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Structural interventions aiming to enable adolescent use of contraception in low- and middle-income countries

Helen Burchett, Sally Griffin, Malica de Melo, Joelma Joaquim Picardo, Dylan Kneale and Rebecca French



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Please direct any comments or queries to the corresponding author, Helen Burchett at helen.burchett@lshtm.ac.uk.

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Authors

Helen Burchett

Dylan Kneale

Sally Griffin

Joelma Joaquim Picardo

Malica de Melo

Rebecca French

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Abstract

Reducing adolescent pregnancy is a global public health priority and enabling contraceptive use is one way to achieve this. Broader determinants of contraceptive use, such as poverty, education and social norms, can affect knowledge, attitudes, motivation and ability to access and use contraception. Structural interventions aim to address these broader determinants and include cash transfer interventions, interventions to encourage participation in school, empowerment interventions and interventions aiming to change social norms. We conducted an evidence synthesis to explore a) what structural interventions have been evaluated for their effect on adolescent contraceptive use in low- and middle-income countries and b) how such interventions may work.

We conducted a systematic search of eight academic databases, studies included in an evidence gap map and relevant websites, and screened references for inclusion based on set criteria. After coding studies to identify intervention and evaluation characteristics, we focused on a subset of studies for in-depth analysis using a case-based approach (Intervention Component Analysis).

We screened 6,993 references and included 61 papers, which reported on 40 unique intervention evaluations. Economic empowerment interventions were the most common structural intervention, followed by interventions which aimed to increase schooling (e.g. through legislation or cash transfers) and interventions which aimed to change social norms. We then focused on 17 studies, with 29 structural intervention arms, but found so much methodological diversity (e.g. in terms of outcomes, outcome samples and follow-up timings) that it was not possible to determine which were effective or ineffective. We built on an existing framework of family planning use to propose three steps for designing interventions: 1) tailor interventions to the adolescent life stages; 2) assess the baseline situation; and 3) select appropriate intervention activities to match gaps, particularly relating to interventions aimed at increasing the desire to limit/avoid/space/delay childbearing, at increasing agency to use contraception and at fostering an enabling environment. These steps will aid developers and evaluators of structural adolescent contraceptive interventions to develop an evidence base that is of use across a wide range of settings and scenarios.

Abbreviations

AGI-K	Adolescent Girls Initiative Kenya
BALIKA	Bangladeshi Association for Life Skills, Income and Knowledge for Adolescents
CERCA	Community-Embedded Reproductive Health Care for Adolescents
CI	Confidence Interval
cRCT	Cluster Randomised Control Trial
DHS	Demographic and health survey
DISHA	Development Initiative Supporting Healthy Adolescents
ELA	Empowerment and Livelihoods for Adolescents
FP	Family Planning
GBV	Gender-Based Violence
GREAT	Gender Roles, Equality and Transformations
ICA	Intervention Component Analysis
ICRW	International Center for Research on Women
LMIC	Low- and Middle-Income Country
MCTG	Multiple Category Targeted Grant
nRCT	Non-Randomised Controlled Trial
OR	Odds Ratio
PRACHAR III	Promoting Change in the Reproductive Behaviour of Adolescents – Phase III
PRAF II	Programa de Asignación Familiar
QCA	Qualitative Comparative Analysis
RCT	Randomised Controlled Trial
RH	Reproductive Health
SCTP	Social Cash Transfer Program
SHAZ!	Shaping the Health of Adolescents in Zimbabwe
SRH	Sexual and Reproductive Health
SRHR	Sexual and Reproductive Health and Rights
WHO	World Health Organization

1. Introduction

Description of the project

Adolescent pregnancy is a concern in many low- and middle-income countries (LMICs) and enabling contraceptive use is one means of addressing this. Most evaluations have assessed interventions targeting either the supply of, or demand for, contraception. As such, they neglect broader determinants, such as poverty, education and social norms, that can affect knowledge, attitudes, motivations and capacity to access and use contraceptives. Structural interventions target these broader determinants, i.e. 'the physical, social, cultural, organizational, community, economic, legal, or policy aspects of the environment' that can affect health and contraceptive behaviours (Sumartojo *et al.*, 2000, p. 1). However, these structural interventions – which aim to reduce poverty; enable education, employment or income generation; shift social norms; or empower adolescent girls and young women (hereafter referred to as 'adolescent girls') – have been relatively neglected in comparison to interventions that directly address the supply of, or demand for, contraception.

Objectives of the project

The current study aimed to address a gap in knowledge through an evidence synthesis of structural adolescent contraception interventions conducted in LMICs. We aimed to develop a mid-range theory to explain how such interventions work and also to reflect on the methods we used. We had three research questions relating to the theory development, as follows.

1. What types of upstream intervention have been evaluated that aim to encourage adolescent use of contraception in LMICs?
2. What characteristics of these interventions and their underlying theory, implementation, population and settings might facilitate or hinder their effectiveness?
3. What mid-range theory could explain how upstream interventions encourage adolescent use of contraception?

The study comprised two phases: we developed a map of the evidence base to answer Research Question 1, and we conducted an in-depth review to answer Questions 2 and 3.

Contribution to the literature

As far as we are aware, this project has conducted the most comprehensive search for, and map of, structural adolescent contraceptive intervention evaluations. In 2016, 3ie produced an evidence gap map of adolescent sexual and reproductive health (SRH) impact evaluations (Rankin *et al.*, 2016), which we have updated and also expanded through additional hand-

searching for grey literature. We also looked more in depth at structural interventions specifically. Other systematic reviews have been conducted, but either include both structural and non-structural interventions (e.g. McQueston *et al.*, 2013; Gottschalk and Ortayli, 2014; Nkhoma *et al.*, 2020) or include a broader range of outcomes than just contraception/childbearing (e.g. Sarkar *et al.*, 2015; Rankin *et al.*, 2016; Levy *et al.*, 2020). In Phase 2, we have built on and operationalised existing theories and frameworks to produce a three-step process for developing structural adolescent contraceptive interventions that are appropriate for specific contexts and use scenarios. We have considered the methodological characteristics of the included studies in order to highlight areas that could be addressed in order to strengthen the evidence produced in this field.

Policy relevance

Reducing adolescent childbearing is a priority in many LMIC settings, and the adolescent birth rate is an indicator for Sustainable Development Goal 3 (Ensure healthy lives and promote well-being for all at all ages) (United Nations, 2015). Encouraging contraceptive use is one means of addressing this issue.

The factors shaping adolescent use of contraception are numerous, interacting and complex. Factors are typically delineated into those relating to the supply of, or access to, contraceptives and contraceptive services, and those relating to demand for contraception. Structural interventions target the broader determinants that can affect access to and demand for contraception. The most commonly evaluated adolescent contraceptive intervention has been sexual health education. Fewer evaluations and syntheses have addressed structural interventions.

The range of structural interventions available creates challenges for policy-makers and practitioners: it can be difficult to judge which intervention would be most feasible and effective in a specific context. Previous syntheses have also noted a lack of theory underpinning interventions, as well as the need to document why interventions work (Glinski *et al.*, 2014; Rankin *et al.*, 2016). Mid-range theory could help these decisions through integrating broad theories (in this case around reproductive decision-making and contraceptive use) with empirical evidence from trials. The mid-range theory developed in this study should help inform policy-makers, evaluators and implementers by providing clear steps in the process of developing a context-sensitive structural adolescent contraceptive intervention.

Innovation and relevance to CEDIL

This study used innovative methods to explore a poorly understood aspect of development, i.e. structural interventions. We used Qualitative Comparative Analysis (QCA), a method that has rarely been used in the development field. We used this method to explore methodological heterogeneity. As far as we are aware, this is the first time the method has

been used in this way. We also used Intervention Component Analysis (ICA), a case-based method, to synthesise the included studies (Sutcliffe *et al.*, 2015). This method is also relatively novel, particularly within development research.

2. Methodology

We conducted an evidence synthesis with a comprehensive systematic search and mapping of the evidence base, followed by an in-depth review using QCA and ICA, in order to develop a mid-range theory.

Selection criteria

For the first phase (mapping the evidence, to answer the question ‘What types of intervention have been evaluated?’), we developed the following set of exclusion criteria to ensure the studies included were relevant.

References were excluded if they were:

- published before 2005
- NOT conducted in LMICs, as defined by the World Bank in 2019
- not about SRH or reproductive health (RH)
- not an intervention evaluation
- not reporting at least one of the following outcomes:
 - uptake or use of modern contraception¹
 - intention/readiness to use contraception
 - desire to avoid, delay, space or limit childbearing
 - desire to use contraception
 - pregnancy/birth
- not focused on adolescents aged 10–19 (i.e. excluded if the intervention did not target 10–19-year-olds, or if at least 50% of study sample were not aged 10–19, or if the mean or median age was not 19 years or younger, or if the results were not presented separately for this age group)
- not focused on structural interventions (girls’ economic or other empowerment; school enrolment and retention; shaping norms around gender, sexual behaviour or fertility; advocacy and other interventions to reduce gender and other inequalities)

After discussing the findings of our map with our advisory group, we sought their advice regarding the focus of our second phase of work. It was agreed that, since our project focused on contraceptive use, it made sense to focus on studies reporting contraceptive use outcomes. In other words, we excluded studies that only reported pregnancy, birth or fertility-related attitudes, since these outcomes could result from delayed first sex/marriage or reduced frequency of sex rather than from increased contraceptive use. We also decided to exclude studies with historical control groups, since variation in contraceptive use and related

¹ Evaluations reporting condom use only were only included if the intervention clearly stated a goal of pregnancy prevention and condoms were used for contraceptive purposes or for dual protection.

factors (e.g. gender and fertility norms) over time meant it would be difficult to be confident that the true difference between intervention and control was due to the intervention alone.

Search

We used three main sources to identify relevant references. First, we included studies identified in an earlier, broader evidence gap map of adolescent SRH interventions (Rankin *et al.*, 2016). Second, we conducted a systematic search of eight databases, covering the period between 2016 (to avoid duplicating the evidence gap map search) and July 2020, using free-text and controlled terms to identify studies of 'adolescence', 'contraception' and 'LMICs' (see Annex 1 for the search strategy). Third, we conducted extensive searches of relevant organisations' webpages in order to identify unpublished literature.

Phase 1: Mapping the evidence

After the searches were complete and duplicates had been removed, each reference was screened based on title/abstract. Those not excluded at this stage were retrieved and the full text was screened. An initial subset of references were screened by four researchers (HB, SG, MM and JJP) to ensure consistency of understanding and application of criteria. Once at least 80% consistency had been achieved, the remaining references were screened by individual researchers. For references included at title/abstract screening stage, full reports were obtained and screened by two researchers (HB and either SG, MM, JJP or DK). Where agreement could not be reached, the paper was discussed with a third researcher.

Some studies were reported in more than one paper. In these cases, a 'main paper' that presented the outcome used in our review was identified, and secondary papers were 'linked' to it to avoid counting studies multiple times.

For this first phase of the study, we developed a standardised coding tool to capture study information – e.g. setting, activities, population and evaluation methods – and applied it to all the included studies (Burchett *et al.*, 2022a).

Phase 2: Developing a mid-range theory

In this in-depth review phase, we included only those studies that reported contraceptive use outcomes in both the intervention arm(s) and either contemporary control arms or at baseline. This was because the studies' outcomes were felt to be too diverse to be able to combine them into categories of effectiveness, and for our outcome of interest, the methodological issues of historical controls were too great for us to be confident in our categorisation of effectiveness.

We used ICA to develop our mid-range theory. ICA is an iterative, case-based method that involves reading the included references numerous times, extracting information about all aspects of the intervention and its evaluation from all sections of the reports (i.e. not just the

methods and results, but also the introduction and discussion sections). The benefits of the method stem from its ability to draw insights from reports beyond those traditionally incorporated into reviews, particularly those related to the evaluation's context and the intervention's implementation – two factors that are understood to be of critical importance to understanding transferability, as well as to developing theories of complex interventions (Sutcliffe *et al.*, 2015). We considered the characteristics of both the interventions and their evaluations, along with authors' insights into why they believed their interventions were (or were not) effective and insights into the implementation and context of the studies. We compared and contrasted studies and, where different intervention arms within a study yielded different results, we explored the possible factors that might explain this variance. Interspersed with these readings and data extraction, the team discussed the studies through many meetings, when we also considered the different factors that might affect contraceptive use (Burchett *et al.*, 2022b).

Divergence from the protocol

Following completion of the map and the second round of full-text screening using the in-depth inclusion criteria, we extracted contraceptive use outcomes that were as similar to 'current use of hormonal/barrier methods at 12 months' as possible. As planned, we examined the distribution of effect sizes to enable us to categorise studies as follows.

- Likely effective: Studies with an odds ratio (OR) over 1, indicating higher contraceptive use than the control, with a 95% Confidence Interval (CI) that did not include 1.
- Possibly effective: Studies with an OR of 1.5 or more, or with an OR over 1 and a 90% CI that did not include 1 (not 95% CI).
- Possibly ineffective: Studies with an OR between 0.75 and 1.25 and a 90% and 95% CI that included 1.
- Likely ineffective or harmful: Studies with an OR under 1, indicating lower contraceptive use than the control, with a 95% CI that did not include 1, or with an OR lower than 0.75

These categories reflected a balance of the magnitude and direction of the effect size, as well as its precision. Studies where an effect size could not be calculated, or where the precision of the effect size could not be determined, were manually assigned to a category.

We then planned to quality appraise the included studies and conduct an ICA to inform our QCA. However, we did not complete the quality appraisal for all the included studies, as we realised early on in the process that a range of methodological issues were preventing us from feeling confident about categorising the studies as likely or possibly effective or ineffective, but that these issues were not being picked up using in standard quality appraisal tools (see the findings section and Annex 5 for details).

We therefore took the decision to explore all of the studies in depth rather than to focus on only the 'likely effective' and 'likely ineffective' ones. This methodological uncertainty also meant that the planned QCA would not be possible. Instead, we conducted a QCA of methodological issues before conducting an ICA for theory development.

3. Results

Description of the studies

Our searches identified 6,993 references, of which 61, reporting 40 unique intervention evaluations, were included in the evidence map (see Annex 2 for PRISMA flow diagram). Almost half of the studies ($n = 17/40$) had not been published and were only reported in the grey literature.

Almost two-thirds of the studies were conducted in Africa ($n = 24/40$); eight were conducted in Asia, six in South America and three in the Middle East (five were multi-country studies; one spanned two continents) (see Annex 3 for a table of study characteristics).

Half of the studies ($20/40$) aimed to increase contraceptive use or improve SRH, either explicitly or implicitly including contraception. The remaining studies had other aims, such as preventing HIV, delaying early marriage/reducing sexual abuse or reducing poverty/increasing schooling.

There were three main types of structural intervention activities, which were often combined with non-structural intervention components, such as health service staff training or mass media campaigns. Activities aiming to increase economic empowerment were most common ($n = 29$), followed by activities aiming to encourage school participation ($n = 17$) and activities aiming to change community social norms ($n = 13$).

Economic empowerment interventions were the most common type of structural activity in the evaluations. These interventions included different activities: financial literacy training; vocational or livelihoods training; the provision of conditional or unconditional cash or non-cash transfers; microfinance; the creation of savings accounts for girls; or the provision of employment opportunities.

The 17 studies that evaluated interventions aimed at increasing schooling did so either through legislative changes (e.g. extending primary school education/making it free; conditional cash transfers; payment of school fees; provision of school supplies, such as uniforms) or by working with schools, parents and/or communities to support girls re-joining, or remaining in, school.

Thirteen studies explicitly aimed to change community or social norms around gender or SRH and RH issues, although others may also have aimed to do so implicitly. Activities were mostly some form of community meetings and dialogue, such as 'community conversations'. Others involved community groups working through a programme or developing their own action plan.

It was notable that, although not necessarily a structural activity itself, 'safe space groups' were a common intervention activity, present in half the studies (n = 20). Safe space groups were where girls could meet regularly – often with a mentor (typically a slightly older woman from the community) – for education, training and/or recreational purposes. We considered interventions to have a safe space component if they either explicitly described themselves as such, or if they took the form of girls-only groups and mentioned that one of their aims was to increase girls' social/peer networks.

Half the interventions (n = 20) were evaluated using randomised controlled trials (RCTs), 14 were non-randomised controlled trials (nRCTs) and eight were natural experiments using survey data (two studies used different designs in different areas).

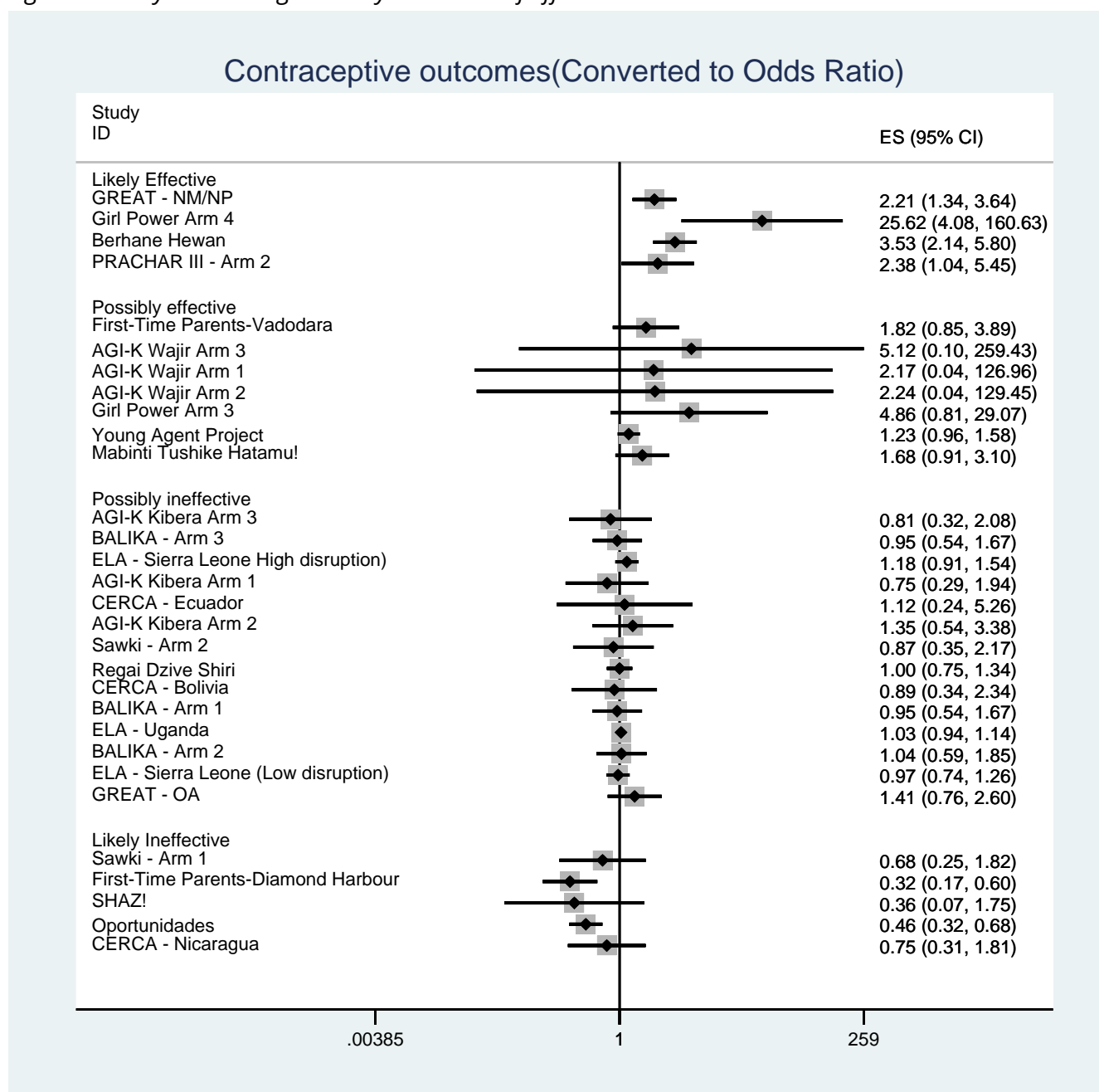
There was variation in the timing of endline outcome data collection, from immediately after the intervention ended to eight years later. For the majority of interventions (n = 30), pregnancy or birth were used as outcome measures. Twenty studies measured contraceptive use and nine included other related measures, such as the ideal number of children or unmet need for family planning (FP).

Following this mapping phase, 17 studies,² with 29 structural intervention arms, were included in the in-depth review. We categorised five study arms as 'likely effective' at increasing contraceptive use^{3f} and five as 'likely ineffective or harmful' (hereafter 'likely ineffective') (Figure 1). The remaining study arms were considered 'possibly effective' or 'possibly ineffective'. There was substantial diversity in terms of methodological considerations, as reported below.

² Three studies reporting contraceptive use outcomes were excluded from the in-depth review, either because they used historical controls (Mexican and Turkish schooling legislation) or because they reported contraceptive use outcomes for the intervention arm only (Safe and Smart Savings).

³ One, DISHA, was not included in the meta-analysis as it did not report control arm data, only baseline data.

Figure 1: Study arms categorised by likelihood of effect⁴



Methodological characteristics

Seven studies used an RCT study design; six of these used cluster RCT (cRCT) designs and two were individually randomised (some studies used different designs in different arms⁵) (see Annex 4 for study design and outcomes). Eight studies used non-randomised (quasi-experimental) designs, two were natural experiments and one used a pre- and post-intervention design.

⁴ See p. 10 for methods of how we categorised studies and study arms.

⁵ One study, AGI-K, used a cRCT design in one arm and an individually RCT in the other. study, CERCA, used an RCT design in one arm and a non-RCT in two other arms.

Control groups varied in terms of the intervention they received or the extent to which they may have been contaminated with the intervention (seen Annex 5 for methodological issues). For example, control groups for the Adolescent Girls Initiative Kenya (AGI-K) study and the Shaping the Health of Adolescents in Zimbabwe (SHAZ!) study both received substantial interventions; in the former, the control group received a structural intervention – community conversations were held on violence prevention and valuing girls (Austrian *et al.*, 2020b). In the latter, the control arm received life skills training, home-based HIV care training, health screening and treatment, and free contraceptives were offered (Dunbar *et al.*, 2014). Five studies had no baseline; in these, effectiveness was assessed through comparison with a control group at endline (Cowan *et al.*, 2010; Darney *et al.*, 2013; Mercycorps, 2015; Hallman *et al.*, 2016; Pandey *et al.*, 2016; Rankin *et al.*, 2016). One study, Development Initiative Supporting Healthy Adolescents (DISHA), presented no findings for their control group; 'in this study, outcomes were compared pre- and post-intervention and considered self-reported exposure to the intervention (Kanesathasan, 2008).

Where available (n = 7), we used the outcome 'current contraceptive use' at the 12-month follow-up. For the remainder of the studies, other measures of contraceptive use were included, e.g. 'ever use of contraception', or 'current use' at a different follow-up time; 'contraceptive use at last sex'; or 'ever used contraception to delay their first birth'. Most had binary answer options, but a minority asked whether use was 'often or always' (e.g. ELA Sierra Leone: Bandiera *et al.*, 2018). All but one study used self-reporting methods to capture this outcome; the exception (Girl Power Malawi) used clinic data for receipt of hormonal implants, injections or the contraceptive pill, corroborated with self-reported use (Rosenberg *et al.*, 2018a). There was also variation in what types of contraception were included in the outcome. Some studies, e.g. Promoting Change in the Reproductive Behaviour of Adolescents – Phase III (PRACHAR III), included emergency contraception (Pandey *et al.*, 2016), while others asked about condom use separately from hormonal contraception, which may have led to underestimates of actual contraceptive use (e.g. Empowerment and Livelihoods for Adolescents (ELA) Uganda; AGI-K) (Bandiera *et al.*, 2020a; Austrian *et al.*, 2020b). Several did not specify which types of contraceptive methods were included in their outcome measure.

Contraceptive use was measured among different samples. In some studies, those who received the intervention were then followed up at endline, whereas others sampled adolescents from the intervention community regardless of whether they had been directly exposed to the intervention. Some only asked married respondents about their contraceptive use, e.g. Berhane Hewan (Erulkar and Eunice, 2009). One study, Community-Embedded Reproductive Health Care for Adolescents (CERCA), asked all endline participants about their contraceptive use without disaggregating male/female responses and counting all those who had never had sex as not using contraception (Michielsen *et al.*, 2015). Only one study, SHAZ!, specified that they asked this question of those who had reported having sex in the previous

month (Dunbar *et al.*, 2014). Two other studies reported only asking those who were 'sexually active' about their contraceptive use, but failed to define whether this meant respondents had ever had sex, whether they had had sex within a specific period of time or whether the sex was vaginal (Bandiera *et al.* 2020a; Bandiera *et al.*, 2020b). In general, questions referring to sex did not distinguish between vaginal and other types, despite this having implications for contraceptive outcome measures (as well as the risk of pregnancy).

Several interventions aimed at delaying sexual initiation and, when successful, the intervention itself would therefore have reduced the size of the subsample of participants who had ever had sex and were asked about their contraceptive use relative to the control arm. Conceptual issues around the changing nature of the denominator was not often acknowledged within trial reports. In some studies, only a minority of participants had ever had sex at endline (Michielsen *et al.*, 2015; Austrian *et al.*, 2020b), or it was unclear how many had ever had sex at endline (e.g. PRACHAR III; DISHA) (Kanesathasan, 2008; Pandey *et al.*, 2016). Although most studies only asked participants who had ever had sex about their contraceptive use, it should also be noted that this assumed these respondents were continuing to have regular sex. However, data from the SHAZ! study showed that only a minority of the 16–19-year-olds in their study who had ever had sex had done so in the previous three months (Dunbar *et al.*, 2014). Even among a group of married and/or parenting adolescents in the Gender Roles, Equality and Transformations (GREAT) project study, only 70–80% had had sex in the previous three months (Wadiembe *et al.*, 2015). This has implications for 'current contraceptive use' as an outcome measure; sexually initiated respondents who are not currently sexually active might be recorded as not using any current contraception, despite not being at risk of pregnancy. Arguably, a more pertinent outcome measure would be frequency of unprotected vaginal sex, but this was only rarely used (e.g. in the ELA Sierra Leone study) (Bandiera *et al.*, 2018).

Quality of the studies

As explained in the methods section, we did not complete a formal quality appraisal for the studies included in the in-depth review phase of the project. Instead, a QCA was conducted that focused on methodological factors.

None of the studies with arms that were categorised as 'likely effective' had been evaluated using an RCT study design, whereas two of the 'likely ineffective' had been (SHAZ! and CERCA) (Dunbar *et al.*, 2014; Michielsen *et al.*, 2015). The QCA identified methodological issues in both the 'likely effective' and 'likely ineffective' sets of studies, as well as for the 'possibly effective' and 'possibly ineffective' sets. A table of the methodological characteristics considered in the QCA is shown in Annex 6.

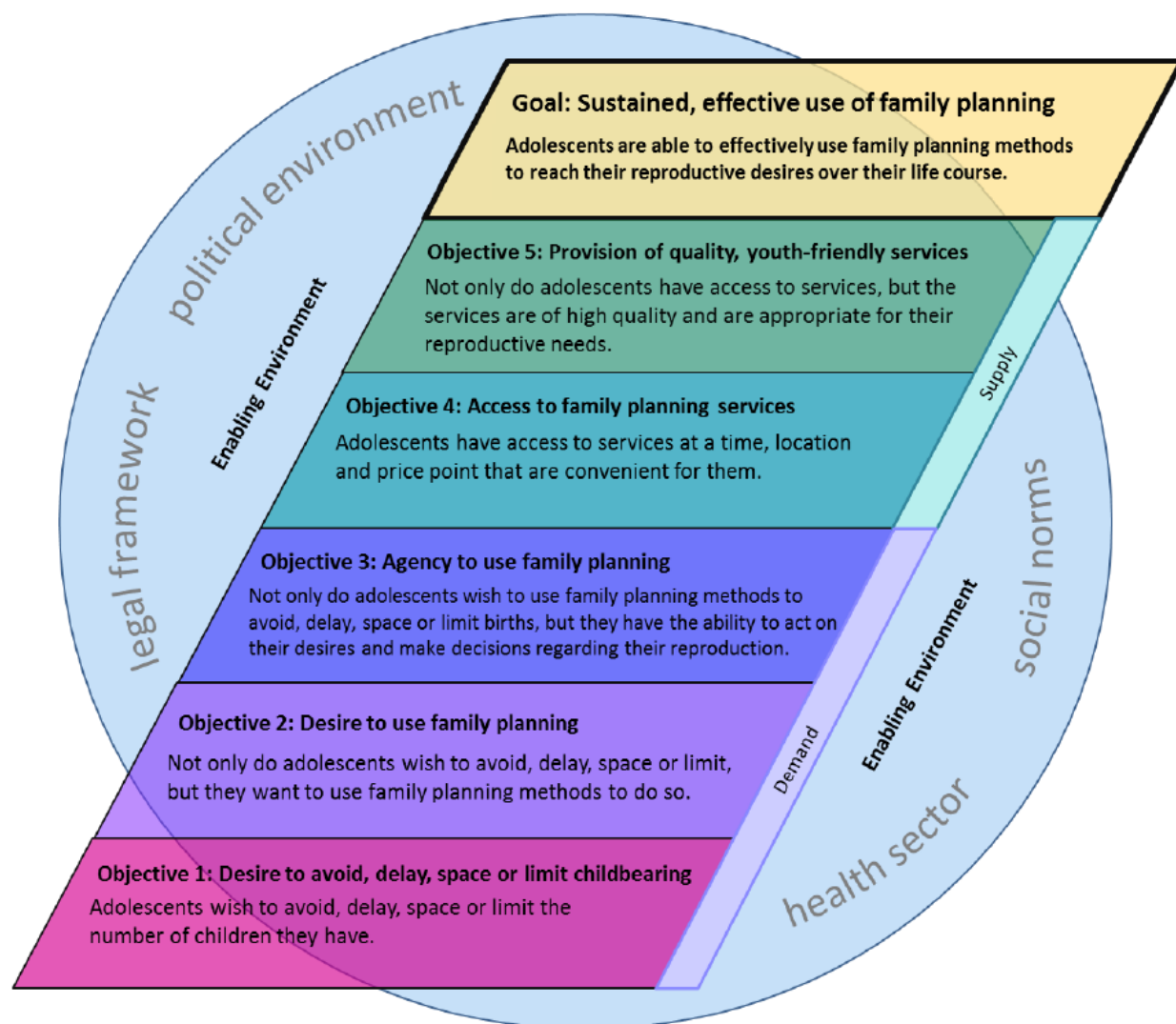
Using QCA methods, we developed a truth table from this data table with characteristics that might detract from or improve confidence in the findings: whether the study was an RCT; whether it included a control group; and whether the measures were collected among a relevant population (sexually active females) (see Annex 6). We were only able to identify a configuration with a single likely effective study with methodologically weak characteristics, with other likely effective studies distributed across other configurations.

Notably, the truth table shows that no configuration of studies was identified that had no risk of bias in terms of selection (offset by an RCT design) and no risk of attribution bias (offset by having a control group and measuring the outcome among sexually active participants). In short, it is not possible to say with any certainty what characteristics of interventions – their implementation or the setting in which they were evaluated in – were associated with ‘likely effective’ or ‘likely ineffective’ studies. Any observations made would be undermined by serious methodological issues. Instead, the remainder of the paper presents an alternative synthesis approach using ICA.

A mid-range theory for contraceptive use interventions

In view of the methodological issues discussed above, we used ICA to develop a mid-range theory drawing on evidence from the full set of studies, not just those identified as ‘likely effective’ or ‘likely ineffective’. To develop a mid-range theory that can then be tested through rigorous evaluations in the future, we used existing conceptual models and frameworks as our foundation. This meant that we were not ‘reinventing the wheel’ but building on cumulative knowledge, in combination with examples from the intervention evaluations identified. We built on an existing conceptual framework developed by the International Center for Research on Women (ICRW) (Glinski *et al.*, 2014), which has been recognised by others as useful (Rankin *et al.*, 2016; Chandra-Mouli and Akwara, 2020). The framework contains three demand-side and two supply-side objectives (plus an enabling environment – hereafter referred to as the sixth objective) that ICRW proposes leads to sustained effective contraceptive use (Figure 2).

Figure 2: ICRW's conceptual framework for adolescent family planning use (Glinski et al., 2014)



While Objective 2 and Objectives 4–5 could be addressed through non-structural interventions (e.g. information provision to increase desire to use contraception; service delivery improvements to increase access to contraceptive services; and providing quality, youth-friendly services), Objectives 1, 3 and 6 (desire to avoid/delay/space/limit childbearing; agency to use contraception; and an enabling environment) are strongly influenced by upstream factors that are likely to be best addressed by structural interventions. We theorise that, for contraceptive use to be enabled, all six objectives need to be met. Some objectives may already have been met at baseline, in which case interventions should focus on those objectives that are still outstanding. In many cases, interventions will need to be multi-component, incorporating both structural and non-structural elements in order to ensure all six objectives are met.

We propose three steps to design effective interventions that ensure the six objectives are met, based on an ICA of the studies included in this review: 1) tailor interventions to the adolescent life stage; 2) assess the baseline situation for each objective; and 3) select appropriate intervention activities to match objectives.

Step 1: Tailor interventions to the adolescent life stage

Only five of the 17 studies took account of different life stages. One, the First-Time Parents Project, focused exclusively on married adolescents, although it did not distinguish outcomes between nulliparous girls and parents (Santhya *et al.*, 2008). Another study, AGI-K, focused on very young adolescents (Austrian *et al.*, 2020b), and three more provided different interventions depending on life stage: Berhane Hewan, for unmarried and married girls (Erulkar and Eunice, 2009); GREAT, for unmarried nulliparous and married/parents (indeed this intervention explicitly aimed to ‘test life-stage specific strategies’: Wadiembe *et al.*, 2015, p. 1); and PRACHAR III, which tailored the interventions by both marital status and parity (Pandey *et al.*, 2016).

Adolescence is a time when girls can transition rapidly through different life stages. Girls at different life stages (e.g. nulliparous or parents; married or unmarried; with or without a regular partner) will likely have very different situations, needs and intervention requirements relating to contraception. Those commissioning or developing interventions, and those designing evaluations, must recognise that adolescent girls are not a homogenous group and should decide explicitly which life course stages they wish to target before the intervention activities are selected and to ensure evaluations assess effectiveness in different subgroups.

Married adolescent girls often experience different pressures and experiences in comparison with unmarried girls. Some studies noted social pressure – often exerted by family and partners, as well as by society more widely – for newly married adolescent girls to have children. Yet at the same time, contraception might also become more accessible as it becomes more socially acceptable for girls to be sexually active. Some interventions noted that it was easier to increase contraceptive use among married than among unmarried women, e.g. Regai Dzive Shiri (Cowan *et al.*, 2010), although others were able to increase use among both married and unmarried women (albeit with higher contraceptive use rates among the former) (e.g. Girl Power Malawi: Rosenberg *et al.*, 2018a). The importance of tailoring interventions to married adolescent girls at different life stages was noted by those evaluating the First-Time Parents Project, who recognised that some women would be trying to conceive while others would want to delay their first pregnancy, or would be pregnant or new mothers (Santhya *et al.*, 2008).

Motherhood is a life stage that can affect the ease with which adolescent girls feel willing and able to use contraception. There is evidence from the included studies that interventions are often more successful at spacing subsequent births than at avoiding first births, e.g. Oportunidades, PRACHAR III (Gulemetova, 2011; Pandey *et al.*, 2016). Social and familial

pressure to have children can ease after the first birth, and new parents gain access to health services that may have been harder to reach when nulliparous.

Even among unmarried nulliparous girls, circumstances may vary. Those with a regular partner are more likely to use a hormonal contraceptive, while those without are less likely to use contraception overall, but if they do they are often more likely to use condoms (e.g. CERCA: Decat, 2016).

Younger adolescents and those in school are often easier for interventions to reach than older adolescents and those out of school, which could not only affect what interventions are suitable and how best to recruit and engage participants, but can also affect outcomes – e.g. the Bangladeshi Association for Life Skills, Income and Knowledge for Adolescents (BALIKA), CERCA and GREAT (Michielsen *et al.*, 2015; Wadiembe *et al.*, 2015; Amin *et al.*, 2016). How livelihoods training or support for schooling is experienced and the effect they have may differ depending on the life course stage and the age of the adolescent girls involved. Some studies, e.g. the Young Agent Project, found greater impact among older than among younger adolescents, possibly due to greater agency or reflecting differences between those having sex at a younger age and those with a later sexual debut (Martinez-Restrepo, 2012).

The baseline situation in relation to each objective of the ICRW framework may vary by life stage, as may the activities required to achieve each objective. The framework could be further broken down by life stage: for example, the desire to space births among mothers is distinct from the desire to delay or avoid childbearing among nulliparous women, and the same intervention activities may not have the same effect on both of these ‘sub-objectives’. Whereas spousal communication and spousal support for contraception may be important to increase girls’ agency to use contraceptives among married adolescents (as will be discussed in more detail later), this is less likely to have an immediate effect for unmarried adolescents without a regular partner, but may be of use in the future when they do have a regular partner.

Step 2: Assess the baseline situation for each objective

It seems logical that all six objectives would need to be met in order to attain higher rates of contraceptive use. However, it may be that interventions do not necessarily need to target all six objectives if one or more have already been met.

While most studies had some form of baseline (although not all used these to compare outcomes at endline) or formative research, few reported the baseline levels of the six objectives. Furthermore, a lack of consensus about which indicators are most appropriate to measure each objective means it was not possible to compare the studies’ baseline situations.

In the first step of the intervention development process, the context and experience of adolescents (at the life stage being targeted) should be assessed to ascertain the baseline situation in relation to each objective. This will allow an understanding of which objectives

should be focused on and prioritised in the intervention package. For example, married adolescent mothers may already have a desire to space or limit childbearing, but may lack the desire or agency to use FP. In this case, an intervention should target these two objectives rather than the former. In assessing the context, the need for tailored consideration of life stages remains. For example, it may be that youth-friendly contraceptive services exist but are only 'youth-friendly' for married youth, with barriers or concerns about confidentiality still perceived by unmarried adolescent girls.

Understanding the local context is of critical importance. If there is already (as is often assumed in many contexts) a high desire to avoid or delay childbearing among unmarried adolescents with no regular partner, interventions need not focus on activities to increase it, as was the case among unmarried adolescents at baseline in PRACHAR III (Pandey *et al.*, 2016). Instead, intervention efforts should focus on other parts of the pathway. In summary, interventions may not need to address all six objectives, but rather, an understanding of the baseline situation is required.

Step 3: Select appropriate intervention activities to match objectives

Studies rarely stated explicitly whether they were attempting to address specific objectives within the broader goal of increasing contraceptive uptake (e.g. whether they aimed to increase desire to limit, avoid/space births or improve access to FP services).

Once the target subpopulation is selected and the focus of the intervention has been determined following an assessment of the baseline situation, the specific intervention strategies can be selected. As mentioned above, structural intervention activities could most usefully target three objectives in the framework – Objective 1: desire to avoid, delay, space or limit childbearing; Objective 3: agency to use contraception; and Objective 6: an enabling environment. The remaining three objectives could be addressed primarily through non-structural interventions (e.g. mass media campaigns or sex education for Objective 2: desire to use FP; and service delivery improvements for Objective 4: access to FP and Objective 5: youth-friendly services). However, structural interventions could still have a direct or indirect effect on these, for example an intervention aiming to increase participation in school could increase desire to use FP by increasing access to school-based sex education, while economic empowerment interventions could increase the affordability of contraception, thereby addressing access.

A) Interventions aiming to increase desire to limit/avoid/space/delay childbearing

Within this objective, we view the desire to limit, avoid or delay childbearing as distinct from the desire to space births. Almost all of the studies focused either on delaying or avoiding first births (or did not specify which of these were focused upon). None focused solely on the objective of spacing subsequent births, although a small minority of studies explicitly targeted

this alongside delaying first births (e.g. Institute for Reproductive Health Georgetown University, 2016; Pandey *et al.*, 2016). Interventions aiming to delay or space births often provided information about the risks of early pregnancy and short birth spaces, or the benefits to the mother and existing child(ren) of delaying or spacing births, as well as structural interventions.

The structural interventions included in our review, which aimed to increase the desire of adolescent girls to delay or avoid first births, did so by trying to increase the value of girls beyond motherhood. This may relate to either their potential future value (e.g. by increasing their aspirations, education or future employment opportunities) or their current value (e.g. through skills training or economic opportunities). Interventions could target girls' perceptions of their own value, the perceptions of the husband or family and/or the perceptions of the wider community.

Interventions to increase girls' future value aimed to increase girls' aspirations through vocational training, encouraging schooling or provision of life skills. For example, the BALIKA study included an arm providing vocational training for two weeks, which aimed to increase aspirations (as opposed to providing sufficient training for work) (Amin *et al.*, 2016). The Sawki study aimed to enhance girls' current value through income generation activities (Mercycorps, 2015), while in Berhane Hewan, married adolescent girls were given skills and support to improve the nutritional status and living conditions of their families through gardening and learning to build basic furniture and more efficient cooking fires (Karei and Erulkar, 2010).

Few studies measured the desire to delay or space births, or indicators of aspirations. An exception was the ELA Uganda study, which aimed to 'break the vicious cycle between low participation in skilled jobs and high fertility' (Bandiera *et al.*, 2020a, p. 212). They combined vocational training with life skills training, delivered through a safe space model. They found that perceptions of what age was suitable for women to have their first child increased significantly among girls in the intervention arm compared to those in the control arm (Bandiera *et al.*, 2020a). The Sawki study compared a control arm to a safe space intervention and to a safe space plus livelihoods training intervention (Mercycorps, 2015). Girls in both intervention arms reported a higher ideal age at childbirth compared to the control; this was highest in the arm offering livelihoods training.

The ethics and public health benefits of avoiding or delaying childbearing among older adolescents is beyond the scope of this project, but should nevertheless be considered by those developing or funding interventions.

B) Structural interventions aiming to increase agency to use contraception

The concept of agency is fundamental to many of the included studies, albeit addressed in diverse ways. The ICRW framework describes barriers to agency to use contraception, such as limited decision-making autonomy and power for girls, early marriage, family pressures, poor partner communication, sexual violence and transactional sex and limited self-efficacy (Glinski

et al., 2014). It is clear that 'agency' is a multidimensional construct requiring further unpacking.

A conceptual model of women and girls' empowerment, developed in 2017, recognises three key elements within agency: choice, voice and power (van Eerdewijk *et al.*, 2017). Although the included studies provide examples of activities aiming to develop one or more of these three elements, there is insufficient evidence to identify which aspects of agency should be targeted to enable contraceptive use, or how to increase specific aspects of agency in relation to contraceptive use.

Intervention activities aiming to increase adolescent girls' agency could aim to have impact at three levels: the societal, the interpersonal and the individual adolescent girl. Overarching patriarchal norms pervade not only community gender norms, but also social and governmental systems and structures. This, combined with norms around children's power and voice, means that the agency of girls cannot be substantially improved by targeting girls alone. Gender transformative interventions target the societal level and aim to shift norms around women's roles, value and gender equity. This overlaps with Objective 6 (develop an enabling environment) and will be discussed further below.

The importance of targeting the interpersonal level (i.e. partners, parents and other family members) has also been recognised. Indeed, most interventions included in this review (n = 11/18) addressed the role played by boys, partners, parents and/or the wider community. However, when we look at how studies aimed at increasing interpersonal agency, most did so through communication skills training targeting girls, or girls and boys. Some also incorporated training or awareness raising of girls and boys, partners and/or parents or the wider community, around gender norms and healthy relationships. Nevertheless, some studies did go beyond training or awareness raising, for example creating discussion groups for 'adult-youth partnership' (DISHA: Kanesathasan, 2008); for parents (Regai Dzive Shiri and CERCA: Cowan *et al.*, 2010; Michielsen *et al.*, 2015); and for young married husbands (PRACHAR III: Pandey *et al.*, 2016).

In terms of targeting aimed at the individual level, we can identify several different intervention options used in the included studies for van Eerdewijk *et al.*'s model of choice, voice and power (Table 1) (van Eerdewijk *et al.*, 2017).

Table 2: Summary of intervention activities targeting adolescent girls to increase their agency

Agency element	Agency sub-element	Example intervention activities
Choice	Aspirations/opportunities	Livelihoods experience Support for schooling Employment opportunities
	Value beyond motherhood	Livelihoods training/vocational support Income generating support Practical skill development Employment opportunities Cash transfers
Voice		Community development/civic engagement projects Communication/negotiation training SRH training Gender rights training
Power	Power to make decisions	Decision-making training Experience of decision-making Economic empowerment
	Power within (esteem)	Safe space groups – to build confidence
	Power with (support)	Safe space groups – to build social network Safe space – mentors

Assessing whether interventions were successful in empowering girls is challenging without a consensus about what empowerment is, or what indicators could measure it. A range of indicators were used to capture different aspects of agency. It is difficult to know which indicators map directly onto contraceptive agency. For example, in AGI-K, Arms 3 and 4 had no effect on general self-efficacy compared to Arm 1 (control), nor did they impact on girls' perceptions of gender norms or the acceptability of intimate partner violence. However there was a positive impact on condom self-efficacy and help-seeking self-efficacy (Austrian *et al.*, 2020b). The extent to which condom self-efficacy and help-seeking self-efficacy align with contraceptive self-efficacy is not clear, particularly since the former requires much greater buy-in from male partners than other, female-controlled contraceptive methods.

The most commonly used agency indicators related to spousal communication, either generally or with regards to contraception, or spousal support (or adolescent girls' perceptions of their support) for contraception. Only a minority of studies evaluated whether interventions had an effect on partners, parents or community members. For example, CERCA

asked adolescents whether they communicated with their partner or with their parents, about 'sexuality' (Kanesathasan, 2008).

A minority of studies measured outcomes relating to choice, mostly related to the desired age at first birth or the desired number of children. Sawki was unusual in that it asked girls whether they felt in control of, and had hope for, their future (Mercycorps, 2015). Few interventions measured indicators of 'voice', particularly not their capacity to voice their opinions in relation to their own contraceptive or fertility behaviours specifically. For example, the First-Time Parents Project reported the intervention's effect on women's ability to express their own opinion to their husband when they disagreed with them, but this was not specific to contraception or fertility (Santhya *et al.*, 2008). In terms of 'power', although some studies measured their interventions' effect on self-efficacy, few measured contraceptive self-efficacy specifically. The GREAT study asked adolescents about 'their confidence to use contraceptives correctly all the time', their 'knowledge of the location of FP services and their 'ability to easily reach the location of FP services', which they combined into a composite contraceptive self-efficacy indicator (Wadiembe *et al.*, 2015, p. 42). A few measured confidence in terms of whether the respondents felt important (Sawki) or in terms of adolescent girls' gender norm attitudes (Mercycorps, 2015). Finally, some studies measured the effect of interventions on social networks and social support – elements of 'power with' (e.g. the number of female friends); whether they had a friend they met regularly, or a place to meet friends (e.g. Sawki); or whether they communicated with a friend about 'sexuality' (sic) (e.g. CERCA: Mercycorps, 2015; Michielsen *et al.*, 2015).

The lack of consensus around which indicators to measure to capture interventions' effect on elements of agency clearly inhibits the development of a strong evidence base in this area.

C) Structural interventions aiming to foster an enabling environment

An enabling environment underpins all five other objectives in the ICRW framework and is therefore fundamental to interventions aiming to enable adolescent contraceptive use. Two main activities were used in the included interventions to foster an enabling environment: active engagement with communities to change social norms related to gender, adolescence, fertility and/or contraception; and activities to demonstrate the value of adolescent girls beyond motherhood.

Several interventions actively and intensively engaged with the community to attempt to develop an enabling environment for adolescent girls' contraceptive use. For example, in AGI-K, committees were established (albeit in the control arm as well as the intervention arms) where facilitated 'community conversations' were used to 'identify key issues in the community that lead to the undervaluing of girls and the perpetuating of violence against girls and women', as well as to develop an action plan to address the challenges they identified as being faced by girls in their area, with a small fund to assist its implementation (Austrian *et al.*, 2020b, p. 3).

Activities to demonstrate the value of girls beyond motherhood were rarely explicit about this aim. In many cases, it was not clear whether intervention activities were aiming to, or were successful in, changing perceptions of girls' value. Some interventions used innovative activities; for example, BALIKA developed girls' digital skills (e.g. the use of computers and tablets, which were novel in the context), and this helped change perceptions of girls as liabilities, turning them into 'potentially important assets' (Amin *et al.*, 2016, p. 36). In Berhane Hewan, married adolescent girls were given seeds, training and support to start a small garden to provide food for their families, and were also trained in other home-improvement activities such as furniture construction and building fuel-saving stoves (Karei and Erulkar, 2010).

It was rare for an evaluation to assess whether community attitudes or beliefs had changed. Two exceptions were the GREAT study, which surveyed adults (as well as adolescents) and asked them a range of questions about their attitudes related to gender, adolescent sex and fertility (Wadiembe *et al.*, 2015), and DISHA, which measured adults' attitudes to whether contraceptive information should be available for adolescents (Kanesathasan, 2008).

4. Conclusions

Main results

Our map identified a range of structural interventions aiming to address upstream factors that have been evaluated in terms of their impact on adolescent contraceptive use and/or pregnancy/birth. Furthermore, aside from the variation in the intervention content, there is diversity in the populations targeted and settings. The evaluations were also diverse in terms of the study design, follow-up period and outcome measures.

Limitations in the evidence prevented us from identifying which intervention factors were associated with effectiveness. Through a case-based analysis of studies, we propose a mid-range theory for structural adolescent contraception interventions. This sets out that interventions should be tailored to the specific life stage of the adolescent, focus on elements where baseline gaps have been demonstrated and incorporate intervention activities to address gaps in terms of motivation, agency and access to contraception.

Strengths and limitations of the project

A limitation of our work stems from a lack of consensus around what constitutes a structural intervention, as well as challenges around classifying interventions as structural or not based on sometimes limited information in the available documentation. As such, we may have excluded interventions that others consider structural, or included some that others would not consider structural. Nevertheless, we are not aware of any other review that has identified a similar number and range of structural interventions evaluating contraceptive/childbearing outcomes as we have. This supports our belief that a strength of our systematic approach to identifying studies (see the systematic map) is its comprehensiveness and its inclusion of grey literature from a number of sources. Others have noted the importance of this, particularly for structural interventions (Nkhoma *et al.*, 2020).

A clear limitation of our in-depth review is our inability to ascertain which studies were 'likely effective' or 'likely ineffective' due to serious methodological concerns about a number of the studies, including several that would otherwise be considered 'effective'. These concerns revolved around study design, but there were also conceptual issues around the measurement of the outcome and around the sample from whom outcomes were measured. This impeded the work that we had planned to do, identifying critical components or features of effective and ineffective groups of studies. We are further limited by the methodological and intervention heterogeneity of the included studies, as well as the information provided in study documentation. Nevertheless, a strength of this study is the comprehensiveness of the

search, which identified several unpublished studies and, by including a range of intervention types and study designs, was able to draw on a broad evidence base to develop the theory proposed. A further strength lies in the methods used, which enabled us not only to consider the methods and outcomes reported, but also to give in-depth consideration to the process, context and experience of the studies, bringing in evidence from qualitative and quantitative data and from study authors' insights into the process of the intervention and its evaluation. Finally, we built on and developed an existing, respected framework to further understandings of how to operationalise it, particularly with regard to structural intervention activities. The new preliminary steps outlined here should help future triallists and policy-makers to consider the match between their specific target population, its needs and the intended intervention activities.

Implications for practice

We have proposed three steps that practitioners should take when developing a structural adolescent contraceptive intervention for their specific context: 1) tailor interventions to the adolescent life stage; 2) assess the baseline situation; and 3) select appropriate intervention activities to match gaps, particularly relating to interventions aimed at increasing desire to limit/avoid/space/delay childbearing, at increasing agency to use contraception and at fostering an enabling environment. These steps will help those developing adolescent contraceptive interventions to ensure the use of the most appropriate intervention activities for their particular setting and scenario.

Implications for research

We encourage those implementing, researching and funding activities in this field to engage in discussions around the methodological challenges highlighted. Reaching a consensus around which indicators and outcome measures to use, as well as other aspects of study design such as the optimal duration of follow-up (particularly for interventions targeting very young adolescents), will enhance future studies and their comparison and synthesis. In particular, consensus around which indicators are most useful and feasible for assessing the six ICRW framework objectives, as well as how best to assess specific aspects of contraceptive agency, is of critical importance.

Future research is needed to develop our understanding of how interventions can increase agency for contraceptive uptake in adolescents, as well as which aspects of agency are critical for contraceptive empowerment in different contexts. Research is also needed into the most effective approaches to develop an enabling environment.

Further work is now needed to test, and potentially refine, the proposed theory through the development and evaluation of structural interventions to enable adolescent contraceptive use in a variety of LMIC settings, with a range of adolescent target populations.

These steps should lead to the development of a rich and useful evidence base to support future activities aiming to enable adolescent contraceptive use in LMICs.

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Annex 1: Search strategy

Databases searched

The following bibliographic databases were searched on 29 and 30 July 2020:

- OvidSP Medline ALL (1946 to 27 July 2020)
- OvidSP Embase (1947 to 29 July 2020)
- OvidSP Global Health (1910 to 2020 week 29)
- Ebsco CINAHL Plus (complete database to search date)
- Ebsco Africa-Wide Information (complete database to search date)
- Clarivate Analytics Web of Science, Science Citation Index-Expanded (1970–present; data last updated 16 September 2020)
- ProQuest ERIC (1966 to search date)
- World Health Organization (WHO) Global Index Medicus (complete database to search date)

Websites hand searched

1. Advocates for Youth
2. Family Health International
3. Guttmacher Institute
4. Interagency Youth Working Group
5. International Center for Research on Women (ICRW)
6. International Planned Parenthood Federation
7. Family Planning High Impact Practices:
8. Marie Stopes International
9. Pathfinder International
10. Population Council
11. United Nations Population Fund
12. United Nations Children's Fund
13. World Health Organization (WHO)
14. National Bureau of Economic Research
15. World Bank (2016 onwards)
16. JSI (2016 onwards)

Example search strategy: Medline OvidSP

1. adolescent/or child (2,806,512)
2. puberty/or menarche (17,517)
3. homeless youth (1,290)
4. minors (2,576)
5. disabled children (6,288)
6. students (58,686)
7. child*.ti,ab. (1,383,127)
8. (girl or girls or boy or boys).ti,ab. (229,162)

9. (paediatric* or pediatric*).ti,ab. (350,866)
10. (schoolage* or (school adj1 age*)).ti,ab. (22,762)
11. minor*.ti,ab. (295,741)
12. ((school or college) adj3 (pupil* or student*)).ti,ab. (46,075)
13. prepubescen*.ti,ab. (1,008)
14. puberty.ti,ab. (27,560)
15. pubescent*.ti,ab. (865)
16. adolescen*.ti,ab. (278,039)
17. juvenil*.ti,ab. (81,699)
18. underage*.ti,ab. (1,211)
19. (preteen* or pre-teen*).ti,ab. (481)
20. (teen or teens or teener).ti,ab. (10,684)
21. teenage*.ti,ab. (21,165)
22. (youth or youths).ti,ab. (72,797)
23. young people*.ti,ab. (28,285)
24. young person*.ti,ab. (3,499)
25. young wom#n.ti,ab. (30,614)
26. (young man or young men).ti,ab. (20,422)
27. (highschool or (high adj1 school*)).ti,ab. (32,452)
28. sophomore*.ti,ab. (708)
29. (university adj3 student*).ti,ab. (19,647)
30. (transition adj4 adult*).ti,ab. (4,374)
31. emerging adult*.ti,ab. (2,446)
32. young adult*.ti,ab. (94,952)
33. early adult*.ti,ab. (7,360)
34. freshm?n.ti,ab. (2,313)
35. (('10' or '11' or '12' or '13' or '14' or '15' or '16' or '17' or '18' or '19') adj (year* old or year* of age)).ti,ab. (169,296)
36. ((ten or eleven or twelve or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen) adj (year* old or year* of age)).ti,ab. (4,540)
37. (age* adj ('10' or '11' or '12' or '13' or '14' or '15' or '16' or '17' or '18' or '19') adj year*).ti,ab. (36,798)
38. (age* adj (ten or eleven or twelve or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen) adj year*).ti,ab. (183)
39. or/1-38 (3,983,043)
40. exp Contraception (26,828)
41. Family Planning Services (24,812)
42. exp Contraceptive Devices (25,273)
43. Contraception Behavior (8,044)
44. family planning.ti,ab. (21,238)
45. contracept*.ti,ab. (67,679)
46. ((childbear* or pregnan*) adj2 (avoid* or delay* or prevent* or limit* or space or spacing or timing)).ti,ab. (9,890)
47. or/40-46 (116,173)

48. Developing Countries (74,803)
49. ((developing or less* developed or under developed or underdeveloped or middle income or low* income) adj (economy or economies)).ti,ab. (561)
50. ((developing or less* developed or under developed or underdeveloped or middle income or low* income or underserved or under served or deprived or poor*) adj (countr* or nation? or population? or world)).ti,ab. (101,164)
51. (low* adj (gdp or gnp or gross domestic or gross national)).ti,ab. (247)
52. (low adj3 middle adj3 countr*).ti,ab. (16,855)
53. (Imic or Imics or third world or lami countr*).ti,ab. (7,757)
54. transitional countr*.ti,ab. (160)
55. global south.ti,ab. (394)
56. 'Democratic People's Republic of Korea' (229)
57. (North Korea or (Democratic People* Republic adj2 Korea)).ti,ab. (421)
58. Cambodia (3,310)
59. Cambodia.ti,ab. (3,856)
60. Indonesia (10,492)
61. (Indonesia or Dutch East Indies).ti,ab. (12,412)
62. (Kiribati or Gilbert Islands or Phoenix Islands or Line Islands).ti,ab. (244)
63. Laos (1,922)
64. (Laos or (Lao adj1 Democratic Republic)).ti,ab. (1,966)
65. Micronesia (1,172)
66. Micronesia.ti,ab. (656)
67. Mongolia (1,792)
68. Mongolia.ti,ab. (4,033)
69. Myanmar (2,472)
70. (Myanmar or Burma).ti,ab. (4,131)
71. Papua New Guinea (3,453)
72. (Papua New Guinea or German New Guinea or British New Guinea or Territory of Papua).ti,ab. (4,504)
73. Philippines (8,326)
74. (Philippines or Philippine Islands).ti,ab. (8,346)
75. Solomon Islands.ti,ab. (805)
76. Timor-Leste (204)
77. (Timor-Leste or East Timor or Portuguese Timor).ti,ab. (525)
78. Vanuatu (352)
79. (Vanuatu or New Hebrides).ti,ab. (690)
80. Vietnam (12,258)
81. (Viet Nam or Vietnam or French Indochina).ti,ab. (15,137)
82. American Samoa (183)
83. American Samoa.ti,ab. (362)
84. exp China (193,285)
85. China.ti,ab. (180,908)
86. Fiji (944)
87. Fiji.ti,ab. (1,704)

88. Malaysia (15,038)
89. (Malaysia or Malayan Union or Malaya).ti,ab. (16,085)
90. Marshall Islands.ti,ab. (302)
91. Nauru.ti,ab. (153)
92. 'Independent State of Samoa' (247)
93. ((Samoa not American Samoa) or Western Samoa or Navigator Islands or Samoan Islands).ti,ab. (559)
94. Thailand (26,407)
95. (Thailand or Siam).ti,ab. (26,674)
96. Tonga (244)
97. Tonga.ti,ab. (431)
98. (Tuvalu or Ellice Islands).ti,ab. (74)
99. Melanesia (1071)
100. Melanesia.ti,ab. (301)
101. Polynesia (1,873)
102. Polynesia.ti,ab. (1,298)
103. Kyrgyzstan (1,285)
104. (Kyrgyzstan or Kyrgyz Republic or Kirghizia or Kirghiz).ti,ab. (980)
105. Moldova (688)
106. Moldova.ti,ab. (515)
107. Ukraine (15,939)
108. Ukraine.ti,ab. (4,675)
109. Uzbekistan (1,895)
110. Uzbekistan.ti,ab. (1,104)
111. Albania (839)
112. Albania.ti,ab. (1,051)
113. Armenia (1,408)
114. Armenia.ti,ab. (1,044)
115. Azerbaijan (1,202)
116. Azerbaijan.ti,ab. (1,353)
117. 'Republic of Belarus' (2,064)
118. (Belarus or Byelarus or Byelorussia or Belorussia).ti,ab. (1,543)
119. Bosnia-Herzegovina (2,121)
120. (Bosnia or Herzegovina).ti,ab. (2,317)
121. Bulgaria (6,358)
122. Bulgaria.ti,ab. (4,189)
123. 'Georgia (Republic)' (1,802)
124. Georgia.ti,ab. not Georgia (5,960)
125. Kazakhstan (2,665)
126. (Kazakhstan or Kazakh).ti,ab. (2,743)
127. Kosovo (202)
128. Kosovo.ti,ab. (923)
129. Montenegro (214)
130. Montenegro.ti,ab. (823)

131. 'Republic of North Macedonia' (557)
132. North Macedonia.ti,ab. (55)
133. Romania (10,034)
134. Romania.ti,ab. (5,512)
135. exp Russia (53,208)
136. 'Russia (Pre-1917)' (5,981)
137. USSR (42,765)
138. (Russia or Russian Federation or USSR or Union of Soviet Socialist Republics or Soviet Union).ti,ab. (28,150)
139. Serbia (3,133)
140. Serbia.ti,ab. (4,315)
141. Turkey (34,585)
142. (Turkey.ti,ab. not animal/) or (Anatolia or Asia Minor).ti,ab. (25,104)
143. Turkmenistan (576)
144. Turkmenistan.ti,ab. (343)
145. Tajikistan (741)
146. Tajikistan.ti,ab. (580)
147. Asia, Central (475)
148. Asia, Northern (20)
149. Central Asia.ti,ab. (2,269)
150. Haiti (3,156)
151. (Haiti or Hayti).ti,ab. (3,035)
152. Bolivia (2,571)
153. Bolivia.ti,ab. (3,228)
154. El Salvador (871)
155. El Salvador.ti,ab. (1,237)
156. Honduras (1,119)
157. Honduras.ti,ab. (1,737)
158. Nicaragua (1,480)
159. Nicaragua.ti,ab. (1,852)
160. Argentina (15,692)
161. (Argentina or Argentine Republic).ti,ab. (16,531)
162. Belize (576)
163. (Belize or British Honduras).ti,ab. (843)
164. Brazil (93,168)
165. Brazil.ti,ab. (82,703)
166. Colombia (10,376)
167. Colombia.ti,ab. (12,026)
168. Costa Rica (3,662)
169. Costa Rica.ti,ab. (4,837)
170. Cuba (5,016)
171. Cuba.ti,ab. (4,477)
172. Dominica (98)
173. Dominica.ti,ab. (472)

174. Dominican Republic (1,561)
175. Dominican Republic.ti,ab. (1,887)
176. Ecuador (3,711)
177. Ecuador.ti,ab. (4,468)
178. Grenada (142)
179. Grenada.ti,ab. (314)
180. Guatemala (2,966)
181. Guatemala.ti,ab. (3,500)
182. Guyana (683)
183. (Guyana or British Guiana).ti,ab. (1,080)
184. Jamaica (3,426)
185. Jamaica.ti,ab. (3,226)
186. Mexico (38,352)
187. (Mexico or United Mexican States).ti,ab. (41,958)
188. Paraguay (786)
189. Paraguay.mp. (1,678)
190. Peru (8,735)
191. Peru.ti,ab. (10,340)
192. Saint Lucia (69)
193. (St Lucia or Saint Lucia or Lyonala or Hewanorra).ti,ab. (339)
194. 'Saint Vincent and the Grenadines' (52)
195. (Saint Vincent or St Vincent or Grenadines).ti,ab. (603)
196. Suriname (927)
197. (Suriname or Dutch Guiana).ti,ab. (572)
198. Venezuela (4,896)
199. Venezuela.ti,ab. (5,227)
200. Djibouti (226)
201. (Djibouti or French Somaliland).ti,ab. (384)
202. Egypt (14,699)
203. Egypt.ti,ab. (13,915)
204. Morocco (5,673)
205. Morocco.ti,ab. (5,460)
206. Tunisia (8,275)
207. Tunisia.mp. (10,358)
208. (Gaza or West Bank or Palestine).ti,ab. (2,434)
209. Algeria (3,040)
210. Algeria.ti,ab. (3,189)
211. Iran (26,728)
212. (Iran or Persia).ti,ab. (37,869)
213. Iraq (4,619)
214. (Iraq or Mesopotamia).ti,ab. (6,991)
215. Jordan (4,207)
216. Jordan.ti,ab. (6,109)
217. Lebanon (4,260)

218. (Lebanon or Lebanese Republic).ti,ab. (4,462)
219. Libya (1,120)
220. Libya.ti,ab. (1,250)
221. Syria (1,810)
222. (Syria or Syrian Arab Republic).ti,ab. (1,994)
223. Yemen (1,381)
224. Yemen.ti,ab. (1,814)
225. Afghanistan (3,197)
226. Afghanistan.ti,ab. (5,834)
227. Nepal (8,128)
228. Nepal.ti,ab. (9,629)
229. Bangladesh (10,942)
230. Bangladesh.ti,ab. (13,312)
231. Bhutan (458)
232. Bhutan.ti,ab. (731)
233. exp India (102,909)
234. India.ti,ab. (97,774)
235. Pakistan (17,537)
236. Pakistan.ti,ab. (17,947)
237. Maldives.ti,ab. (330)
238. Sri Lanka (5,993)
239. (Sri Lanka or Ceylon).ti,ab. (6,894)
240. Angola (997)
241. Angola.ti,ab. (1,388)
242. Cameroon (5,461)
243. (Cameroon or Kamerun or Cameroun).ti,ab. (6,869)
244. Cape Verde (199)
245. (Cape Verde or Cabo Verde).ti,ab. (598)
246. Comoros (307)
247. (Comoros or Glorioso Islands or Mayotte).ti,ab. (554)
248. Congo (1,848)
249. (Congo not ((Democratic Republic adj3 Congo) or congo red or crimean-congo)).ti,ab. (2,549)
250. Cote d'Ivoire (3,114)
251. (Cote d'Ivoire or Cote dlvoire or Ivory Coast).ti,ab. (3,806)
252. Eswatini (579)
253. (eSwatini or Swaziland).ti,ab. (912)
254. Ghana (8,167)
255. (Ghana or Gold Coast).ti,ab. (10,613)
256. Kenya (15,935)
257. (Kenya or East Africa Protectorate).ti,ab. (17,819)
258. Lesotho (420)
259. (Lesotho or Basutoland).ti,ab. (704)
260. Mauritania (441)

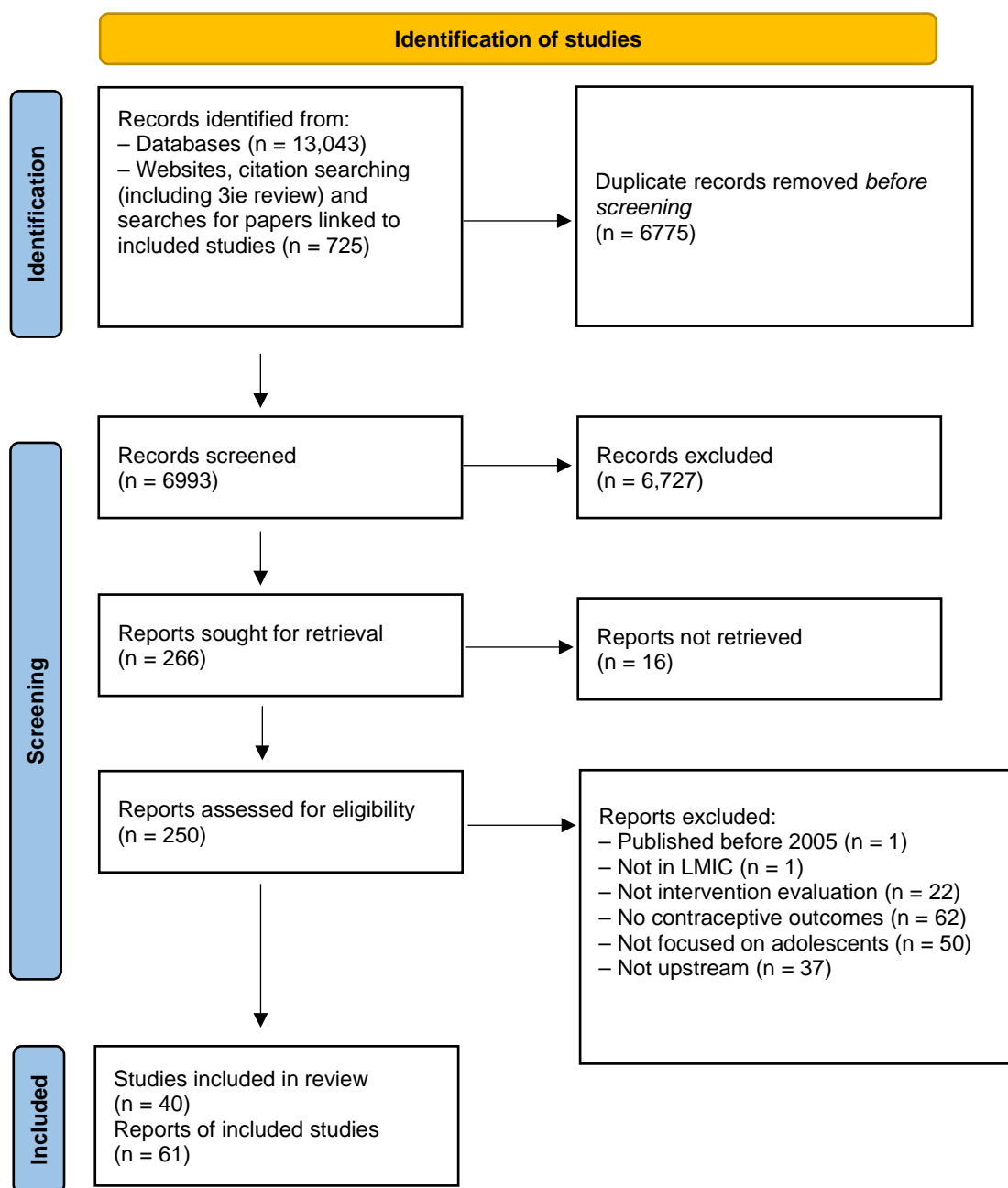
261. Mauritania.ti,ab. (617)
262. Nigeria (28,351)
263. Nigeria.ti,ab. (28,272)
264. (Sao Tome adj2 Principe).ti,ab. (151)
265. Senegal (5,694)
266. Senegal.ti,ab. (5,639)
267. Sudan (4,684)
268. (Sudan not South Sudan).ti,ab. (7,349)
269. Zambia (4,496)
270. (Zambia or Northern Rhodesia).ti,ab. (5,215)
271. Zimbabwe (5,793)
272. (Zimbabwe or Southern Rhodesia).ti,ab. (5,620)
273. Botswana (1,786)
274. (Botswana or Bechuanaland or Kalahari).ti,ab. (2,549)
275. Equatorial Guinea (265)
276. (Equatorial Guinea or Spanish Guinea).ti,ab. (424)
277. Gabon (1,449)
278. (Gabon or Gabonese Republic).ti,ab. (1,722)
279. Mauritius (562)
280. (Mauritius or Agalega Islands).ti,ab. (967)
281. Namibia (1,074)
282. (Namibia or German South West Africa).ti,ab. (1,507)
283. South Africa (41,839)
284. (South Africa or Cape Colony or British Bechuanaland or Boer Republics or Zululand or Transvaal or Natalia Republic or Orange Free State).ti,ab. (33,743)
285. Benin (1,539)
286. (Benin or Dahomey).ti,ab. (3,401)
287. Burkina Faso (3,219)
288. (Burkina Faso or Burkina Fasso or Upper Volta).ti,ab. (4,184)
289. Burundi (634)
290. (Burundi or Ruanda-Urundi).ti,ab. (884)
291. Central African Republic (778)
292. (Central African Republic or Ubangi-Shari).ti,ab. (1,014)
293. Chad (718)
294. Chad.ti,ab. (1,153)
295. 'Democratic Republic of the Congo' (4,186)
296. (((Democratic Republic or DR) adj2 Congo) or Congo-Kinshasa or Belgian Congo or Zaire or Congo Free State).ti,ab. (4,465)
297. Eritrea (345)
298. Eritrea.ti,ab. (536)
299. Ethiopia (12,687)
300. (Ethiopia or Abyssinia).ti,ab. (15,414)
301. Gambia (2,407)
302. Gambia.ti,ab. (2,290)

- 303. Guinea (1,036)
- 304. (Guinea not (New Guinea or Guinea Pig* or Guinea Fowl or Guinea-Bissau or Portuguese Guinea or Equatorial Guinea)).ti,ab. (2,608)
- 305. Guinea-Bissau (925)
- 306. (Guinea-Bissau or Portuguese Guinea).ti,ab. (1,022)
- 307. Liberia (1,204)
- 308. Liberia.ti,ab. (1,541)
- 309. Madagascar (3,421)
- 310. (Madagascar or Malagasy Republic).ti,ab. (4,712)
- 311. Malawi (5,263)
- 312. (Malawi or Nyasaland).ti,ab. (6,875)
- 313. Mali (2,331)
- 314. Mali.ti,ab. (3,471)
- 315. Mozambique (2,393)
- 316. (Mozambique or Mocambique or Portuguese East Africa).ti,ab. (3,567)
- 317. Niger (1,186)
- 318. (Niger not (Aspergillus or Peptococcus or Schizothorax or Cruciferae or Gobius or Lasius or Agelastes or Melanosuchus or radish or Parastromateus or Orius or Apeergillus or Parastromateus or Stomoxys)).ti,ab. (3,410)
- 319. Rwanda (2,407)
- 320. (Rwanda or Ruanda).ti,ab. (2,980)
- 321. Sierra Leone (1,516)
- 322. (Sierra Leone or Salone).ti,ab. (2,209)
- 323. Somalia (1,581)
- 324. (Somalia or Somaliland).ti,ab. (1,476)
- 325. South Sudan (149)
- 326. South Sudan.ti,ab. (528)
- 327. Tanzania (11,298)
- 328. (Tanzania or Tanganyika or Zanzibar).ti,ab. (13,390)
- 329. Togo (1,133)
- 330. (Togo or Togolese Republic or Togoland).ti,ab. (1,459)
- 331. Uganda (12,017)
- 332. Uganda.ti,ab. (14,085)
- 333. 'africa south of the sahara' (11,035)
- 334. africa, central (1,278)
- 335. africa, eastern (4,070)
- 336. africa, southern (2,373)
- 337. africa, western (5,817)
- 338. ('Africa South of the Sahara' or sub-Saharan Africa or subSaharan Africa).ti,ab. (21,003)
- 339. Central Africa.ti,ab. (3,108)
- 340. Eastern Africa.ti,ab. (975)
- 341. Southern Africa.ti,ab. (4,279)
- 342. Western Africa.ti,ab. (831)
- 343. or/48-342 (1,488,989)

- 344. 39 and 47 and 343 (16,244)
- 345. limit 344 to yr='2016 -Current' (2,845)
- 346. limit 345 to (english or portuguese) (2,792)

Annex 2: PRISMA flow diagram

Figure A2: Flow of references through the project



Annex 3: Study characteristics

Table A3: Characteristics of studies included in the map

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Punjab Female School Stipend Program (Punjab FSSP) (Alam <i>et al.</i> , 2011) Linked references: (Independent Evaluation Group, 2011)	To promote participation in public education for girls in middle school	<i>Intervention arm:</i> Conditional cash transfer – conditional on 80% attendance at school <i>Control arm:</i> No cash transfer	Girls only Enrolled in Grades 6–8 in public schools Pakistan Natural experiment; historical control
* BALIKA (Amin <i>et al.</i> , 2016) Linked references: (Amin <i>et al.</i> , 2014; Amin <i>et al.</i> , 2018)	To delay child marriage	<i>All intervention arms:</i> <ul style="list-style-type: none"> – Safe spaces – weekly meetings with mentor; computer and life skills – Community discussions around the importance of girls' education and developing their skills, the risk of marrying girls early and other SRH and gender rights issues – Activities included meetings for parents/guardians, local support groups formed with community representatives, advocacy meetings, local events, district workshops 	Girls only 12–18-year-olds in and out of school, plus parents and community Bangladesh cRCT

⁶ FP = family planning; GBV = gender-based violence; SRH = sexual and reproductive health; SRHR = sexual and reproductive health and rights; RH = reproductive health.

⁷ cRCT = cluster randomised controlled trial; nRCT = non-randomised controlled trial; RCT = randomised controlled trial.

* = included in the in-depth review.

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<p>Plus:</p> <p><i>Arm 1:</i> Educational tutoring (maths and English if in school; computing or financial training if out of school)</p> <p><i>Arm 2:</i> Gender rights awareness training (life skills training on gender rights, negotiation, critical thinking and decision-making)</p> <p><i>Arm 3:</i> Livelihoods interventions (training in computers, entrepreneurship, mobile phone servicing, basic first aid)</p> <p><i>Control arm:</i> No intervention</p>	
<p><i>Mexican school legislation</i> (Andalón <i>et al.</i>, 2014)</p> <p>No linked references</p>	To increase schooling	<p><i>Intervention:</i> Legislation extending compulsory schooling from Grades 6–9; building of schools</p> <p><i>Control:</i> Women not exposed to the reform (15–22-year-olds)</p>	<p>Boys and girls</p> <p>Grades 6–9 (typically 12–14-year-olds)</p> <p>Mexico</p> <p>Natural experiment</p>
<p>Adolescent Girls Empowerment Program (Austrian <i>et al.</i>, 2020a)</p> <p>Linked references: (Duby <i>et al.</i>, 2016; Hewett <i>et al.</i>, 2017; Mott MacDonald Evaluation Team, 2017; Austrian <i>et al.</i>, 2018a; Austrian <i>et al.</i>, 2019; Psaki <i>et al.</i>, 2019; Chae <i>et</i></p>	To empower adolescent girls by building their social, health and economic assets, allowing them to reduce their vulnerabilities and capitalise on opportunities to improve their health, fertility	<p><i>Arm 1:</i> Safe spaces – weekly mentor-led girls group meetings on SRH, HIV, life skills and financial education; segmented by age and marital status</p> <p><i>Arm 2:</i> Arm 1 + health voucher (to use at facilities for general or SRH health services)</p> <p><i>Arm 3:</i> Arm 2 + provision of adolescent-friendly savings account</p> <p><i>Control arm:</i> No intervention</p>	<p>Girls only</p> <p>‘Most vulnerable’ unmarried 10–19-year-olds</p> <p>Zambia</p> <p>cRCT</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
<i>al.</i> , 2020; McCarthy <i>et al.</i> , 2022)	and educational outcomes		
Safe and Smart Savings Products for Vulnerable Adolescent Girls (Safe and Smart Savings) (Austrian and Muthengi, 2013) Linked references: (Yitzhak, 2013)	Not clear, but evaluation was 'To understand the social, economic, and health effects of girls' savings and safe spaces'	<i>Intervention arm:</i> – Safe spaces – weekly group meetings with mentor, stratified by age, with savings activities, health education, fun days, parents' meetings – Financial education – Individual savings account with incentives to save <i>Control arm:</i> No intervention	Girls only 10–19-year-olds Kenya and Uganda nRCT
* AGI-K (Austrian <i>et al.</i> , 2020b) Linked references: (Austrian <i>et al.</i> , 2015; Austrian <i>et al.</i> , 2016; Austrian <i>et al.</i> , 2018b; Austrian <i>et al.</i> , 2021)	To delay childbearing for adolescent girls	<i>Arm 1 (control):</i> 'Community conversations' on violence prevention and valuing girls, plus small fund for implementing action plan <i>Arm 2:</i> Arm 1 + conditional cash transfer for school enrolment and attendance and other education support (fees paid direct to school, kits with sanitary towels, underwear and basic school supplies, incentives paid to schools for enrolment) <i>Arm 3:</i> Arm 2 + safe spaces, weekly meetings stratified by age and schooling status, with health, life skills and nutrition curriculum <i>Arm 4:</i> Arm 3 + financial education, piggy bank (Wajir) or savings account (Kiberia), plus small incentive (\$3 per year)	Girls only 11–14-year-olds and community Kenya, Wajir (rural) and Kiberia (urban) RCT and cRCT

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Zomba Cash Transfer Program (Baird <i>et al.</i> , 2016) Linked references (Baird <i>et al.</i> , 2010; Baird <i>et al.</i> , 2011; Baird <i>et al.</i> , 2012; Baird <i>et al.</i> , 2014)	HIV prevention	<i>Intervention arm:</i> Conditional cash transfer for school enrolment and 80%+ attendance OR unconditional cash transfer of varying amounts for household head and individual girl. <i>Control arm:</i> No intervention	Girls only 13–22-year-olds, never married cRCT
* ELA Uganda (Bandiera <i>et al.</i> , 2020a) Linked references: (Bandiera <i>et al.</i> , 2010; Bandiera <i>et al.</i> , 2012)	To break the vicious cycle between low participation in skilled jobs and high fertility	<i>Intervention arm:</i> – Life skills training – Vocational training – Safe spaces ('adolescent development clubs'), open five days a week <i>Control arm:</i> No intervention	Girls only 12–20-year-olds Uganda cRCT
* ELA Sierra Leone (Bandiera <i>et al.</i> , 2018) Linked references: (Bandiera <i>et al.</i> , 2019; Bandiera <i>et al.</i> , 2020b)	Young women's socioeconomic empowerment	<i>Intervention arm:</i> – Safe spaces with mentor ('adolescent development clubs'), open five days a week – Life skills training with SRH education – Vocational training (17 years old +) – Microfinance (18 years old +) <i>Control arm:</i> No intervention	Girls only 12–25-year-olds Sierra Leone, high Ebola disruption area and low Ebola disruption area cRCT
Red de Protección Social (Barham <i>et al.</i> , 2018)	To address current and future poverty	<i>Intervention:</i> Conditional cash transfer – Part 1 was conditional on preventive healthcare visits for under-fives and attendance at health information workshops	Boys and girls, poor households Rural Nicaragua cRCT

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Linked references: (Stecklov <i>et al.</i> , 2006; Thomas, 2012)		<ul style="list-style-type: none"> – Part 2 was conditional on school attendance and enrolment for 7–13-year-olds who had not yet completed Grade 4 – Information sessions for adolescents on RH and contraception; contraceptives available through healthcare providers <p><i>Control:</i> Delayed intervention</p>	
Ishraq – pilot phase ('enlightenment' or 'sunrise') (Brady <i>et al.</i> , 2007) Linked references: (Brady <i>et al.</i> , 2006; Ringler, 2009)	To transform girls' lives	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Trained programme promoters (17–25-year-old women), who also mentored girls – Established village committees – Safe spaces (three hours per day, four times a week) with literacy, sports, life skills (SRH rights (SRHR)), home and vocational skills – Health ID card – Life skills classes for 13–17-year-old boys (especially participants' brothers) to encourage gender-equitable thinking, four times a week for six months – Workshops with parents, community leaders, youth centre staff – Parents' meetings to discuss education, RH, female genital cutting <p><i>Control arm:</i> No intervention</p>	Girls and boys 13–15-year-olds and girls out of school, plus parents and community members Egypt nRCT; pre- and post-intervention, with control
Kishoree Kontha (Adolescent Girl's	To reduce child marriage and teenage childbearing and	<p><i>Arm 1:</i> Empowerment programme</p> <ul style="list-style-type: none"> – Safe spaces with peer educators for two hours, five or six times per week, for six months for curriculum, then ongoing 	Girls only 10–19-year-olds, Arm 1

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Voice) (Buchmann <i>et al.</i> , 2018) Linked references: (Buchmann <i>et al.</i> , 2016)	to increase education	<ul style="list-style-type: none"> – Education support: literacy, numeracy and oral communication – Social competency: life skills, nutritional and RH knowledge – Half also received financial literacy training and encouragement to generate own income <p><i>Arm 2:</i> Incentive – cooking oil for household every four months if girl remained unmarried until legal age of consent (18 years)</p> <p><i>Arm 3:</i> Arm 1 + Arm 2</p> <p><i>Control:</i> No intervention</p>	15–17-year-olds and unmarried, Arm 2 Bangladesh cRCT
ELA Tanzania (Buehren <i>et al.</i> , 2017) Linked references: (Buehren <i>et al.</i> , 2015)	To improve the human capital of young women	<p><i>Arm 1:</i> ELA intervention</p> <ul style="list-style-type: none"> – Safe spaces (adolescent girls clubs) with mentor for recreation and socialising, five days per week, with: – Life skills training – Livelihood and vocational training – Community meetings with parents and village elders <p><i>Arm 2:</i> Arm 1 + microcredit services for older girls, plus financial literacy training and business planning support</p> <p><i>Control arm:</i> No intervention</p>	13–17-year-olds Girls only, plus parents and community Tanzania cRCT
* Regai Dzive Shiri (Cowan <i>et al.</i> , 2010) Linked references: (Cowan <i>et al.</i> , 2002;	HIV prevention; to change societal norms	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Youth programme for in- and out-of-school youth – Community-based programme for parents and stakeholders to improve RH knowledge, parent-child 	Girls and boys Age unclear ('youth') Plus parents and community

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Cowan <i>et al.</i> , 2008; Langhaug <i>et al.</i> , 2011)		communication, community support for adolescent RH – Clinic staff training to increase accessibility <i>Control</i> : Delayed intervention (to 2007, year of final survey)	Zimbabwe cRCT
Social Cash Transfer Program (SCTP) and Multiple Category Targeted Grant (MCTG) (Dake <i>et al.</i> , 2018) No linked references	SCTP: To reduce poverty and hunger and improve school enrolment rates MCTG: To reduce extreme poverty and intergenerational transfer of poverty	<i>Intervention, SCTP</i> : Unconditional cash transfer, two years, Malawi <i>Intervention, MCTG</i> : Unconditional cash transfer three years, Zambia <i>Control</i> : No intervention	Girls and boys 14–21-year-olds (for evaluation; programmes were for broader group of households) Most vulnerable households Malawi and Zambia cRCT
* Oportunidades (Darney <i>et al.</i> , 2013) Linked references: (Lamadrid-Figueroa <i>et al.</i> , 2008; Galárraga and Gertler, 2009; Gulemetova, 2011)	To reduce poverty and develop human capital in poor households via improvements in child nutrition, health, and education	<i>Intervention</i> : – Cash transfer conditional on school attendance – Six-monthly health check-ups for adolescents and adults – Health promotion talks to household head and students of middle–high education level – Nutritional supplementation <i>Control</i> : Not exposed to intervention	Girls only 15–19-year-olds (for evaluation; programme available for boys and households with other ages) Mexico

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
			Natural experiment – survey of exposure to programme
<i>Ghanaian School scholarship programme</i> (Duflo <i>et al.</i> , 2012) Linked references: (Duflo <i>et al.</i> , 2017)	To increase secondary school education	<i>Intervention:</i> Four-year scholarship programme for senior high school tuition fees, paid directly to school <i>Control:</i> No intervention	Boys and girls 13–25-year-olds Ghana RCT
<i>Kenyan School subsidies and teacher training</i> (Duflo <i>et al.</i> , 2015) No linked references	Not explicit, but assumed to encourage primary school education and HIV prevention	<i>Arm 1:</i> Provision of free school uniform <i>Arm 2:</i> Teaching training on HIV/AIDS prevention curriculum for upper primary school (focusing on abstinence until marriage, plus discussion of condoms) ⁸ <i>Arm 3:</i> 1 and 2 <i>Control arm:</i> No intervention	Boys and girls Enrolled in Grade 6 Kenya cRCT
* SHAZI (Dunbar <i>et al.</i> , 2014) Linked references: (Kang <i>et al.</i> , 2008; Dunbar <i>et al.</i> , 2010)	HIV prevention	<i>Intervention:</i> – Control arm activities – Financial literacy education – Vocational training and micro grant on completion – Integrated social support (guidance counselling plus mentors)	Girls only 16–19-year-old out-of-school orphans (who have lost at least one parent) Zimbabwe RCT

⁸ Not structural.

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<i>Control:</i> <ul style="list-style-type: none"> – RH health screening and provision of free FP every six months (for intervention and control groups) – Life skills education and home-based care training 	
<p>* Berhane Hewan ('Light for Eve') (Erulkar and Eunice, 2009)</p> <p>Linked references: (Karei and Erulkar, 2010; Mekbib and Molla, 2010)</p>	To reduce early marriage and support married adolescent girls	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Parents of unmarried girls pledge that they will not be married during the two-year programme – Goat incentive for parents, if girls remain unmarried and attend 80% or more safe-space meetings – Community conversations – Community water wells constructed <p>In-school girls:</p> <ul style="list-style-type: none"> – Provision of school materials, mentors to track and support attendance and performance and encouragement to remain in school <p>Out-of-school girls:</p> <ul style="list-style-type: none"> – As above, if want to return to school <p>OR</p> <ul style="list-style-type: none"> – Safe space groups for married (weekly) or unmarried (five times per week) girls with basic literacy and numeracy, livelihoods skills, financial literacy, group savings and loan scheme, as well as referrals to health centres for those requesting, with the cost of a clinic card provided <p><i>Control:</i> No intervention</p>	<p>Girls only</p> <p>10–19-year-olds</p> <p>Married and unmarried, plus community</p> <p>Ethiopia</p> <p>nRCT; pre- and post-intervention, with control</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
<i>Kenyan education reform</i> (Ferré, 2009) No linked references	To increase education	<i>Intervention:</i> Reform of education system – increased primary school by one year in 1985 <i>Control:</i> Historical control	Girls and boys (age not stated) Kenya Natural experiment – DHS data from before/after reform
<i>Turkish schooling legislation</i> (Günes, 2016) No linked references	To increase education level	<i>Intervention:</i> – Change in compulsory schooling law – extended basic educational requirement from five to eight years (free of charge) in 1997 <i>Control:</i> Historical control (i.e. those aged 23 years and above in 2008)	Boys and girls Turkey Natural experiment – DHS data from before/after
<i>Zimbabwean comprehensive school support</i> (Hallfors <i>et al.</i> , 2011) Linked references: (Hallfors <i>et al.</i> , 2015; Hallfors <i>et al.</i> , 2016; Luseno <i>et al.</i> , 2017)	HIV prevention	<i>Intervention:</i> – School support: fees, books, uniforms and other supplies – Female teachers trained as helpers (monitor attendance/assist with absenteeism) <i>Control:</i> No intervention	Girls only Grade 6, orphans (at least one parent deceased) Zimbabwe cRCT
* Mabinti Tushike Hatamu!	To reduce vulnerability to HIV/AIDS, pregnancy and	<i>Intervention:</i> – Girls' groups with safe spaces: SRH training; financial	Girls only 10–19-year-olds, out of school

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
(Girls Let's Be Leaders!) (Hallman <i>et al.</i> , 2016) Linked references: (Hallman <i>et al.</i> , 2015)	gender-based violence (GBV)	and vocational skills; participatory action research; saving money; income generation <i>Control:</i> No intervention	Tanzania nRCT; post-intervention only, with control
Cash Transfer for Orphans and Vulnerable Children (Kenyan Cash Transfer OVC) (Handa <i>et al.</i> , 2015) Linked references: (Handa <i>et al.</i> , 2014)	To reduce poverty	<i>Intervention:</i> Unconditional cash transfer <i>Control:</i> No intervention	Boys and girls Ultra-poor households with at least one orphan/vulnerable child under the age of 18 (at least one deceased parent/parent or carer who is chronically ill) Kenya nRCT, pre- and post-intervention, with control
Child Support Grant (Heinrich <i>et al.</i> , 2017) Linked references: (Department of Social	To improve the quality of life of impoverished children	<i>Intervention:</i> Unconditional cash transfer <i>Control:</i> No intervention	Girls and boys Parent/caregiver of 0–18-year-olds on low income

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
Development <i>et al.</i> , 2011; Department of Social Development <i>et al.</i> , 2012; Ngubane and Maharaj, 2018)			South Africa Natural experiment
<i>Indian employment opportunities intervention</i> (Jensen, 2012) No linked references	Not explicit – assumed to increase employment	<i>Intervention:</i> Employment opportunities (business process outsourcing recruiting services) <i>Control:</i> No intervention	Girls only India cRCT
* DISHA (Kanesathasan, 2008) Linked references: (ICRW, 2006)	To improve SRH outcomes among youth	<i>Intervention:</i> – Established youth groups and youth resource centres (with health education and safe spaces) – Peer educators – Livelihoods training/groups, some linked to microsavings/credit groups – Mass communication activities – Adult groups – Adult-youth partnership groups – Training health workers on youth-friendly health services – Youth depot holders, including married and unmarried (FP counselling and social marketing) <i>Control:</i> No intervention	Boys and girls 14–24-year-olds, married and unmarried, plus parents and community India nRCT; pre- and post-intervention; no control reported

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
<p>* Young Agent Project (Martinez-Restrepo, 2012)</p> <p>No linked references</p>	<p>To keep adolescents in school and out of work and prevent violent and risky behaviours, as well as to make them community leaders in their own <i>Favelas</i> (slums)</p>	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Cash transfer conditional on attendance at both school and after-school programmes (recreation, health talks, trips, computing skills, job training, internship) <p><i>Control:</i> No intervention</p>	<p>Boys and girls</p> <p>15–17-year-olds, urban low income</p> <p>Brazil</p> <p>Natural experiment; post-hoc dataset, with control</p>
<p>Marriage: No Child's Play (Melnikas <i>et al.</i>, 2021a)</p> <p>Linked references: (Melnikas <i>et al.</i>, 2019; Koegler, 2020; Melnikas <i>et al.</i>, 2021b)</p>	<p>To reduce child marriage</p>	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Girls' groups with safe spaces: life skills, SRHR information, peer support, self-defence training, vocational training, arts and sports – Supporting schools to reduce drop-out – Link girls/families to social protection schemes/income generating opportunities – Financial literacy training – Strengthened child protection systems – Outreach SRHR services – Vouchers for SRHR services – Train service providers – Community conversations – Train officials to enforce laws and implement child marriage ban policies – Advocate for policy change 	<p>Girls only</p> <p>14–24-year-olds</p> <p>Unmarried and married, plus families and communities</p> <p>India, Malawi, Mali, Niger</p> <p>cRCT in India and Malawi</p> <p>nRCT in Mali and Niger</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<i>Control:</i> No intervention	
<p>* Sawki (Mercycorps, 2015)</p> <p>Linked references: (2013, 2018, Persha <i>et al.</i>, 2018)</p>	To improve adolescent girls' nutrition before pregnancy; to delay adolescent pregnancy	<p><i>Arm 1:</i> Control group and safe spaces with mentor, weekly meetings</p> <ul style="list-style-type: none"> – Teach life skills, essential nutrition actions, risks of early marriage and early pregnancy, the importance of education, literacy – Married girls learn more about RH – 50 kg of lentils every six months, conditional on attendance at 80% or more of meetings <p><i>Arm 2:</i> Control group and Arm 1 and livelihood training and savings and loan activities</p> <p><i>Control arm:</i></p> <ul style="list-style-type: none"> – Sawki development food assistance programme (aimed to reduce chronic malnutrition among pregnant/lactating women and children under the age of five, and to increase local availability of and household's access to nutrition foods) – Caregivers' groups and husbands' schools, both providing information on nutrition and health (including contraception/fertility) – Mass media and other sensitisation on food production and nutrition – Advocacy sessions for women's groups to obtain property ownership – Practical and technical food production support 	<p>Girls only</p> <p>10–18-year-olds</p> <p>Niger</p> <p>nRCT; post-intervention, with control</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		(vegetables and animals) – Village saving and loan association groups supported	
* CERCA (Michielsen <i>et al.</i> , 2015) Linked references: (Decat <i>et al.</i> , 2013; Jaruseviciene <i>et al.</i> , 2013; Nelson <i>et al.</i> , 2014; Cordova-Pozo <i>et al.</i> , 2015; Decat <i>et al.</i> , 2015; Decat, 2016; Ivanova <i>et al.</i> , 2016; Cordova-Pozo <i>et al.</i> , 2018)	To improve access to, and the use of, SRH services by adolescents	<i>Intervention:</i> – Media, workshops in health centres/community centres (Nicaragua) or schools (Bolivia and Ecuador) and discussion groups with parents/grandparents – Healthcare provider training – Contraceptive supply to health centres – Media campaigns – Information event with officials Bolivia and Ecuador only: – SRH workshops and youth groups in schools Nicaragua only: – Community-level education and door-to-door outreach – Friends of Youth (mentors) <i>Control:</i> No intervention	Boys and girls Urban youth, plus parents and community Nicaragua, Bolivia, Ecuador cRCT – Nicaragua nRCT – Bolivia and Ecuador; pre- and post-intervention, with control
Universal Primary Education Program (UPE) (Osili and Long, 2008) No linked references	Not explicit – assumed to increase primary education rates	<i>Intervention:</i> National introduction of tuition-free primary education in 1976 <i>Control:</i> Women born between 1956 and 1961 (i.e. aged 15–20 when the intervention started)	Boys and girls Nigeria Natural experiment
Girl Empower (Özler <i>et al.</i> , 2020)	To reduce sexual abuse among	<i>Arm 1:</i> Girl Empower: – Safe spaces with mentors, meeting weekly, with life skills curriculum including financial literacy and RH,	Girls only 13–14-year-olds, rural

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
No linked references	females in early adolescence	<p>community action events and graduation ceremonies with community stakeholders</p> <ul style="list-style-type: none"> – Monthly parents/caregivers discussion group, to gain support from parents for intervention and to support/protect girls in their communities – Monthly cash sum (\$2) for eight months to start a savings account, plus savings book and cash box – Training for quality health and psychosocial service providers for survivors of GBV <p><i>Arm 2: Girl Empower+:</i></p> <ul style="list-style-type: none"> – Arm 1 – Caregivers receive conditional cash transfer for each session attended by girl <p><i>Control arm: No intervention</i></p>	Liberia cRCT
<p>* PRACHAR III (Pandey <i>et al.</i>, 2016)</p> <p>Linked references: (Wilder <i>et al.</i>, 2005; Daniel <i>et al.</i>, 2008; Jejeebhoy <i>et al.</i>, 2015; Subramanian <i>et al.</i>, 2018)</p>	To delay the age at first birth and space subsequent births by at least three years	<p><i>Arm 1:</i> Small-group education on SRH and life skills for 15–19-year-old unmarried boys and girls, separately⁹</p> <p><i>Arm 2:</i></p> <ul style="list-style-type: none"> – Arm 1 – Small-group education on RH for 12–14-year-old girls – Home visits to young married women for RH/FP counselling and referrals to FP services – Small group discussion and dialogue among young married men and young married women (separately) on RH and contraception, referrals to health services – Training of providers in youth friendly health services 	Boys and girls 12–24-year-olds, plus family and community India nRCT; post-intervention, with control

⁹ Not structural.

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<ul style="list-style-type: none"> – Training programmes and sensitisation sessions with various groups: parents, husbands, community, healthcare providers <p><i>Control arm:</i> No intervention</p>	
<p>* Girl Power Malawi (Rosenberg <i>et al.</i>, 2018a)</p> <p>Linked references: (Rosenberg <i>et al.</i>, 2017; Rosenberg <i>et al.</i>, 2018b; Brar <i>et al.</i>, 2020; Maseko <i>et al.</i>, 2020; Rosenberg <i>et al.</i>, 2020a; Rosenberg <i>et al.</i>, 2020b)</p>	To impact HIV and SRH health service utilisation	<p><i>Arm 1 (control):</i> Standard care clinic: HIV testing, FP, sexually transmitted infection syndromic management and condoms</p> <p><i>Arm 2:</i> Youth-friendly clinic, including wider opening times, provider training, young peer educators¹⁰</p> <p><i>Arm 3:</i> Arm 2 and monthly small group sessions on HIV and SRH information, healthy and unhealthy romantic relationships, financial literacy, skills e.g. problem solving and communication, for one year</p> <p><i>Arm 4:</i> Arm 3 and monthly cash transfer (to participant) conditional on attending each small group session</p>	<p>Girls only</p> <p>15–24-year-olds</p> <p>Malawi</p> <p>nRCT; pre- and post-intervention, with control</p>
<p>* First-Time Parents Project (Santhya <i>et al.</i>, 2008)</p> <p>Linked references: (Santhya and Haberland, 2007)</p>	To empower married young women and improve their SRH	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Groups for married girls, meeting two to three hours per month; topics such as legal literacy, vocational skills, health, gender, relationships, and worked on development projects. One group set up a group savings account – Home visits by outreach workers to young women and their husbands, providing information on sex, communication, respect, joint decision-making and RH 	<p>Married young women, plus their husbands, families and community</p> <p>Rural India</p> <p>nRCT; pre- and post-intervention, with control</p>

¹⁰ Not structural.

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<p>topics, including FP</p> <ul style="list-style-type: none"> – Community activities, e.g. health fairs – Opportunistic interactions with mothers-in-law and senior female family members about sexual health, contraception, antenatal, delivery and postpartum care, as well as the husband's role in this period – Training health service providers on needs of young married women – Training traditional birth attendants and provision of safe delivery kits – Counselling in clinics – Provision of condoms and pill through peers and clinics – Strengthened antenatal services through outreach, financial assistance when needed for antenatal care, provided postpartum home visits <p><i>Control:</i> No intervention</p>	
<p>Ishraq 'sunrise' – scale up phase (Selim <i>et al.</i>, 2013)</p> <p>Linked references: (Sieverding and Elbadawy, 2016)</p>	<p>To address the specific needs of adolescent girls in a holistic manner</p>	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Safe spaces with mentors, three hours per day, four times a week, with literacy, basic maths, financial literacy, life skills, sports – Savings accounts, with initial deposit (\$15) – Orientation of parents regarding savings accounts – Snacks and monthly food ration conditional on regular attendance – Graduation ceremony with community – Established village committee to inform community about programme, girls' education and gender equity 	<p>Girls and boys 11–15-year-old out-of-school girls 13–17-year-old boys</p> <p>Plus parents and community</p> <p>Rural Egypt</p> <p>nRCT; pre- and post-intervention (compared</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
		<ul style="list-style-type: none"> – Life skills classes for boys aged 13–17 to sensitise them on gender quality, civil and human rights, self-responsibility – Tutoring for girls in Arabic, English and other school subjects – Home visits to convince parents of importance of girls continuing education – Community mobilisation, e.g. community seminars <p><i>Control:</i> No intervention</p>	participants with non-participants)
<p>Programa de Educacion, Salud y Alimentacion (Progresa)</p> <p>Programa de Asignación Familiar – family allowance programme (PRAF II) (Stecklov <i>et al.</i>, 2006)</p> <p>Linked references: (Gertler and Boyce, 2001; Skoufias, 2005)</p>	<p><i>Progresa:</i> To reduce poverty and invest in human capital</p> <p><i>PRAF II:</i> To increase human capital accumulation through education and health, to decrease chronic poverty</p>	<p><i>Intervention (Progresa):</i></p> <ul style="list-style-type: none"> – Cash transfer conditional on school attendance, visits to public health clinics and attendance at educational workshops on health and nutrition <p><i>Intervention (PRAF II):</i></p> <ul style="list-style-type: none"> – Two cash transfers, one conditional on school enrolment and attendance for 6–12-year-olds, another conditional on regular health checks for pregnant women and under-threes <p><i>Control:</i> No intervention</p>	<p>Chronically poor, rural households</p> <p>Mexico (Progresa)</p> <p>Honduras (PRAF II)</p> <p>cRCT</p>
<p>* GREAT (Wadiembe <i>et al.</i>, 2015)</p>	To reduce GBV and improve SRH outcomes	<p><i>Intervention:</i></p> <ul style="list-style-type: none"> – Community action cycle – community action groups – Radio drama aimed at creating discussion around 	<p>Boys and girls</p> <p>10–19-year-olds: newly married/newly</p>

Name (main reference)	Aim	Intervention activities ⁶	Population and study design ⁷
<p>Linked references: (Institute for Reproductive Health Georgetown University <i>et al.</i>; Institute for Reproductive Health Georgetown University, 2016; Dagadu <i>et al.</i>, 2017)</p>		<p>gender equality, GBV and SRH</p> <ul style="list-style-type: none"> – Village health team member training – Toolkit for use in existing groups, tailored to married/parenting 15–19-year-olds, unmarried nulliparous 15–19-year-olds, or 10–14-year-olds in school <p><i>Control:</i> No intervention</p>	<p>parenting (15–19-year-olds), older adolescents (unmarried, nulliparous 15–19-year-olds)</p> <ul style="list-style-type: none"> – 10–14-year-olds in school <p>Plus community</p> <p>Uganda</p> <p>nRCT; pre- and post-intervention, with control</p>

Annex 4: In-depth review studies – design and outcomes

Table A4: Study design and outcome characteristics of studies included in the in-depth review

Name	Study design	Follow-up timing used in meta-analysis (other time points)	Outcome measured used in meta-analysis	Effectiveness category
BALIKA	cRCT	18 months	Used FP methods	Possibly ineffective – Arms 1–3
AGI-K	RCT (Kibera) cRCT (Wajir)	2 years (4 years)	Ever used modern FP methods, excluding male condoms	Possibly ineffective – Kibera Arms 1–3; Wajir Arms 1–3
ELA Uganda	cRCT	2 years (4 years)	Use other form of contraception (excluding condoms)	Possibly ineffective
ELA Sierra Leone	cRCT	2 years (5+ years)	Often/always uses contraception (excluding condoms)	Possibly ineffective – high and low disruption
Regai Dzive Shiri	cRCT	4 years	No pregnancy prevention used with any partner ¹¹	Possibly ineffective
Oportunidades	Natural experiment – survey of exposure to programme	Time since exposure varied	Currently using modern contraceptive method	Likely ineffective
SHAZ!	RCT	12 months (6, 18 and 24 months)	Contraceptive use with current partner	Likely ineffective
Berhane Hewan	nRCT Pre and post, with control	2 years	Ever used contraception	Likely effective

¹¹ We converted this outcome into ‘ever used pregnancy prevention with any partner’.

Name	Study design	Follow-up timing used in meta-analysis (other time points)	Outcome measured used in meta-analysis	Effectiveness category
Mabinti Tushike Hatamu!	nRCT ¹² Post only, with control	3 years	Contraception used in last 12 months	Possibly effective
DISHA	Pre and post, with NO control group	3 years	Current use of modern contraceptive	Note – effect size not calculable, although data suggest the intervention is likely effective
Young Agent Project	Natural experiment – post-hoc dataset with control	1–2 years	Use of contraceptive methods (always or almost always)	Possibly effective
Sawki	nRCT Post, with control	Arm 1: 7–9 months Arm 2: 12–14 months	Currently using contraception	Possibly ineffective – Arm 2
				Likely ineffective – Arm 1
CERCA	cRCT – Nicaragua	20 months	Ever used contraception	Possibly ineffective – Bolivia, Ecuador
	nRCT – Bolivia and Ecuador: pre and post, with control			Likely ineffective – Nicaragua
PRACHAR III	nRCT Post, with control	3–4 years	Currently using contraception	Likely effective – Arm 2
				Possibly effective – Arm 1

¹² Matched control group (matched after intervention delivery): ‘with 36 wards per region randomly selected. Within each of the 9 wards, 3 villages were randomly selected for a total of 27 villages receiving the program. The 27 program villages were matched with 27 comparison villages, with each matched pair being within the same district but not adjacent to one another.’ Page 12 (Hallman et al, 2016)

Name	Study design	Follow-up timing used in meta-analysis (other time points)	Outcome measured used in meta-analysis	Effectiveness category
Girl Power Malawi	nRCT Pre and post, with control	12 months (6 months)	Hormonal contraception uptake (i.e. 12 week supply by clinic of pill, injection or implant)	Likely effective – Arm 4
				Possibly effective – Arm 3
First-Time Parents Project	nRCT Pre and post, with control	2 years 5–10 months	Use of contraceptives to delay the first birth	Possibly effective – Vadadora
				Likely ineffective – Diamond Harbour
GREAT	nRCT Pre and post, with control	2 years 4 months	Current FP use	Likely effective – Newly married/newly parenting
				Possibly ineffective – older adolescents

Annex 5: Methodological issues

Table A5: Methodological issues of studies included in in-depth review

Name (reference)	Methodological issues that may affect comparability/categorisation of studies as 'likely effective' or 'likely ineffective'
BALIKA	<ul style="list-style-type: none"> • Outcome sample: only asked married youth about their contraceptive use, but the intervention reduced probability of child marriage (so less likely to be having sex, or requiring contraception). Married youth were a minority of the total sample • Baseline: high rates of contraceptive use among married girls at baseline (80+%) • Outcome measure: unclear if outcome measure was 'ever use' or 'currently using' FP • Uptake: minority of respondents had ever participated in intervention (around 40% for in-school girls and 20% for out-of-school girls)
AGI-K	<ul style="list-style-type: none"> • Control: control arm received substantial structural intervention • Confounder: sexual debut (and pregnancy) were delayed compared to control • Outcome sample: only a very small minority of sample had ever had sex at endline (intervention targeted very young adolescents) • [Timing of outcome?] • Outcome measure: outcome was 'ever use' rather than 'currently using' • Outcome measure: outcome excludes condoms
ELA Uganda	<ul style="list-style-type: none"> • Outcome sample: measured outcome among girls 'if sexually active' (unclear if this was active in a specific time point or if it was 'had ever had sex')

Name (reference)	Methodological issues that may affect comparability/categorisation of studies as 'likely effective' or 'likely ineffective'
	<ul style="list-style-type: none"> • Outcome measure: <ul style="list-style-type: none"> – Unclear if outcome ('uses contraceptive') was 'currently using' or 'ever used' – Outcome excludes condoms • Uptake: 21% took up the intervention; near-zero uptake of microfinance element • Confounder: intervention delayed marriage/cohabitation
ELA Sierra Leone	<ul style="list-style-type: none"> • Outcome sample: measured outcome among girls 'if sexually active' (unclear if this was active in a specific time point or if it was 'had ever had sex') • Outcome measure: <ul style="list-style-type: none"> – Unclear if outcome ('uses contraceptive') was 'currently using' or 'ever used' – Outcome excludes condoms • Uptake: Only a minority received the financial literacy training (25%), participated in the vocational skills training (34%) or received a microfinance loan (13%)
Regai Dzive Shiri	<ul style="list-style-type: none"> • Outcome sample: <ul style="list-style-type: none"> – Measured outcome among those who reported ever having had sex (including anal sex, but no data on frequency of different types of sex) – Just over half the sample (53%) reported ever having had sex • Follow-up: longer than average (4 years post-baseline) • Implementation: severe implementation challenges due to unstable context, resulting in major shift in intervention
Oportunidades	<ul style="list-style-type: none"> • Outcome sample: unclear how many were asked about contraceptive use • Confounder: intervention exposure associated with reduced pre-marital sex and delayed marriage (i.e. reducing the number of participations who could use contraception)
SHAZ!	<ul style="list-style-type: none"> • Outcome sample: small proportion (less than one-quarter) of participants were sexually active in past month (and so asked about contraceptive use)

Name (reference)	Methodological issues that may affect comparability/categorisation of studies as 'likely effective' or 'likely ineffective'
	<ul style="list-style-type: none"> Control: received substantial intervention Uptake: majority had not completed intervention activities by the 18-month follow-up
Berhane Hewan	<ul style="list-style-type: none"> Confounder: intervention was associated with significantly fewer marriages at endline compared to control Outcome sample: asked only those who were sexually experienced; almost all sex occurred within marriage; only a minority of intervention participants were married (10%) (i.e. the majority of intervention participants were targeted with intervention activities aimed at delaying or preventing marriage rather than enabling contraceptive use) Outcome measure: ever used contraceptives
Mabinti Tushike Hatamu!	<ul style="list-style-type: none"> Outcome sample: <ul style="list-style-type: none"> – Significantly more condom use in intervention than control (always and at last sex) Control: no control
DISHA	<ul style="list-style-type: none"> Data could not be extracted for meta-analysis Limited data reporting of sample characteristics
Young Agent Project	<ul style="list-style-type: none"> Outcome sample: only asked those who reported being sexually active. Overall, the majority of participants did report being sexually active (83%), but this was not reported for intervention and control arms separately, so it is unclear whether the arms were similar in this respect Outcome measure: always or almost always uses contraceptive methods during sexual relations
Sawki	<ul style="list-style-type: none"> Control: <ul style="list-style-type: none"> – Substantial activities in the control arm – Authors note some contamination Baseline: no baseline Sample: majority of participants were very young, unmarried adolescents; only 10% of participants were married

Name (reference)	Methodological issues that may affect comparability/categorisation of studies as 'likely effective' or 'likely ineffective'
	<ul style="list-style-type: none"> • Outcome sample: asked only of those who were married, i.e. a small minority of sample
CERCA	<ul style="list-style-type: none"> • Outcome sample: <ul style="list-style-type: none"> – Combines responses from males and females, unlike majority of studies reporting separately – Unclear percentage of control group had ever had sex, but in intervention arms a minority of respondents had ever had sex at endline
PRACHAR III	<ul style="list-style-type: none"> • Outcome sample: <ul style="list-style-type: none"> – Those who had participated in the training for unmarried adolescents, but were currently married at endline (just under half of the sample) • Follow-up: longer than average (3–4 years after intervention)
Girl Power Malawi	<ul style="list-style-type: none"> • Outcome measure: hormonal contraception (pill, injection or implant) supplied by clinic (i.e. whether they received it not; in the case of the pill, whether they took it consistently; would also lead to under-reporting of 'use' of implant if inserted before the outcome assessment time period) • Population: recruited 15–24-year-old health clinic attendees who had ever had sex • Control: significant differences between control and intervention arms at baseline
First-Time Parents Project	<ul style="list-style-type: none"> • Outcome measure: use of contraceptives to delay first birth • Baseline: <ul style="list-style-type: none"> – Relatively high contraceptive use at baseline – Majority of sample were pregnant or parent at baseline (making it difficult for the intervention to show any effect on 'use of contraceptives to delay first birth', as this would have been before the intervention took place) • Control: <ul style="list-style-type: none"> – Possibly difference in services received in control arm – Differences in intervention and control arm village characteristics • Other: frequent movement of newly married girls between natal and new village, affecting follow-up and potential exposure to intervention

Name (reference)	Methodological issues that may affect comparability/categorisation of studies as 'likely effective' or 'likely ineffective'
GREAT	<ul style="list-style-type: none">• Outcome sample:<ul style="list-style-type: none">– Older adolescent arm: only asked those who were sexually active (unclear if this was active in a specific time point or if it was 'had ever had sex'); minority of sample had ever had sex at endline• Analysis: comparison of exposure level, rather than comparison of intervention and control arms

Annex 6: QCA

Table A6.1: Data table of likely effective and likely ineffective studies/arms and their methodological characteristics

Study (arm)	RCT	Baseline measurements available	Control group	Data collected from sexually active respondents only	Measure reflected current use	Other methods issues	Outcome
Berhane Hewan	No	Yes	Yes	Yes	No	No	Likely effective
GREAT (newly married/parenting arm)	No	Yes	Yes	Yes	Yes	Yes	Likely effective
PRACHAR III (Arm 2)	No	No	Yes	Yes	Yes	Yes	Likely effective
DISHA	No	Yes	No	Yes	Yes	Yes	Likely effective
Girl Power (Arm 4)	No	Yes	Yes	Yes	No	Yes	Likely effective
Oportunidades	No	No	Yes	No	Yes	Yes	Likely ineffective
SHAZ!	Yes	Yes	Yes	No	Yes	Yes	Likely ineffective
Sawki (Arm 1)	No	No	Yes	Yes	Yes	Yes	Likely ineffective
CERCA (Nicaragua)	Yes	Yes	Yes	No	No	No	Likely ineffective
First-Time Parents Project (Diamond Harbour)	No	Yes	Yes	Yes	No	No	Likely ineffective

Table A6.2: Truth table of selected methodological characteristics

RCT	Control group	Data collected from sexually active respondents only	Outcome	Number of studies	Consistency	Proportional reduction in inconsistency
0	0	1	1	1	1	1
0	1	1	0	6	0.667	0.667
1	1	0	0	2	0	0
0	1	0	0	1	0	0

