking)  
DocType=All document types; Language=All languages;
<table>
<thead>
<tr>
<th>#10</th>
<th>((MeSH HEADING: (condoms) OR MeSH HEADING: (contraception behavior)) OR MeSH HEADING: (coitus)) OR MeSH HEADING: (sexual behavior)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#9</td>
<td>(((((MeSH HEADING: (sexual partners) OR TOPIC: (&quot;sexual risk behav&quot;)) OR TOPIC: (&quot;risk* sexual behav&quot;)) OR TOPIC: (&quot;multiple partners&quot;)) OR TOPIC: (&quot;concurrent partners&quot;)) OR TOPIC: (&quot;1+ partner&quot;) OR TOPIC: (&quot;&gt;1 partner&quot;) OR TOPIC: (&quot;overlapping partners&quot;)</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#8</td>
<td>#2 AND #1</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#7</td>
<td>#6 AND #1</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#6</td>
<td>#3 AND #2</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#5</td>
<td>#4 AND #2</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#4</td>
<td>((MeSH MAJOR TOPIC: (female) OR MeSH MAJOR TOPIC: (women)) OR MeSH MAJOR TOPIC: (sex factors)</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#3</td>
<td>(MeSH HEADING: (female) OR MeSH HEADING: (women)) OR MeSH HEADING: (sex factors)</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#2</td>
<td>((((((TITLE: (associat*) OR TITLE: (&quot;related to&quot;)) OR TITLE: (&quot;relationship between&quot;)) OR TITLE: (&quot;common among&quot;) OR TITLE: (correlat*)) OR TITLE: (typical*)) OR TITLE: (predict*)) OR TITLE: (expos*)) OR TITLE: (reason))</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
<tr>
<td>#1</td>
<td>(((((MeSH HEADING: (abortion induced) OR MeSH HEADING: (abortion applicants)) OR MeSH HEADING: (HIV infections)) OR MeSH HEADING: (pregnancy unplanned)) OR MeSH HEADING: (pregnancy unwanted)) OR MeSH HEADING: (chlamydia)) OR MeSH HEADING: (gonorrhea)) OR (TITLE: (syphilis) OR MeSH HEADING: (Syphilis)) OR TOPIC: (&quot;genital warts&quot;) OR TOPIC: (&quot;genital herpes&quot;) OR MeSH HEADING: (sexually transmitted diseases)) OR TOPIC: (trichomoniasis)</td>
</tr>
<tr>
<td></td>
<td>DocType=All document types; Language=All languages;</td>
</tr>
</tbody>
</table>
EMBASE

1. (girl or sex difference).sh. or female*.ti. or woman.ti. or women.ti. or "gender-specific".ab. or "gender specific".ab. or "gender analysis".ab. or "gender-based analysis".ab. or "analysis by gender".ab.
2. (associat* or "related to" or "relationship between" or "common among*" or correlat* or typical* or predict* or expos* or reason*).ti.
3. concurrent sexual partnership.sh. or "multiple partners".ab. or "1+ partner*".ab. or ">1 partner*".ab. or "sexual partner".ab. or "sexual contact".ab.
4. ("condom use" or contraceptive behavior or sexual behavior or "casual sex" or adolescent sexual behavior).sh.
5. high risk behavior.sh.
6. 4 and 5
7. 3 or 6
8. 1 and 2
9. 7 and 8
10. (pregnancy termination or induced abortion or unplanned pregnancy or unwanted pregnancy or sexually transmitted disease or human immunodeficiency virus or genital herpes or gonorrhea or syphilis or chlamydia trachomatis or trichomoniasis or condyloma acuminatum).sh. or "genital warts".ab. or gonorrhoea.ab.
11. 8 and 10
12. limit 11 to (human and embase and yr="1994 - 2014" and (adolescent <13 to 17 years> or adult <18 to 64 years>))
13. 9 or 12
Appendix 4a: Natsal-3 published paper

Candidate contribution: Natalie Edelman prepared the data, conducted the analysis, and took the primary role in writing the paper.
Background

Much social health research to date has focused on how sexual behavior is associated with acquisition and transmission of sexually transmitted infection (STI), and to a lesser degree with unplanned pregnancy (UP) [1]. These approaches have supported the identification of higher risk populations (such as young people and men who have Sex with Men) and the targeting of these populations with sexual health interventions, e.g. England’s National Chlamydia Screening Programme [2]. Accordingly, a number of sexual risk assessment tools have been developed for clinical use. Although some of these address risk of UP, several have been developed to identify those at risk of STIs, typically based on sexual behavior and socio-demographic items such as age, ethnicity, gender and sexual orientation [3-4].

There is also growing evidence that psychosocial factors such as relationship qualities [5], mental health [7], and substance use [1] may also be associated with adverse sexual health outcomes, and with the sexual risk behaviors which mediate them. Thus, they may be of use in identifying at-risk individuals for targeted intervention.

Within social epidemiology, psychosocial factors have been defined as those which influence health outcomes by affecting biology, behavior or psychology [9]. For the purposes of this study we define it as factors which do not fit within the categories of socio-demographics, sexual behavior or health psychology constructs such as risk perception and self-efficacy. Previous use of this definition identified factors that concern health, substance use, formalized experiences, lifestyle, and relationships [10].

This exploratory study was undertaken to underpin the development of a psychosocial clinical prediction rule (CPR) [11], being developed primarily for use in targeting STI testing, safe sex advice and contraception advice and supply (CAS) to women of reproductive age attending British primary care settings. As such, this study reflects a biomedical understanding of women’s sexual health risk, contrasting with the broader definition of sexual health endorsed by the World Health Organization [12]. CPRs are tools used in clinical assessment to direct the nature of clinical intervention, based on response to a short set of patient questions. The CPR, which this work underpins is envisaged as a brief questionnaire which women can self-complete in order to assess their need for STI testing and/or CAS. In this exploratory study we hypothesized that combining psychosocial and socio-demographic factors may help explain variance in sexual risk behaviors within populations, enabling targeting of those at greater risk of adverse sexual health outcomes without the need for clinical staff to take a sexual history. This may be advantageous as sexual history-taking can be time-consuming for staff and patient, and may be perceived as intrusive where the patient has attended primary care for non-sexual health matters. This approach may also flag up psychosocial issues such as binge-drinking, which warrant treatment in their own right and may also be precursors of a broader range of sexual risk – such as risk of STIs through partners, and inconsistent contraception use.

Therefore our aim was to explore the extent to which psychosocial and socio-demographic factors might be used to identify women experiencing higher levels of sexual risk. As a proxy, in this study we examined unadjusted associations between psycho-social and socio-demographic factors with key sexual risk behaviors, using data from a national probability sample survey.

To this end we address three research questions:

1. Which psychosocial and socio-demographic factors are associated with key sexual risk behaviors?
2. Which psychosocial and socio-demographic factors, if any, are associated across different sexual risk behaviors?
3. Do observed associations between psychosocial factors and sexual risk behaviors remain after adjustment for key socio-demographic factors: age, gender, and socio-economic status (measured by housing tenure)?

Methods

Data from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3) were analyzed. This probability sample survey of the British resident population aged 16-74 years was conducted from 2010 to 2012 inclusive, using a multi-stage, clustered and stratified sampling methodology. In line with standard practice for UK surveys, and in response to evidence suggesting that starting a constant form might lead to a greater sense of obligation to complete the interview, we obtained verbal rather than written consent. Full details of the study design are described elsewhere [13, 14]. A sample size of 15,102 was achieved - an overall response rate of 71.7% with only very small (typically 1-3%) amounts of item non-response [15]. Natsal-3 asked about subjects, including sexual partners and practices, experience of depression, substance use, STI diagnosis, unplanned pregnancy, sexual function [15] and non-relationship sex [16]. This has permitted investigation of the wider social and health contexts of sexual health and behaviors [17].

The Natsal-3 dataset provides an opportunity to examine the existence of associations in the general population, which being homogenous in sexual risk is broadly representative of a primary care clinic population. This contrasts with specialist sexual health clinic populations, which tend to report greater sexual risk behavior [18].

The analyses presented in this paper were conducted on a subset of Natsal-3 respondents, defined...
as women aged 16–44 years who reported heterosexual sex (defined as anal, vaginal, or oral sex with a male partner) in the last year. These criteria were used to generate findings most applicable to the development of the CPR.

**Outcome measures.**

Low population prevalence of STI diagnosis, abortion and unplanned pregnancy in the last year, found in this Natsal-3 sample, meant that there was insufficient statistical power to analyse these as outcomes in this study. Instead, three sexual risk behaviour measures [19] were selected as proxies for these adverse sexual health outcomes, on the grounds that STI screening and CAS may be offered in response to reported sexual risk behaviour.

To minimise the risk of Type II error in the analyses we selected three key sexual risk behaviour variables, which were reported by more than 10% of the sub-population of interest, equating to \( n > 500 \) women. **Having 2+ partners in the last year** (abbreviated here as 2PP) was chosen as a variable known to be associated with STI acquisition and commonly used for clinical and research purposes [20, 21]. **Non-use of condoms with 2+ partners in the last year** (abbreviated here as 2PPNC) was chosen as it combines multiple partnerships and condom use to provide a more precise indicator of STI risk behaviour. Specifically this variable refers to at least one episode of non-use of condoms, occurring with two or more partners. Finally, we selected non-use of condoms at first sex with most recent partner (excluding those only reporting having sex once with their most recent partner), abbreviated here as FSNC. This variable represents a sexual encounter when ‘risk’ of infection or unplanned pregnancy might be most highly perceived and we might therefore anticipate a greater likelihood of condom use. However, as a single sexual encounter is unlikely to result in significant risk, this exploratory variable constitutes a potential proxy indicator of broader sexual risk experiences. By focusing only on non-use of condoms this variable may also be more representative of those at risk of STIs through partner, rather than own, sexual risk behaviour.

**Psychosocial and socio-demographic variables**

As this study was undertaken to support the development of a CPR, investigation focused on identifying socio-demographic and psychosocial items strongly and commonly associated with measures of sexual risk which would also be brief, acceptable and easy to score as clinical questionnaire items.

Most of the psychosocial variables selected for testing in bivariate analysis fitted into one of the following broad topics: substance use, mental health, general health, sexual orientation, formative experiences involving family, formative experiences involving sex, partner descriptors and relationship status and satisfaction. We chose a measure of sexual orientation that did not incorporate sexual behaviour. This was driven by a decision to avoid incorporating sexual behaviour items as exposures, coupled with a concern that sexual orientation items which are defined by sexual behaviour with men and women, may be confounded by multiple partnerships.

Questions asked in Natsal-3 regarding non-volitional sex [16] were deemed unlikely to be acceptable for use in a CPR and were therefore excluded from our analyses. Childhood sexual abuse (CSA) was however included covertly, within a dichotomous variable constructed for first heterosexual intercourse <16 years (yes/no), as there is evidence of correlations between sexual risk and morbidity, CSA and early sexual debut [22]. This contrasts with other Natsal-3 papers which report on first heterosexual intercourse <16 years, but exclude from their analysis those reporting first sex under the age of 13 years [23, 24].

Where more than one brief and easy-to-score psychosocial variable remained within the same topic and each was found to be associated with the outcomes of interest, the variable with the highest frequency of response was selected for multivariable analysis. This approach was founded on the rationale that rarer psychosocial factors will explain a low proportion of variance in sexual risk behaviour (no matter how strong the association) and will therefore have less utility in the general population. This corresponds with the notion of ‘adequate prediction’ [11].

Forty-two variables were initially identified from the Natsal-3 dataset as being representative of psychosocial factors (see Additional file 1). The original questions from which they were derived can be viewed at [http://www.natsal.ac.uk/natsal-3/core-survey/questionnaires.aspx](http://www.natsal.ac.uk/natsal-3/core-survey/questionnaires.aspx). Of the 42 variables identified, ten were selected by applying the approach described above. These were:

- relationship status (recorded as cohabiting with partner, stable relationship not cohabiting, not in a relationship but previously cohabited, not in a relationship and never cohabited)
- sexual identity (recorded as heterosexual/not heterosexual)
- belong to any religion now (coded as yes/no)
- smokes cigarettes nowadays (recorded as yes/no)
- weakly drinking of 6+ units of alcohol on one occasion (recorded as yes/no)
- ever taken non-prescribed drugs (yes/no)
- received treatment for depression in the last year (recorded as yes/no)
- lived with both parents until the age of 14 (yes/no)
- first heterosexual intercourse before the age of 16 years (yes/no)
- most recent partner’s ethnicity (white/Asian British/ black British/other)

There is strong existing evidence for associations between sexual morbidity and socio-demographic factors [25, 26]. Therefore age group [13], ethnicity and socio-economic status were also assessed for model inclusion, using rental of current home as a brief and acceptable proxy indicator of the latter.

Statistical methods

In order to make the sample broadly representative of the target population according to the 2011 Census, selection probability weights were applied to the data to adjust for the unequal probability of selection and then post-stratification weights were applied to adjust for non-response bias [14].

Aggregated variable categories were used only where it was necessary to boost cell frequencies or render means briefer and easier to complete. Aggregation was based only on observed gaps in continuous data or on overlapping confidence intervals for categorical data - with the exception of body mass index, now aggregated using the weight boundaries for body mass index (BMI) on a typical 5’7” woman. This approach reduced the number of bivariate analyses and therefore of Type I error. Hence, we did not apply a Bonferroni correction to our analyses [27].

Bivariate analyses were conducted with both psychosocial and socio-demographic variable described above, for each of the three sexual risk behaviour variables. Those which demonstrated an association at \( p \leq 0.35 \) were entered into a multivariable model for that behaviour. Psychosocial variable associations between 0.05 \( \leq p \leq 0.10 \) (after adjustment for socio-demographic variables) were also entered. This approach provided consistency with criteria for removal of variables from the model which was set at \( p \geq 0.1 \). Backwards stepwise multivariable logistic regression was used for the chosen psychosocial and socio-demographic variables to identify which combination of these was retained in the model using pre-set criteria. This approach was chosen as many concerns with other type of analysis were reduced in this study. i.e. we selected empirically only a modest number of variables, and risk of Type II error was reduced by the large sample size and by setting the criteria for removal of the model at \( p \geq 0.1 \). This criterion, and the backwards elimination approach, also acted to reduce suppressor effects [27]. Table 1 in the Results section presents the percentage reporting that risk behaviour in each category of each exposure, the crude odds ratios for each category of that exposure, and the global P value for each exposure. For each of the exposures entered into the multivariable model, Table 1 also presents the global P value, with adjusted odds ratios for each exposure that was retained after adjustment for all other variables.

Results

This analysis included 4911 women aged 14–64 years who reported having heterosexual sex in the year prior to their Nana-3 interview. Sample characteristics are given in Table 1 which also presents the model for each of the sexual behaviours analyzed.

Having 2+ partners in the last year (2PP) was reported by 17.9% of respondents. Non-use of condoms with 2+ partners in the last year (2PPNC) was reported by 8.8% of respondents. Non-use of condoms at first sex with most recent partner (including those only having sex once with their most recent partner) (FSNC) was reported by 41.5% of respondents. FSPNC showed only small overlap with the other two behaviours - among those 41.5% of respondents, 8.5% reported 2PP in the last year and 6.3% reported 2PPNC in the last year.

First heterosexual intercourse at age <16 years and weekly binge drinking in the last year were each associated with all three sexual risk behaviours after adjustment for both socio-demographic variables and all other psychosocial variables, with adjusted odds ratios (AOR) ranging from 1.16 to 1.43. In contrast, two psychosocial variables - sexual identity and most recent sexual partner’s ethnicity - were not associated with any of the three sexual behaviours in multivariable regression.

Of the socio-demographic factors analyzed, not earning a poor property was associated with both 2PP and 2PPNC (\( p < 0.05 \)) after adjustment for all other variables, but only at \( p = 0.077 \) with FSNC. Younger age group was positively associated with both 2PP and 2PPNC (adjusted), although 2PPNC showed no association between those aged 16–24 versus those aged 25–24 years. In contrast, younger women were less likely to report FSNC. After adjustment respondent ethnicity was associated only with FSNC.

Although current smoking and currently belonging to a religion were retained in the model for 2PP they were not retained in the model for 2PPNC. Conversely, treatment for depression in the last year was retained in the model for 2PPNC, but not in the model for 2PP. Not cohabiting with a partner was retained in the models for both 2PP and 2PPNC, but not the model for FSNC. In contrast, the variable for not living with both parents until age 14 was retained in the model for FSNC but not in the models for 2PP or 2PPNC. Although demonstrating a small effect size this exposure was reported by 26.9% of respondents.
| Relationship status | Psychosocial & socio-demographic factors | Outcomes: 2+ sexual partners in the last year (2PP) | 2+ sexual partners in the last year without condom use (2PPNC) | Non-use of condoms at 1st sex with most recent partner (FSNC) | Denominators* 
(unweighted, 
weighted) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of sample (weighted) reporting character</td>
<td>% reporting outcome</td>
<td>Crude OR (95% CI)</td>
<td>Adjusted* OR (95% CI)</td>
<td>% reporting outcome</td>
</tr>
<tr>
<td>Cohabiting with partner</td>
<td>64.9% (63.4–66.4)</td>
<td>5.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>2.7%</td>
</tr>
<tr>
<td>Stable relationship not cohabiting</td>
<td>17.1% (16.0–18.2)</td>
<td>30.9%</td>
<td>7.73 (6.09–9.62)</td>
<td>6.18 (3.95–9.78)</td>
<td>17.7%</td>
</tr>
<tr>
<td>Not in relationship but has cohabited</td>
<td>8.6% (7.9–9.5)</td>
<td>49.6%</td>
<td>17.3 (12.9–22.9)</td>
<td>13.3 (9.81–18.1)</td>
<td>30.4%</td>
</tr>
<tr>
<td>Not in relationship &amp; never cohabited</td>
<td>9.4% (8.5–10.3)</td>
<td>53.4%</td>
<td>21.1 (15.8–26.2)</td>
<td>14.2 (10.4–19.2)</td>
<td>29.2%</td>
</tr>
<tr>
<td>Sexual identity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>97.7% (97.2–98.2)</td>
<td>21.5%</td>
<td>2.12 (1.33–3.38)</td>
<td>Not retained in model</td>
<td>12.3%</td>
</tr>
<tr>
<td>Other</td>
<td>2.23% (1.8–2.61)</td>
<td>33.1%</td>
<td>1.00</td>
<td>17.4%</td>
<td>1.54 (0.64–2.79)</td>
</tr>
<tr>
<td>Currently a smoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26.8% (27.0–26.8)</td>
<td>31.7%</td>
<td>2.25 (1.91–2.69)</td>
<td>1.32 (1.06–1.63)</td>
<td>19.9%</td>
</tr>
<tr>
<td>No</td>
<td>71.7% (70.2–73.0)</td>
<td>17.5%</td>
<td>1.00</td>
<td>1.00</td>
<td>9.4%</td>
</tr>
<tr>
<td>Usually binge-drink at least weekly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13.9% (12.8–15.2)</td>
<td>40.6%</td>
<td>2.91 (2.34–3.67)</td>
<td>2.11 (1.63–2.73)</td>
<td>25.8%</td>
</tr>
<tr>
<td>No</td>
<td>86.1% (84.8–87.2)</td>
<td>19.5%</td>
<td>1.00</td>
<td>1.00</td>
<td>10.8%</td>
</tr>
<tr>
<td>Ever used non-prescribed drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39.4% (37.7–41.0)</td>
<td>28.3%</td>
<td>1.08 (1.61–2.20)</td>
<td>1.31 (1.06–1.61)</td>
<td>17.1%</td>
</tr>
<tr>
<td>No</td>
<td>60.6% (58.8–62.3)</td>
<td>17.6%</td>
<td>1.00</td>
<td>9.0%</td>
<td>1.00</td>
</tr>
<tr>
<td>First heterosexual intercourse at &lt;16 years of age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50.2% (48.5–51.9)</td>
<td>27.9%</td>
<td>2.21 (1.86–2.63)</td>
<td>1.55 (1.26–1.96)</td>
<td>16.6%</td>
</tr>
<tr>
<td>No</td>
<td>49.8% (48.1–51.4)</td>
<td>14.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>9.9%</td>
</tr>
<tr>
<td>Didn’t live with both natural (birth) parents to age 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>73.2% (71.8–74.5)</td>
<td>28.6%</td>
<td>1.64 (1.40–1.91)</td>
<td>Not retained in model</td>
<td>11.4%</td>
</tr>
</tbody>
</table>
Table 1  Psychosocial and socio-demographic characteristics of sample and their association with three key sexual risk behaviours (Continued)

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>26.8%(25.8–26.2)</th>
<th>19.9%</th>
<th>1.00</th>
<th>p = 1.0002</th>
<th>p = 0.3354</th>
<th>p &lt; 0.0001</th>
<th>p = 0.07</th>
<th>p = 0.012</th>
<th>p = 0.2312</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received treatment for depression in last 12 months</td>
<td>Yes</td>
<td>12.7%(11.6–13.8)</td>
<td>27.3%</td>
<td>1.55 (1.23–1.99)</td>
<td>Not retained in model</td>
<td>17.6%</td>
<td>1.75 (1.32–2.32)</td>
<td>1.39 (0.97–1.99)</td>
<td>46.2%</td>
<td>13 (1.06–1.59)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>57.3%(56.2–58.4)</td>
<td>21.2%</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>10</td>
<td>39.2%</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Belong to any religion now</td>
<td>Yes</td>
<td>46.3%(44.6–48.0)</td>
<td>17.7%</td>
<td>1.70 (1.44–2.01)</td>
<td>1.23 (0.93–1.61)</td>
<td>10.3%</td>
<td>1.52 (1.23–1.89)</td>
<td>Not retained in model</td>
<td>41.6%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>53.6%(52.1–55.4)</td>
<td>20.2%</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>39.5%</td>
<td>1.00</td>
<td>2789,1042</td>
</tr>
<tr>
<td></td>
<td>Most recent partner ethnicity</td>
<td>White</td>
<td>56.1%(54.4–57.8)</td>
<td>21.6%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>12.3%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>39.5%</td>
</tr>
<tr>
<td></td>
<td>Asian British</td>
<td>5.6%(4.8–6.6)</td>
<td>11.7%</td>
<td>0.93 (0.44–2.03)</td>
<td>68%</td>
<td>0.63 (0.34–1.17)</td>
<td>55.6%</td>
<td>2.06 (1.54–2.46)</td>
<td>240,193</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black British</td>
<td>4.5%(3.0–5.3)</td>
<td>30.6%</td>
<td>1.61 (1.14–2.28)</td>
<td>14.1%</td>
<td>1.30 (0.82–2.06)</td>
<td>42.1%</td>
<td>1.10 (0.79–1.53)</td>
<td>221,152</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>3.9%(3.2–4.5)</td>
<td>33.3%</td>
<td>2.09 (1.06–4.10)</td>
<td>15.8%</td>
<td>1.96 (1.28–3.03)</td>
<td>39.6%</td>
<td>1.07 (0.75–1.54)</td>
<td>195,130</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age group</td>
<td>15–24 years</td>
<td>26.9%(25.6–26.1)</td>
<td>35.6%</td>
<td>1.00</td>
<td>1.00</td>
<td>20.3%</td>
<td>1.00</td>
<td>1.00</td>
<td>35.4%</td>
</tr>
<tr>
<td></td>
<td>25–34 years</td>
<td>36.3%(35.0–37.7)</td>
<td>15.2%</td>
<td>0.30 (0.25–0.36)</td>
<td>0.62 (0.31–0.78)</td>
<td>9.6%</td>
<td>0.39 (0.21–0.71)</td>
<td>41.9%</td>
<td>1.22 (1.05–1.43)</td>
<td>1.31 (1.11–1.55)</td>
</tr>
<tr>
<td></td>
<td>35–44 years</td>
<td>37.3%(36.1–38.6)</td>
<td>11.4%</td>
<td>0.10 (0.04–0.24)</td>
<td>0.55 (0.42–0.78)</td>
<td>57%</td>
<td>0.16 (0.10–0.29)</td>
<td>3.13 (2.44–3.98)</td>
<td>48.6%</td>
<td>1.58 (1.38–2.86)</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>White</td>
<td>55.2%(54.1–56.3)</td>
<td>22.0%</td>
<td>1.00</td>
<td>1.00</td>
<td>12.6%</td>
<td>1.00</td>
<td>Not retained in model</td>
<td>30.3%</td>
</tr>
<tr>
<td></td>
<td>Asian British</td>
<td>5.5%(5.0–6.0)</td>
<td>11.7%</td>
<td>0.59 (0.31–0.87)</td>
<td>50%</td>
<td>0.39 (0.19–0.78)</td>
<td>56.6%</td>
<td>2.01 (1.57–2.51)</td>
<td>2.89 (2.03–4.09)</td>
<td>237,200</td>
</tr>
<tr>
<td></td>
<td>Black British</td>
<td>3.2%(2.1–4.3)</td>
<td>29.8%</td>
<td>1.05 (0.97–1.17)</td>
<td>14.2%</td>
<td>1.12 (0.69–1.84)</td>
<td>47.7%</td>
<td>1.36 (0.84–2.19)</td>
<td>1.10 (0.61)</td>
<td>127,121</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>3.9%(3.4–4.6)</td>
<td>27.7%</td>
<td>1.65 (1.12–2.42)</td>
<td>14.3%</td>
<td>1.44 (0.88–2.44)</td>
<td>33.5%</td>
<td>1.03 (0.75–1.43)</td>
<td>0.83 (0.50)</td>
<td>202,135</td>
</tr>
<tr>
<td></td>
<td>Currently renting home</td>
<td>Yes</td>
<td>47.6%(45.0–49.4)</td>
<td>26.4%</td>
<td>2.10 (1.78–2.46)</td>
<td>1.31 (1.05–1.60)</td>
<td>10.2%</td>
<td>2.18 (1.78–2.71)</td>
<td>124 (0.97–1.59)</td>
<td>42.2%</td>
</tr>
</tbody>
</table>
|                | No  | 52.4%(50.6–54.2) | 15.6% | 1.00 | 1.00 | 91.1% | 1.00 | 1.00 | 35.2% | 1.00 | 2281,1794

**Entered into model as significant effect found (p = 0.007) after controlling for age group and ethnicity
** **Entered into model as not significant after controlling for ethnicity of respondent
** **Entered into model as significant interaction between sex and age (p = 0.004) after controlling for ethnicity of respondent**
**Significant interaction between sex and age (p = 0.002 after controlling for ethnicity of respondent**
**Due to small frequencies of missing data
**Entered for all other variables in the model**
Compared to currently cohabiting with a partner, each of the non-cohabiting response options showed very large effect sizes (odds ratios) in the 2PP and 2PPNC models, alongside high prevalence - not cohabiting but in a stable relationship (17%) and not being in a stable relationship (cumulatively 18%). For the 2PP and 2PPNC models there was little overlap between ‘stable relationship not cohabiting’ and the two ‘not in a relationship’ response options but great overlap between the latter two options, which also showed the greatest magnitude of effect. In the 2PP and 2PPNC models, drug use ever and currently renting showed very modest, though significant, effect sizes. In the model for FSNC largest effect sizes were observed for Black and Asian ethnicity, and for older age group (25–34 years versus 16–24 years, and 35–44 years versus 16–24 years).

Discussion
Reporting weekly binge drinking in the last year, early sexual debut, younger age group and living in rented accommodation showed association with all three of the sexual risk behaviours studied (2PP, 2PPNC and FSNC). Notably, younger age was positively associated with multiple partnerships but negatively associated with FSNC. FSNC also showed quite different patterns of association to 2PP and 2PPNC overall, with much smaller effect sizes. Not living with both parents to the age of 14 years was associated with FSNC after adjustment for other factors, but not with 2PP or 2PPNC after adjustment. Not cohabiting with a partner was associated with 2PP and with 2PPNC after adjustment but not with FSNC. This may reflect that FSNC is not a good proxy for recent sexual risk, particularly as this variable was not limited to episodes of first sex occurring within the last year.
Binge drinking, early sexual debut and younger age have also been found to correlate with sexual risk in other population studies of sexual risk among women [10, 23, 28, 29]. However, observed associations between the dichotomous housing tenure variable and sexual risk contrast with previous Natal-3 analyses which used comprehensive socio-economic variables [13]. Sexual identity was not found to be associated with sexual risk in our analysis. This may reflect one or more of the following: insufficient power to detect a significant association, a focus on heterosexual risk behaviour in defining the population of interest, or use of a sexual orientation measure based on identity rather than behaviour. However, on this latter point, two population surveys using non-behavioural measures of sexual identity have shown differences in partner numbers among adolescent women [30, 31].

Although a number of studies have examined associations between specific psychosocial factors and sexual risk behaviour, this study is unique in examining three sexual risk behaviours using a combination of psychosocial and socio-demographic items, in order to develop a CPR. Our findings are unique in demonstrating that binge drinking, early sexual debut, younger age and housing tenure remain significant when represented by briefly-worded and common variables, and might in principle be used to target sexual health interventions in primary care settings. This contrasts with existing sexual risk tools in two ways. Firstly, none of the existing tools have been developed for use using population survey dataset. This reflects that only one has been developed for use in primary care (specifically for identifying STIs among paediatric primary care attenders in the United States [32]). Secondly existing tools focus primarily on sexual health symptoms and socio-demographics [33–35]. Where psychosocial items have been included in other tools, selection was not empirically-based but reflected service intentions to identify and address additional issues such as intimate partner violence [36].

Our findings also suggest that different items may indicate different sexual risk experiences. E.g. results indicate that ‘not cohabiting with a partner’ is likely to perform better than ‘drug use ever’ in identifying women experiencing multiple partnerships, while specific identification of FSNC would rest on being older and not living with both parents until the age of 14 years. Finally, the symmetrical treatment of both psychosocial and socio-demographic variables in our analysis allowed us to examine associations between sexual risk and socio-demographic factors (namely age group and socio-economic status) while controlling for psychosocial factors. The findings indicate that these associations are not fully explained by psychosocial factors, and that socio-demographic questions should be combined with psychosocial questions in the CPR under development.

Limitations
This analysis was limited by the variables available in the Natal-3 dataset and by the prevalence of some of those variables given the size of the Natal-3 sample. Hence non-significant findings may reflect a lack of statistical power. Similarly, low prevalence of unplanned pregnancy and of STI diagnoses in the population of interest precluded analysis of these outcomes. As the analysis focused on women heterosexual activity in the previous year, so our findings may not apply to women who were not sexually active in the last year, or who had sex exclusively with women (WSEW) in the last year. Nonetheless, a large proportion of WSEW also have sex with men [38].
Unsurprisingly (as 2PPNC is a sub-category of 2PP) greater similarities were seen in the associations for these two overlapping variables. In contrast to 2PP and 2PPNC, FSNC represents only a proxy measure of risk.
behaviour, i.e., as it concerns only one episode of intercourse which may be non-recent so it cannot be considered a key risk factor for STI acquisition or UP in its own right. It is also important to note that, for some respondents, non-use of condoms may represent attempts to conceive, which is nonetheless considered a sexual risk behaviour for STIs. Natsal-3 was not designed to enable assessment of prospective unplanned pregnancy risk (i.e., lack of effective contraceptive use in those not wishing to become pregnant) and consequently this limited our analysis.

Education is commonly investigated as a proxy measure of socio-economic status. However, it may carry psychosocial dimensions with regard to factors such as belonging, purpose, and social cohesion. However, none of the available education variables were suitable for use across all age groups. This reflects a common problem in such studies that age is a major confounder of both duration of education and qualification attainment. Variables concerning non-volitional sex were also excluded from the analysis, as we anticipated that these questions would be unacceptable in a Primary Care-based assessment, so that measuring and adjusting for them in this analysis was of no practical benefit. This pragmatic approach to adjustment reflects the overarching purpose of this study in developing a CPR for primary care use. This stands in contrast to a conventional complex survey methodology approach - in which all factors likely to confound associations are adjusted for, to achieve a more accurate picture of how an exposure and outcome are independently associated.

Although a conservative approach was undertaken towards aggregation of response categories, wide confidence intervals may have led to aggregation of distinct categories with loss of data sensitivity as a result. Nonetheless, most of the substance use variables were associated with sexual risk outcomes, while very few of the relationship quality variables were; this topic-based pattern suggests that aggregation-bias-intensity was not likely to be responsible for the overall patterns of association.

Conclusions

This study indicates that there are a number of variables which are worthy of further investigation for use in a Clinical Prediction Rule to identify women experiencing sexual risk in primary care settings, and are suitable for self-completion. Certain socio-demographic and psychosocial variables which were associated with only one or two of the risk behaviours studied may also be useful in differentiating between those needing STI testing or CAS.

From this analysis we cannot draw conclusions about causation. Our working definition of ‘psychosocial’ may have incorporated variables whose association with sexual risk behaviours represent spurious associations - rather than being ‘the causes of the causes’ [39]. Nonetheless, factors such as binge drinking may constitute wider determinants of sexual health, prevention of which may reduce sexual (and other) morbidity. This is highlighted by England’s Sexual Health Improvement Framework, 2012 [40].

We also cannot assume that the performance of questions investigated in Natsal-3 will directly translate to a clinical prediction rule administered in Primary Care. This is because of differences in purpose (research versus clinical practice) and delivery (random sampling versus clinical delivery). Further research is focusing on the performance of psychosocial and socio-demographic variables as CPR questions in clinical settings - using the variables found in this analysis and in systematic review of relevant literature [10]. This ongoing work by the authors is investigating the degree and type of sexual risk explained by these variables, and their acceptability and delivery as questions used in primary care assessment.

**Additional file**

Additional file 1: Description of data. List of Natsal-3 variables initially considered for variable inclusion. (DOCX 30 KB)

**Abbreviations**

AFR, 2 or more sexual partners in the last year; AENHC, 2 or more sexual partners in the last year with whom a condom was not used; AIDS, acquire- ed immune deficiency syndrome; BMI, body mass index; CAS, Confidential advice and support; CPR, Clinical prediction rule; CSA, Childhood sexual abuse; FAS, Fetal alcohol syndrome; HSE, Health Survey for England; HIV, Human immunodeficiency virus; SAPPHIRE, Sex, Attitudes and Lifestyles; STI, Sexually transmitted infections; UP, Unplanned pregnancy

**Acknowledgements**

The authors would like to acknowledge the Natsal-3 team for allowing access to the dataset, and supporting this analysis.

**Funding**

This is a summary of independent research funded by the National Institute for Health Research (NIHR)’s Doctoral Research Fellowship programme. The views expressed are those of the authors and not necessarily those of the NIHR, the NHS or the Department of Health. Natsal-3 is a collaboration between University College London (London, UK), the London School of Hygiene and Tropical Medicine (London, UK), Bangor Social Research, Public Health England (formerly the Health Protection Agency), and the University of Manchester (Manchester, UK). The study was supported by grants from the Medical Research Council (G0701757) and the Wellcome Trust (083440), with contributions from the Economic and Social Research Council and the Department of Health. The funders had no role in study design, data collection, analysis and interpretation of the data, the writing of the manuscript or the decision to submit for publication.

**Availability of data and materials**

The dataset supporting the conclusions of this article is available in the UK Data Service repository, unique persistent identifier: 10.5255/UKDA-EN-7799-1; https://discover.ukdataservice.ac.uk/catalogue/?an=7799&type=Data%20catalogue.


Appendix 4b: Reviewed Natsal-3 exposures

Listed here are the 42 Natsal-3 variables considered for inclusion in the model as psychosocial variables or as socio-demographic or other confounders (grouped by type). The variables which were then selected for possible model inclusion are underlined.

Relationships

- Relationship status (cohabiting with partner/stable relationship not cohabiting/not in a relationship but previously cohabited/not in a relationship and never cohabited)
- Marital status at present (married or civil partnership and living with partner/cohabiting but not married or civil partnership/previously married or civil partnership/never married or had civil partnership and not cohabiting)
- How happy are you in your relationship with your partner (not applicable/1/2/3/4/5/6/7)
- Share same sexual likes and dislikes as partner (not applicable/agree strongly/agree/neither agree nor disagree/disagree/strongly disagree)
- Share same level of interest in having sex as partner (not applicable/agree strongly/agree/neither agree nor disagree/disagree/strongly disagree)
- How long experiencing lack of interest in sex (not applicable/3-6 months/6-12 months/1-5 years/5+ years)
- Preference of frequency of sex (not applicable/to have sex much more often/to have sex a bit more often/about right/to have sex a bit less often/to have sex much less often)
- Feel distressed or worried by sex life (not applicable/agree strongly/agree/neither agree nor disagree/disagree/strongly disagree)
- One week or less between meeting most recent partner and first sex (yes/no)
- How easy is it to talk about sex with your most recent partner (for those reporting 2+ partners) (not applicable/ easy with spouse/regular partner but difficult with new partner/easy with new partner but difficult with previous partner/easy with any partner/difficult with any partner/sometimes easy, sometimes difficult)
- Where first met most recent partner (17 response options)
- Partner ethnicity (white/Asian British/black British/other)

**Sexual identity**
- Sexual identity (heterosexual/ not heterosexual)

**Religion**
- Belonging to a religion (yes/no)
- Importance of religion and religious beliefs now (very/ fairly/ not very/not important at all)
- Frequency of attendance to religious meetings (not applicable/at least once a month/less often but at least once a year/less often than once a year)

**Substance use**
- Smokes cigarettes nowadays (yes/no)
- Current smoker status (non/ex/light/heavy)
- How often have you had more than six units on one occasion? (less than weekly/at least weekly)
- How often have you had more than six units on one occasion in the last year? (never/less than monthly/monthly/weekly/daily or almost daily)
- Average alcohol consumption per week in units (0/1-7/8-14/15-21/>21)
- Average frequency of alcohol consumption in the last 12 months of 3 or more days a week (yes/no)
- Ever taken drugs (yes/no)
- Have you taken cannabis in the last 12 months (yes/no)
- Have you taken drugs other than cannabis in the last 12 months (yes/no)
- Have you taken cannabis in the last 4 weeks (yes/no)
- Have you taken drugs in the last year (yes/no)

**General health**
- Respondent’s opinion of own health as fair or better than fair (yes/no)
- Treatment for a medical condition in the last year (yes/no)
- Respondent weight in kgs (continuous)
- Backache lasting for 3+ months in the last year (yes/no)
Mental health
- Currently taking medication for depression (yes/no)
- Received treatment for depression in the last year (yes/no)
- Positive screen for current depression based on PHQ9-2 (yes/no)

Formative experiences
- First heterosexual intercourse < age 16 years (yes/no)
- Lived with both parents until the age of 14 (yes/no)
- Discussed sex with parents at age 14 (didn’t discuss with either parent/discussed with 1+ parent/ didn’t live with either parent continuously)

Education
- Passed any exams or got any qualifications (yes/no)
- Completed continuous full-time education at age 16 or less (yes/no)

Respondent socio-demographics
- Age group (16-24/25-34/35-44)
- Tenure (renting/not renting)
- Ethnicity (white/Asian British/black British/other)
# Appendix 4c Natsal-3 bivariate analyses

**Natsal-3 Exposure selection based on bivariate analyses**

(Lowest cell count value given if below 100)

<table>
<thead>
<tr>
<th>Exposures:</th>
<th>2+P</th>
<th>2+PNC</th>
<th>FSNC</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relationships</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married status grouped (ms2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Too many response options</td>
</tr>
<tr>
<td>Relationship status grouped (relstatgp)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Predictive across all 3 outcomes. Minimum cell count &gt;99</td>
</tr>
<tr>
<td>Relationship satisfaction (relsat1)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>For first 2 outcomes significance is for Not Applicable (not in a relationship all year). FSNC significance is for very dissatisfied (v. satisfied or N/A)</td>
</tr>
<tr>
<td>Same sexual likes and dislikes as partner (sfrlikes1)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p≥0.05</td>
<td>Aggregated from sfrlikes but confidence interval suggest that it is N/A (not in a relationship all year) that is predictive</td>
</tr>
<tr>
<td>Shares same level of interest in having sex as partner (sfrint1)</td>
<td>p&lt;0.05</td>
<td>p≤0.05</td>
<td>p≥0.05</td>
<td>Aggregated from sfrint but confidence intervals suggest that it is N/A (not in a relationship all year) that is predictive</td>
</tr>
<tr>
<td>How long experiencing lack of interest in sex (sfprlng1)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p≥0.05</td>
<td>Aggregated from Sfprlng. Mixed performance. Confidence interval suggest that it is N/A (not in a relationship all year) that is predictive</td>
</tr>
<tr>
<td>Preference for frequency of sex now (frequent1)</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>p&lt;0.05</td>
<td>Aggregated from Frequent. Mixed performance</td>
</tr>
<tr>
<td>Feel distressed/worried by sex life (sffdst1)</td>
<td>p≥0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Aggregated from Sffdst but frequencies still too small for modelling</td>
</tr>
<tr>
<td>Time between 1st meeting most recent partner and 1st sex (r1known2)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Good performer overall but response category dependent on other (r1meet) variables</td>
</tr>
<tr>
<td>How easy to talk about sex with 2+ lifetime partners (easyoub1)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Aggregated from easyoub. Good performer overall but significance likely to be conflated by number of partners</td>
</tr>
<tr>
<td>Where first met most recent partner (r1meet2)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Aggregated from r1meet. CI very close and/or the odds ratio only slightly &gt;1</td>
</tr>
<tr>
<td>Ethnic group of partner aggregated (r1ethni2)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Predictive but small frequencies. Asian consistently protective and both other non-white groups consistently risk associated (black more than other/mixed).</td>
</tr>
<tr>
<td>Exposures:</td>
<td>2+P*</td>
<td>2+PNC</td>
<td>FSNC</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>-------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passed any exams (anyexam)</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>p&lt;0.05</td>
<td>Mixed performance but likely to be confounded by age</td>
</tr>
<tr>
<td>Age completed full-time continuous education (tedage2)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Good performance but likely to be confounded by age as confidence intervals with least overlap are for ‘still in education’ category</td>
</tr>
<tr>
<td>Sexual identity aggregated to heterosexual/ other (sexiddi)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p≥0.05</td>
<td>Concern re small responses to ‘other’ (n=121) and small cell count for primary outcome 2+P</td>
</tr>
<tr>
<td>Belong to any religion now (belrelig)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Comparatively good prevalence</td>
</tr>
<tr>
<td>Importance of religion and religious beliefs now (religimp)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Very large confidence intervals with no consistent confidence interval overlap for aggregation. Small cell count for primary outcome</td>
</tr>
<tr>
<td>Frequency of attendance at religious services/meetings, aggregated (oftrelig1)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>No consistent confidence interval overlap for aggregation. Similar to belrelig but &gt;2 categories</td>
</tr>
<tr>
<td><strong>Formative experience</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at first sexual intercourse (firstint aggregated to &lt;16 or 16+ years) (early_debut)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Good performance</td>
</tr>
<tr>
<td>Lived more or less continuously to age 14 with both natural parents (bothmapa2)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Good performance</td>
</tr>
<tr>
<td>Discussed sex with parents around age 14 (notalk)</td>
<td>p≥0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Mixed performance and different direction of association for 2+PNC</td>
</tr>
<tr>
<td><strong>Health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent’s opinion of own health aggregated (healthdi)</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>p&lt;0.05</td>
<td>Varying performance</td>
</tr>
<tr>
<td>Respondent reported treatment for a medical condition listed in Card D in the last year (medcond)</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>Poor performance</td>
</tr>
<tr>
<td>Respondent body weight in kg (kgweight)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Continuous data unsuitable for CPR self-scoring</td>
</tr>
<tr>
<td>Exposures:</td>
<td>2+P</td>
<td>2+PNC</td>
<td>FSNC</td>
<td>Comment</td>
</tr>
<tr>
<td>------------</td>
<td>-----</td>
<td>-------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>Received treatment for backache in last year (medwchd1)</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>p≥0.05</td>
<td>Poor performance</td>
</tr>
<tr>
<td>Currently taking medicine for depression (drgdep)</td>
<td>p&lt;0.05</td>
<td>p≥0.05 (n&lt;50)</td>
<td>p&lt;0.05</td>
<td>Varying performance</td>
</tr>
<tr>
<td>Received treatment for depression in last year (medwchd3)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Good performance and stand-alone item</td>
</tr>
<tr>
<td>PHQ2 depression score derived from Mood1 &amp; Mood2 (depscr)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Derived from mood1 and mood2</td>
</tr>
</tbody>
</table>

### Substance use

<table>
<thead>
<tr>
<th>Substances</th>
<th>2+P</th>
<th>2+PNC</th>
<th>FSNC</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smokes cigarettes nowadays (smokenow)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Comparatively high prevalence</td>
</tr>
<tr>
<td>Current smoking status (smoking)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Similar to ‘Smokenow’ but more response options</td>
</tr>
<tr>
<td>Average frequency of alcohol consumption in last 12 months (drinkofdtdi)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&gt;0.05</td>
<td>Dichotomised from Drinkofdtdi using confidence intervals into 3+ days per week versus &lt;3 days per week</td>
</tr>
<tr>
<td>How often have &gt;6 units on one occasion (drinknum)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Too many response options</td>
</tr>
<tr>
<td>How often have &gt;6 units on one occasion aggregated (binge_drink)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Replaces drinknum1 by amalgamating weekly and daily binge-drinking</td>
</tr>
<tr>
<td>Average alcohol consumption per week, aggregating unitspw (alcohol4)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>Aggregated from units per week</td>
</tr>
<tr>
<td>Taken cannabis in last 12 months (drcan12m)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>NS</td>
<td>Mixed performance but low counts and already dichotomous so can’t aggregate</td>
</tr>
<tr>
<td>Taken cannabis in last 4 weeks (drcan4w)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>BS</td>
<td>Lower frequencies than Drcan12m</td>
</tr>
<tr>
<td>Taken drugs other than cannabis in last 12 months (drg12m)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>SS</td>
<td>Similar pattern to ‘Drcan12m’ but lower frequencies</td>
</tr>
<tr>
<td>Taken drugs in last year, including injected drugs (drugsyr)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>NS</td>
<td>Same response pattern as ‘drcan12m’ but with slightly higher frequencies</td>
</tr>
<tr>
<td>Ever taken drugs, including injected drugs (drugsever)</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>NS</td>
<td>Highest cell frequencies of all drug variables &amp; perhaps most acceptable</td>
</tr>
</tbody>
</table>
Appendix 5a: Published Brighton & Hove survey paper

Candidate contribution: Natalie Edelman took the lead role in designing the study, conducting the analyses and writing the paper.

Deriving a clinical prediction rule to target sexual healthcare to women attending British General Practices


# Brighton & Sussex Medical School, United Kingdom
# University of Brighton, United Kingdom
# University College London, United Kingdom
# Princess General Practice, United Kingdom
# University of Sussex, United Kingdom

ARTICLE INFO

Keywords:
- Primary care
- Sexually transmitted infections
- Women
- Contraception
- Sexual healthcare
- Reproductive healthcare

ABSTRACT

Some women attending General Practices (GPs) are at higher risk of unintended pregnancy (UIJ) and sexually transmitted infections (STIs) than others. A clinical prediction rule (CPR) may help target resources using age-based questions as an acceptable, effective means of assessment. The aim was to derive a CPR that discriminates women who would benefit from sexual health discussion and intervention.

Participants were recruited to a cross-sectional survey from six GPs in a city in South-East England in 2016. On arrival, female patients aged 16–44 years were invited to complete a questionnaire that addressed the socio-demographic and health factors, and the following ID risk factors: sexual activity; number of sexual partners in the last year (NP) and RUJ. For each sexual risk, psychosocial questions were included using logistic regression to identify the best identified women at risk using a Clinical Risk Score. Sensitivity and specificity were established in consultation with GP staff.

The final sample comprised 2,031 patients. RUJ was predicted by 16 questions including age, history of pregnancy, relationship status, alcohol consumption, number of sexual partners in the last year, and emergency contraception use in the last 6 months. CPR was better discriminated than RUJ but not to a clinically important degree. The finding that different psychosocial factors predicted each outcome has implications for prevention strategies. Further research should investigate causal links between psychosocial factors and sexual risk.

1. Introduction

In Britain, General Practices (GPs) act as the gatekeepers to specialist secondary services, and are staffed by Practice Nurses and General Practitioners (akin to Family Physicians in the United States). In England 85,969,664 people (approximately 90% of the resident population) are currently registered with a GP (NHS Digital, 2018) from whom they can also obtain a range of interventions directly. Britain's sexual health guidance and policy (DH, 2001, 2013) recommends GPs as sites for provision of sexual health interventions. This widens the availability of testing for sexually transmitted infections (STIs) and contraception to a broad population who are likely to vary in need for these interventions to a greater degree than those attending specialist contraception and sexual health (CASH) services (Cassell, et al., 2006).

Without an evidence-based means of targeting these interventions to women in GPs, resources may be wasted offering interventions unnecessarily (Fairley, 2016). Opportunities may also be missed to offer STI testing and contraception to high-risk individuals presenting for unrelated problems.

Within CASH clinics, a sexual history is the standard approach to determining appropriate intervention. This is resource-intensive during GP appointments for unrelated concerns and may feel unacceptable to some GP attenders (Edelman et al., 2013; Defina, 2009), leading to possible underreporting (Defina, 2009). Guidance recommends STI screening in GP settings only for target populations such as men who have sex with men, and for symptomatic individuals. The absence of
Table 1
Candidate predictors (prospective CPR items)

<table>
<thead>
<tr>
<th>Item wording</th>
<th>Response options</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>How old are you?</td>
<td>+ 15 years or less</td>
<td>Natchai-3 wording, categories developed by author</td>
</tr>
<tr>
<td></td>
<td>+ Between 16 and 24 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Between 25 and 34 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Between 35 and 44 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ 45 years or older</td>
<td></td>
</tr>
<tr>
<td>Thinking about whom you are living now, which statement best describes your</td>
<td>+ I am living or living recently (including living with parents or staying with</td>
<td>Natchai-3 response options with different piloting question wording</td>
</tr>
<tr>
<td>circumstances?</td>
<td>friends) + living in my own house (including mortgage, shared ownership or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>brought or single</td>
<td></td>
</tr>
<tr>
<td>Did you live more or less continuously with [both members of couple]</td>
<td>+ Yes</td>
<td>Natchai-3 with underline instead of lengthy explanatory text</td>
</tr>
<tr>
<td>at home until you were 14?</td>
<td>+ No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>How often is each of the following kinds of support available to you if you</td>
<td>+ None of the time</td>
<td>Canadian Community Health Survey (systematic review)</td>
</tr>
<tr>
<td>need it?</td>
<td>+ A little of the time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Some of the time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Most of the time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ All of the time</td>
<td></td>
</tr>
<tr>
<td>To what extent is the statement 'I have high self-esteem' true for you</td>
<td>+ Not very true of me</td>
<td>Robin's Single Item Self-esteem Scale (2010)</td>
</tr>
<tr>
<td></td>
<td>+ Somewhat untrue of me</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Neither untrue nor true of me</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Somewhat true of me</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Very true of me</td>
<td></td>
</tr>
<tr>
<td>In the last 12 months have you received treatment from a health professional</td>
<td>+ Yes</td>
<td>Natchai-3 with slightly adapted wording (as this was presented in a</td>
</tr>
<tr>
<td>for depression?</td>
<td>+ No</td>
<td>card)</td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>How strongly do you agree with the statement 'Having a partner at all times is</td>
<td>+ Agree</td>
<td>Atlanta Center for Disease Control (CDC) study</td>
</tr>
<tr>
<td>important to me?</td>
<td>+ Strongly agree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Agree</td>
<td></td>
</tr>
<tr>
<td>How often do you have 5 or more units of alcohol on one occasion?</td>
<td>+ Daily or almost daily</td>
<td>Natchai-3 (also an item in the validated Fast Alcohol Screening Test)</td>
</tr>
<tr>
<td></td>
<td>+ Weekly or almost weekly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Monthly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Less than monthly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Never</td>
<td></td>
</tr>
<tr>
<td>Do you smoke cigarettes at all nowadays?</td>
<td>+ Yes</td>
<td>Natchai-3 with additional e-cigarette category developed following FPI</td>
</tr>
<tr>
<td></td>
<td>+ No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Have you ever taken any non-prescribed, illicit or illegal drugs, including</td>
<td>+ Yes</td>
<td>Natchai-3 with wording adapted to specify legal highs included following FPI</td>
</tr>
<tr>
<td>legal highs?</td>
<td>+ No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Don't know</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>At present are you...</td>
<td>+ Living as a couple with a partner or spouse</td>
<td>Natchai-3</td>
</tr>
<tr>
<td></td>
<td>+ In a steady relationship but not living together</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ In a casual relationship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Single</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Place rate how emotionally satisfying your current relationship is, or how</td>
<td>+ Extremely satisfying</td>
<td>Tusa et al., 2005 (not systematic review)</td>
</tr>
<tr>
<td>emotionally satisfying you must meet relationship was if you are currently</td>
<td>+ Very satisfying</td>
<td></td>
</tr>
<tr>
<td>single?</td>
<td>+ Moderately satisfying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Slightly satisfying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Not at all satisfying</td>
<td></td>
</tr>
<tr>
<td>Place indicate how strongly you agree with the following statement:</td>
<td>+ Prefer not to answer</td>
<td>Atlanta CDC study</td>
</tr>
<tr>
<td>My partner tells me when I can spend time with</td>
<td>+ Strongly agree</td>
<td></td>
</tr>
<tr>
<td>My partner does what he wants even if I don't want him to</td>
<td>+ Agree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Disagree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Strongly disagree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>During your current or most recent relationship did your partner ever have</td>
<td>+ No                               + Definitely not</td>
<td>Tusa et al., 2005 (not systematic review)</td>
</tr>
<tr>
<td>sexual intercourse with anyone besides you</td>
<td>+ No                               + I don't think so</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ No                               + It's quite likely</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Yes                               + Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Have you ever been in a relationship with a partner who...</td>
<td>+ No                               + Prefer not to answer</td>
<td>NTV domestic violence tool (GP in place of Australian Women's Health Survey tool in systematic review)</td>
</tr>
<tr>
<td>involved or talked down to you often?</td>
<td>+ No                               + Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Shamed or swore at you often?</td>
<td>+ No                               + Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Thrown you with harm sometime?</td>
<td>+ Yes                               + Prefer not to answer</td>
<td></td>
</tr>
<tr>
<td>Physically hurt you sometimes?</td>
<td>+ No                               + Prefer not to answer</td>
<td></td>
</tr>
</tbody>
</table>
Table 1 (continued)

<table>
<thead>
<tr>
<th>Item wording</th>
<th>Response options</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>How old were you when you first had sexual intercourse with someone of the</td>
<td>• Under 16 years old</td>
<td>Natural-3</td>
</tr>
<tr>
<td>opposite sex (including experiences you may not have wanted or that</td>
<td>• 16 years or older</td>
<td></td>
</tr>
<tr>
<td>happened at an early age?)</td>
<td>• Ever had sexual intercourse with someone of the opposite sex</td>
<td></td>
</tr>
<tr>
<td>The man I most recently had not with in 5 or more years older than me</td>
<td>• Prefer not to answer</td>
<td>Natural-3</td>
</tr>
<tr>
<td>In the last six months have you used emergency contraception at all?</td>
<td>• True</td>
<td></td>
</tr>
<tr>
<td>In the last six months have you taken a pregnancy test because you thought you</td>
<td>• Probably true</td>
<td></td>
</tr>
<tr>
<td>might be pregnant?</td>
<td>• I have no idea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Probably not true</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Not true</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prefer not to answer</td>
<td></td>
</tr>
</tbody>
</table>

Incentives for contraception and chlamydia screening in Britain and elsewhere may further demotivate opportunistic questioning by GP staff, who may struggle to initiate sexual health discussions (Oksby, 2006; Carroll et al., 2011). Interventions to address this have had limited impact (Mclowald et al., 2010; Toven et al., 2015). Together this evidence suggests that a brief, acceptable, bespoke tool to target sexual healthcare could benefit GP staff and patients.

Clinical prediction rules (CPRs) identify risk of current or future adverse outcomes in individuals (Armstrong and Eborall, 2012) using several patient characteristics (Falarino et al., 2014a), to inform decisions about whether to offer interventions (Adams and Lennon, 2012). Many existing sexual health risk assessment tools and risk scores are CPRs (Falarino et al., 2014b). Most comprise sexual behavioural and socio-demographic ‘known factors’ (Blomko et al., 2012; Gaydos et al., 2015) and focus on STI risk (Falarino et al., 2014b). However, no CPRs have been developed to identify women at risk of STIs and/or risk of unintended pregnancy (RUUP) in primary care, and few have used psychosocial questions (Falarino et al., 2014b).

Psychosocial factors are increasingly being explored alongside socio-demographic and sexual-behavioural predictors of sexual health, reflecting growing recognition of the need to address the social determinants of sexual health (DHH, 2012). A systematic review and survey analysis identified several psychosocial factors associated with sexual risk in general population surveys of women, which may be usefully deployed as questions in a CPR for women attending GPs (Edelman et al., 2014; Edelman et al., 2017). That work suggests a psychosocial CPR should focus on identifying women experiencing recent potential risk of:

- STI acquisition through multiple partnerships in the last year (the primary outcome in this study)
- RUUP (desire to avoid pregnancy and not consistently using contraception in last six months)
- STI acquisition (through a potentially infected partner).

The latter outcome was included in the hope of identifying a novel population at risk through their partner’s behaviour (Miral et al., 2012). Re-infection from the same partner is believed to be a key factor in the re-infection rates for Chlamydia trachomatis, estimated at 20% (cumulative risk) (Walker et al., 2012). Together these outcomes facilitate CPR use for primary prevention (contraception and promotion of condom use) and for secondary prevention (pregnancy and STI testing and treatment).

The aim of this study was to identify the best combination of psychosocial questions to form an acceptable CPR to target sexual health interventions in general practice to women of reproductive age. To do this we addressed the following research question: What combination of acceptable psychosocial and socio-demographic questions discriminates best those women experiencing multiple partnerships, potential risk of STIs through partner and risk of unintended pregnancy?

2. Methods

We undertook a cross-sectional quantitative survey across GPs in a city in South-East England between April and September 2016. All female GP attenders aged 16–44 years were eligible to participate; we included women who did not report any male sexual partners in the last year so that we could assess the discriminatory power of the CPR.

2.1. Recruitment

We identified psychosocial questions for inclusion in the survey questionnaire from a variety of sources based on the findings of preliminary studies (Edelman et al., 2014; Edelman et al., 2017; Robins et al., 2003; Gao and Chen, 2011; Raiford et al., 2008; Teas et al., 2002; Wellings et al., 2015; Sherin et al., 1998). These are listed in full in Table 1, and included questions on age group and housing tenure (renting or living rent-free versus home ownership) which remained predictive of multiple partnerships after adjustment for psychosocial questions in a preliminary study (Edelman et al., 2014). We chose psychosocial items that were brief and had few response options so that they would be easy to self-score and therefore suitable for self-completion in the CPR. We privileged items that were more common to ensure adequate prediction (i.e. applying the rationale that rare exposures would lead to the identification of fewer women). We added a ‘prefer not to answer’ option to exposures that might be deemed unacceptable in order to measure this.

2.2. Outcomes

We developed a model for each of the following outcomes, which were designed to represent recent histories that would warrant sexual health discussion and possible intervention.

1. Report of 2+ male sexual partners in the last year (2MP) - indicating possible need for sexual health advice and STI testing. This outcome was measured using a single item ‘In the last year, how many men have you had sexual intercourse with?’ Sexual intercourse means a man penis in a woman’s vagina, mouth or anus’.
2. Report of 2MP and/or risk of STI through a male partner (i.e. that the participant perceived that their most recent male sexual partner had had other sexual partners in the last year and had not always used condoms with those other partners).
3. Report of risk of unintended pregnancy in the last six months
(RIIP), indicating a possible need for contraception. At the time of development, there was no suitable existing measure. Therefore, we constructed a composite measure from an item measuring contraception use (Wollings et al., 2011a) and an item measuring desire to avoid pregnancy (Miller et al., 2013), adapting each to report retrospectively in the last six months.

These outcomes were limited to heterosexual experiences on the basis that women who only have sex with other women are at considerably lower risk for STI acquisition than other women (Reeveret, 2013). Nonetheless, the exclusion criteria did not incorporate women who self-identified as lesbian, as their exclusion from sexual health research is a growing concern as sexual health moves away from a disease-focused biomedical model (Wollings and Johnson, 2011). In addition, evidence suggests that some women who identify as lesbian may also report recent sexual activity with men (Reeveret, 2015) and may therefore experience the outcomes of interest.

2.3. Data collection

Data collection was designed to mimic envisaged delivery of the CPR – in which women self-complete and self-score the CPR during a clinic visit using a paper-and-pencil format. Patient and Public Involvement (PPI) was conducted by consultation with women attending a GP, a Women’s Centre and a Youth Forum (who commented on a range of health services and research) to decide this delivery method and finalise the following approach to data collection.

On arrival, women attending GPs were offered an envelope by research or reception staff, except visibly distressed women, those known to have insufficient English language skills, or those who were clearly outside of the eligible age range. Each envelope contained a pen, patient information sheet (PIS) and a brief questionnaire, comprising potential CPR items and the outcomes of interest. The questionnaire was designed to take 5 minutes to complete, while awaiting an appointment. This was deemed feasible as a 2016 study of General Practices in the study location found a mean waiting time of 15.6 minutes (McKee et al., personal communication, 2017). Participants were instructed to complete the questionnaire anonymously, sitting alone in the waiting area if possible. Consent was implied by completion of the questionnaire. Three questions on the front of the questionnaire were used to screen out ineligible patients (those who had completed the questionnaire previously and/or did not identify as female and/or were outside the eligible age range were instructed by questionnaire test to seal and return their questionnaire without completing further). The questionnaire and PIS instructed participants to seal their questionnaire in the envelope before returning to staff to be securely returned to the researchers.

2.4. Data storage and management

Questionnaires were stored at Brighton & Sussex Medical School for the duration of the study. Data were collected by an external company and analysed in a statistical software dataset - Statistix v13 (StatSoftCorp, 2013). Accuracy checks were performed on a random 10% sample and anomalies checked and addressed individually by researchers.

2.5. Statistical analysis

Weighing techniques were not applied as pseudo-inclusion probabilities (Elliott and Valliant, 2017) which approximate the likelihood of study inclusion) could not be calculated. Available case analysis was used because item non-response was low. Bivariate analyses were conducted between psychosocial questions and each outcome. To avoid overfitting the models, these analyses were only used to exclude from model entry: 1. exposures not associated with any outcomes and 2. Exposures reported by < 10% of respondents. We selected which psychosocial variables to enter into each model and then generated three models, one for each of the outcomes listed above. We used backwards stepwise multivariable logistic regression as an established methodology for CPR derivation (Adams and Lewsece, 2012; Falissierin, 2014; Gutz et al., 2015).

To assess model performance as a potential set of CPR questions, we used the C statistic to quantify how well the model discriminated between those with, or without, the sexual risk of interest. The amount of variance explained by each model was assessed using McFadden’s pseudo R² and calibration using Hosmer-Lemeshow goodness-of-fit test. Bayesian information criteria (BIC) were used to compare the parsimony of models. Exposures were not manually removed from the models if the corresponding p-value was > 0.05 as CPR derivation is a process of elimination rather than hypothesis testing. This is a recognised statistical approach to clinical prediction modelling (King et al., 2012). For each finalised model the coefficients were used to generate a scoring system for the CPR (Stallman et al., 2014). A cumulative CPR score was then calculated for each participant based on their survey responses. For each model, participants’ scores were cross-tabulated against their self-report of that outcome to assess how many participants would be classified as false positive or false negative using the derived scoring system. Optimal cut-off values for sensitivity and specificity were then selected in a group consultation with five General Practitioners at one of the participating recruitment sites.

A sample size of 1500 was set in order to achieve an anticipated 150 reporting 2FP based on previous analyses (Edelman et al., 2017), sufficient to generate a 10–12 item CPR using the 18 events per variable approach (Pelizzari et al., 1992). CPR was chosen as the primary outcome of interest as a known broad indicator of sexual risk (Soenenberg et al., 2013). We ceased data collection at n = 1200 when n = 150 reporting 2FP had been exceeded.

3. Results

The final sample comprised n = 1200 women, 21.7% (n = 263) were aged 16–24 years, 41.8% (n = 510) were aged 25–34 years, and 36.4% (n = 451) were aged 35–44 years. 69.8% (n = 859) reported that they were currently resting or living rent-free and 29.7% (n = 360) owned their own home. Fig. 1 presents completion rates. We were unable to estimate response rates or investigate reasons for non-participation. Low rates of missing data and ‘prefer not to answer’ responses indicated that the questions were highly acceptable. Those exposures without the latter category still captured missing data n = 40, comparable with those exposures that did offer a ‘prefer not to answer’ option.

The final model identified for ‘2 = sexual partners in the last year’ comprised 11 items (Table 3). The Variance Inflation Factor of 1.21 indicated no multi-colinearity. Therefore no candidate predictors for this model needed to be removed to avoid inflated standard errors. This generated reasonable discriminatory power of C = 0.83 but low amount of variance explained (McFadden’s pseudo R² = 0.21). Good model calibration was indicated by H-L = 5.15 (p = 0.74). Although statistical significance is not the primary concern of modelling for estimation purposes (as in this case), the majority of exposures demonstrated an independent statistically significant association with the outcome modelled. Through GP consultation a cut-off score of nine or above (range = 0–18) was chosen. This afforded a sensitivity of 72.8% and specificity of 78.7%.

The model identified for ‘combined risk through multiple partnerships or most recent partner’ comprised 11 items (Table 3), similar to those in the model for 2FP. The Variance Inflation Factor was 1.49, therefore no candidate predictors for this model needed to be removed to improve the accuracy of coefficients. It generated reasonable discriminatory power of C = 0.79 but explained only a small amount of the variance in outcome values (McFadden’s Pseudo R² = 0.21). H-
L = 3.85 (p = 0.07) indicated good model calibration and moderate to good level of discrimination (Alba et al., 2017), only slightly lower than 2IP alone. However, the BIC value was higher for this model (BIC = 912) than for 2IP (BIC = 762). Through GP consultation a cut-off score of six or above (range = 0–17) was chosen. This afforded a sensitivity of 79.2% and specificity of 62.9%.

The model identified for ‘risk of unintended pregnancy risk in the last 6 months’ (RUP) is presented in Table 4. The model had VIF = 1.21 so that no exposures needed to be removed for reasons of multi-linearity. The model contained only five predictors, within the allowable number for the entered exposures and events, and accordingly had a lower BIC score (BIC = 402) than the other models. Although it showed good calibration (H-L = 1.0, p = 0.06), the RUP model demonstrated a lower amount of variance explained (Pseudo-R² = 0.12) and lower discriminatory power (C statistic = 0.70) compared to the other models. Nonetheless, this indicates moderate discrimination (on the basis that 0.5 denotes random chance and 1.0 perfect discrimination) (Alba et al., 2017). Although statistical significance is not the primary concern of modelling for estimation purposes (as in this case), it is noteworthy that only two of the exposures demonstrated an independent statistically significant association (p < 0.05) with the outcome modelled. Using the 5 items retained in the RUP model, a score was developed with range 0–11. A cut-off score of three or above optimised sensitivity and specificity, giving a sensitivity of 69.0% and specificity of 56.8% and yielding n = 315 false positives and n = 52 false negatives.

The stakeholder consultation indicated that the sensitivity and specificity afforded by the CPR scores were too low for ubiquitous use in General Practices. However, the group felt that further research was warranted to investigate targeted use.

### Table 2

<table>
<thead>
<tr>
<th>Psychosocial question (yes vs no)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>z-statistic</th>
<th>p value</th>
<th>98% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 16–24</td>
<td>0.8</td>
<td>0.23</td>
<td>3.93</td>
<td>0.0003</td>
<td>(0.22, 1.13)</td>
</tr>
<tr>
<td>Living in rental accommodation</td>
<td>0.62</td>
<td>0.22</td>
<td>2.34</td>
<td>0.021</td>
<td>(0.03, 1.40)</td>
</tr>
<tr>
<td>Ever had a partner who invaded or swore at you often</td>
<td>0.34</td>
<td>0.20</td>
<td>1.68</td>
<td>0.094</td>
<td>(0.03, 1.30)</td>
</tr>
<tr>
<td>‘Life was too busy with chores’</td>
<td>0.27</td>
<td>0.23</td>
<td>1.29</td>
<td>0.203</td>
<td>(0.00, 0.20)</td>
</tr>
<tr>
<td>Terminated pregnancy in last 6 months</td>
<td>0.39</td>
<td>0.22</td>
<td>1.22</td>
<td>0.223</td>
<td>(0.00, 0.20)</td>
</tr>
<tr>
<td>Reports good or high allusions</td>
<td>0.90</td>
<td>0.22</td>
<td>3.95</td>
<td>&lt;0.0001</td>
<td>(0.46, 1.24)</td>
</tr>
<tr>
<td>Having a partner for all times is not important to me</td>
<td>0.42</td>
<td>0.23</td>
<td>2.01</td>
<td>0.045</td>
<td>(0.02, 0.88)</td>
</tr>
<tr>
<td>Risperidone weekly or more often</td>
<td>0.70</td>
<td>0.20</td>
<td>3.46</td>
<td>0.001</td>
<td>(0.30, 1.10)</td>
</tr>
<tr>
<td>Smoked cigarette all</td>
<td>0.45</td>
<td>0.22</td>
<td>2.06</td>
<td>0.043</td>
<td>(0.02, 0.67)</td>
</tr>
<tr>
<td>Ever used illegal or illicit drugs incl. legal highs</td>
<td>0.38</td>
<td>0.22</td>
<td>1.67</td>
<td>0.096</td>
<td>(0.07, 0.83)</td>
</tr>
<tr>
<td>Not in a steady relationship</td>
<td>2.06</td>
<td>0.22</td>
<td>9.25</td>
<td>&lt;0.0001</td>
<td>(1.60, 2.50)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.39</td>
<td>0.40</td>
<td>-11.07</td>
<td>&lt;0.0001</td>
<td>(-5.14, -3.61)</td>
</tr>
</tbody>
</table>

4. Discussion

Our findings demonstrate that a variety of psychosocial variables are associated with sexual risk among GP-attending women of reproductive age. The results indicate that it is possible to discriminate women attending General Practices who report experiencing multiple male partners and/or risk through partners, to a greater degree than those experiencing RUP. The findings also suggest that RUP is predicted by a different profile of psychosocial factors. However, the findings indicate that our CPR does not warrant further validation and evaluation for routine use in GP settings using the particular psychosocial questions that we tested, because the level of discrimination achieved is unlikely to be practical for decision making in GP settings.

Interestingly, various tools for related issues are already validated for use in General Practices, and may already be used in practice despite large differences in sensitivity and specificity. For example the HTIS (Hurt, Invited, Threatened with harm, Screamed at) domestic violence screening tool has demonstrated 94% sensitivity and 91% specificity in a General Practice setting (Sherin et al., 1998). The AUDIT-C (Alcohol Use Disorder Identification Test of Consumption) demonstrated sensitivity of 73% and specificity of 91% among women attending General Practice (Bradley et al., 2007). This sensitivity was therefore akin to this CPR. However, the specificity of our CPR was much lower, raising concerns among our stakeholders about its routine use in GP environments. Nonetheless, it is important to note that the specificity of our CPR may be lower in the study than in practice, as women who have been sexually inactive in the last year are likely to decline in use.

Unlike many sexual health tools that are developed without preliminary investigation (Palasimiu et al., 2014b), our CPR included candidate predictor variables selected on the basis of two separate
preliminary studies of random probability surveys (Ildelam et al., 2015; Ildelam et al., 2017). This survey was conducted on the population for whom the CPR is intended, and in the same setting, using a similar paper and pencil self-completion approach. This improves the validity of the dataset and findings, although it is important to note that while the models demonstrate proof-of-concept, they are not validated or evaluated for use by this study.

This survey indicates that age group and housing tenure were sociodemographic factors independently associated with sexual risk, rather than being fully explained by psychosocial items. This mirrors previous studies (Ildelam et al., 2012; Sheringham et al., 2013; Woolsall et al., 2015). Our findings concurred with previous research regarding a positive association between sexual risk/morbidity and early sexual debut (Ildelam et al., 2017; Wellsling et al., 2013b; Xaverius et al., 2009), social support (Goz and Chen, 2013), drug use (Ildelam et al., 2017; Wellsling et al., 2013b; Cannons-Regh et al., 2011) and emotional dissatisfaction (Tenta et al., 2003). However, we found opposite directions of association to previous studies examining self-esteem (Steck et al., 2009) partner importance (Hausfeld et al., 2009) and treatment for depression (Ildelam et al., 2017). The former were two studies of African-American women, which may account for the differences in direction of association. However the latter finding was from female participants in the National Survey of Sexual Attitudes and Lifestyles3 (Natal-3) who were aged 16–44 and who reported sexual activity in the last year. ‘Treatment for depression’ is a composite of both experiencing depression and accessing treatment for it, which may explain the different direction of association. Alternately, our contradictory findings may reflect the use of a convenience sample from within an urban clinical setting in South-East England as described below.

The CPR was developed to meet patient delivery preferences and assumed a recognised need for brief sexual health assessment using simple self-scoring (Duke et al., 2008). Low proportions of participants with missing data and reporting ‘prefer not to answer’ suggests that the questions asked were acceptable. However, if the CPR had been developed for digital delivery, e.g. as a computer-assisted self-interview, this may have resulted in even lower rates of missing data and potentially more accurate reporting of both outcomes and exposures (Riechers et al., 2010). This may have enabled the CPR to achieve higher sensitivity and specificity. Similarly, electronic delivery would have allowed for the development of a more complex and potentially more sensitive scoring system, using a larger number of response options.

In order to tailor the CPR towards primary prevention, the outcomes of interest in this study concerned recent sexual behaviour rather than morbidity. Thus, we could not verify self-report using more objective measures, recall bias may also have occurred in the self-report of both exposures and outcomes particularly as the study was cross-sectional and several items in the survey were unvalidated.

The study benefited from having a large sample, ensuring sufficient statistical power to undertake multivariable regression. However, using convenience sampling may have resulted in an under-representation of those reporting sexual risk behaviour and adjunct psychosocial issues, such that sample bias cannot be ruled out. Because brevity and self-completion were key concerns, we were unable to recruit immigrant or other minority status, and the findings may be biased towards those with stronger English language skills and towards those not experiencing current distress. Nonetheless, it is possible that those who were unable or chose not to participate in the study would be equally unlikely to complete the CPR practice so our findings still anticipate the CPR’s performance in practice.

The generalisability of the findings may also be limited by the particular demographics within the city where the study was undertaken. Compared with other geographical areas in the United Kingdom, the population is young, urban, wealthy, University-educated and ethically homogeneous (Brighton and Hove City Council, 2012). A 2016 survey of the city’s General Practices attendees (K. Mankell, personal communication, November 9, 2017) found that 91.6% were White, 87.5% had English as their First Language, 42.4% were educated to degree level, and the mean age was 49.3 years (sd = 18.9).

Although low sensitivity and specificity suggest that widespread delivery of the CPR to all women of reproductive age is not advisable, the CPR may be worthy of further validation and evaluation for targeted use in GP settings to those where poor sexual health is suspected, particularly as a means of generating discussion where adjunct issues such as binge-drinking and intimate partner violence are also a potential cause for concern. In these scenarios the CPR may provide an efficient alternative to clinical decision-making based on either use of socio-demographic data (as a population health approach) or

---

### Table 4

<table>
<thead>
<tr>
<th>Psychosocial question (yes v no)</th>
<th>Coefficient (log-odds)</th>
<th>Standard error</th>
<th>t-statistic</th>
<th>p-value</th>
<th>95% confidence limits (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexual debut (including untested) &lt; 16-years of age</td>
<td>0.8</td>
<td>0.20</td>
<td>1.20</td>
<td>0.196</td>
<td>-0.25, 0.96</td>
</tr>
<tr>
<td>Had emergency contraception in last six months</td>
<td>2.35</td>
<td>0.36</td>
<td>6.36</td>
<td>&lt;0.001</td>
<td>1.60, 3.20</td>
</tr>
<tr>
<td>Emotionally dissatisfied with current or most recent relationship</td>
<td>0.42</td>
<td>0.28</td>
<td>1.49</td>
<td>0.147</td>
<td>-0.13, 0.97</td>
</tr>
<tr>
<td>Having had treatment for depression in the last year</td>
<td>0.96</td>
<td>0.40</td>
<td>1.45</td>
<td>0.149</td>
<td>-0.01, 1.31</td>
</tr>
<tr>
<td>Partnjer had other partners during relationship</td>
<td>0.72</td>
<td>0.42</td>
<td>1.38</td>
<td>0.169</td>
<td>-0.07, 1.51</td>
</tr>
</tbody>
</table>
opportunistic, detailed sexual history (as an individual health approach).

5. Conclusion

Our findings contribute to the broader study of associations between social factors and sexual health. In particular, they indicate that a different set of issues are predictive of RUP. Further research should take into account how differences in which populations are offered which interventions may affect predictors of sexual risk (e.g. young age may have dropped out of the RUP model because young women are more likely to be fitted with long acting reversible contraception). Together these findings suggest that further research should be carried out to investigate the role of psychosocial factors both as causal factors in sexual risk and as means of identifying and differentiating between those experiencing different types of sexual risk.

Pending

This is a summary of independent research funded by the National Institute for Health Research (NIHR)’s Doctoral Research Fellowship programme DRF-2013-05-004. The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health.

Ethical approval

Ethical approval for this study was granted by University of Sussex and by the National Research Ethics Service Ref 16/AD/026.

Conflict of interests

There are no conflicts of interest to declare.

Acknowledgements

The authors wish to acknowledge all those who have helped with and contributed to the study. This includes attendees at Brighton Women’s Centre and at Newhaven Youth Forum, the NIHR Clinical Research Network Kent, Surrey and Sussex, the site Principal Investigators: Dr. Jennifer Whetam, Dr. Abbie Gunter and Dr. Paul Deffley; and the staff and patients of all the participating sites: Pavilion Surgery, St Peter’s Medical Centre, Brighton Health and Wellbeing Centre, Charter Medical Centre, Reusefield Medical Practice and Trinity Medical Centre (formerly Salisbury) for references.

References


Appendix 5b: PPI work plan for the Brighton & Hove survey

Objectives of lay involvement in survey design

1. Questionnaire content and design:
   a. To review and shape the direction of questionnaire layout and format, with a view to maximising the acceptability and completion of the questionnaire with full and valid responses.
   b. To review questionnaire items identified for possible inclusion—identifying those that are likely to have poor face validity or to cause distress, and informing selection of items where more than one is available for the same construct

2. Questionnaire recruitment and data collection
   a. To review and shape the direction of questionnaire recruitment and data collection plans, with a view to:
      i. maximising participation through acceptable and feasible study design
      ii. ensuring that consent is informed, but that participation is not unduly limited by this requirement

In particular this focused on issues of:

1. Ensuring privacy for those completing the questionnaire (including those attending with a partner, friend or family member)
2. Identifying strategies to maximise completion and return by participants who are called into their appointment before they have completed the questionnaire

Any further objectives related to questionnaire design, recruitment and data collection identified by lay advisors were also considered for action.

RE-DEFINING END-USERS

For the purposes of the survey ‘end users’ were defined not as the target population most at risk of adverse sexual health outcomes, but more broadly as the population who would be exposed to the CPR. In addition, in relation to study design, GPs and other General Practice staff are also recognised as ‘end
users’ of the study, given their potential role in administering and working with CPR results, alongside their role in survey recruitment. Finally a member of CASH staff (the PI for that site who is a GUM Consultant) was also consulted on the study design to ensure that it fitted around clinical priorities without unduly skewing the dataset. This extends the notion of ‘end user’ beyond the patient/public, chiming with comments by (McKinley et al., 2002).

**APPROACHING AND ENGAGING ‘END USERS’**

In contrast to previous attempts at PPI the revised strategy focused primarily on ad-hoc and opportunistic consultation with lay people and ongoing collaboration with 1 lay woman and 2 professionals: a GP and a GUM consultant. Consultation focused on three activities:

1. Two planned group consultations with female members attending Newhaven Youth Forum (after initial plans fell through to consult an young person’s research advice group in Bristol)
2. Ad-hoc opportunistic consultation with female GP attendees
3. Two planned group consultations with GP staff at practice meetings – firstly to discuss study recruitment plans and latterly to establish best cut-off scores.

Ongoing collaboration focused on two activities:

1. a GP and a GUM Consultant (each of who acted as PI for one of the recruitment sites)
2. a lay woman who had met the candidate socially and volunteered her involvement

Collaboration with both professionals involved email, face-to-face meetings at their place of work and text for the entire duration of the study, from design to publication. Collaboration with the lay woman involved email and skype sessions but was only sustained during the design period, following which contact ceased.

This replaced the original plan to engage 3-5 lay women as regular collaborators, by getting GP staff to hand out the amended role description (in which previous or current risk might define the end-users and anonymous,
remote involvement was offered). As noted by (McKinley et al., 2002) it is clear that consumer involvement in research poses particular challenges for primary care. However their suggestion that GPs and patients alike can be unnecessarily excluded from research design and debate, and that both are consumers of research is an extremely valid one.

**REIMBURSEMENT**

A fee was negotiated with the young person’s group for their time, whilst £5 Boots or M&S vouchers were offered as a ‘thank you’ to women providing lay consultation in Pavilion GP surgery. £10 Amazon vouchers were posted to the lay collaborator as reimbursement for her time, at her request.

**GP INVOLVEMENT**

One GP provided ongoing advice throughout the survey design, implementation and analysis process, and was a named co-author on the accompanying publication. In addition five GPs from the same practice were consulted during the survey design phase on issues of feasibility. The same GPs were consulted again after analysis was complete, to gain feedback on the potential utility of the CPR given those results.

**PPI BRIEF FOR LAY CONSULTATION/COLLABORATION**

A detailed brief was used by the candidate to ensure a consistent and thorough approach to gaining feedback on the proposed study design and materials. The candidate was unable to carry out formal cognitive interviewing for the pilot questionnaire, due to unavailability of training. Instead some of the principles of good questionnaire design were assessed during lay consultation and collaboration. This is therefore included in the brief that is given below.

**SECTION 1: POSTER**

Content – sufficient? Do I need to mention sexual health?
Format- Ideas for colour, size, format
Display- ideas for placement

**SECTION 2: PIS**

Wording clear?
Too long, too short? How long does it take to read through?
Best means of delivery? Separate sheet, front of questionnaire?

SECTION 3: RECRUITMENT AND DATA COLLECTION PLAN
Is this acceptable to women as a data collection approach?
What about if your friend or partner is next to you?
Worried about missing an appointment?
Would you complete after appointment? Do you usually rush off somewhere?
Ensure that consent is informed, but that participation is not unduly limited by this requirement
In addition to PIS comments, anything else re autonomy, and feeling fully informed. E.g. would women feel pressured? What would they do if they had a question?

SECTION 4: SURVEY INSTRUMENT
Questionnaire content and design PPI and piloting objectives:
1. To review questionnaire items identified for possible inclusion- identifying those that are likely to have poor face validity or to cause distress, and informing selection of items where more than one is available for the same construct.
2. To review and shape the direction of questionnaire layout and format, with a view to maximising the acceptability and completion of the questionnaire with full and valid responses.

Piloting is an important means of assessing face validity of questionnaires, performing some of the functions of cognitive interviewing. In particular, previous research has shown that recall and report of sexual activity is dependent on clear and acceptable questions. Piloting can be used to address all aspects of what is termed ‘Response Process’. This process included the four steps that a participant must carry out in order to respond to a survey item, which will be used to guide the questionnaire piloting phase:
1. Comprehension of what the participant is being asked to do
2. Retrieval of relevant information
3. Response mapping – in which the respondent must ‘map’ their retrieved information onto the available response options
4. Supplementation of available information using judgement and estimation
The questionnaire was piloted with GP attenders using the first three of these steps (as the last was not applicable); to ensure clarity and face validity and to reduce measurement error.

**COMPLETION**

How long does completion take?
Do questions appear to be in a sensible order? Do any ‘jar’?
Does the order of questions create confusion or bias?
Does the questionnaire appear intimidating?
What sort of presentation (colour, size etc…) would be best?

**TIMEFRAMES**

Timeframe for pregnancy intention and for use of contraception
Timeframe for items on condom use and partner numbers

**ACCEPTABILITY**

Are the items acceptable in the intended context of completion?
Do we need to change completion or item wording?
Do we want a ‘prefer not to answer’ acceptability response option for all items or just exposures?

**FACE VALIDITY**

A. **COMPREHENSION**

Where item instructions, response options, explanations, or question wording were altered from source items attention was paid to Grice’s four maxims (from his Co-Operative Principle). In practice this means:

Using terms that most people will interpret the same way (improving lexical quality)

Providing definitions (improving semantic quality)

Trying to block unintended inferences by participants (improving pragmatic quality) ref MOOC

This was done by focusing on the following questions during piloting:

Do people understand what they are being asked?

Do they understand the words and are they interpreting them as intended?

Do participants have a clear understanding of what is meant by ‘sexual partner’?
Do they have a clear understanding of what is meant by ‘relationship’?
Do they have a clear understanding of what is meant by ‘sexual intercourse’?

B. RETRIEVAL
Recall of behaviours and events may rely on semantic memory (for similar and regular events) and on episodic memory (dissimilar and irregular events)
The piloting assessed whether the 1 year time frame for sexual encounters was too long for good recall (e.g. too distant or detailed for accuracy)
Piloting also assessed the usefulness of context re-instatement (e.g. thinking about last relationship) as a retrieval tool that was effective and understandable

C. RESPONSE MAPPING
This is particularly important as categories may have been collapsed down in such a way that respondents find it difficult to find a response option that matches their retrieved information. Piloting focused on whether the response options were constructed in such a way that respondents find it easy to map their retrieved/supplemented information onto one of the options?
Due to lack of time and training the piloting did not however cover:
Primacy effects (this is ‘satisficing’ in which respondents are pre-disposed to use the first response option that sufficiently represents their retrieved information, rather than assessing all options)
Interpretation of scales- in particular ensuring even spacing such that the midpoint of the scale available matches the conceptual mid-scale in the respondents’ mind.
## Appendix 5c: Adapted survey items

### Questionnaire items (exposures) adapted or generated from Natsal-3 variables

<table>
<thead>
<tr>
<th>Theme</th>
<th>Original format/ sourced items</th>
<th>Reason for adaptation</th>
<th>Adapted format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (16-24, 25-34, 35-44)</td>
<td>What is your date of birth? INTERVIEWER: enter in the format \textit{dd/mm/yyyy}. If not known press &lt;Ctrl+K&gt;. IF (RDoBY = NONRESPONSE) THEN \textbf{Rage} Can I just check, what was your age last birthday?</td>
<td>This variable originally captured date of birth from which current age was calculated. The prompt was used instead and the responses given as categories which represent those used in natsal-3 analysis and also serve to exclude those outside the age criteria</td>
<td>What was your age last birthday? Less than 16 years Between 16-24 years Between 25-34 years Between 35-44 years</td>
</tr>
<tr>
<td>Sex of participant</td>
<td>UK Census 2011 What is your sex? Male / Female</td>
<td>No option for intersex or transgender people</td>
<td>Third response option ‘don’t identify as predominantly female or male’ included following piloting</td>
</tr>
<tr>
<td>Housing tenure (renting v other)</td>
<td>Do you (or your household) own or rent this (house/ flat/ accommodation)? Just tell me the number on the card. 1 Own it outright 2 Buying it with the help of a mortgage or loan 3 Pay part rent and part mortgage (shared ownership) 4 Rent it 5 Live here rent free</td>
<td>This was adapted so that it matches the derived variable (tenure2) that was found to be associated with sexual risk behaviour in the Natsal-3 analysis.</td>
<td>&quot;Thinking about where you are living now, are you?&quot; 1 &quot;renting or living rent-free&quot; 0 &quot;buying with a mortgage, shared ownership or outright ownership&quot;</td>
</tr>
<tr>
<td>Theme</td>
<td>Original format/ sourced items</td>
<td>Reason for adaptation</td>
<td>Adapted format</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Weekly binge-drinking (6+ units on 1+ occasion) in the last year</td>
<td>The 4 item FAST measure of hazardous drinking</td>
<td>The single item on weekly binge-drinking (from within FAST) was found to be significantly associated with sexual risk behaviour in the Natsal-3 analysis. The order of instructions was altered slightly so that this would be a stand-alone item</td>
<td>How often do you have [six/eight] or more units on one occasion</td>
</tr>
<tr>
<td>Sexual debut &lt;16 years of age</td>
<td>How old were you when you first had sexual intercourse with someone of the opposite sex, or hasn't this happened?</td>
<td>The instruction was amended to capture abusive experiences also. In addition those reporting first sex under aged 13 were included in the analysis, as this was associated with sexual risk in the natsal-3 analysis. The response option ‘I’ve never had sexual intercourse’ was also added.</td>
<td>How old were you when you first had sexual intercourse with someone of the opposite sex (including abusive experiences)?</td>
</tr>
<tr>
<td>Current relationship status (cohabiting, stable but not cohabiting, not in a relationship but previously cohabited, not in a relationship and never cohabited)</td>
<td>The original Natsal-3 database variable ‘relstatgp’ was itself derived from relstat, which was in turn derived from ms (from marstat i.e. marriage status), from r1rel, and from r1sexagn.</td>
<td>The instruction wording for ‘Marstat’ (marriage status) was combined with the cohabiting category: ‘steady but not living together’ adapted from r1rel. 2 categories were collapsed into ‘not in a steady relationship’ in Natsal-3 but PPI showed preference to distinguish so these two categories were aggregated only for analysis). A category for never had a relationship was introduced so that those who met this criteria could skip relationship-specific items (i.e. section 2)</td>
<td>‘At present are you’:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Living with a partner or spouse as a couple</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• In a steady relationship but not living together</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• In a casual relationship</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Single</td>
</tr>
<tr>
<td>Theme</td>
<td>Original format/ sourced items</td>
<td>Reason for adaptation</td>
<td>Adapted format</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Living with both parents</td>
<td>Did you live more or less continuously with both of your natural parents at home until you were 14? EXPLAIN IF NECESSARY: That is your birth parents. 1 Yes 2 No IF (BothMaPa2 = No) THEN YNotBoth2 Is that because there was ...READ OUT... 1...a divorce or separation, 2 or, a death, 3 or, you are adopted, 4 or, your parents never lived together, 5 or, is there another reason?</td>
<td>Adapted from Natsal bothmapa2 but reverse coded to pick up on risk and re-worded to be suitable for self-completion. The following explanatory wording was included for the pilot: If you or a natural parent, were away just temporarily, or you were at boarding school while your natural parents were at home, score this as ‘Yes’. If you were adopted, your parents never lived together, you experienced the death of a parent before the age of 15 or you were raised in care or by another family member score this as ‘No’. However, lay consultants felt it was un-necessary and burdensome. ‘Prefer not to answer’ was added to capture acceptability</td>
<td>Did you live more or less continuously with both of your natural (birth) parents at home until you were 14? 1 Yes 2 No Prefer not to answer</td>
</tr>
<tr>
<td>Current smoking</td>
<td>‘SmokeNow’ Do you ever smoke cigarettes at all nowadays? (Include roll-ups but exclude cigars). 1. Yes 2. No</td>
<td>After piloting ‘ever’ was removed from the question and a category added for e-cigarettes. The instruction: ‘You can tick more than one answer to this question’ was added to allow analysis of e-cigarettes as a stand-alone category or in conjunction with cigarettes and roll-ups</td>
<td>Do you smoke cigarettes at all nowadays? 1. Yes I smoke cigarettes/roll-ups 2. Yes I smoke e-cigarettes 3. No 4. Prefer not to answer</td>
</tr>
</tbody>
</table>

---

**Note:** The adapted format for living with both parents includes a preference for omitting the question, as it was felt to be unnecessary and burdensome. The explanation and reasoning for the adaptation are included in the table.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Original format/ sourced items</th>
<th>Reason for adaptation</th>
<th>Adapted format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment for depression in last year</td>
<td>In the last 12 months, have you received treatment from a health professional for any of the following conditions? (card shown by interviewer)</td>
<td>Adapted from Natsal-3 interviewer-delivery prompt so that asked about depression treatment only.</td>
<td>In the last 12 months, have you received treatment from a health professional for depression? Yes No Prefer not to answer</td>
</tr>
<tr>
<td>Drug use ever</td>
<td>DrNone Have you ever taken any of the drugs listed below? If you have never taken any drugs, type ‘11’. 1 Cannabis (marijuana, grass, hash, ganja, draw, skunk, weed, spliff), 2 Amphetamines (speed, whizz, uppers, billy), 3 Cocaine or coke (charlie), 4 Crack (rock, stones, white) 5 Ecstasy (E), 6 Heroin that was not injected (smack, skag, H, brown, gear, horse), 7 Acid or LSD (tabs, trips) or magic mushrooms, 8 Crystal Meth, 9 Amyl Nitrates (poppers, liquid gold, rush), 10 Other non-prescribed drugs, 11 None of these</td>
<td>The variable drug use ever was generated by the candidate from DrugUse which itself was derived from DrNone and inject2 (presented in the left-hand column). These source variables were re-examined and adapted into the single item in the right-hand column in order to reduce to condense to one item without losing any detail. Wording was used which best reflected the construct of drug use ever. After piloting the wording was changed to specify that legal highs were included and to add ‘Don’t know’ and ‘Prefer not to answer’ options. This reflected the legal situation at the time (those legal highs are mostly now illegal), and captured acceptability and the possibility of confusion with this item.</td>
<td>Have you ever taken non-prescribed, illicit or illegal drugs, including legal highs? Yes No Don’t know Prefer not to answer</td>
</tr>
<tr>
<td>Theme</td>
<td>Original format/ sourced items</td>
<td>Reason for adaptation</td>
<td>Adapted format</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| Sherin et al. | HITS measure | Wording changed from ‘current partner’ to ‘ever’ to improve acceptability and frequency rates. Frequency of response options also truncated and ‘Prefer not to answer’ added to capture acceptability | Have you ever been in a relationship with someone who….
Insulted or talked down to you often
Shouted or swore at you often
Threatened you with harm sometimes
Physically hurt you sometimes
Response options: ‘Yes, No, Prefer not to answer’ |
| Partner 5+ years older (Mercer et al.) | Age difference between partners of less than 5 years (compared to a male partner 5+ years older) - this was a variable derived from participant age and reported partner age. | Variable derived from multiple questions which needed to be converted to a stand-alone item. Generated in consultation with author of original paper (and supervisor) Dr. Mercer with slight construct difference ‘man you last had sex with’ rather than ‘man you last had a relationship with’. | The man I most recently had sex with is 5 or more years older than me:
Yes
Probably true
I have no idea
Probably not true / Not true |
| Partner characteristics- non-monogamy (Testa) | During your relationship did your partner ever have sexual intercourse with anyone besides you? ‘No, definitely not’ to ‘Yes, I’m sure he did’ | Author non-response re response option wording, so constructed these and piloted. Also changed to capture current or most recent partner. | ‘During your current or most recent relationship….’:
Definitely not
I don’t think so
It’s quite likely
Yes definitely |
<table>
<thead>
<tr>
<th>Theme</th>
<th>Original format/ sourced items</th>
<th>Reason for adaptation</th>
<th>Adapted format</th>
</tr>
</thead>
</table>
| Relationship satisfaction    | Please rate how emotionally satisfied you are with your relationship  
• Not at all satisfied (1)  
• A little dissatisfied (2)  
• Neither satisfied nor dissatisfied (3)  
• Quite satisfied (4)  
• Extremely satisfied (5) | This was reworded to capture current or most recent relationship. Accordingly the tense of response options was altered. The neutral middle option was also removed to simply analyses and because this is good practice in questionnaire design. | thinking about your current relationship, or most recent *Please rate how emotionally satisfying your current relationship is, or your most recent relationship was if you are currently single:*  
• Not at all satisfying  
• Slightly satisfying  
• Moderately satisfying  
• Very satisfying  
• Extremely satisfying |

(Testa)
Appendix 5d: Review of sexual health guidance

Relevant guidance was sought from the websites of the following organisations: British Association for Sexual Health and HIV (BASHH), Family Planning Association (FPA), Brook, National Chlamydia Screening Programme (NCSP), British HIV Association (BHIVA), Faculty of Sexual and Reproductive Health (FSRH), Royal College of General Practitioners (RCGP).

From these sites a number of guidance documents with relevant titles were reviewed as follows. The BASHH ‘STIs in Primary Care’ guidance provides management guidance based on different symptoms and STI diagnoses. However, it does not provide guidance on how to intervene based on reported risks. Symptoms and risk behaviours are comparable in the sense that they are both indicative of the need for intervention, so that it is interesting that only the former is addressed. Similarly, the BASHH 2013 ‘UK national guideline for consultations requiring sexual history taking’ sets out guidance on how to take sexual histories from individuals presenting for STI screens, but does not specify when to take histories, or how to act on them differentially based on those histories. Asymptomatic females screening guidance from BASHH (Sexually Transmitted Infections: UK National Screening and Testing Guidelines) paints a similar picture, although aimed primarily at screening and testing in Genito-Urinary clinics. This latter document only alludes to sexual history and risk in the following two lines of text which are specific to Gonorrhoea:

1. ‘…screening procedures are influenced by sexual history’ p. 20
2. ‘Advice on frequency of screening in the absence of symptoms is dependent on individual risk of infection and is determined by pragmatism rather than prospective studies’ p.21

There is no further discussion on what level or type of individual risk or sexual history would warrant testing. Similarly the Chlamydia Trachomatis (CT) guidance in this document suggests that (due to its frequently asymptomatic nature) CT screening should take place regardless of symptomatology, without reference to how sexual histories might guide the decision to test an individual woman.

The FSRH Quality Standards for Contraceptive Services was also reviewed, and similarly focused on provision of different interventions, rather than on the
factors that may require those interventions. The Brook, FPA and NCSP websites were also searched unsuccessfully for relevant documents. Following this the NCSP were contacted directly and confirmed that they do not recommend either stand-alone chlamydia screening or full STI screens on the basis of particular sexual risk behaviour profiles. This lack of attention in the guidance to how sexual risk profiles may determine the need for STI screening or CAS likely reflects that, firstly, opportunistic full STI screens or CAS are uncommon in primary care settings, and secondly that STI screening is routine procedure in GUM and CASH settings, and increasingly contraception advice and supply too.
Appendix 5e: Rejected measures of unintended pregnancy

An informal review of pregnancy measures was undertaken in the hope of finding one which matched the concept specification of ‘retrospектив unintended pregnancy risk’. This review highlighted how pregnancy measures vary around the following dimensions, reflecting some of the conceptual issues discussed in chapter 2:

1. intentionality (psychological) versus planning (behavioural)
2. ‘risk of pregnancy’ versus ‘categorisation of actual pregnancy’
3. prospective versus retrospective measurement
4. individual versus population use
5. predictors of future experience versus measurement of existing states

All these dimensions described above must be considered when identifying a suitable outcome for retrospective unintended pregnancy risk and for considering how it should be analysed. In particular validated measures were sought via abstracts identified in the systematic review process, and proxy variables were also considered (such as use of emergency contraception and pregnancy testing).

At the time of investigation no appropriate measures existed (one was published late in 2016 (Moreau and Bohet, 2016) and also a new prospective measure of pregnancy desire (Rocca et al., 2016). This reflects that most measures (e.g. the London Measure of Unplanned Pregnancy) were developed for epidemiological purposes (e.g. to estimate population rates by retrospectively categorising pregnancies on a continuum from ‘unplanned’ to ‘planned’). In contrast, measures of actual likelihood of acquiring an unintended pregnancy would include factors such as fertility (both partners), menstrual cycle, contraception use and pregnancy intentions.

Several existing measures were reviewed for possible use, the first of which was the London Measure of Unplanned Pregnancy (LMUP) (Barrett et al., 2004). This is perhaps the most well-known measure used in survey research. In its validated form it has been designed to retrospectively categorise pregnancies which did occur (rather than sexual risk encounters that would place one at risk of pregnancy) for the purposes of providing population-level estimates of unplanned pregnancy. An adapted form is also being developed to prospectively measure actual unplanned pregnancies in a US-based
longitudinal follow-up study. Although this doctorate sits at the cusp of population health and clinical medicine the LMUP was rejected because of its focus on categorization of existing pregnancies rather than risk of pregnancies, and its intended use for population-level research. Indeed the LMUP’s creator corresponded directly with the candidate about her concerns over its use in addressing individual-level research questions. In addition, the LMUP conflates intention and behaviour (e.g. the LMUP carries both these constructs on a continuum) but also demonstrates how public health priorities (providing contraception to all women who aren’t actively seeking pregnancy) can actually ‘pathologise’ a valid choice by ambivalent women to not consistently use contraception.

The Attitude towards Potential Pregnancy Scale (2014) (Paterno and Han, 2014) was rejected because it was prospective, based on attitudes rather than actions or intentions, and was only validated for African-American women attending obstetric appointments. The Intensity of Pregnancy Planning (Morin et al., 2003) scale was rejected because it is lengthy, assumes a current partnership and includes psychosocial items- i.e. it is not a measure of women at risk of unplanned pregnancy but rather a tool for identifying women at risk of unplanned pregnancy. Information was unsuccessfully sought regarding the measurement and definition of prospective unintended pregnancy in a 2014 paper (Tyler et al., 2014). The concept of ‘unsupportable pregnancy’ has been put forward by Catrina Macleod (Macleod, 2016). However, this has not been developed into a quantitative measure and to do so would likely involve a number of items owing to its multi-faceted nature.

Three papers by Moreau were reviewed for a suitable measure after an initial paper was found during the systematic review process (Moreau et al., 2013b). Two more recommended by Moreau herself during email correspondence (Moreau et al., 2014, Moreau et al., 2013a) the last of which was adapted for use in the questionnaire. The first paper measured current potential risk of unintended pregnancy (Moreau et al., 2013b) but the author was unable to supply the candidate with detailed information about how this construct had been developed. The paper itself stated that this construct was defined as ‘being sexually active in the last 12 months, with a current partner, non-sterile,
and not pregnant or trying to get pregnant at the time of the study’. This measure was deemed too lengthy and unsuitable for use without the exact wording. A second paper by Moreau (Moreau et al., 2014) examined the effect of wording on population estimates of unplanned pregnancy by examining categorisations of existing pregnancies. Therefore, this was rejected on the same grounds as the LMUP (though it importantly highlighted the importance of avoiding the term ‘unwanted’ as this yields low estimates).
### Appendix 5f: Exposures reviewed for possible inclusion in the research questionnaire

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
<th>Nature of association</th>
<th>Quality rating</th>
<th>Rating justification</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUBSTANCE USE ITEMS CONSIDERED FOR INCLUSION AS EXPOSURES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoking</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with 2+ partners in the last year; and with non-use of condoms at first sex with most recent partner</td>
<td>High</td>
<td>Associated with &gt;1 outcome after adjustment, relevant population. Good prevalence of n=4230 (27.9%).</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Current smoker</td>
<td>Xaverius 2009 Systematic review</td>
<td>Associated with current non-use of contraception among those not wishing to get pregnant</td>
<td>Medium</td>
<td>Problematic analysis - categorised EC users as contraceptive users</td>
<td>REJECT</td>
</tr>
<tr>
<td>Current smoking</td>
<td>Wellings 2013 Systematic review</td>
<td>Associated with experience of unplanned pregnancy in the last year</td>
<td>Medium</td>
<td>Analyses were restricted to bivariate</td>
<td>SAME AS ACCEPTED ITEM</td>
</tr>
<tr>
<td>Current smoking</td>
<td>Hansen 2010 Systematic review exclusion</td>
<td>Associated with lifetime diagnosis of genital warts</td>
<td>Medium</td>
<td>Non-recent and very specific outcome. Population just outside relevant parameters</td>
<td>REJECT</td>
</tr>
<tr>
<td>Weekly binge drinking (6+ units on at least one occasion) in the last year</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with 2+ partners in the last year; non-use of condoms with 2+ partners in the last year; non-use of condoms at first sex with most recent partner</td>
<td>High</td>
<td>Associated with &gt;1 outcomes after adjustment, relevant population. Prevalence of n=2251 (16.41%).</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Lifetime alcohol or drug dependency</td>
<td>Mota 2010 Systematic review exclusion</td>
<td>Associated with abortion ever</td>
<td>Low</td>
<td>DSM-IV defined too complex for CPR. Exposure comparatively rare and age-dependent</td>
<td>REJECT</td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-----------------------</td>
<td>----------------</td>
<td>----------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Drug use ever</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with 2+ partners in the last year; non-use of condoms with 2+ partners in the last year</td>
<td>High</td>
<td>Associated with &gt;1 outcome after adjustment, relevant population. High prevalence of n=5125 (35.41%).</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Use of drugs for non-medical purposes ever</td>
<td>Khan 2005 Systematic review exclusion</td>
<td>Associated with STI in previous four years</td>
<td>Medium</td>
<td>Associated with relevant outcome but bias due to follow-up sample</td>
<td>REJECT</td>
</tr>
<tr>
<td>Drugs other than cannabis used in last year</td>
<td>Wellings 2013 Systematic review</td>
<td>Associated with experience of unplanned pregnancy in the last year</td>
<td>Medium</td>
<td>Analyses were restricted to bivariate. In doctorate performed less well than ‘drugs ever’</td>
<td>REJECT</td>
</tr>
<tr>
<td>Substance use variables, various</td>
<td>Cavazos-Rehg 2011 Systematic review</td>
<td>Associated with lifetime number of partners</td>
<td>Medium</td>
<td>Outcome non-recent, study conducted only on young people</td>
<td>REJECT</td>
</tr>
</tbody>
</table>

**MENTAL HEALTH & PSYCHOLOGICAL ITEMS CONSIDERED FOR INCLUSION AS EXPOSURES**

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
<th>Nature of association</th>
<th>Quality rating</th>
<th>Rating justification</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment for depression in the last year</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with non-use of condoms with 2+ partners in the last year</td>
<td>Medium</td>
<td>Only associated with one outcome but predictive in many studies. Prevalence of n=1625 (10.7%)</td>
<td>INCLUDE</td>
</tr>
<tr>
<td>Current depression (score &gt;2 on PHQ-2)</td>
<td>Wellings 2013 Systematic review</td>
<td>Associated with unplanned pregnancy in the last year</td>
<td>Low</td>
<td>Association based on bivariate analysis. Requires combination scoring of two items. Excluded from doctoral analysis of Natsal-3 in favour of ‘been treated for depression in the last year’</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Major depressive episode and/or depression</td>
<td>Chen 2008 Systematic review exclusion</td>
<td>Associated with diagnosis of STI ever</td>
<td>Low</td>
<td>Association based on bivariate analysis. Items derived from 27 item measure unsuitable for CPR use. Outcome non-recent</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-----------------------</td>
<td>----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Depression</td>
<td>Shrier et al. 2001 Systematic review exclusion</td>
<td>Associated with history of STI</td>
<td>Low</td>
<td>19 item (CES-D) depression scale too complex for CPR</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>Shrier et al. 2001 Systematic review exclusion</td>
<td>Associated with history of STI</td>
<td>Low</td>
<td>Not retained when depression added. 6 item scale too complex</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>Robins et al. 2001 Alternative psychosocial construct</td>
<td>Alternative to other self-esteem measures</td>
<td>Medium</td>
<td>Single-item and validated</td>
<td>INCLUDE</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>Sterk et al. 2004 Alternative psychosocial construct</td>
<td>Associated with several sexual risk behaviours</td>
<td>Low</td>
<td>7 item scale too complex for CPR. Population not relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>Altschuler et al. Alternative psychosocial construct</td>
<td>Associated with relationship power and sexual decision making</td>
<td>Low</td>
<td>Outcomes not directly relevant. Not a probability survey.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Anxious most of the time for 6m+ (ever)</td>
<td>Walsemann 2006 Systematic review exclusion</td>
<td>Associated with inconsistent oral contraception use in the last 3 months</td>
<td>Low</td>
<td>Outcome specific only to sub-set of women. Association only held for women experiencing multiple episodes of anxiety</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Anxious attachment</td>
<td>Ahrens et al. 2012 Alternate psychosocial construct</td>
<td>Associated with sexual risk experiences (composite score)</td>
<td>Low</td>
<td>Explored as attachment part of ‘Early Development and Social Affiliation’. 4 items but vignettes and complex scoring</td>
<td>EXCLUDED</td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Stress (mean stress score)</td>
<td>Khan et al. 2005</td>
<td>Associated with STI diagnosis in previous 4 years</td>
<td>Low</td>
<td>Follow-up study. Complicated scoring unsuitable for CPR. Alternative measures also too complex or ‘state’ focused (e.g. Trier Inventory for Chronic Stress; Depression and Anxiety and Stress Scale)</td>
<td>EXCLUDED</td>
</tr>
<tr>
<td>Dissatisfaction with life in general</td>
<td>Langstrom and Hanson 2006</td>
<td>Association with lifetime number of partners</td>
<td>Medium</td>
<td>Unvalidated. Wording not be obtained (3 author emails sent). Population not very relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td><strong>FORMATIVE EXPERIENCE VARIABLES CONSIDERED FOR INCLUSION AS EXPOSURES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual debut (&gt;12 and &lt;16 years)</td>
<td>Wellings et al. 2013</td>
<td>Associated with Unplanned Pregnancy</td>
<td>Medium</td>
<td>Bivariate analysis only</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Sexual debut (&lt;16 years)</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with 2+ partners in last year; non-use of condoms with 2+ partners in last year; non-use of condoms at 1st sex with most recent partner</td>
<td>High</td>
<td>Relevant population, adjusted association with &gt;1 outcome. Includes debut under 13 years so proxy indicator of child sexual abuse.</td>
<td>INCLUDE</td>
</tr>
<tr>
<td>Living with both parents to age 14</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with non-use of condoms at first sex with most recent partner</td>
<td>Medium</td>
<td>Only associated with one outcome. Prevalence of n=3769 (24.9%) Important psychosocial</td>
<td>INCLUDE</td>
</tr>
<tr>
<td>Separation from parents in childhood</td>
<td>Langstrom &amp; Hanson 2006</td>
<td>Associated with partner numbers</td>
<td>Medium</td>
<td>Insufficient wording detail to reproduce and authors could not be contacted.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Leaving home at an early age</td>
<td>Coleman et al. 2009 Systematic review</td>
<td>Associated with abortion ever</td>
<td>Medium</td>
<td>Insufficient wording detail to reproduce and authors could not be contacted. Outcome was non-recent.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Lack of closeness to mother in childhood</td>
<td>Coleman et al. 2009 Systematic review</td>
<td>Associated with abortion ever</td>
<td>Medium</td>
<td>Insufficient wording detail to reproduce and authors could not be contacted. Outcome was non-recent.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Lack of closeness to father in childhood</td>
<td>Coleman et al. 2009 Systematic review</td>
<td>Associated with abortion ever</td>
<td>Medium</td>
<td>Insufficient wording detail to reproduce and authors could not be contacted. Outcome was non-recent.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Family structure</td>
<td>Lehti et al. 2013 Systematic review exclusion</td>
<td>Associated with abortion in early adulthood and/or adolescence</td>
<td>Low</td>
<td>Ambiguous meaning. Attempts to contact author for clarification unsuccessful. Outcome not directly relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Childhood conduct problems (parent report of Rutter sub-scale)</td>
<td>Lehti et al. 2013 Systematic review exclusion</td>
<td>Associated with abortion in early adulthood/adolescence</td>
<td>Low</td>
<td>31-item sub-scale (Rutter conduct problems) too lengthy. Designed for parent report. Outcome not directly relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Educational performance in school</td>
<td>Lehti et al. 2013 Systematic review exclusion</td>
<td>Associated with abortion in early adulthood/adolescence</td>
<td>Low</td>
<td>Original wording not available. Designed for use by teachers. Outcome not directly relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Peer group norms</td>
<td>Stulhofer et al. 2009 Systematic review exclusion</td>
<td>Associated with composite sexual risk behaviour scale</td>
<td>Medium</td>
<td>Items are specific to young people</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Parental influence</td>
<td>Stulhofer et al. 2009</td>
<td>Associated with composite sexual risk behaviour scale</td>
<td>Medium</td>
<td>Items are specific to young people</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Systematic review exclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Health, Social Support and Belonging Variables Considered for Inclusion as Exposures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social support</td>
<td>Gao et al. 2011</td>
<td>Associated with diagnosis of STI ever for younger and older women</td>
<td>Medium</td>
<td>Social support fits definition of psychosocial. Tangible support associated</td>
<td>INCLUDE</td>
</tr>
<tr>
<td></td>
<td>Systematic review exclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social support (tangible support sub-dimension)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zimet et al. 1990</td>
<td>Sought as alternative social support measure</td>
<td>Low</td>
<td>Multidimensional Scale of Perceived Social Support - lengthy 12 item LIKERT scale</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Alternative psychosocial construct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Edelman 2017</td>
<td>Associated with 2+ partners in the last year</td>
<td>Medium</td>
<td>Associated with one outcome. High prevalence (46.3%). Potentially sensitive item.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>doctorate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Belong to any religion now</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regular religious attendance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moreau et al. 2013</td>
<td>Associated with non-use of condoms at first sex and use of less effective contraceptive methods</td>
<td>Medium</td>
<td>Outcomes not directly relevant</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Systematic review exclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obesity</td>
<td>Low</td>
<td>Emergency contraception users categorised as contraceptive users. Used BMI – too complex for CPR scoring</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Xaverius et al. 2009</td>
<td>Associated with current non-use of contraception among those not wishing to get pregnant</td>
<td>Low</td>
<td></td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Systematic review</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of 'leisure time physical activity'</td>
<td>Medium</td>
<td>Emergency contraception users categorised as contraceptive users.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>Xaverius et al. 2009</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Source</td>
<td>Nature of association</td>
<td>Quality rating</td>
<td>Rating justification</td>
<td>Decision</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------</td>
<td>------------------------------------------------------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>Tao 2008 Systematic</td>
<td>Not associated with genital herpes/warts ever</td>
<td>Low</td>
<td>Not associated. Outcome rare and non-recent.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>review exclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>Edelman 2017 doctorate</td>
<td>Associated with 2+ partners in the last year</td>
<td>Low</td>
<td>Associated only in bivariate analysis. Possibly unacceptable</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2+ previous children</td>
<td>Wellings 2013 Systematic</td>
<td>Associated with unplanned pregnancy in last year</td>
<td>Medium</td>
<td>Bivariate analysis only. Likely to be confounded by age group.</td>
<td>EXCLUDE</td>
</tr>
<tr>
<td></td>
<td>review</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5g: Study materials

Participant information sheet (GP recruitment sites)

**THE PACDCT (PSYCHOSOCIAL AND DEMOGRAPHIC CLINICAL ASSESSMENT TOOL) STUDY**

Information about this anonymous questionnaire

We would like to invite you to take part in the PACDCT study. This means taking 5-10 minutes to complete the enclosed questionnaire anonymously. If possible, please sit separately from anyone who is with you so that your answers are private. Please read this information sheet before deciding whether to take part, and keep it if you would like to.

Do I have to take part?

Do I have to take part? You do not have to take part. Your decision will not affect your treatment or care.

What would taking part involve?

- To take part, simply complete the questionnaire that has been given to you. This should take 5-10 minutes.
- Seal it in the envelope provided. Please do not write your name on it.
- Return it to a member of staff or researcher or put it in a collection box (available in the clinical rooms and at reception)
- If you don’t have time to complete your questionnaire before leaving, please return it anyway. Alternatively, you can request a stamp and address label from clinic staff, and return your questionnaire later by post.

Why are we doing the study?

Contraception, sexual health advice, and testing for sexually transmitted infections (STIs) are available in many General Practice (GP) surgeries. To access these treatments in a private and convenient way, some women may wish to complete a self-assessment on their own rather than discuss their needs in detail with a practice nurse or GP. This study is being done to develop that quiz.

Why have I been invited to take part?

You have been invited to take part because you are a woman aged 16-44 years attending this General Practice. Even if you are not in need of contraception or other sexual healthcare, we would like you to complete a questionnaire so that we can compare your answers with women who are in need. This helps us to identify which questions should go in the quiz and which should be left out.

Who will see my answers or know that I’ve taken part?

Your answers will only be seen by data entry staff and by researchers at Brighton & Sussex Medical School who will open the envelopes. They will not be seen by Practice staff unless you ask a member of staff to help you complete the questionnaire. We won’t take your name or tell anyone that you have taken part in this study. Because of this, you may be offered a questionnaire more than once. If you have already completed a questionnaire, please tell us or return the questionnaire uncompleted.

What are the possible benefits of taking part?

There are no direct benefits to you from taking part. But your questionnaire answers will help us identify which questions should be put in the quiz and which should be left out. The quiz will then be tested and used by women who need contraception or STI testing in a confidential and easy way.

What are the possible drawbacks of taking part?

The questionnaire includes some sensitive personal questions which might make you feel embarrassed or even a little upset when thinking about your answers. You don’t have to answer a question if you don’t want to and you can choose not to hand in your questionnaire or to return it incomplete. If the questionnaire raises any issues that you would like to discuss with your GP, please feel free to do so. Contact numbers for other sources of support are also given below.

What happens after I’ve handed in my questionnaire?

After you have handed in your completed questionnaire, you will not be asked to do anything else. You won’t be able to retrieve your questionnaire or ask for your answers to be deleted as we won’t be able to tell which questionnaire is yours. Questionnaires will be securely stored for 10 years at Brighton & Sussex Medical School before being destroyed. The answers will be entered into a database for analysis.

Who can I contact about this study?

If you are not sure whether to take part please feel free to discuss this with your GP or practice nurse. If you have any questions or concerns about this study you can also contact Natalie Boyle on 020894 995558 or University of Sussex on 01273 878899. You can also raise any complaints with Natalie, your GP surgery or by contacting the Research Ethics Committee. The Universities of Brighton and Sussex have insurance in place to cover their legal liabilities in respect of this study.

For advice and support on contraception, abortion and sexual health:
- call the BPMS helpline on 03457 50 40 50 (24 hours) or email info@bpms.org.uk
- For advice and support on domestic violence: call the National Domestic Violence Helpline on 0808 200 247 (24 hours)
- For advice and support on mental health: call the MIND Helpline 0300 123 3333 (weekdays 8am - 8pm) or email info@mind.org.uk or Sunshine on 0845 787 8000 (everyday 8pm - 11pm)
Do I have to take part? 
You do not have to take part. Your decision will not affect your treatment or care.

What would taking part involve? 
- To take part simply complete the questionnaire that has been given to you. This should take 5-10 minutes.
- Seal it in the envelope provided. Please do not write your name on it.
- Return it to a member of staff or researcher or put it in a collection box (available in the clinical rooms and at reception).
- If you do not have time to complete your questionnaire before leaving, please return it anyway. Alternatively you can request a stamped and address label from clinic staff, and return your questionnaire later by post.

Why are we doing the study? 
Contraception, sexual health advice, and testing for sexually transmitted infections (STIs) are available in many General Practice (GP) surgeries. To assess these treatments in a private and convenient way, some women may want to complete a short quiz on their own rather than discuss their needs in detail with a practice nurse or GP. This study is being done to develop that quiz.

Why have I been invited to take part? 
You have been invited to take part because you are a woman aged 16-44 years attending this clinic. Even if you yourself are not in need of contraception or other sexual healthcare we’d like you to complete a questionnaire so we can compare your answers with women who are in need. This helps us to identify when questions should go in the quiz and which should be left out.

Who will see my answers or know that I’ve taken part? 
Your answers will only be seen by data entry staff and by researchers at Brighton & Sussex Medical School who will open the envelopes. They will NOT be seen by Practice staff unless you ask a member of staff to help you complete the questionnaire. You won’t take your name or tell anyone that you’ve taken part in this study. Because of this you may be offered a questionnaire more than once. If you have already completed a questionnaire please tell us or return the questionnaire uncompleted.

What are the possible benefits of taking part? 
There are no direct benefits to you from taking part. But your questionnaire answers will help us identify which questions should be put in the quiz and which should be left out. The quiz will then help women who need contraception or STI testing to access it in a confidential and easy way.

What are the possible drawbacks of taking part? 
This questionnaire includes some sensitive personal questions which might make you feel embarrassed or even a bit upset when thinking about your answers. You don’t have to answer a question if you don’t want to and you can choose not to hand in your questionnaire or to return it incomplete. If the questionnaire causes any anxiety that you would like to discuss with a member of clinic staff, please feel free to do so. Contact numbers for other sources of support are also given below.

What happens after I’ve handed in my questionnaire? 
After you have handed in your completed questionnaire you will not be asked to do anything else. You won’t be able to retrieve your questionnaire or ask for your answers to be deleted, as we won’t be able to tell which questionnaire is yours. Questionnaires will be securely stored for 10 years at Brighton & Sussex Medical School before being destroyed. The answers will be entered into a database for analysis.

For advice and support on contraception, abortion and sexual health: call the BiPAG hotline on 03457 30 40 30 (24 hours) or email info@bipag.org

For advice and support on domestic violence: call the National Domestic Violence Helpline on 0808 200 2085 (24 hours)

For advice and support on mental health: call the MIND Infoline 0300 123 3333 (weekdays 8am-8pm) or email info@mind.org.uk or Salesline on 0845 767 8000 (everyday 8am-11pm)
Are you a woman aged between 16 and 44 years of age?

Please take 5-10 minutes to anonymously complete a ‘PADCAT’ questionnaire

Who can take part?
All women aged between 16-44 years who are attending a General Practice – including this one. Whether or not you are in need of contraception or other sexual healthcare yourself, we would really like you to complete a questionnaire, so that we can compare your answers with other women’s.

What is the PADCAT study?
It’s a research project that involves women simply completing a short questionnaire. The answers will be used to develop a quiz (a Psychosocial And Demographic Clinical Assessment Tool). This quiz will enable women to access contraception or other sexual healthcare in GP surgeries in a private and convenient way without discussing their needs in detail.

How do I take part?
Just ask any Practice staff for a PADCAT questionnaire. This will be given to you with an envelope that has a pen inside so that you can complete the questionnaire while you wait for your appointment. It should take 5-10 minutes.

Who will see my answers?
Only researchers at Brighton & Sussex Medical School will see your answers, they will not be seen by Practice staff. They cannot be traced to you anyway. We ask you NOT to put your name on the questionnaire and to seal it in a blank envelope before returning it to staff.

How do I find out more?
Ask a member of staff for a PADCAT questionnaire – the front page tells you more about the study and you will be able to see all the questions. Then complete as much or as little as you like.

Study poster (CASH recruitment site)
Thank you for agreeing to complete this PADCAT study questionnaire, which is divided into 3 brief sections. If you have not read the information about the study please do so before you begin. A pen is provided in the envelope.

When you’ve finished please seal it in the envelope provided before giving it to a member of staff to be placed in a PADCAT questionnaire collection box. Do not write your name anywhere on it. Your answers will not be shared with clinic staff.

1. What is your sex?
   Please tick one answer only
   a. Female  
   b. Male  
   c. Don’t identify as predominantly male or female  
   If you ticked b or c please now seal and return your questionnaire

2. How old are you?
   Please tick one answer only
   a. 15 years or less  
   b. Between 16-24 years  
   c. Between 25-34 years  
   d. Between 35-44 years  
   e. 45 years or more 
   Please now seal and return your questionnaire
   Please continue to question 3
   If you ticked a or e

3. Have you completed this questionnaire before?
   Please tick one answer only
   a. Yes  
   b. No  
   c. Don’t know  
   If you ticked a please now seal and return your questionnaire
Section 1: Some questions about your life in general

4. Thinking about where you are living now, which statement best describes your circumstances?
   Please tick one answer only
   a. I am renting or living rent-free (including living with parents or staying with friends)
   b. I own my own home (including mortgage, shared ownership or bought outright)

5. Did you live more or less continuously with both of your natural (birth) parents at home until you were 14?
   Please tick one answer only
   a. Yes
   b. No
   c. Prefer not to answer

6. People sometimes look to others for companionship, assistance or other types of support. How often is each of the following kinds of support available to you if you need it?
   Please circle one number on each row

<table>
<thead>
<tr>
<th>None of</th>
<th>A little of</th>
<th>Some of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most of the time</td>
<td>All of the time</td>
</tr>
<tr>
<td></td>
<td>time</td>
<td>time</td>
</tr>
</tbody>
</table>

- Someone to help you if you're confined to bed
  1  2  3  4

- Someone to take you to the doctor if you need it
  1  2  3  4

- Someone to prepare your meals if you're unable to do it yourself
  1  2  3  4
Someone to help with daily chores if you're sick

7. To what extent is the statement ‘I have high self-esteem’ true for you? Please tick one answer only

a. Not very true of me
b. Somewhat untrue of me
c. Neither true nor untrue of me
d. Somewhat true of me
e. Very true of me

8. In the last 12 months have you received treatment from a health professional for depression? Please tick one answer only

a. Yes
b. No
c. Prefer not to answer

9. How strongly do you agree with the statement ‘Having a partner at all times is important to me’? Please circle one answer only

Strongly agree  Agree  Disagree
   Strongly disagree

10. How often do you have 6 or more units of alcohol on one occasion? 2 units of alcohol is the same as a pint of lager/beer, a medium glass of wine or a double-shot of spirits. Please tick one answer that best describes your experience

a. Daily or almost daily
b. Weekly, or almost weekly
c. Monthly
d. Less than monthly  
e. Never  
f. Prefer not to answer

11. Do you smoke cigarettes at all nowadays?  
*You can tick more than one answer to this question*  
a. Yes, I smoke cigarettes or roll-ups  
b. Yes, I smoke e-cigarettes  
c. No  
d. Prefer not to answer

12. Have you ever taken any non-prescribed, illicit or illegal drugs, including legal highs?  
*Please tick one answer only*  
a. Yes  
b. No  
c. Don’t know  
d. Prefer not to answer

13. At present are you…..  
*Please tick one answer only*  
a. Living as a couple with a partner or spouse  
b. In a steady relationship but not living together  
c. In a casual relationship  
d. Single  
d. Prefer not to answer

*If you have always been single please now skip to Section 3 on page 6.*  
*Otherwise please continue to the next page*
Section 2: Some questions about your current relationship or your most recent relationship if you are currently single

14. Please rate how emotionally satisfying your current relationship is, or how emotionally satisfying your most recent relationship was if you are currently single

*Please tick one answer only*

- Extremely satisfying
- Very satisfying
- Moderately satisfying
- Slightly satisfying
- Not at all satisfying
- Prefer not to answer

15. Thinking about your current or most recent relationship please indicate how strongly you agree with each of the following statements

*Please circle one answer only*

<table>
<thead>
<tr>
<th>My partner tells me who I can spend time with</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| My partner does what they want, even if I do not want them to | Strongly Agree | Agree | Disagree | Strongly Disagree |
|-------------------------------------------------------------|----------------|-------|----------|
| Disagree                                                    |                |       |          |

- Prefer not to answer

16. During your current or most recent relationship did your partner ever have sexual intercourse with anyone besides you?

*Please tick one answer that best describes your experience*

- a. No, definitely not
- b. I don’t think so
- c. It’s quite likely
- d. Yes, definitely
- e. Prefer not to answer
Section 3: Some final questions about your sexual experiences. Please remember all your answers are anonymous and not seen by Practice staff.

17. Have you ever been in a relationship with a partner who....:
Please tick all that apply

Insulted or talked down to you often answer
Yes No Prefer not to answer

Shouted or swore at you often answer
Yes No Prefer not to answer

Threatened you with harm sometimes answer
Yes No Prefer not to answer

Physically hurt you sometimes answer
Yes No Prefer not to answer

Prefer not to answer answer
Yes No Prefer not to answer

18. How old were you when you first had sexual intercourse with someone of the opposite sex (including experiences you may not have wanted or that happened at an early age)?
Please tick one answer only. By sexual intercourse we mean a man’s penis in a woman’s vagina, mouth or anus.

a. Under 16 years old
b. 16 years old or older
c. I’ve never had sexual intercourse with someone of the opposite sex
d. Prefer not to answer

If you ticked ‘c’ please now skip to question 30 on page 10. Otherwise please continue

19. In the last year, how many men have you had sexual intercourse with?
Please tick one answer only. By sexual intercourse we mean a man’s penis in a woman’s vagina, mouth or anus.

a. 0
b. 1
c. 2
d. 3-5
20. The following statements are about the man you last had sex with. This may or may not be someone you are in a relationship with. For each statement please tick one answer

a. The man I most recently had sex with is 5 or more years older than me
   True  Probably true  I have no idea  Probably not true  Not true
b. The man I most recently had sex with had at least one other sexual partner in the last year before me
   True  Probably true  I have no idea  Probably not true  Not true
c. The man I most recently had sex with didn’t always use condoms for vaginal sex with previous partners
   True  Probably true  I have no idea  Probably not true  Not true
d. The man I most recently had sex with would have an STI test if he had vaginal sex with someone else without using a condom
   True  Probably true  I have no idea  Probably not true  Not true

21. Thinking about condom use with your most recent male sexual partner, which of the following best matches your experience? Please tick one answer only. ‘Vaginal sex’ means a man’s penis in a woman’s vagina.

a. I’ve not had vaginal sex with any male sexual partners in the last year
b. Condoms were always used for vaginal sex
c. Condoms were sometimes used for vaginal sex

d. Condoms were never used for vaginal sex

e. Prefer not to answer

If you ticked ‘a’ please now skip to question 29 on page 10. Otherwise please continue

22. Thinking about condom use with your second most recent male sexual partner which of the following best matches your experience?

Please tick one answer only. ‘Vaginal sex’ means a man’s penis in a woman’s vagina.

a. I’ve only had vaginal sex with one male sexual partner in the last year

b. Condoms were always used for vaginal sex

c. Condoms were sometimes used for vaginal sex

d. Condoms were never used for vaginal sex

e. Prefer not to answer

23. Are you currently, or have you been, pregnant at all in the past six months?

Please tick one answer only

a. Yes I am currently pregnant

b. Yes I was pregnant in the last six months but am no longer

c. No

d. Maybe

If you have been pregnant throughout the last six months please now skip to Question 29. Otherwise please continue to the next question

24. Overall, in the last six months how much have you WANTED to get pregnant?
Please tick one answer only

a. I have very much wanted to get pregnant
b. I have wanted to get pregnant quite a lot
c. I haven’t minded either way
d. I haven’t wanted to get pregnant very much
e. I haven’t wanted to get pregnant at all

In the last six months have you used emergency contraception at all?

Emergency contraception means a ‘morning after pill’ taken within 72 hours of unprotected sex to help a woman avoid pregnancy, or an IUD or coil inserted within 5 days of unprotected sex to help a woman avoid pregnancy

Please tick one answer only

a. Yes
b. No
c. Prefer not to answer

25. Thinking about your use of contraception in the last six months please tick one statement which most applies to you.

‘Contraception’ includes condoms, pills, implants, injections, the coil, other IUDs and being sterilised. It does NOT include emergency contraception like the morning-after pill

a. Contraception was always used
b. Contraception was used, but not on every occasion
c. Contraception was used, but the method failed at least once (e.g. broke, moved, came off, came out)
d. Contraception was never used
e. I have not had vaginal sex in the last six months
f. Prefer not to answer

26. Overall, in the last six months how much have you wanted to AVOID getting pregnant?

Please tick one answer only

a. I have very much wanted to avoid getting pregnant
b. I have wanted to avoid getting pregnant quite a lot

c. I haven’t minded either way

d. I haven’t wanted to avoid getting pregnant very much

e. I haven’t wanted to avoid getting pregnant at all

27. **In the last six months have you taken a pregnancy test because you thought you might be pregnant?**

Please tick one answer only

a. Yes

b. No

c. Prefer not to answer

29. **What do you do next?**

You have now completed the questionnaire. Please seal it in the envelope provided and ask a member of staff to place it into a ‘PADCAT questionnaire box’. Staff will NOT see your answers but if this questionnaire has raised any issues that you’d like to discuss with your GP or practice nurse feel free to do so. Thank you for taking part in this study.
RESEARCH PROTOCOL: PSYCHOSOCIAL AND DEMOGRAPHIC CLINICAL ASSESSMENT TOOL (PADCAT) STUDY

TITLE
PADCAT (Psychosocial and Demographic Clinical Assessment Tool) study

FUNDING
National Institute for Health Research (Doctoral Research Fellowship Programme)

ROLES AND RESPONSIBILITIES
Protocol contributors
Natalie Edelman – Lead Applicant and doctoral student (Brighton & Sussex Medical School)
Jackie Cassell – Primary supervisor with responsibility for overseeing study (Brighton & Sussex Medical School)
Richard de Visser- Second Supervisor with responsibility for advising on survey design and recruitment (University of Sussex)
Catherine Mercer- Third supervisor with responsibility for overseeing data collection and analysis (University College London)

Study sponsor
University of Sussex. Representative is Professor Kevin Davies (contactable via Lisa Costick and Ellen Thomas) at medicineAnatomyDA@bsms.ac.uk Tel: 01273 877890

Steering group membership
Natalie Edelman (Chair)
Jackie Cassell (Supervisor and Brighton & Sussex Medical School representative)
Abbey Gersten (General Practitioner representative)
Kay Meher (Clinical Research Network representative)
Debbie Lambert (Data manager for the Clinical Trials Unit)
Lay consultants (TBC)
INTRODUCTION

BACKGROUND
Testing for sexually transmitted infections (STIs) and Contraceptive Advice and Supply (CAS) are interventions which are now available in many primary care settings such as General Practices (GPs) (DH, 2001). This means that a wide range of patients have access to these interventions, including people at very low or very high risk of acquiring an STI or having an unintended pregnancy. This creates a need to develop acceptable and efficient means of targeting STI testing and CAS to the right patients. In specialist sexual health services recent sexual history is used to assess individual patient need. However, in non-specialised settings such as General Practice, this approach may be too time-consuming, and unacceptable with some target groups (Define, 2008, Edelman et al., 2013). In addition, as CAS and STI testing are both often available in GP surgeries, a single means of targeting both these interventions for women would be beneficial.

There is already substantial evidence that different populations experience different rates of unplanned pregnancy (UP), sexually transmitted infection (STI) acquisition, and sexual risk experiences such as unprotected intercourse and multiple partners (Mercer et al., 2013b). Younger age groups, certain ethnic minorities and people from lower socio-economic groups are known variously to experience disproportionate burdens of STI diagnoses and of unplanned pregnancy (Mercer et al., 2013b). England’s National Chlamydia Screening Programme for young people (aged < 25 years and sexually active) is an example of how interventions may be targeted to sub-populations which are defined on the basis of sociodemographic factors such as age (DH). This knowledge that sexual risk and morbidity are linked to socio-demographic factors is part of broader scientific enquiry into the ways in which sexual behaviour, social determinants of health, sexual health outcomes and availability and uptake of sexual healthcare are related to each other (Johnson et al., 2006).

Part of that enquiry has shown that psychosocial factors (e.g. social support, mental health or substance use) are also associated with sexual risk behaviours.
and health (Edelman et al., 2015). These may be a useful way of targeting CAS and STI testing to women who would benefit. In addition, they have the potential to enrich our understanding of sexual health and explain some of the differences in sexual health that are found within high-risk populations. Some psychosocial factors in themselves may warrant medical attention (such as substance use) as well as being ‘wider determinants of sexual health’. Therefore identifying these factors may open other opportunities for care (such as helping patients reduce substance use) that also act to prevent STI and unintended pregnancies from occurring. This point is highlighted by England's Sexual Health Improvement Framework, 2013 (DH, 2013).

RESEARCH AIM AND OBJECTIVES
The overarching aim of the PADCAT study is to develop a clinical assessment tool – based on psychosocial and socio-demographic questions – that can be used to target STI testing and contraceptive advice and supply (CAS) to those women attending General Practice who would most benefit. The research objectives are:

To identify the combination of psychosocial and socio-demographic factors which explains the most variance in sexual risk encounters associated with STI acquisition (eg. Multiple partnerships and non-use of condoms) among women attending clinical settings

To identify the combination of psychosocial and socio-demographic factors which explains the most variance in sexual risk encounters associated with unintended pregnancy (ie. Non-use and inconsistent use of condoms or any other contraception by sexually active women) among women attending clinical settings

To identify which psychosocial and socio-demographic factors - if any - are common to both types of sexual risk encounters among women attending clinical settings

To identify which psychosocial factors and socio-demographic factors are acceptable to women for inclusion in a clinical assessment tool for use in General Practice settings
STUDY DESIGN
The study comprises a cross-sectional quantitative survey across several General Practices in the city of Brighton & Hove, East Sussex. This design is chosen to mimic use of the clinical assessment tool; therefore participants will self-complete a survey questionnaire using paper-and-pen.

METHODS: PARTICIPANTS AND OUTCOMES

STUDY SETTING
The study will be conducted in General Practices within the city of Brighton & Hove. Limiting data collection to a single city population enables a focus on psychosocial, socio-demographic and sexual risk factors within that population. As the clinical assessment tool will be designed for use with women in GP settings so recruitment will also take place in General Practice. Recruitment will take place in 9 General Practices across the city.

ELIGIBILITY CRITERIA
The sample population will comprise General Practice attendees. Women aged 16-44 will be invited to participate. Exclusion criteria are: previous participation; visible physical or emotional distress; or insufficient level of English language skills – anticipated to prevent informed consent or valid questionnaire responses.

OUTCOMES
Sexual risk of STIs (measured as 2+ partnerships in the last year where a condom was not used, or as 1+ partnership in the last year where a condom was not used with a partner who themselves had previous multiple partnerships).
Sexual risk of unplanned pregnancy (measured as desire to avoid pregnancy combined with report of inconsistent contraception use and/or use of emergency contraception and/or pregnancy testing in the last six months)

PARTICIPANT TIMELINE
Participants will complete the survey immediately after reading the participant information sheet and their participation will end when they return the questionnaire immediately after completion. The participant information sheet
makes clear that once questionnaires have been handed in they cannot be retrieved and the responses cannot be discounted from analyses. This is due to the anonymous nature of the questionnaire and data collection process.

SAMPLE SIZE
To identify the combination of questionnaire items that explains the most sexual risk for each outcome multivariable regression must be used. The primary outcome for this survey (report of 2+ sexual partners in the last year with whom a condom is not used) is anticipated to be reported by 10% of respondents to this survey. This is based on analysis of a comparable population – 16-44 year old female respondents to the National Survey of Sexual Attitudes and Lifestyles-3. Amongst this sub-sample 86% reported being sexually active in the last year, of which 12% (10% of the total sub-sample) reported non-use of condoms with 2+ partners.

As a general rule it is expected to have 1500 cases are needed in order to carry out multivariable regression for an outcome that is anticipated to be reported by 10% of a sample (e.g. the primary outcome for this study). Therefore a total sample of 2000 participants is sought to allow for incomplete data collection and to ensure that a minimum of 150 participants report the primary outcome of interest.

RECRUITMENT
Recruitment will take place between 4/4/16 and 31/3/2017, but will cease early should the sample size of n=2000 be achieved for the close of the study. Posters advertising the study will be displayed on electronic information boards and on the walls of participating practices, and in the ladies’ toilets of participating practices. Reception staff will offer female patients a study pack on arrival. An optional script has been developed with reception staff that they can use when offering the study pack:
‘We have a short questionnaire about women’s health that we are asking all our female patients aged 16-44 if they would like to complete today. Please take one if you are happy to do so’.
Clinical Research Network (CRN) staff and the CI (following research passport approval) will also offer study packs - to those female patients who have checked-in using electronic booking rather than Reception. Each pack will comprise: a blank envelope, a pen, a blank questionnaire and a participant information sheet attached to the front of the questionnaire. Instead of formal written consent the study will use the principle of ‘implied consent’ indicated by questionnaire completion.

DATA COLLECTION METHODS
Participants will complete their questionnaire using pen and paper in the waiting area at participating surgeries. They will then seal it in a blank envelope and hand it in to clinical staff or to receptionists. These envelopes will then be placed in clearly marked boxes allocated for that purpose. If participants don’t have time to complete their questionnaire before leaving the surgery, they can request a stamp and address label from clinic staff, in order to return the questionnaire by post. This is set out in the participant information sheet.

DATA MANAGEMENT
Questionnaire boxes will be emptied on a weekly basis by practice staff, the Principal Investigator or by CRN staff, who will transport the questionnaires to Brighton & Sussex Medical School (BSMS). Paper questionnaires will be stored in a locked filing cabinet within a locked office in BSMS (Mayfield House building) for the duration of the study. Afterwards they will be archived in accordance with BSMS policy for 10 years. Survey data will be securely couriered to a reputable data entry company experienced in sexual health research where it will be entered before being returned for archiving.

STATISTICAL METHODS
Data entry accuracy checks will be performed on a random 10% of entries by the Chief Investigator. Analyses will be conducted in STATA by the Chief Investigator, and overseen by Dr. Mercer (UCL) and Dr. de Visser (University of Sussex) as supervisors. Bivariate analyses and investigation of interactions between exposures will be conducted, to inform the development of a multivariable regression model for each sexual risk. A backwards stepwise elimination approach will be used to develop an empirically based and
parsimonious model for each sexual risk. Pseudo-R squared values will be
generated to measure the amount of variance on each sexual risk which is
explained by each psychosocial question. Exposures remaining in the model
will comprise the items for the clinical assessment tool itself. Finally co-efficients
for the models will be used – in conjunction with item response codes – to
generate a scoring system for the clinical assessment tool itself.

METHODS: DATA MONITORING
DATA MONITORING
A data monitoring committee will not be formed for this cross-sectional survey.
Instead a steering group member has been recruited with specific expertise to
oversee data monitoring. In addition, the practice codes on returned
questionnaire envelopes will be used to monitor recruitment rates across sites.
The Principal Investigator will liaise with the CRN to address low recruitment
rates and report accrual to the National Institute for Health Research (NIHR) as
study funders.

HARMS
The Universities of Brighton and Sussex have insurance in place to cover their
legal liabilities in respect of this study. Adverse events or other unintended
effects are considered unlikely. First, the study does not involve administration
of treatment. Second, patient and public involvement has demonstrated that the
questionnaire is valid, takes approximately 6 minutes to complete and is
acceptable and non-distressing. Nonetheless, two mechanisms have been put
in place. First, the participant information sheet invites participants to contact
the study team to report any concerns or complaints – a telephone number is
provided for this purpose. Second, each recruitment site is required to report
any observed adverse effects to the study team, via either the CRN sexual
health lead (Kay Meher) or the Principal Investigator (Natalie Edelman). These
will then be discussed with the steering group team members and recruitment
reviewed and halted/amended if necessary.

AUDITING
The data may be audited by Brighton and Sussex Medical School (BSMS) as
part of their research procedures.
RESEARCH ETHICS APPROVAL

This proposal will be subjected to ethics review by the National Research Ethics Service (NRES) for studies involving National Health Service patients. In conjunction with this application research governance approvals will be sought for participating sites.

PROTOCOL AMENDMENTS

Any protocol amendments will be made with oversight from the study steering group and will be communicated to the NIHR CRN, to the NRES, to University of Sussex as sponsor, to recruitment sites, and to the participating Trusts.

CONSENT OR ASSENT

Instead of formal written consent the study will use the principle of ‘implied consent’ indicated by questionnaire completion. This common approach simplifies the recruitment process in busy clinical settings and may reduce barriers to participation, particularly given the sensitive nature of the questionnaire. The participant information sheet has been developed in consultation with patient and public consultants (as described below) and will be attached to the front of the questionnaire using a perforated line to ensure that participants read it before participating, and can also take it away with them if required.

CONFIDENTIALITY

No identifying or clinical information will be gathered – participants’ names and contact details will not be recorded at any stage in the study. To further ensure confidentiality and anonymity participants will be asked to seal their completed questionnaires in a blank envelope before returning it to clinic staff, CRN staff or the Chief Investigator.

DECLARATION OF INTERESTS

There are no competing interests to report with regard to this study, which is funded independently by the NIHR as part a doctoral research fellowship award.

ACCESS TO DATA
Access to data will be limited to the research assistant entering data, the chief investigator and supervisors, Dr. Lambert as data management expert, and to BSMS research data auditors if required.

ANCILLARY AND POST-STUDY CARE
In the unlikely event that a participant requires follow-on care in relation to study participation, the Principal Investigator can negotiate for the participant to receive this from a General Practitioner of their choosing at their recruitment site. Examples include referral to counselling, access to sexual healthcare or support with addressing related issues addressed in the questionnaire such as depression, partner violence, smoking or binge drinking. As such, any follow-on care is anticipated to be identified - but not caused - by study participation.

DISSEMINATION POLICY
Findings will be disseminated to academic, clinical and lay audiences. To reach academics and clinicians in sexual health and primary care, presentations are planned at two international conferences and in a peer-reviewed academic journal. To reach local General Practice staff and attendees, a summary of findings will be produced as a leaflet disseminated to local surgeries via the CRN and made available in reception areas. (Given the anonymous nature of the questionnaire, participants cannot be targeted directly). To reach the local sexual health clinical and academic community findings will be summarised and disseminated in the Brighton and Sussex Sexual Health Newsletter and to local service providers on request.
Appendix 5h: Instructions for data entry

Enter the code on the top right of the questionnaire. Please include in the code any letters that are in a circle (ignore the circle). Each code will begin with one of the following letter combinations:

a. BC  
b. BH  
c. BHWC  
d. CH  
e. CN  
f. PV  
g. SP  
h. SV

Screening Question 1: If the respondent ticks either of the following response options, please code as 888 all remaining blank data items:

- Male
- Don’t identify as male or female

Screening Question 2: If the respondent ticks either of the following response options, please code as 888 all remaining blank data items:

- 15 years or less
- 45 years or more

Screening Question 3: If the respondent ticks the following option, please code as 888 all remaining blank data items:

Questions 14, 15 and 16: If the respondent leaves all 3 of these items blank please code all blank response options for these items as 888, unless they have indicated in question 13 that they are either:

- Living as a couple with a partner or spouse
- In a steady relationship but not living together

Question 18: If the respondent ticks ‘I’ve never had sexual intercourse with someone of the opposite sex’ please code all remaining blank items as 888.

Question 19: If the respondent indicates ‘0’ please code all remaining blank items as 888.

Question 21: If the respondent ticks ‘I’ve not had any male sexual partners in the last year’ please code all remaining blank items as 888.
Question 23: If the respondent ticks either of the following response options, please code all remaining blank items as 888
   Yes I am currently pregnant
   Yes I was pregnant in the last six months but am no longer

DATA ANOMALIES TO WATCH OUT FOR:
Q19: 1 partner selected, then Q21 ‘I've not had any male sexual partners in the last year’ selected
Q19: 2, 3-5, 6+ selected then Q22 ‘I've only had 1 male sexual partner in the last year’ selected

GENERAL INSTRUCTIONS:
Please code all other blank response options as 999 (i.e. those not addressed above)
Where more than 1 response option has been ticked for items that instruct the respondent to ‘Please tick one answer only’ choose whichever option is printed lower on the page. E.g. Question 21 if a respondent ticked both ‘Condoms were always used’ and ‘Condoms were sometimes used’ please select ‘Condoms were sometimes used’.

IN THE ABOVE CASE AND ANY OTHER DATA ANOMALIES, PLEASE MAKE A NOTE IN A SEPARATE FIELD AT THE END.
Appendix 5i: Data cleaning, consistency checking and allocation of missing data codes

- 10% random check on data entry quality
- Create inclusion/exclusion variable for those that don’t get past screening (incomplete screening data or excluded)
- Allocate as excluded those cases with screening data which is incomplete or meets exclusion criteria
- Address anomalies flagged up by Abacus data-entry company, logging them and their resolution in an Excel database and discussing with R de V as supervisor
- Run the following data consistency checks:
  - Answering Q.14, 15 or 16 while leaving Q.14, 15 or 16 blank (i.e. incompleteness for this section)
  - Reporting being single in Q.13, then not completing items 14-16 (suggestive that always single) but then completing Q.17 in Section 3 on most recent relationship
  - Reporting in Q.18 never having had sexual intercourse with someone of the opposite sex, AND either reporting more than 1 or more sexual partners in the last year in Q.19 OR answering questions 20 onwards on sexual behaviour in last year.
  - Reporting in Q.19 no sexual partners but answering any questions 20 onwards.
  - Reporting in Q.21 no vag. sex with any male ptns. but answering questions 22 onwards.
  - Reporting in Q.21 no vag. Sex but giving valid response on condom use to Q.22
  - Giving inconsistent responses between Q.25 and Q.27 re pregnancy intentions
  - Reporting contraception not always used (q.26) and condoms always used (q.21 and q.22)
- Allocate missing values as not applicable or missing based on consistency checks
- Use the following filters in the dataset to allocated remaining missing values as not applicable or missing:
1. After Q.13 (which asked about relationship status) the instruction was given:

‘If you have always been single please now skip to Section 3 on page 6’
(This enabled women who had always been single to skip Q.14-Q16 which address ‘current or most recent relationship’)

2. Q.18 (which asked about age of sexual debut) included the following response option and instruction:

‘I’ve never had sexual intercourse with someone of the opposite sex’
‘If you have never had sexual intercourse with someone of the opposite sex, please now skip to Question 29 on page 10’
(This enabled women who had never had sexual intercourse with a male partner to skip the remaining questions which concerned male partners, condom use for vaginal sex, contraception and pregnancy intentions)

3. Q.19 (which asked about number of male sexual partners in the last year) included the response option ‘0’ and the instruction:

‘If you circled ‘0’ please now skip to Question 29 on page 10’
(This enabled women who reported no male sexual partners in the last year to skip the remaining questions as they all related to the last year or less)

4. Q.21 (which asked about condom use with most recent male sexual partner) included the following response option and instruction:

‘I’ve not had vaginal sex with any male sexual partners in the last year’

‘If you’ve not had vaginal sex with any male sexual partners in the last year please now skip to Question 29 on page 10’

(This ensured that remaining items, which related to pregnancy or second vaginal sex male partner, were skipped)

5. After Q.23 (which asked about pregnancy in the last six months) the following instruction was given:

‘If you have been pregnant throughout the last six months please now skip to Q.29 on page 10’
(This ensured that those who had been pregnant in the last six months were not asked about desire to be pregnant, contraception use or pregnancy testing in that time period)

- Discuss, resolve and record all outstanding anomalies with supervisor
- Select available case analysis or complete case analysis (excluding cases accordingly)
- Transfer included data into STATA ready for analysis
Appendix 6a: Aggregating categorical into dichotomous variables

To make the CPR easier to administer in practice and to increase the degrees of freedom available for multivariable modelling, response categories to original questionnaire items were aggregated as follows:

<table>
<thead>
<tr>
<th>Source variable</th>
<th>Original response options</th>
<th>Aggregated response options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant age in years</td>
<td>• 15 years or less • Between 16-24 years • Between 25-34 years • Between 35-44 years 45 years or older</td>
<td>• 16-24 years • 24-44 years (other categories excluded from study)</td>
</tr>
<tr>
<td>Functional social support items</td>
<td>• None of the time • A little of the time • Some of the time • Most of the time • All of the time</td>
<td>• None, a little or some of the time • Most or all of the time</td>
</tr>
<tr>
<td>Statement of high self-esteem</td>
<td>• Not very true of me • Somewhat untrue of me • Neither untrue nor true of me • Somewhat true of me • Very true of me</td>
<td>• Not very true or somewhat untrue • Neither, somewhat true or very true</td>
</tr>
<tr>
<td>Statement that having a partner at all times is important</td>
<td>• Strongly agree • Agree • Disagree • Strongly disagree</td>
<td>• Strongly agree or agree • Disagree or strongly disagree</td>
</tr>
<tr>
<td>Frequency of binge-drinking</td>
<td>• Daily or almost daily • Weekly or almost weekly • Monthly • Less than monthly • Never • Prefer not to answer</td>
<td>• Almost weekly or more often • Monthly or less often (Prefer not to answer excluded due to low values)</td>
</tr>
<tr>
<td>Relationship status</td>
<td>• Living as a couple with a partner or spouse • In a steady relationship but not living together • Single • Prefer not to answer</td>
<td>• In a steady relationship or living together • In a casual relationship or single (Prefer not to answer excluded due to low values)</td>
</tr>
<tr>
<td>Emotional satisfaction with current or most recent relationship</td>
<td>• Extremely satisfying • Very satisfying • Moderately satisfying • Slightly satisfying • Not at all satisfying • Prefer not to answer</td>
<td>• Very or extremely satisfying • Moderately to not at all satisfying (Prefer not to answer excluded due to low values)</td>
</tr>
<tr>
<td>Source variable</td>
<td>Original response options</td>
<td>Aggregated response options</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Statement that partner tells me who I can spend time with | • Strongly agree  
• Agree  
• Disagree  
• Strongly disagree                                      | • Strongly agree or agree  
• Disagree or strongly disagree |
| Statement that partner does what he wants            | • Strongly agree  
• Agree  
• Disagree  
• Strongly disagree                                      | • Strongly agree or agree  
• Disagree or strongly disagree |
| Partner non-monogamy                                 | • No definitely not  
• I don’t think so  
• It’s quite likely  
• Yes, definitely  
• Prefer not to answer                                      | • Definitely not or I don’t think so  
• It’s quite likely or yes definitely  
(Prefer not to answer excluded due to low values) |
| Age of sexual debut                                  | • Under 16 years old  
• 16 years or older  
• I’ve never had sexual intercourse with someone of the opposite sex  
• Prefer not to answer                                      | • Under 16 years  
• 16 years or older  
(other categories excluded from analysis) |
| Most recent partner 5+ years older                   | • True  
• Probably true  
• I have no idea  
• Probably not true  
• Not true                                                      | • True or probably true  
• Probably not true or not true  
(I have no idea excluded as n=6)  
(Not applicable responses excluded as those reporting no sex in the last year or ever would be unlikely to use the CPR in practice) |
Appendix 6b: Assignation of missing data codes

Assigning missing data codes based on responses to previous items

The data entry company were instructed to type in all responses given to all items – even where this exposed anomalies - and then to code all uncompleted items as ‘missing’. These were then reviewed by the candidate and allocated as follows:

If respondents reported that they were living as a couple or in a steady relationship in q.13 and then did not answer any of the items q.14-16 these were coded as missing data. If they answered ‘single’ or ‘causal’ relationship or ‘prefer not to answer’ to q.13 and answered NONE of the items q.14-16 these were coded as 888 (not applicable). If however they answered SOME of the items q.14-16 then the un-answered ones were coded as 999 ‘missing data’.

If respondents reported ‘I’ve never had sexual intercourse with anyone of the opposite sex’ to q.18 AND all subsequent items were blank, these subsequent items were all allocated as 888 (not applicable). If respondents gave any other answer to q.18 then subsequent blank items were allocated as 999 (missing data).

If respondents reported 0 sexual partners in the last year to q.19 AND all subsequent items were blank, these subsequent blank items were all allocated as 888 (not applicable). If respondents reported 1+ sexual partners in the last year to q.19 then subsequent blank items were allocated as 999 (missing data).

As multiple partnerships is an outcome in this survey it was therefore important to ensure conservative estimates, so that respondents who did not respond to Q19 or selected ‘Prefer not to answer’ were allocated as missing and made exempt from the analyses.

If respondents reported ‘I’ve not had any vaginal sex with any male partners in the last year’ to Q.21, then all subsequent blank items were allocated as 888 (not applicable). If respondents gave any other answer to q.21 then all subsequent blank items were allocated as 999 (missing data).

If respondents reported that they had been pregnant in the last six months or were currently pregnant to q.23, then all subsequent blank items were coded as
888 (not applicable). If however they answered only SOME of the subsequent items then the un-answered ones were coded as ‘missing data’.

If respondents reported that they had not or had only ‘maybe’ been pregnant in the last six months to q.23, then all subsequent blank items were coded as 999 (missing data).

In addition the questionnaire itself provided a response option of ‘prefer not to answer’ for many questions. After application of these various codes, any remaining blank items were coded as ‘999’ to represent missing data.

**Scoring those who have never had a relationship**
Participants who reported being currently single and then omitted all three items in section 2 (which was about most recent relationship) were assumed to have never had a relationship. The decision was taken pragmatically to score those participants who met this criteria as a ‘no’ for items reporting on a risk factor related to current or most recent relationship. This decision averted the need for an extra item in the final CPR on ‘ever had a relationship’ and was also taken pragmatically as only n=31 of the GP sample met this criteria.

**Constructing and coding the variable for risk of STI acquisition through partner**
The outcome ‘risk through partner’ was constructed by combining: partner had at least with one other sexual partner in the year before me (Q20B true or probably true or no idea) & partner didn’t always use condoms for vaginal sex with previous partners (Q20C true or probably true or no idea) & condoms were sometimes or never used with most recent sexual partner (Q21). This was consistency checked against Q19 (as those who reported no male partners in the last year should then have skipped to the end of the questionnaire) and against Q18 which contained the response option ‘I’ve never had sex with someone of the opposite sex’. As above, because this was an outcome of interest it was important not to overestimate frequencies (i.e. by assuming non-response indicated assent). Therefore, if a participant failed to respond or selected ‘Prefer not to answer’ to Q20B and/or Q20C and/or Q21) they were allocated as missing and made exempt from analyses.
Constructing and coding the variable for combined risk of STI acquisition through partner and/or through multiple partnerships

The combined variable ‘Multiple partnerships or risk through partner’ was only generated after the source variables had been consistency-checked and had all missing data codes assigned (as described above). Once generated the combined variable was then cross-tabulated against the source variables to check correct assignation of codes such that all respondents who reported multiple partners and/or risk through partner were assigned the code ‘1’ (at risk), ‘0’ (not at risk) or ‘999’ (missing data).

Assignation of missing data codes discussed with supervisors

When consistency checking Q18 ‘no opposite sex partners’ n=3 participants who selected this option were found to have not skipped to the end of the questionnaire but instead to have answered Q19 (by reporting 0 partners). Therefore their responses to Q.19 onwards were allocated as not applicable. When consistency checking those who reported 0 male partners in the last year (Q.19) n=36 who reported this did not skip subsequent items, but gave answers consistent with this (e.g. no pregnancy testing, no vaginal sex etc..). These were allocated as not applicable. A further n=4 reported Q.19 no partners but then reported condom use for Q21 and answered other items – these were allocated as N/A after checking with Richard (on the basis that Q21 and Q22 didn’t specify a time frame whereas Q.19 did, and so was more likely to be the valid answer).
Appendix 6c: Critical appraisal of questionnaire quality

The following two criticisms only came to light when the candidate attended Cognitive Interviewing training (which was available after the survey had run):

1. Items number 11 and 17 used ‘tick all that apply’ which carries a primacy effect that reduces validity, and is better replaced with a Yes/No choice for each response option.
2. Items number 14, 15 and 19 did not pay attention to the ‘visual middle’ on response options. The ‘Prefer not to answer’ option should have been visually separated from the rest.

In addition the following criticisms were noted:

Q. 4 did not specify to which category ‘homelessness’ should apply (to limit the explanatory text). However, as this population are known to experience particular sexual health vulnerability this should have been made explicit.

Q.8 asked only about depression consistent with the Natsal-3 item from which it was derived. However, a number of participants (ticking either yes or no) clarified with additional text that they had been treated for anxiety rather than depression. Two participants reported that they were on the waiting list for depression treatment after an initial GP appointment. These were categorised as ‘yes’ but would need clarification text in a CPR.

Q9 Ten respondents ticked or circled both agree and disagree or the space between the two. These were recorded as missing. This is a previously used item without a ‘neither agree nor disagree’ response option, but the number of participants who had to be recorded as missing on this basis may render the item of little predictive value.

Q.10 A number of respondents provided additional text to clarify that they were recovering alcoholics or had stopped drinking a few months ago (some because they added text reporting current pregnancy). These were recorded as non-weekly-binge drinkers. Nonetheless ‘Was a regular binge-drinker but am no longer’ would have an interesting category to have added to this FAST measure.
Q15B several participants circled the middle space between agree and disagree on this item about ‘My partner does what they want, even if I do not want them to’. These were recorded as missing. This indicates the item is likely to be of lower predictive value and perhaps has less actual validity in measuring attachment, though it replicated the exact wording from previous studies conducted by the CDC in the USA.

Q16. A number of respondents indicated that they wanted a ‘maybe’ option and had to be treated as missing data, despite this being an item used previously in other studies. One participant reported her and her boyfriend were swingers.

Q19 Some participants reported (using free text) non-consensual sex for Q19 onwards. There is an ethical issue perhaps in deciding that someone who has been assaulted has high sexual risk. On other hand, sexual health interventions are likely to be vital in such scenarios. Equally, there is perhaps an ethical requirement on researchers to allow respondents a response option where they can distinguish non-consensual sex. For example, in the extreme case of gang-rape to simply report multiple partners might be very distressing for the respondent.

Q20a Q25 and Q28 (respectively: last partner 5+ years older, emergency contraception and pregnancy testing) are exposures placed after Q19 (which routed people out who had not had any male sexual partners in the last year). Therefore these 3 exposures were only captured for people sexually active in the last year, limiting analysis of how well these exposures discriminate between women who would benefit from interventions and those who would not.

Q20-22 did not give a time frame so many people with no male sexual partners in the last year completed these items where they didn’t notice the routing instruction to the end of the questionnaire.

Q20, Q23, Q24, Q27 did not have the response option ‘prefer not to answer’ (Questions 24 and 27 because these were adapted from validated items that did not offer that response option). This may have affected the validity of responses to those items. In particular ‘prefer not to answer’ response options
were erroneously not provided for Q20 items including the exposure (and thus potential CPR item) ‘most recent partner 5+ years older’. Reassuringly n=30 provided missing data on this item, equivalent to others in the third ‘sensitive section questionnaire that did have the ‘prefer not to answer’ response option (e.g. Q18, Q21 and Q22).

Q.20d The man I most recently had sex with would have an STI test if he had vaginal sex with someone else without using a condom’ was deemed to convoluted and hypothetical to be worthy of analysis, after reviewing it following cognitive interview training.

Q22 was problematic in two ways. Firstly a number of participants who reported 1 sexual partner in the last year in Q.19 and completed Q21 then ticked not only ‘I’ve only had 1 sexual partner in the last year’ in Q.22 but also one of the condom response options. These were coded as the former once previous item responses had been checked. There was also a difficulty with consistency checking for q.22 where participants reported 2+ partners in Q.19. In these instances –as Q.19 refers not only to vaginal intercourse – it was difficult to discern how to allocate a response to Q.22 for those who ticked more than 1 box in this item, and these were discussed and resolved with Dr. de Visser (supervisor) on a case-by-case basis.

Q23-28 None of the pregnancy and contraception items gave a response option for those who are infertile – comments on infertility were made by a handful of participants, but may have affected more. One participant also reported ‘no womb’.

Q.24 some respondents added the text ‘with this partner’. This is interesting- the pregnancy items do not pick up on this distinction. This may partly account for inconsistencies in direction of association between Q.24 (pregnancy wantedness) and Q27 (desire to avoid pregnancy) although neither item specifies with whom the respondent wants to gain or avoid pregnancy. Specifically women may have answered the wantedness item in relation to a specific partner and the latter not (e.g. participant CN0589).
More generally sensitive questions were not embedded in a way which indicates acceptability (e.g. using general question about ‘others’ before asking about the ‘respondent’ or using introductory text which is permissive of undesirable behaviour- ‘deliberate loading’). An example of this is ‘It can be hard to X given Y. Have you ever….?’

Finally, it was necessary to drop analysis of the outcome ‘2+ male partners in the last year with whom a condom was not consistently used (2PPNC)’ as questions were not asked to enable this outcome to be constructed meaningfully for the whole dataset. I.e. a participant could have had 6 partners in the last year and only used condoms consistently with the last two. In this instance they should be categorised as positive for 2PPNC but would actually be recorded as a negative for 2PPNC if the variable is derived using Q21 and Q22. A total of n=360 participants reported >2 ptns and therefore cannot be accurately allocated on the 2PPNC variable.