BMJ Open

Intervention Now To Eliminate Repeat Unintended Pregnancy in Teenagers (INTERUPT): a systematic review of intervention effectiveness and cost-effectiveness, qualitative and realist synthesis of implementation factors and user engagement

Rh Whitaker,[1] M Hendry,[2] A Booth,[3] B Carter,[4] J Charles,[5] N Craine,[6] R T Edwards,[5] M Lyons,[7] J Noyes,[8] D Pasterfield,[2] J Rycroft-Malone,[8] N Williams[1]

To cite: Whitaker R, Hendry M, Booth A, *et al*. Intervention Now To Eliminate Repeat Unintended Pregnancy in Teenagers (INTERUPT): a systematic review of intervention effectiveness and cost-effectiveness, qualitative and realist synthesis of implementation factors and user engagement. *BMJ Open* 2014;**4**:e004733. doi:10.1136/bmjopen-2013-004733

▸ Prepublication history and additional material is available. To view please visit the journal (http://dx.doi.org/10.1136/bmjopen-2013-004733).

Received 13 January 2014
Accepted 13 March 2014

For numbered affiliations see end of article.

Correspondence to
Rh Whitaker;
r.whitaker@bangor.ac.uk

ABSTRACT

Background: The UK has the highest rate of teenage pregnancies in Western Europe, a fifth are repeat pregnancies. Unintended conceptions can result in emotional, psychological and educational harm to teenage girls, often with enduring implications for their life chances. Babies of teenage mothers have increased mortality in their first year and increased risk of poverty, educational underachievement and unemployment later in life, with associated societal costs.

Methods and analysis: We will conduct a streamed, mixed-methods systematic review to find and evaluate interventions designed to reduce repeat unintended teen pregnancies.

Our aims are to identify: Who is at greater risk of repeat unintended pregnancies? Which interventions are effective, cost-effective, how they work, in what setting and for whom? What are the barriers and facilitators to intervention uptake? Traditional electronic database searches will be augmented by targeted searches for evidence 'clusters' and guided by an advisory group of experts and stakeholders. To address the topic's inherent complexities, we will use a highly structured, innovative and iterative approach combining methodological techniques tailored to each stream of evidence. Quantitative data will be synthesised with reference to Cochrane guidelines for public health interventions. Qualitative evidence addressing facilitators and barriers to the uptake of interventions, experience and acceptability of interventions will be synthesised thematically. We will apply the principles of realist synthesis to uncover theories and mechanisms underpinning interventions. We will conduct an integration and overarching narrative of findings authenticated by client group feedback.

Ethics and dissemination: We will publish the complete review in 'Health Technology Assessment' and sections in specialist peer-reviewed journals. We will present at national and international conferences in the fields of public health, reproductive medicine and review methodology. Findings will be fed back to service users and practitioners via workshops run by the partner collaborators.

Trail registration number: PROSPERO CRD42012003168.

Cochrane registration number: i=fertility/0068.

INTRODUCTION

Background

Despite data from the UK that are consistent with a gradual decline in teenage conception rates, the UK continues to have the highest rate of teenage pregnancies in Western Europe.[1 2] Teenage pregnancies are a target within the *England Teenage Pregnancy Strategy* and their equivalents within the devolved governments of the UK.[3–6] Teenage pregnancies have considerable impacts on the individual well-being of teenage parents and their children. Inherent within the national strategy responses, and a range of other national policy documents addressing this issue, is the recognition that babies of teenage mothers have increased mortality in their first year and a significantly increased risk of living in poverty, achieving less at school and being unemployed later in life[7] with substantial costs to society.

Repeat pregnancies represent a considerable proportion of the overall rate; one-fifth

of births among under-18s are repeat pregnancies[8] and are thus a crucial potential focus for intervention. Around three quarters of teenage pregnancies are unplanned with up to half resulting in abortion.[3] Within the UK, teenage pregnancy is strongly associated with social disadvantage. The social predictors of repeat adolescent pregnancy are varied and have previously been usefully grouped into predictors operating at individual, couple, family, community and social levels.[9] These predictors share much common ground with those of first teenage pregnancy.

Aims of the review

The overall aims are to identify and evaluate the effectiveness of interventions for preventing repeat unintended pregnancies among adolescents, and to investigate the barriers and facilitators for their implementation and uptake. While these overall aims are broad, the focus will be on the *implementation* of interventions; specific research objectives are to determine:

- What factors characterise subgroups which are at greater risk of repeat unintended pregnancies (ie, what are the predictors of a repeat unintended pregnancy)?
- Which (elements of) interventions appear to be effective, how do they work, in what setting and for whom (conversely, why are they ineffective, why don't they work)?
- What are the barriers and facilitators to the acceptability, uptake and implementation of interventions?
- What is the relative cost-effectiveness of interventions?

METHODS

Overall plan of research

Initial scoping searches informed a tailored, four-phase approach to the review (figure 1). For the overall framework of the mixed method review, we will draw on the structured, phased Evidence for Policy and Practice Information (EPPI)-Centre approach[10] and use their reviews of young people, pregnancy and social exclusion, and the barriers to and facilitators of children's healthy eating as methodological exemplars.[10 11] After conducting extensive literature searches, screening the evidence against explicit inclusion and exclusion criteria and appraising study quality, a mapping exercise is undertaken to organise and describe the evidence so as to give a clear picture of the body of research. From this, the scope of the review can be refined in order to focus in depth on the most important areas of the topic in question. Our research will be guided by an expert panel whom we will engage with via a regular agenda item on the quarterly meeting of the Public Health Wales's Addressing Teenage Conceptions in Wales; Task and Finish group, and we will present our findings for feedback and discussion to a group of young mothers who have experience of teenage pregnancy and early parenthood and are in contact with the Flying Start programme. The Task and Finish group draws its membership from public health practitioners, policymakers, general practitioners and specialist doctors, midwives, academics and third sector representatives from across Wales with a professional interest in reducing teen conception rates.

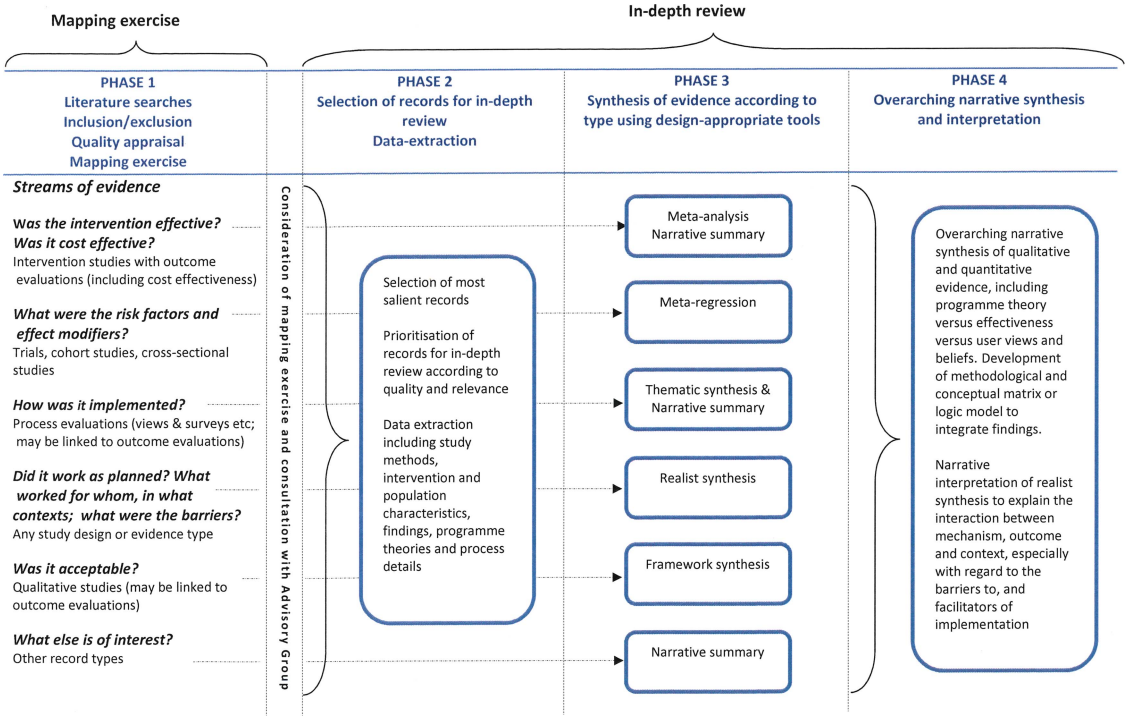

Figure 1 Overview of review methods.

Phase 1: Identifying the literature, quality appraisal and mapping the evidence

Search strategies

Principal searches

We will search the following electronic databases for published literature using strategies that combine thesaurus terms and keywords relating to pregnancy, termination of pregnancy or parenthood with adolescence and text word synonyms for repeat or subsequent:

MEDLINE and MEDLINE in Process, PsycInfo, CINAHL (Cumulative Index to Nursing & Allied Health Literature), the Cochrane Library (Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, the Health Technology Assessment (HTA) Database, National Health Service (NHS) Economic Evaluation Database), EMBASE (The Excerpta Medica database), BNI (British Nursing Index), ERIC (Educational Resource Index and Abstracts), SocAbs (Sociological Abstracts), ASSIA (Applied Social Sciences Abstract & Indexes), BiblioMap (The EPPI-Centre register of health promotion and public health research) and the Social Sciences Citation Index. We will use a search strategy developed and piloted in MEDLINE (see online supplementary appendix 1) and subsequently modified for use in the remaining databases (full details available from the authors).

Supplementary searches

Further modified versions of the same strategy will be used to search the following databases for 'grey' literature: OpenGrey, Scopus, Scirus, Social Care Online, National Research Register, NIHR portfolio database, and Index to theses. Similarly, to capture economics studies, we will search RePEc (Research Papers in Economics) and EconLit. We will apply an alternative search strategy specifically designed to capture the type of descriptive titles that are common in qualitative studies to selected databases: SocAbs, ASSIA, BNI and the Social Sciences Citation Index. This strategy will combine additional synonyms for 'pregnancy', 'adolescence' and 'repeat' with a brief qualitative filter comprising three broad free-text terms, 'qualitative', 'findings' and 'interviews', which has been shown to be as effective as a more complex one.[12 13]

Since the issues surrounding implementation of interventions are a primary focus of this review, qualitative and process evaluation evidence associated with trials is highly relevant—particularly to better understand the facilitators and barriers to implementation.[14] Therefore, a key feature of our search strategy will be to identify 'evidence clusters' related to key randomised controlled trials; we will use search engines such as Google and Google Scholar, conduct citation searches and contact Principal Investigators to ascertain whether a qualitative/views study or process evaluation was conducted, as these data are sometimes published separately or not published at all.

We will be further guided by our expert panel members, some of whom have frequent contact with young women who have experience of teenage pregnancy and early parenthood; they will inform the direction of our searches by identifying interventions which their clients may have experienced and giving us feedback. This will help identify areas where evidence is lacking and supplementary searches may be necessary. Additional sources will include the bibliographies of included papers. If necessary, we will also manually search key journals such as the *Journal of Epidemiology and Community Health, the Journal of Adolescent Health, Contraception, the Journal of Adolescence and Health Care, the Journal of Paediatric and Adolescent Gynaecology, Adolescence, Maternal and Child Health Journal* and *the Journal of Reproductive Medicine* and make personal contact with professional networks such as the Family Planning Association, reproductive health nursing networks, General Practitioners' fora, etc to identify Department of Health and third sector policy documents and evaluations. Finally, we will circulate a list of included studies to key stakeholders and researchers in the field and ask them if they are aware of any important omissions.

A number of systematic reviews related to teenage pregnancy have been published in the past two decades. The earliest we found in our scoping search was dated 1997.[15] Therefore, we will limit our searches to 1995 onwards, but we will conduct a separate search excluding the terms for second or subsequent pregnancies but including a filter for systematic reviews as a means of capturing relevant data from earlier studies.

References will be managed by using bibliographic reference management software (Endnote). Two reviewers will independently screen titles and abstracts to identify potentially relevant documents, which will be retrieved and assessed according to the inclusion criteria below. Disagreements will be resolved by discussion or, if necessary, by a third reviewer.

Study eligibility

Study type

Our search strategy will capture published studies of any design including trials of interventions, effectiveness studies, interrupted time series studies (ITS), cost-effectiveness studies, process evaluations, surveys and qualitative studies of participants' views and experiences of interventions. We will also consider relevant grey literature of any type, such as unpublished reports, service evaluations and theses.

Population

The population of interest is young women, who are aged up to and including 19 years and have had at least one unintended pregnancy, whether the outcome was termination, miscarriage or delivery. Where study populations are mixed, we will include all studies whose reported population comprised at least 75% young women in our target age group.[16]

Intervention

We will include studies of any intervention designed to reduce repeat unintended pregnancies (also referred to as 'birth-spacing' or 'pregnancy-spacing') in these young women, delivered in any educational, healthcare or

community setting. Interventions may have single or multiple components, and could be delivered to individuals or communities. We will also include studies designed to identify risk factors or subgroups at increased risk of repeat unintended pregnancy, where there may be no actual intervention.

We will include studies that identify barriers and facilitators to the implementation and uptake of interventions, and explore the views of intervention recipients or providers or health professionals, particularly with regard to whether the intervention was implemented and worked in the way it was intended. We will look for studies that help us identify programme theories and logic—and we will look for, and develop, candidate theories as to why some young women have more than one unplanned pregnancy, which could begin to explain the relative success or failure of particular interventions.

Comparator

Comparators could be no intervention, standard practice or another intervention. Comparators are likely to be location-specific and standard care in one setting may be seen as an intervention in another setting.

Outcomes and other phenomena of interest

We will report on the primary and secondary outcomes and other phenomena of interest below. Outcomes will be addressed by a range of evidence types and analytical techniques (see figure 1).

Primary outcomes and other phenomena of interest

- Identification of at-risk groups
- Identification of barriers and facilitators of interventions relating to:
  - Acceptability
  - Uptake
  - Feasibility of implementation
- Views and experiences of young women, families and professionals
  - Conceptualisation of repeat teenage pregnancy rates as an issue
  - Effectiveness of interventions
  - Uptake of interventions
  - Change in repeat pregnancy rates

Other outcomes and other phenomena of interest

- Identification of, access to and uptake of reproductive services and social care
- Feasibility of widespread adoption of interventions in health and social care
- Cost of interventions
- Effectiveness of interventions:
  - Change in validated quality-of-life indices
  - Change in rate of abortion
- Cost-effectiveness of interventions

Study exclusion criteria

We will include published studies from any country as, although there may be different cultural and social attitudes towards teenage pregnancy, they may have a bearing on minority populations within the UK. If any major studies (eg, randomised controlled trials or national cohort studies) are found in non-English language publications, we will attempt translation. Smaller qualitative studies or process evaluations published in other languages may be missed, but exclusion of those studies is unlikely to bias any synthesis of evidence. We will limit our searches for unpublished material to the UK to enhance the direct applicability of the results to the NHS and UK public health bodies. We will not exclude studies on the basis of quality, but will incorporate judgements about study quality when interpreting the evidence.

Quality appraisal

RCTs and quasi-RCTs will be assessed using the Cochrane Collaboration's Risk of Bias (RoB)[12]; we will categorise and report the overall risk of bias of each of the included trials:

- Low risk of bias (plausible bias unlikely to seriously alter the results) if all criteria were met;
- Unclear risk of bias (plausible bias that raises some doubt about the results) if one or more criteria were assessed as unclear;
- High risk of bias (plausible bias that seriously weakens confidence in the results) if one or more criteria were not met.

The Cochrane RoB tool will be supplemented by the Mixed Methods Appraisal Tool (MMAT) for mixed studies reviews.[17] This tool has the advantage of incorporating the appraisal of several different study designs (qualitative, RCT, non-RCT, observational, mixed methods) using a single tool with a coherent range of quality criteria. Piloting suggests that the MMAT is an efficient and reliable tool; however, it does not cover economic evaluations, so we will also use the Drummond checklist[18] and the Phillips checklist[19] recommended for economic studies and economic models, respectively.[20] Where the evidence comprises, for example, policy documents or reports of locally implemented initiatives, it is unlikely that we will be able to formally assess quality. We will therefore take a broad view of the evidence as being most relevant for the context and be guided by the advisory group as to its merit.

Certainty of evidence

We will use GRADE as the accepted approach to assessing the certainty of findings of reviews of effectiveness,[21] but since GRADE is not suitable for appraising the certainty of qualitative evidence, we will also use a recently developed method, CerQual (certainty of the quality of evidence).[22] The CerQual approach is based on the methodological limitations of individual studies contributing to the review finding, in this case indicated by the MMAT, combined with the coherence of each review finding. Coherence is assessed by the extent to

which a clear pattern is identifiable across the individual study data, and is strengthened where findings are consistent across multiple contexts or where variation across individual studies is explained, especially where studies contributing to the finding are drawn from a wide range of settings. CerQual is similar to GRADE in that both approaches aim to assess the *certainty* of (or confidence in) the evidence and both rate this certainty for each finding across studies rather than for each individual study. GRADE also bases its assessment on a combination of the quality of the evidence and other factors, including consistency across studies.

Mapping the evidence

We will undertake a mapping exercise following the EPPI-Centre methods.[10] We will assign codes to records using lists that we will develop of predefined keywords to aid the sorting and grouping of documents for mapping and synthesis. Keywords will be related to, for example, the study design or type of record (intervention study, process evaluation, qualitative study, report, etc), the country and health, educational or community setting in which the study took place, the topic or focus of the study/report, the population focus of the study/report and study design. From the coding exercise, we will develop a descriptive map of the literature and identify gaps in the research. The map will also provide a context for interpreting the results of the synthesis and a basis for refining the scope of the review, that is, it will aid the advisory group in identifying areas for in-depth focus and, possibly, areas where additional searches need to be conducted. The advisory group will meet with the review group late in phase 1 to discuss the results of the mapping exercise and to ratify or recommend refinements to that work which would be needed prior to the completion of phase 2 where the evidence will be selected and prioritised for an in-depth review.

Phase 2: Selecting and prioritising the evidence for in-depth review and data extraction

Study selection

The review team, with advice from the advisory group obtained during the mapping exercise, will prioritise the evidence for in-depth review. Beginning with evidence relating to primary outcomes, and within each grouped set of data, we will prioritise the best quality evidence of most relevance to address the research questions. We will be particularly interested in 'evidence clusters', that is, trials of interventions accompanied by qualitative studies, process evaluations, reports etc; 'sibling' studies, that is, trials of interventions paired with qualitative studies using the same participants, and 'orphan' studies where effectiveness studies and views studies relate to similar interventions and populations (and so can inform each other), although the actual participants are different. These studies have the potential to indicate the effectiveness of an intervention as well as its acceptability to users and barriers to implementation and uptake. We will apply the CART framework, where evidence is judged on the criteria of Completeness, Accuracy, Relevance and Timeliness.[23] Thus, we will prioritise the evidence according to relevance and stop when data-saturation is reached.

Study selection for the Cochrane Review

We have registered the title with the Cochrane Fertility Regulation review group, and will develop a separate Cochrane protocol to be published in the Cochrane library. The main difference between the Cochrane protocol and this HTA protocol is that we will adapt the inclusion and exclusion criteria to exclude unpublished evidence and PhD theses from the Cochrane review. The intention is to follow the same design and methods across the two reviews. This variation in inclusion criteria between the Cochrane and HTA reviews offers an opportunity to undertake a sensitivity analysis to see what contribution unpublished evidence makes to overall outcomes and interpretation of evidence. The Cochrane Collaboration is also calling for exemplar reviews of complex interventions where complexity is considered important. The Cochrane version of the HTA review has the potential to be classified as an 'innovative' review in the Cochrane library and would be one of the first to demonstrate the value of an additional realist synthesis in understanding complexity at multiple levels of context, intervention and implementation.

Data extraction

We will create a bespoke set of data extraction forms to collect data from each study: study characteristics (design, sample type, sample size, etc); description of intervention or risk factors; contextual factors in the study setting; outcomes including costs of implementing intervention; programme theories or mechanisms described by the authors in the rationale behind the intervention or postulated in the explanation of the results. We will draw on the components of Greenhalgh *et al*[24] framework to map facilitators and barriers to intervention implementation, including characteristics of the intervention (eg, risk, complexity, acceptability), the contextual elements that influence whether it might be used or not (eg, resources, organisation of services, leadership) and what implementation processes are required to implement the intervention (eg, change agents, project management support and communication). Data extraction will be undertaken by two reviewers independently; disagreements will be resolved by discussion.

Study summaries

We will present the findings of the data extraction exercise in a table of study characteristics. This will include: the study details, setting, population, quality score, methods, etc. We will present sociodemographic characteristics known to be important from an equity perspective. For this process, the PROGRESS (Place,

Race, Occupation, Gender, Religion, Education, Socioeconomic status (SES), Social capital) framework will be utilised.[25]

Phase 3: Evidence synthesis by type of evidence

Data to be considered in this review will be extremely diverse, and data synthesis complex. The choice of synthesis method depends on the questions addressed and the type of data included; in this review, there are many questions and diverse data. Figure 1 illustrates the method of synthesis proposed for each evidence type.

Quantitative synthesis

Measures of intervention effect

We will present quantitative continuous outcomes on the original scale as reported in each individual study. These may be standardised, if they use different scales, by dividing the estimated mean difference by its SD. Dichotomous outcome data will be fitted with a random effects model using the Mantel-Haenzel test and presented as risk ratio (RR). ITS studies will be analysed by using the rate change (α) and slope (β) parameters as the intervention effect. Time to event data will be analysed using HRs as the intervention effect. All outcomes data will be reported as their effect size with associated 95% CIs.

Unit of assessment

We anticipate that many of the studies will be clustered by community, service or geographical area. Where possible, cluster RCTs (or quasi-RCTs) that do not account for the correlated nature of the data will be reanalysed by inflating the study standard. If this is not possible, we will report only the point estimate, and adjust the 'other risk of bias' to account for the likely impact of not accounting for the clustering.

Multiple time-points per outcome in non-ITS study designs

If RCT, quasi-RCT or cohort studies are found reporting repeated incidence of repeat pregnancy over time, these outcomes will be defined and summarised at both short-term and long-term time. We will follow the Cochrane Effective Practice and Organisation of Care Group (EPOC) and non-randomised studies methods group guidance on incorporating these diverse types of evidence in the review.

Assessment of heterogeneity

We will assess both heterogeneity of the populations, context and interventions (clinical) and statistical heterogeneity. Clinical heterogeneity will be assessed by examining the characteristics of the studies, the similarity between the types of participants and the interventions, while statistical heterogeneity will be assessed using the I^2 statistic. We will report heterogeneity as important if it is at least moderate to substantial by I^2 >30% and will not pool data if the statistical heterogeneity is severe I^2 >90%. If there is statistical heterogeneity between 60% and 90% and this can be explained by clinical reasoning and a coherent argument can be made for combining the studies, they will be entered into a meta-analysis. After exploring the heterogeneity where a coherent scientific argument is not found, the included study causing the heterogeneity will be excluded and the analysis repeated as a sensitivity analysis. Where the heterogeneity cannot be adequately explained, the data will not be pooled in a meta-analysis. In this case, or when only single outcomes are reported, we will present study findings in tables and explore the relationships within and between studies in a narrative summary.[26]

Assessment of reporting biases

Where there are an adequate number of studies (nominally at least 10), an assessment of reporting bias will be carried out by testing for funnel plot asymmetry.[27] Funnel plots will only be presented where there is some evidence of asymmetry in the plots. Possible sources of asymmetry will then be explored with an additional sensitivity analysis and the studies at greatest risk of bias will be removed and the most likely unbiased intervention effect will be summarised in the meta-analyses.

Dealing with missing data

Where we have missing or unclear data or information, we will contact the investigators of the primary research. Following this, correspondence data may be reanalysed according to a treatment by allocation principle whenever possible.[28] If loss to follow-up data is not fully reported and authors have conducted a perprotocol analysis, we will inspect the degree of imbalance in the dropout between the groups to determine the potential impact of bias. In the absence of a treatment by allocation population, we will use an available case population. Where possible, an intention to treat analysis will be carried out. In cases where non-ITT analyses are reported, we may report the missing data using a best–worst and worst–best scenario analysis if an adequate number of studies were included in a meta-analysis (nominally three).[28] Where there are missing variances, these will be imputed using methods that will be highlighted explicitly in the methods section and the assumptions fully described.

Subgroup analysis

Subgroups included and highlighted within the primary research as important confounders will be used to identify risk factors. If there are adequate studies, we will investigate the following subgroup of studies, or subgroups within studies to try to identify differences in intervention effectiveness: age of mother, deprivation index of area, length of follow-up, history of substance misuse, looked after children (or care leavers).

Qualitative synthesis

For qualitative studies or qualitative elements in mixed-method studies, we will develop an a priori coding framework specifically designed to address questions and issues of interest and conduct thematic syntheses

using the framework method developed by Ritchie and Spencer.[29] We will use Greehalgh *et al*'s[24] framework to support the synthesis of findings about the facilitators and barriers to intervention implementation.

Surveys, process evaluations and other types of data

Data from surveys, process evaluations and other sources, for example, reports may be either semiqualitative or quantitative or both. Data may be extracted to present evidence of acceptability or uptake of interventions and synthesised in a narrative summary or aggregated using thematic analysis.

Realist synthesis

We will select subsets of evidence and apply the principles of realist synthesis.[30–32] We will identify explicit or implicit *theories* by which it is postulated how an intervention has an underlying causal *mechanism* that works in a defined social *context* to result in a particular outcome. Such theories may also be used to explain the failure of an intervention to work. Additional theories will be identified from the wider literature (eg, policy documents), the advisory group members or personal contact with other experts in the field. Data synthesis will involve individual reflection and team discussion and will question the integrity of each theory, adjudicate between competing theories, consider the same theory in different settings and compare the stated theory with actual practice.[33] Coded data from the studies will then be used to confirm, refute or refine the candidate theories. Thus, we will attempt to explain what interventions work, for whom and in what circumstances.

Investigation of risk factors using meta-regression

A key aim of the review will be to search, identify and summarise the population of young girls who are at greatest risk of repeat pregnancy (eg, considering income, social deprivation, ethnicity, degree of rurality, substance misuse, currently in care or care leavers, those from a vulnerable or in at-risk communities). We anticipate that these factors will be considered and summarised as important confounding variables within RCTs, quasi-RCTs and controlled before and after studies (CBAs) for studies investigating an intervention to reduce repeat pregnancies. We will also identify non-interventional studies that present epidemiological data (eg, cohort studies, cross-sectional studies and policy documents) of effect modifiers associated with an increased risk of repeat pregnancy. Data will be extracted and summarised and, if possible, presented in a meta-regression of summarising the standardised effect sizes, with their associated 95% CIs.

Cost-effectiveness

We will provide a narrative review of economic evaluations of interventions specifically designed to address the issue in question. We will stratify any economic studies found by the public health lever mechanism used, for example, government, statutory or legal, public information, school-based group or targeted intervention, NHS initiated, charity initiated. We will be particularly interested in perspective of analysis, type of economic evaluation (eg, cost analysis, cost–benefit analysis, cost-effectiveness analysis, cost-utility analysis). We will document the way that these studies have attempted to overcome the particular methodological challenges of this type of complex, preventative, behaviour change-based intervention.[34–37] Where possible, we will conduct a meta-analysis of the economic evidence (if there is sufficient homogeneity to allow it).

Phase 4: Overarching syntheses

Reporting the studies

Results will be presented with reference to the PRISMA reporting guidelines for systematic reviews,[38] the MOOSE guidelines for Meta-analyses of observational studies[39] and the RAMESES publication standards for realist syntheses.[40] We will summarise the evidence for each outcome in a summary of findings table.

Overarching narrative synthesis and interpretation of findings

We will conduct an overarching narrative synthesis, juxtaposing the qualitative and quantitative data on service user views and implementation issues and comparing programme theories with effectiveness.[41] To aid this process, we will develop a methodological and conceptual matrix or logic model to integrate our findings.[42 43] The processes involved in this review are essentially iterative; thus, we anticipate that the mapping exercise and the work on relevant programme theory will contribute towards a framework for the meta-synthesis.

Discussing the evidence

Within the discussion, we will consider the following areas:

- Summary of findings, strength and certainty of evidence;
- Strengths and limitations of the review;
- Implications for UK policy and practice, including intervention implementation;
- Implications for further research.

During the draft stage of the final report, a consultation process, defined and facilitated by the frontline organisations engaged with our team, will be undertaken with service users via their representatives in the voluntary sector. This aim of this process is to share our emerging findings and to seek comments and feedback, which will also feed into the discussion section of the report.

DISCUSSION

Systematic reviews of complex interventions are challenging[44]; interventions in the field of teenage pregnancy prevention are diverse in terms of content, context and implementation factors. To encompass this diversity, the methods for this review are ambitious and innovative,

drawing on a number of methodological sources and with a degree of flexibility built into the design. To ensure the validity and reliability of findings based on novel research methods, our review includes:

- An overall framework to provide structure to the review;
- A high degree of methodological expertise in the review team;
- An expert advisory group including access to stakeholders in the field;
- Feedback from clients/service users to authenticate findings.

These factors will ensure that we deliver a high quality review with a high degree of relevance in its findings that will be of interest to policymakers and those who design and commission services, as well as making a valuable contribution to the debate on methods for conducting systematic reviews of complex interventions, where understanding complexity is considered important.

Author affiliations
[1]North Wales Organisation for Randomised Trials in Health, Y Wern, Normal Site, Holyhead Road, Bangor University, Bangor, Gwynedd, UK
[2]North Wales Centre for Primary Care Research, Bangor University, Wrexham, UK
[3]School of Health and Related Research, University of Sheffield, Sheffield, UK
[4]Institute of Primary Care and Public Health, Cardiff University School of Medicine, Cardiff, UK
[5]Centre for Health Economics & Medicines Evaluation, Institute of Medical and Social Care Research, Bangor University, Bangor, UK
[6]Micobiology Department/Adran Microbioleg, Public Health Wales/Iechyd Cyhoeddus Cymru, Ysbyty Gwynedd, Bangor, Gwynedd, UK
[7]Health Protection Division, Temple of Peace, Cathays Park, Cardiff, UK
[8]Centre for Health Related Research, School of Healthcare Sciences, Fron Heulog, Bangor University, Bangor, UK

Acknowledgements The authors wish to thank Dr Huw Roberts for his invaluable contribution to the study management team and Dr Richa Sinha for her contribution to the development of the search strategies.

Contributors RW and NC initiated the study. MH devised the study structure and all authors contributed to its design. RW, MH and BC drafted the manuscript. AB, MH, DP and JC contributed to the search strategies. BC contributed to the quantitative analysis and JN to the qualitative analysis and mixed methods synthesis. JRM was involved in the realist synthesis, ML, NC and NW in the health care perspective and RTE and JC in the health economics perspective. All the authors read and approved the final manuscript.

Funding This work is funded by the National Institute for Health Research Health Technology Assessment project number 11/141/05. Professor Rhiannon Tudor Edwards and Dr Joanna Charles are funded by Public Health Wales.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. Office for National Statistics. UK National Statistics Publication Hub: conception and fertility rates. 2011.
2. UNICEF. *Child poverty and perspective: an overview of child well being in rich countries. Innocenti Report Card 7*. Florence: UNICEF Innocenti Research Centre, 2007.
3. Department of Health. *Teenage pregnancy strategy: beyond 2010*. 2010.
4. Welsh Assembly Government. Sexual Health and Wellbeing Action Plan For Wales, 2010–2015. 2010.
5. Northern Ireland Department of Health SSaPS. Sexual Health Promotion Strategy & Action Plan 2008–2013. 2008.
6. The Scottish Executive. Respect and Responsibility: Strategy and Action Plan for Improving Sexual Health. 2005.
7. Parker R, *et al*. Teenage Pregnancy Strategy Evaluation: Final report synthesis. 2005.
8. The Teenage Pregnancy Independent Advisory Group (TPIAG). Teenage pregnancy: you can make a real difference to teenage pregnancy, (undated).
9. Rowlands S. Social predictors of repeat adolescent pregnancy and focused strategies. *Best Pract Res Clin Obstet Gynaecol* 2010;24:605–16.
10. Evidence for Policy and Practice Information and Co-ordinating Centre. *EPPI-Centre methods for conducting systematic reviews*. University of London, 2007.
11. Thomas J, Sutcliffe K, Harden A, *et al*. *Children and healthy eating: a systematic review of barriers and facilitators*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, 2003.
12. Flemming K, Briggs M. Electronic searching to locate qualitative research: evaluation of three strategies. *J Adv Nurs* 2006;57:95–100.
13. Shaw R, Booth A, Sutton A, *et al*. Finding qualitative research: an evaluation of search strategies. *BMC Med Res Methodol* 2004;4:5.
14. O'Cathain A, Thomas K, Drabble S, *et al*. What can qualitative research do for randomised controlled trials? A systematic mapping review. *BMJ Open* 2013;3:e002889.
15. NHS Centre for Reviews and Dissemination: University of York. Preventing and reducing the adverse effects of unintended teenage pregnancies. *Effective Health Care* 1997;3.
16. Oringanje C, Meremikwu M, Eko H, *et al*. Interventions for preventing unintended pregnancies among adolescents. *Cochrane Database Syst Rev* 2009;(4):CD005215.
17. Pace R, Pluye P, Bartlett G, *et al*. Testing the reliability and efficiency of the pilot Mixed Methods Appraisal Tool (MMAT) for systematic mixed studies review. *Int J Nurs Stud* 2012; 49:47–53.
18. Drummond M, Jefferson T. The BMJ Economic Evaluation Working Party. Guidelines for authors and peer reviewers of economic submissions to the BMJ. *BMJ* 1996;313:275–83.
19. Philips Z, Ginnelly L, Sculpher M, *et al*. Review of guidelines for good practice in decision-analytic modelling in health technology assessment. *Health Technol Assess* 2004;8:iii-iv, ix-xi, 1–158.
20. Shemilt I, Mugford M, Byford S, *et al*. Chapter 15: Incorporating economics evidence. In: Higgins JPT, Green S (editors), *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. http://www.cochrane-handbook.org
21. Guyatt GH, Oxman AD, Schunemann HJ, *et al*. GRADE guidelines: a new series of articles in the journal of clinical epidemiology. *J Clin Epidemiol* 2011;64:380–2.
22. Glenton C, Colvin C, Carlsen B, *et al*. Barriers and facilitators to the implementation of lay health worker programmes to improve access to maternal and child health: qualitative evidence synthesis. *Cochrane Database of Systematic Reviews* 2013;2:CD010414. doi:10.1002/14651858.CD010414
23. Tennison B. Understanding data, information, and knowledge. In: Guest C, Ricciardi W, Kawachi I, Lang I, eds. Oxford handbook of public health practice. 3rd edn. pp 74–83. Oxford: Oxford University Press, 2013.
24. Greenhalgh T, Robert G, MacFarlane F, *et al*. Diffusions of innovation in service organisations: systematic review and recommendations. *Milbank Q* 2004;82:581–629.
25. Ueffing E, Tugwell P, Welch V, *et al*. For the Campbell and Cochrane Equity Methods Group. Equity Checklist for Systematic Review Authors. Version 2012-10-02, 2009.
26. Deeks JJ, Higgins JPT, Altman DG (editors). Chapter 9: Analysing data and undertaking meta-analyses. In: Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. www.cochrane-handbook.org.
27. Sterne JAC, Egger M, Moher D, eds. Chapter 10: Addressing reporting biases. In: Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Intervention*. Version 5.1.0

(updated March 2011). The Cochrane Collaboration, 2011. www.cochrane-handbook.org
28. Higgins JPT, Deeks JJ, Altman DG (editors). Chapter 16: Special topics in statistics. In: Higgins JPT, Green S (editors), *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. www.cochrane-handbook.org
29. Ritchie L, Spencer J. Qualitative data analysis for applied policy research. In: Bryman A, Burgess R, eds. *Analysing qualitative data*. London: Routledge, 1994:173–94.
30. Pawson R. *Evidence-based policy: a realist perspective*. London: Sage, 2006.
31. Rycroft-Malone J, McCormack B, DeCorby K, *et al*. Chapter 25. Realist synthisis. In: Gerrish K, Lacey A, eds. *The research process in nursing*. 6th edition. Chichester, West Sussex, UK: Wiley-Blackwell, 2010.
32. Greenhalgh T, Kristjansson E, Robinson V. Realist review to understand the efficacy of school feeding programmes. *BMJ* 2007;335:858–61.
33. Rycroft-Malone J, McCormack B, Hutchinson A, *et al*. Realist synthesis: illustrating the method for implementation research. *Implement Sci* 2012;7:33.
34. Kelly M, McDaid D, Ludbrook A, *et al*. *Economic appraisal of public health interventions*. London: Health Development Agency, 2005.
35. Craig P, Dieppe P, Macintyre S, *et al*. Developing and evaluating complex interventions: new guidance. Medical Research Council, 2008. http://www.mrc.ac.uk/complexinterventionsguidance
36. Vos T, Carter R, Barendregt J, *et al*. Assessing Cost-Effectiveness in Prevention (ACE–Prevention): Final Report. University of Queensland, Brisbane and Deakin University, Melbourne. http://www.sph.uq.edu.au/bodce-ace-prevention
37. Payne K, McAllister M, Davies L. Valuing the economic benefits of complex interventions: when maximising health is not sufficient. *Health Econ* 2013;22:258–71.
38. Moher D, Liberat iA, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. *BMJ* 2009;339:b2535.
39. Stroup D, Berlin J, Morton S, *et al*. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of Observational Studies in Epidemiology (MOOSE) group. *JAMA* 2000;283:2008–12.
40. Wong G, Greenhalgh T, Westhorp G, *et al*. RAMESES publication standards: realist syntheses. *BMC Med* 2013;11:20.
41. Noyes J, Popay J, Pearson A, *et al*. Chapter 20: Qualitative research and Cochrane reviews. In: Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. www.cochrane-handbook.org
42. Oliver S, Harden A, Rees R, *et al*. An emerging framework for including different types of evidence in systematic reviews for public policy. *Evaluation* 2005;11:428–46.
43. Thomas J, Harden A, Oakly A, *et al*. Integrating qualitative research with trials in systematic reviews: an example form public health. *BMJ* 2004;328:1010–12.
44. Shepperd S, Lewin S, Straus S, *et al*. Can we systematically review studies that evaluate complex interventions? *PLoS Med* 2009;6: e1000086.