Interventions for preventing unintended pregnancies among adolescents (Review)

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This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2010, Issue 1

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[Intervention Review]

Interventions for preventing unintended pregnancies among adolescents

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Editorial group: Cochrane Fertility Regulation Group.
Publication status and date: Edited (no change to conclusions), published in Issue 1, 2010.
Review content assessed as up-to-date: 29 December 2008.

Citation: Oringanje C, Meremikwu MM, Eko H, Esu E, Meremikwu A, Ehiri JE. Interventions for preventing unintended pregnancies among adolescents. *Cochrane Database of Systematic Reviews* 2009, Issue 4. Art. No.: CD005215. DOI: 10.1002/14651858.CD005215.pub2.

ABSTRACT

Background

Unintended pregnancy among adolescents represent an important public health challenge in developed and developing countries. Numerous prevention strategies such as health education, skills-building and improving accessibility to contraceptives have been employed by countries across the world, in an effort to address this problem. However, there is uncertainty regarding the effects of these intervention, and hence the need to review their evidence-base

Objectives

To assess the effects of primary prevention interventions (school-based, community/home-based, clinic-based, and faith-based) on unintended pregnancies among adolescents.

Search strategy

We searched electronic databases (CENTRAL, PubMed, EMBASE) ending December 2008. Cross-referencing, hand-searching, and contacting experts yielded additional citations.

Selection criteria

We included both individual and cluster randomized controlled trials (RCTs) evaluating any interventions that aimed to increase knowledge and attitudes relating to risk of unintended pregnancies, promote delay in the initiation of sexual intercourse and encourage consistent use of birth control methods to reduce unintended pregnancies in adolescents aged 10-19 years.

Data collection and analysis

Two reviewers independently assessed trial eligibility and risk of bias in studies that met the inclusion criteria. Where appropriate, binary outcomes were pooled using random effects model with a 95% confidence interval (Cl).

Main results

Forty one RCTs that enrolled 95,662 adolescents were included. Participants were ethnically diverse. Eleven studies randomized individuals, twenty seven randomized clusters (schools (19), classrooms (5), and communities/neighbourhoods (3). Three studies were mixed (individually and cluster randomized). The length of follow up varied from 3 months to 4.5 years. Data could only be pooled for a number of studies (15) because of variations in the reporting of outcomes.

Results showed that multiple interventions (combination of educational and contraceptive interventions) lowered the rate of unintended pregnancy among adolescents. Evidence on the possible effects of interventions on secondary outcomes (initiation of sexual intercourse, use of birth control methods, abortion, childbirth, sexually transmitted diseases) is not conclusive.

Methodological strengths included a relatively large sample size and statistical control for baseline differences, while limitations included lack of biological outcomes, possible self-report bias, analysis neglecting clustered randomization and the use of different statistical test in reporting outcomes.

Authors' conclusions

Combination of educational and contraceptive interventions appears to reduce unintended pregnancy among adolescents. Evidence for program effects on biological measures is limited. The variability in study populations, interventions and outcomes of included trials, and the paucity of studies directly comparing different interventions preclude a definitive conclusion regarding which type of intervention is most effective

PLAIN LANGUAGE SUMMARY

Interventions for preventing unintended pregnancy among adolescents

Interventions for preventing unintended pregnancy include any activity (health education or counselling only, health education plus skills-building, health education plus contraception education, contraception education and distribution, faith-based group or individual counselling designed to: increase adolescents' knowledge and attitudes relating to risk of unintended pregnancies; promote delay in initiation of sexual intercourse; encourage consistent use of birth control methods and reduce unintended pregnancies.

This review included forty one randomized controlled trials comparing the aforementioned interventions to various control groups (mostly usual standard sex education offered by schools). The search for trials was not limited by country, though most of the included trials were conducted in developed countries, it mainly represented the lower socio-economic groups and a few in less developed countries. Interventions were administered in schools, community centres, health care facilities and homes. Meta-analysis was performed for studies where it was possible to extract data.

All interventions including education, contraception education and promotion, and combinations of education and contraception promotion, reduced (at a slightly significant level) unintended pregnancy over the medium term and long term follow up period. Results for behavioural (secondary) outcomes were inconsistent across trials.

Limitations of this review include reliance on program participants to report their behaviours accurately and methodological weaknesses in the trials.

BACKGROUND

The World Health Organization (WHO 1980) defines adolescents as individuals between 10 and 19 years of age. Adolescence is a period of transition, growth, exploration, and opportunities. During this phase of life adolescents tend to develop an increased interest in sex: with attendant risks of unintended pregnancies, health risks associated with early childbearing, abortion outcomes, and sexually transmitted infections, including HIV/AIDS.

Adolescents who have an unintended pregnancy face a number of challenges, including abandonment by their partners, inability to complete school education (which ultimately limits their future social and economic opportunities), and increased adverse pregnancy outcomes (Kosunen 2002, Phipps 2002, Koniak-Griffin

2001, Henshaw 2000, Moore 1993, Upchurch 1990).

Description of the condition

Unintended pregnancy among adolescents is a common public health problem in industrialized, middle or low income countries (WHO 1995). In the US for example, 9% of adolescents between the ages 15 to 19 years become pregnant each year, and about half of these pregnancies end in abortions (Darroch 2001). In India, adolescent pregnancies constitute 19% of the total fertility (Mehra 2004) and an Israeli study estimated the incidence of teenage pregnancy to be 32 per 1000 adolescent girls in the country (Sikron 2003).

Repeat pregnancies among adolescents are also common and are associated with increased risks of adverse maternal and child health outcomes (Nelson 1990). Unintended pregnancy is not only costly to the teenagers and their families, it is a huge financial burden to societies as well. Societal cost include welfare support for mothers experiencing financial difficulties, implementation of programs (educational and skills training) to empower mothers to gain financial independence and lost tax revenues arising from reduced employability and earning (Rich-Edwards 2002, Maynard 1996, Haveman 1997, Burt 1986).

Adolescent mothers are more likely to perform poorly in school, come from low socio-economic homes and less advantageous environment; are themselves children of mothers with limited school education and history of unintended teenage pregnancies (Elfebein 2003). Children born to adolescent mothers are more likely to have low birth weight, and become victims of physical neglect and abuse (Elfebein 2003).

Description of the intervention

On account of the short and long-term consequences of unintended pregnancies for the adolescent, their families and the society at large (Trussell 1997, Burt 1990), government public health programs, bilateral agencies, and nongovernmental organizations (NGOs) have implemented (and continue to implement) various interventions to address the problem, using a variety of approaches.

Such interventions include Curriculum-based Sex and STD/HIV education programs (Safer Choices (Coyle 2001), Becoming a Responsible Teen (St. Lawrence 2005), All for You (Coyle 2006); Abstinence-alone programs (Postponing Sexual Involvement (Kirby 1997b), Sex can Wait (Denny 2006); Comprehensive Programs - combination of multiple components example Sexual Health and Relationship (SHARE) (Henderson 2007), RIPPLE (Stephenson 2004), Children's Aid Society-Carrera Program (Philliber 2002; Parents/teens sex and STD/HIV education program (Keepin' it R.E.A.L (Dilorio 2006), REAL Men (Dilorio 2007); Interactive video-based and computer-based interventions (DeLamater 2000, Downs 2004); Clinical protocol and One - on - One program which include Advance promotion of Emergency Contraceptive promotion (Raymond 2006, Raine 2000), clinic based programs (Lindberg 2006), promotion of clinic appointments and supportive activities (Danielson 1990, Orr 1996); Youth development programs (Service learning such as the Reach for Health Service Learning Program (O'Donnell 2003), Teen Outreach Program (TOP) (Philliber 1992) and Vocational Education (Summer Training and Education Program (STEP) (Grossman 1992).

How the intervention might work

Interventions that are designed to reduce teen pregnancy appears to be most effective when a multifaceted approach is used, as the problem is multiple determined and multidimensional. The interventions should not only focus on sexual factors and related consequences, rather they should include non sexual factors such as skills training, and personal development as well. Further, stakeholders including pregnant teens, parents, health sector, schools and churches should work together to devise programs that are practical, evidence based, culturally appropriated and acceptable to the target population.

Some interventions focuses primarily on changing the psychosocial risk and protective factors that involve sexuality. One of such is the Safer Choices (Coyle 2001) which improves teens' knowledge about risks and consequences of pregnancy and STD, values and attitudes regarding sexual values and beliefs, perceptions of peer norms about sex and contraception, self efficacy (ability to say 'no' to unwanted sex), consistent use of contraception including condoms and their intentions regarding sexual behaviours. Some interventions promotes abstinence only (Denny 2006), and others adds a comprehensive health education approach wherein safer sexual practices are also included (Jemmott III 1998). Parents/ teens sex and STD/HIV education programs seeks to improve parent/child communication regarding sexual health and sexuality, and promote connectedness (Dilorio 2006). Clinic protocols and one-on-one programs promotes practices that provide advance provision of emergency contraceptive to high risk adolescents (Orr 1996, Lindberg 2006), as well as providing health counselling for young men (Danielson 1990).

Other interventions focuses on nonsexual factors such as the youth development endeavours to engender positive values in adolescents, inspiring hope for future aspirations, improving performance in school and bolstering family relationships. They also aim to reduce risky behaviours such substance abuse and violence; promote service learning programs which provides supervised volunteer community service opportunities as well as mentoring opportunities on skills building for adolescents (O'Donnell 2003, Philliber 1992). Some make use of trained peer educators to conduct the health education sessions serving as mentor/role model in achieving sustained behavioural changes (Borgia 2005).

Experts suggest that in order to reduce teenage pregnancies, interventions should be designed to address multiple sexual and non-sexual antecedents that correlate with adolescent sexuality, and which may be related to the adolescents, their families, schools, communities and cultural factors - notably religion (Kirby 2002a). With regard to cultural factors, an Israeli study showed that the incidence of pregnancy was three times higher among Muslims than among Jews (Sikron 2003). This raises questions about the possible impact of faith-based interventions, which tend to start early and are often sustained for long periods at the home and community levels. Premarital or extra-marital sex whether by young or older people is seen by the larger society as a violation of morality. Most moral codes and laws that prescribe acceptable conducts of sexual relationships have their origin in major religions.

Why it is important to do this review

Evaluation studies of specific interventions as well as reviews and meta-analyses of the effects of current strategies show discrepant evidence of effectiveness (DiCenso 2002, Fullerton 1997). For example, a review of 73 studies reported that four intervention programs resulted in delay in initiation of sexual intercourse, increased condom and contraceptive use, and reduced unintended teenage pregnancy (Kirby 2002ba). The interventions identified as being effective in that review were: sex and HIV education curricula; one-on-one clinician-patient protocols in healthcare settings; service learning programs; and intensive youth development program (Kirby 2002b).

Another systematic review of randomized controlled trials showed that several primary prevention measures did not delay the initiation of sexual intercourse or reduce the number of pregnancies among adolescents (DiCenso 2002). As this review demonstrated, a small number of programs actually led to an increase in the number of pregnancies among partners of male participants of abstinence programs (DiCenso 2002). One author had attributed the small decline in the level of adolescent pregnancy in the US to a decrease in sexual activity and an increase in contraceptive use, especially long-term contraceptive injectables and implants (Pettinato 2003), fear of contracting HIV/AIDS, health education programs, a changing moral climate, new contraceptives, and improved economic climate (Klerman 2002).

It is possible that discrepancies in results of existing reviews and meta-analyses may partly be explained by design flaws in the evaluation studies and reviews. For example, most reviews included non-randomized and observational studies; most were limited in scope through their exclusion of unpublished studies; very few included rigorous statistical analysis, and some were based on surveys (Franklin 1997).

This call for rigorous reviews to more clearly elucidate the effects of these interventions, taking cognizance of the complex and multifactorial nature of adolescent sexuality and pregnancy.

Moreover, most of the reviews were limited to industrialized nations (DiCenso 2002), and thus could not account for any influences of social, cultural, and economic factors in diverse populations. Such reviews have limited value to bilateral agencies and international NGOs working in the field of adolescent health promotion. In light of this, the Cochrane systematic approach was used to limit bias (systematic errors) and reduce chance effects, thereby providing more reliable results upon which to draw conclusions and make rational and evidence-based recommendations (Oxman 1993, Antman 1992). This review draws from the expertise and resources already developed within the Cochrane Collaboration in general and the Fertility Regulation Group in particular.

In this review, we assessed and summarized the effects that adolescent pregnancy prevention interventions have on: [i] their knowledge and attitudes relating to risks of unintended pregnancies, [ii] delay in initiation of sexual intercourse, [iii] consistent use of birth control methods, and [iv] reduction in unintended pregnancies. To reduce publication bias (Cook 1993, Dickersin 1990), we considered all published and unpublished randomized controlled studies that assessed the effectiveness of interventions to reduce unintended pregnancy among adolescents, written in any language. Studies conducted in both developed and less developed countries (WHO 1995) were also considered. This body of evidence will help to elucidate what works, and what does not in the efforts to reduce unintended pregnancies among adolescents, and thus help to justify use of scarce resources, train public health professionals, and facilitate design of interventions that are effective.

OBJECTIVES

To assess the effects of primary prevention interventions (school-based, community/home-based, clinic-based, and faith-based) on unintended pregnancies among adolescents.

METHODS

Criteria for considering studies for this review

Types of studies

Randomized controlled trials, including cluster randomized trials where the unit of randomization is the household, community, youth centre, school, classroom, health facility, or faith-based institution.

Types of participants

Male and female adolescents aged 10-19 years

Types of interventions

"Intervention: Any activity (either health education or counselling only, health education plus skills-building, health education plus contraception-education, contraception education and distribution, faith-based group or individual counselling) designed to: increase adolescents' knowledge and attitudes about the risk of unintended pregnancies, promote delay in initiation of sexual intercourse, encourage consistent use of birth control methods and reduce unintended pregnancies. Where our search strategy identified studies that were not specifically designed to influence adolescent pregnancy, but were later reported to influence any of our primary or secondary outcomes, we included such studies if they met the other eligibility criteria.

Interventions were categorized as follows: (i) Educational interventions: health education, HIV/STD education, community services, counselling only, health education plus skills-building, faith-based group or individual counselling. (ii) Contraception promotion: contraception-education with or without contraception distribution (iii) Multiple interventions: combination of educational intervention with contraception promotion.

Control: No additional activity/intervention to existing conventional population-wide activities.

Types of outcome measures

Primary outcomes

1. Unintended pregnancy.

Secondary outcomes

1. Reported changes in knowledge and attitudes about the risk of unintended pregnancies.
2. Initiation of sexual intercourse.
3. Use of birth control methods
4. Abortion.
5. Childbirth.
6. Morbidity related to pregnancy, abortion or childbirth.
7. Mortality related to pregnancy, abortion or childbirth.
8. Sexually transmitted infections (including HIV)

Search methods for identification of studies

See:Fertility Regulation Group methods used in reviews.

No language restrictions were imposed, and translations were sought where necessary. No restrictions on journal of publication were imposed and no country names or other geographical terms were used in the search. Full search strategies are shown below.

Electronic searches

We searched all relevant studies regardless of language or publication status (published, unpublished, in press, and in progress).

We searched the Cochrane Central Register of Controlled Trials (CENTRAL), published in The Cochrane Library (Issue 1, 2009).

We were assisted by the Trials Search Coordinator of the Cochrane Fertility Regulation Group to search the Group's specialized trial register (Code: SR-FERTILREG).

We searched the Specialist Health Promotion Register (Social Science Research Unit (SSRU), Institute of Education, University of London at: http://eppi.ioe.ac.uk; June 2005.

We searched LILACS (La Literatura Latinoamericana y del Caribe de Informacion en Ciencias de la Salud) database 2008 (www.bireme.br; accessed December 2008) and the Social Science Citation Index and Science Citation Index (1981 to June 2007).

We also searched the following electronic databases: MEDLINE (1966 - December 2008), EMBASE (1980 - November 2008), Dissertations Abstracts Online (http://library.dialog.com/bluesheets/html/bl0035.html), The Gray Literature Network (http://www.osti.gov/graylit/), HealthStar, PsycINFO, CINAHL and POPLINE for randomized controlled trials using the Cochrane Fertility Regulation Group search strategy (Helmerhorst 2004):

For search terms, see Appendix 1.

Searching other resources

In addition, we contacted individual researchers, national and international research institutes/centres and organizations (including non-governmental organizations) working in the field of adolescent reproductive health in order to obtain information on unpublished and on-going trials. To ensure that no relevant studies were left out, we read through the list of references in each identified study in order to follow up on articles that may have qualified for inclusion in the review.

Data collection and analysis

Ninety eight (98) potentially relevant studies were identified of which 41 studies met the inclusion criteria and one is awaiting data extraction (Studies awaiting classification) pending the collection of complete data from the author.

Selection of studies

Two authors (CO and EE) independently applied the inclusion criteria to all identified studies and made decisions on which studies to include. The studies were initially checked for duplicates and relevance to the review by looking at the titles and abstracts. Where it was not possible to exclude a publication by looking at the title or the abstract, the full paper was retrieved. Differences were resolved by discussion and consultation with a third author

(MM, HE or JE) when in doubt. The results section of each publication was blinded during screening to minimize bias. There were no language preferences in the search or the selection of articles.

Data extraction and management

Data extraction was undertaken by two authors (CO and EE), using a standard data extraction form. We extracted the following data from each study that qualified for inclusion in the review:
Methods: The nature of concealment of allocation to study or control group (whether adequate, unclear, inadequate, or not done), study duration, type of trial, provider and outcome assessor blinding, extent of drop-outs and cross-overs, co-interventions, other potential confounders, and any validity criteria that were used.
Participants: Study setting (including country, state, region, community) and unit of randomization (schools, households, communities, faith-based institutions), age, gender, race/ethnicity, and other socio-demographic characteristics of participants.
Interventions: Nature of the intervention delivered to the study and control groups, and how it was delivered; timing and duration, and length of follow-up.
Outcome measures and results: Differences between intervention and control groups in terms of unintended pregnancy (first pregnancy), reported knowledge and attitudes about the risk of unintended pregnancies, initiation of sexual intercourse, use of birth control methods, abortion, childbirth, morbidity related to pregnancy, abortion or childbirth, and mortality related to pregnancy, abortion or childbirth.
Missing data: Missing data arose from two sources: participant attrition and missing statistics.

Assessment of risk of bias in included studies

We assessed the methodological quality of included studies using standard methods for randomized controlled trials as described in the Cochrane Handbook for systematic reviews of interventions Version 5.0.1 (Higgins 2008).
We considered six parameters: generation of allocation sequence, concealment of allocation sequence, blinding, incomplete outcome data, selective outcome reporting and other sources of bias.
a) Generation of allocation sequence: Yes - if the method described was suitable to prevent selection bias (such as computer generated random numbers, table of random numbers or drawing lots); Unclear - if the method was not described but trial was described as "randomized"; and No - if sequences could be related to prognosis (case record number, date of birth, day, month, or year of admission).
(b) Concealment of allocation: Yes - if there was evidence that the authors took proper measures to conceal allocation through for example, through centralized randomization or use of serially numbered, opaque, sealed envelopes; Unclear - if the authors either did not report an allocation concealment scheme at all, or reported an approach that is unclear; No - if concealment of allocation was inadequate (such as alternation or reference to participant identification numbers or dates of birth).
(c) Blinding: Yes - if there was evidence of no blinding and outcomes are unlikely to be influenced by lack of blinding or blinding of participants and key study personnel was ensured and unlikely that it was broken or outcome assessment was blinding and the non-blinding of others unlikely to introduce bias; Unclear - insufficient information or outcome not addressed; No - No blinding and outcome likely to be influenced by lack of blinding or blinding carried out but likely to be broken.
(d) Incomplete outcome data: Yes - if there is evidence that there are no missing outcome data or reason for missing outcome data unlikely to be related to true outcome or missing outcome data balanced in numbers across intervention groups and with similar reasons across groups or for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk not enough to have a clinically relevant impact on the intervention effect estimate or for continuous outcome data, plausible effect size (difference in means or standardized difference in means) among missing outcomes not enough to have a clinically relevant impact on observed effect size or missing data have been imputed using appropriate methods; Unclear - Insufficient reporting of attrition/exclusions to permit judgement of 'Yes' or 'No' (e.g. number randomized not stated, no reasons for missing data provided) or outcome not addressed; No - reason for missing outcome data likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across intervention groups or for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk enough to induce clinically relevant bias in intervention effect estimate or for continuous outcome data, plausible effect size (difference in means or standardized difference in means) among missing outcomes enough to induce clinically relevant bias in observed effect size or 'As-treated' analysis done with substantial departure of the intervention received from that assigned at randomization or potentially inappropriate application of simple imputation
(e) Selective outcome reporting: Yes - if there is evidence that all of the study's pre-specified (primary and secondary) outcomes that are of interest in the review have been reported as stated in the protocol or it is clear that the published reports include all expected outcomes, including those that were pre-specified in the absence of the protocol; Unclear - Insufficient information to permit judgement of 'Yes' or 'No'; No - Not all of the study's pre-specified primary outcomes have been reported; or One or more primary outcomes is reported using measurements, analysis methods or subsets of the data (e.g. subscales) that were not pre-specified or One or more reported primary outcomes were not pre-specified or One or more outcomes of interest in the review are reported incompletely so that they cannot be entered in a meta-analysis or The study report fails to include results for a key outcome that would be expected to have been reported for such a

study.
(f) Other sources of bias: Yes - if study is free of other sources of bias; Unclear - insufficient information to assess if an important risk of bias exists or insufficient rationale or evidence that an identified problem will introduce bias; No - has extreme baseline imbalance or claimed to have been fraudulent or stopped early due to some data-dependent process (including a formal - stopping rule) or potential source of bias related to the specific study design used.

Measures of treatment effect

Data entry and analysis were performed in Review Manager (Revman) version 5. For meta-analysis of categorical variables we calculated Relative Risk (RR) or Peto's Odd Ratio (OR) with 95% confidence interval (Cl). For meta-analysis of continuous variables we calculated weighted mean differences (WMD).

Unit of analysis issues

Cluster randomized trials
Only cluster-randomized trials for which adjustment had been made for design effect were included in the meta-analyses. Where possible, we corrected for design effects using standard procedures (Rao 1992). Before entering the results of cluster-randomized studies into RevMan, we transformed outcome data according to the procedure in the Cochrane Handbook (Higgins 2005, supported in Adam 2004), dividing the number of events and number of participants by the design effect [1 + (1 - m) * r]. We used the details provided by each study (total n and number of clusters) to calculate the average cluster size (m). Since most of the trials did not provide the intra cluster correlation coefficient, we adopted fairly reliable intra cluster correlation coefficient of 0.02 which had been used in a similar systematic review (DiCenso 2002).
Trials with multiple groups
Eight studies had multiple groups (Herceg-Brown 1986, Jemmott III 1998, Morberg 1998, Downs 2004, Jemmott III 2005, Raine 2005, Walker 2006, Dilorio 2006). For studies included in the meta analyses (Herceg-Brown 1986, Jemmott III 1998, Morberg 1998, Raine 2005, Dilorio 2006), we combined all relevant experimental intervention groups in the studies into a single group. The same was done for the control groups as recommended by the Cochrane Handbook, Section 16.5.4.

Dealing with missing data

Missing data arose from participant attrition and missing statistics. Where possible, we extracted data by allocation intervention, irrespective of compliance with the allocated intervention, in order to allow an 'intention-to-treat' analysis as this minimizes bias (Hollis, 1999); otherwise we performed an 'as treated' analysis. We included these variables in a meta-analysis using Review Manager 5.0 for the outcomes selected above (Review Manager 2008). We conducted sensitivity analyses to investigate attrition as a source of heterogeneity and possible bias.
Where statistics were missing (numbers of participants per group, attrition rates, percentage affected for each outcome), we contacted primary study authors to supply the information. Where the information was unavailable due to data loss or non-response, we reported the available results as stated in the trial report in the Additional table (Table 1).

Table 1. Studies That Can Not Be Included in Meta Analysis

Intervention	Outcome	Study ID	Number Assessed	Case affected	Control affected	summary Of effects by authors	Test Statistics	95% CI	p-value
Educational Intervention	Pregnancy	O'Donnell 2002	195	6.8%	18.5%	Favour intervention	-	-	-
		Mitchell-DiCenso 1997	1701	-	-	Favour intervention	OR: 0.97	0.98 to 1.0	0.04
		Allen 1997	560	-	-	Favour intervention	OR: 0.41	-	-
	Initiation of Intercourse	Clark 2005	156	-	-	No significant effect	Beta: 1.604 and SE: 1.00	-	< 0.11

Table 1. Studies That Can Not Be Included in Meta Analysis (*Continued*)

		O'Donnell 2002	195	40.1%	66.1%	Favour intervention	OR: 0.39	0.20 to 0.76	0.005
	Use of birth control at last sex	Mitchell-DiCenso 1997 (females)	109	42.2%	46.7%	No significant effect	OR: 1.03	1.00 to 1.07	0.03
		Mitchell-DiCenso 1997 (males)	214	39.3%	35.9%	No significant effect	OR: 1.06	1.02 to 1.77	0.005
	Use of condom at last sex	Okonofua 2003	1896	39.1%	31.9%	Favour intervention	OR: 1.41	1.12 to 1.77	-
Multiple Intervention	Pregnancy	Coyle 2006	308	-	-	No significant effect	OR; 0.84	-	0.61
		Diclemente 2004	460	-	-	No significant effect	OR: 0.53	0.27 to 1.03	0.06
		Stephenson 2004	1172	2.3%	3.3%	No significant effect	-	-	0.07
		Kirby 2004	2145	-	-	Favour Intervention	OR: 1.34	0.98 to 1.84	0.07
		Coyle 2006	417	-	-	No significant effect	OR: 0.77	0.49 to 1.23	0.28
		Smith 1994	95	-	-	Favour intervention	-	-	< 0.05
	Initiation of sexual intercourse (Mixed gender)	Coyle 2006	94	-	-	No significant effect	OR: 1.23	0.51 to 2.97	0.65
		Smith 1994	95	.Mean: 1.19	.Mean: 2.74	Favour intervention			
		Basen-Engquist	8326	-	-	No significant effect	OR: 1.03	0.88 to 1.21	0.69

Table 1. Studies That Can Not Be Included in Meta Analysis (*Continued*)

		2001							
	Initiation of sexual intercourse (Males)	Coyle 2004	1412	19.3%	27.7%	Favour Intervention	model R^2: 0.118	-	0.02
		Kirby 2004	809	-	-	No significant effect	OR: 1.08	0.80 to 1.46	0.63
		Stephenson 2004	8156	32.7%	31.1%	No significant effect	OR: 0.90	0.65 to 1.23	0.35
		Eisen 1990	408	36%	44%	Favour Intervention	-	-	-
	Initiation of intercourse (female)	Coyle 2004	1417	20.3%	22.1%	No significant effect	model R^2: 0.145	-	0.53
		Kirby 2004	1220	-	-	No significant effect	OR: 0.88	0.59 to 1.31	0.54
		Stephenson 2004	8156	34.7%	40.8%	Favour intervention	OR: 0.80	0.66 to 0.97	0.008
		Eisen 1990	480	27%	22%	No significant effect	-	-	-
	Use of condoms at last sex	Kirby 2004	2145	-	-	Favour intervention	OR: 1.38	1.06 to 1.79	0.02
		Coyle 2006	359	-	-	No significant effect	OR: 1.00	0.49 to 1.23	0.99
		Diclemente 2004	460	-	-	Favour intervention	OR: 3.94	2.58 to 6.03	< .001
		Downs 2004	258	-	-	No significant effect	OR: 2.13	-	0.15
	Childbirth	Henderson 2007	4196	300/1000	274/1000	No significant effect	OR: 14.6		0.32

Table 1. Studies That Can Not Be Included in Meta Analysis (*Continued*)

	Abortion	Henderson 2007	4196	127/1000	112/1000	No significant effect	OR: 26.4		0.40

Assessment of heterogeneity

We assessed data sets for heterogeneity by visual assessment of forest plots and chi-square tests for heterogeneity with a 10% level of statistical significance, and applied the I square test statistic with a value of 50% or higher denoting significant levels of heterogeneity.

Assessment of reporting biases

Since asymmetry of funnel plots may result from publication bias, heterogeneity, or poor methodological quality, we planned to examine funnel plots using Review Manager 5 but found insufficient number of trials to do this.

Data synthesis

Fixed effects model (FEM) was used for data synthesis and Random effects model (REM) for cases where we detected heterogeneity, and considered it appropriate to still perform meta-analysis.

Subgroup analysis and investigation of heterogeneity

We sub-grouped the use of birth control into "condom use at last sex", "consistent condom use" and "use of hormonal contraceptive". We found insufficient data to conduct sub-group analysis of homosexual and heterosexual intercourse. We excluded quasi-experimental studies (controlled before and after, and interrupted time series) as this was cumbersome and would have prolonged the completion of this review.

Sensitivity analysis

We conducted sensitivity analysis of the primary outcome (unintended pregnancy) including and excluding trials with high attrition rates (> 20%). The number of trials that used adequate allocation concealment was insufficient to allow for sensitivity analysis to assess the possible influence of high risk bias in trials that did not apply allocation concealment.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification.

Results of the search

One hundred and one studies were found, of which forty one were included, sixty excluded with one awaiting assessment (Characteristics of studies awaiting classification); primary authors of this paper have been approached for relevant additional information.

Included studies

All the studies were randomized controlled trials. Eleven of the studies randomized individuals, twenty six randomized clusters (schools (19), classrooms (5), and communities/neighbourhoods (2). Three studies were mixed (individually and cluster randomized) (Eisen 1990, Allen 1997, Kirby 1997b). The length of follow up varied from 3 months to 4.5 years, with greater than 12 months being the most common duration.

Participants: A total of 95662 participants were included in all the included studies. The number of participants per study varied greatly (Characteristics of included studies). Most of the studies confined inclusion of participants to specific age requirements, others restricted inclusion based on specific grade levels (varying between 6th - 12 grade). The age of participants in the included studies ranged from 9-19 years, except four studies which included participants aged 9 -24 years (Shrier 2001 (13 - 22 years (median 17)); Okonofua 2003 (14 - 20 years); Raine 2005 (15 - 24 years (mean 19.9); and Raymond 2006 (14 - 24 years). For these four studies, more than 75% of the participants were within the stipulated age limit of 10-19 years. Five studies included participants who were sexually active (Diclemente 2004, Downs 2004, Jemmott III 2005, Raine 2005, Raymond 2006,); one study recruited adolescent mothers <18 years at time of delivery living with their mothers (Black 2006). Participants included males and females in most studies. Eleven studies included females only (Herceg-Brown 1986, Ferguson 1998, Shrier 2001, Diclemente 2004, Downs 2004, Cabezon 2005, Jemmott III 2005, Raine

2005, Black 2006, Raymond 2006, Henderson 2007) and one males only (Dilorio 2007).

Settings: Two trials were conducted in developing countries (Fawole 1999, Okonofua 2003), and all others were conducted in developed countries: United States of America (31), England (2), Canada (1), Italy (1), Mexico (3) and Scotland (1). Most of the studies were conducted in schools. Other sites included hospitals or family planning health agencies, neighbourhoods/communities and clubs.

Intervention:

Educational intervention; Five studies compared an educational intervention to a standard school curriculum (control) for 9 months (Allen 1997), 12 months (Clark 2005), 15 months (Aarons 2000), 4 years (Mitchell-DiCenso 1997, O'Donnell 2002) and one to no intervention for 12 months (Okonofua 2003). One study compared an educational intervention to an intervention unrelated to sexual behaviour (good nutrition and exercise) for 12 months (Dilorio 2007). Another study offered the same intervention to the two groups differing in instructors (peers and teachers) for 5 months (Borgia 2005).

Contraception promotion: Two studies compared contraception access methods; two intervention groups (pharmacy access and advance provision of contraceptives) and a control (clinic access) for 6 months (Raine 2005) and increased access versus standard access for 1 year (Raymond 2006). Another study compared contraception education to regular school sex education over 6 months (Graham 2002).

Multiple Intervention (educational and contraceptive promotion): Thirteen studies compared a combination of education intervention and contraceptive promotion with standard school curriculum for 6 months (Fawole 1999), 3 years (Philliber 2002), standard school curriculum plus condom distribution for 7 months (Coyle 1999), 12 months (Eisen 1990, Shrier 2001), 17 months (Kirby 1997a, Kirby 1997b), 18 months (Coyle 2006), 2 years (Wight 2002), 31 months (Basen-Engquist 2001, Kirby 2004), 36 months (Coyle 2004), 4.5 years (Henderson 2007). , .

Two studies compared multiple interventions with health promotional intervention unrelated to sexual behaviour (control) for 12 months (Diclemente 2004, Villarruel 2006). Two studies compared multiple interventions with no intervention for 24 months (Black 2006) and 4 years (Cabezon 2005). One study offered written materials on contraception and decision making to the control group (Smith 1994).

Six studies had more than one intervention (including regular clinic services and staff supports through telephone calls) and a control (regular clinic services) for 15 months (Herceg-Brown 1986); same intervention (one with an emphasis on abstinence and the other the use of contraceptives) and health issues not related to sex for 12 months (Jemmott III 1998); same intervention (one with emphasis on condoms and the other emergency contraceptives) versus biology based sex education for 16 months (Walker 2006); same intervention (informative and skill-based(practical) versus health promotion for 12 months (Jemmott III 2005); social cognitive theory and problem behaviour theory versus 1-hr HIV prevention session for 24 months (Dilorio 2006); 4 week intervention over 3 years and 12 week intervention over one year versus regular school curriculum for 3 years (Morberg 1998).

One study had an intervention and two control groups; same intervention differing in their method of administration (interactive video, book or brochure) for 6 months (Downs 2004).

One study offered a peer-led multiple interventions versus usual teacher-led sex education for 18 months (Stephenson 2004).

Outcomes: Fifteen studies assessed and reported on unintended pregnancy (Herceg-Brown 1986, Zabin 1986, Howard 1990, Allen 1997, Kirby 1997a, Kirby 1997b, Mitchell-DiCenso 1997, Ferguson 1998, Philliber 2002, Diclemente 2004, Stephenson 2004, Cabezon 2005, Raine 2005, Coyle 2006, Raymond 2006) , and one study reported second unintended pregnancy (Black 2006). Other outcomes reported were initiation of intercourse (24 studies), consistent use of contraceptive or condoms (8), use of contraceptives or condoms at last sex(18), use of hormonal contraceptives (3), knowledge about the risk of pregnancy (1), abstinence (1), sexually transmitted diseases (10), childbirth (2) and abortion (1).

Excluded studies

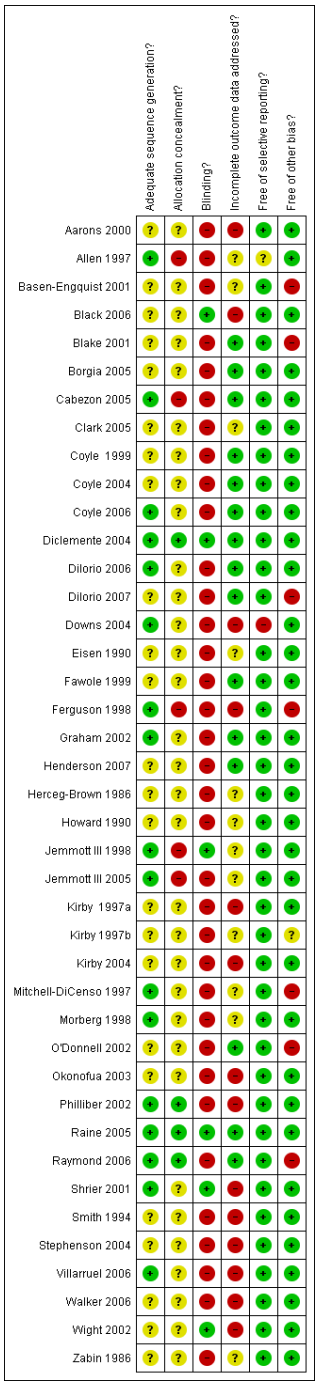
Fifty-six studies were excluded; twenty-eight studies, though randomized studies were excluded for either of the following reasons: none of the desired outcomes were measured, participants were either pregnant or couples, participants were above the required age range, did not use the desired intervention and stated method of randomization not adequate. The remaining studies (28) were not randomized controlled studies (Characteristics of excluded studies).

No ongoing studies were found.

Risk of bias in included studies

See Figure 1

Figure 1. Risk of bias summary: review authors' judgments about each risk of bias item for each included study.



Allocation

Generation of allocation sequence: For eight studies, allocation sequence was computer generated (Jemmott III 1998, Graham 2002, Stephenson 2004, Jemmott III 2005, Raine 2005, Dilorio 2006, Raymond 2006, Villarruel 2006,), four used a table of random numbers (Mitchell-DiCenso 1997, Shrier 2001, Downs 2004, Diclemente 2004), one used simple balloting (Cabezon 2005), two used coin toss technique (Allen 1997, Ferguson 1998). Two trials used restricted randomization involving multiple steps (Coyle 2004, Coyle 2006), and two other studies used block randomization (Morberg 1998, Philliber 2002,). One trial reported use of "balanced randomization" (Wight 2002) but gave no details to explain the procedure and another one used quarterly marking period within school (Blake 2001). The remaining studies (20) had insufficient or no information on randomization generation method and used terms such as "assigned at random" or "randomly assigned" leaving us uncertain whether trial results were vulnerable to selection bias.

Allocation concealment: Four studies reported adequate allocation concealment that used sealed, opaque envelopes (Philliber 2002, Diclemente 2004, Raine 2005, Raymond 2006). The remaining studies did not provide information on concealment of allocation.

Baseline differences can be increased by inadequate and clustered randomization sequences. Out of the forty one trials, 15 reported at least one significant group difference at baseline (Zabin 1986, Smith 1994, Allen 1997, Kirby 1997b, Mitchell-DiCenso 1997, Jemmott III 1998, Morberg 1998, Aarons 2000, Basen-Engquist 2001, Okonofua 2003, Coyle 2004, Jemmott III 2005, Coyle 2006, Dilorio 2006, Raymond 2006,) and each one of these trials controlled for baseline differences in analyses.

Three trials did not report a clear statement of baseline differences between groups (Ferguson 1998, Dilorio 2007, Henderson 2007,) but controlled for these differences in their analyses. One trial used a significance level of P<0.01 for these calculations (Kirby 1997a), and two reported baseline differences only for sexual behaviours (O'Donnell 2002, Clark 2005).

Blinding

For most of the trials, staff (assessors and administrators) were not blinded to group assignment as every trial utilized written self-reported questionnaires, although assessor blinding was reported in six studies (Jemmott III 1998, Shrier 2001, Wight 2002, Diclemente 2004, Raine 2005, Black 2006). Blinding was not reported in the remaining thirty five studies. The impossibility of blinding intervention staff may have given rise to performance bias.

Contamination or "exchange of information" of the control group might have occurred as the intervention and control groups sometimes attended different programs at the same site . This is more likely to be present in trials that randomized participants by individual or classroom, rather than by entire community centre, school or neighbourhood. This, however, leads to bias in the findings in the direction of no effect rather than in the direction of significance.

Incomplete outcome data

Attrition rates at final follow-up ranged from 0.5% (Henderson 2007) to 48% (Shrier 2001).Two trials did not report number lost to follow up (Blake 2001, Philliber 2002). Fourteen trials reported overall attrition rates that exceeded 20% at final follow up (Eisen 1990, Smith 1994, Kirby 1997a, Mitchell-DiCenso 1997, Basen-Engquist 2001, Shrier 2001, O'Donnell 2002, Coyle 2004, Coyle 1999, Kirby 2004, Borgia 2005, Clark 2005, Coyle 2006, Walker 2006).

Most trials conducted a modified intention-to-treat analysis (whereby all student were included in the analysis regardless of number of sessions attended as long as they provided baseline and follow up data). Outcomes such as pregnancy, use of condoms, contraceptive and sexually transmitted diseases were analyzed using the number who initiated sex as the sample size. Coyle 2004 made use of a rich-imputation model based on baseline peer norms, group, time, ethnicity, and group-by-time interaction to account for dropouts. O'Donnell 2002 conducted several sets of analyses according to different principles: not reporting results according to original dropouts.

Studies with outcomes that could not be included in the meta analysis are reported in the Additional Table (Table 1).

Selective reporting

Apart from the primary outcome, most included studies reported a range of outcomes (sexual behaviour), using different recall periods and grouping outcomes such as initiation of intercourse at 3 months, 6 months, and use of condoms at last sex thus suggesting no standard set of outcomes for evaluation, preventing a comprehensive meta-analysis.

Results were also analyzed based on subgroups of participants, for example, measuring initiation of intercourse among virgins and non - virgins at baseline. More often, sexual initiation was often assessed only among participants who reported never having had sexual intercourse at baseline.

Few studies reported at least one outcome separately by gender without providing overall summaries of effect (Aarons 2000, O'Donnell 2002, Coyle 2004,).

Due to missing information such as numbers of participants per trial arm and percentages for dichotomous outcomes, meta-analysis could not be carried out for some studies.

The lack of statistical controls for cluster-randomized data, is a limitation for this study. While most cluster randomized studies controlled for clustering in their analyses, some did not (Allen 1997, Kirby 1997a, Fawole 1999, Aarons 2000) suggesting that studies which did not report statistical methods for dealing with clustered data, analyzed their results on an individual level.

Few studies attempted to control for the occurrence of a Type I er-

ror which is likely to occur when different outcomes are analyzed; Allen 1997, Raine 2005 used a Bonferroni correction when considering the significance of statistical tests, and Coyle 2004 stated it use though the method was not specified.

Other potential sources of bias

Limitations of self-report and behavioural outcome data

Most of the studies made use of self reported data which is an inevitable source of bias for studies evaluating sexual behaviours (as there is the tendency for respondents to agree with statements associated with healthier behaviours or attitudes). However, the veracity of the self-reported behaviours was improved by privacy and confidentiality in most studies.

Heterogeneity in program design and implementation across trials

A major source of bias in this review is a high degree of heterogeneity in the ways programs were designed and implemented across trials. This can be seen in some of the meta-analyses carried out. Our inclusion criteria specified that we would accept interventions that aimed to prevent unintended pregnancy while promoting safer-sex strategies such as condom use or contraceptive use but it is unclear how much emphasis was put on these goals. An example is Eisen 1990 that offered almost the same intervention to both groups differing only in the level of emphasis and duration of the intervention.

Finding relevant trials

Though the search for relevant trials was comprehensive, it is likely that relevant trials may have been omitted from this review, if the specified search terms were not mentioned in the title and abstracts plus inability to assess all unpublished trials.

Underreporting of implementation data

Inadequate description of program design and implementation made the assessment of heterogeneity challenging. Differences in the way that programs were designed, delivered, and taken up may have made the studies too heterogeneous to permit comparisons across trials; however, these differences are difficult to determine from the available data and could have influenced the meta-analyses. Few studies reported strategies to monitor and promote the extent to which programs were delivered by facilitators and taken up by participants as planned. Such strategies include take home assignments, keeping attendance, conducting interviews with program staff and participants, conducting exit interviews with participants and communication with participants by phone (Herceg-Brown 1986, Dilorio 2006). Though these strategies were put in place, trials rarely stated the extent of implementation fidelity. One study Morberg 1998, reported difficulties for community-based program activities to convey program messages related to sexual behaviour due to vocal opposition; at one program site a member of the community opposition group attended every program session related to sexual behaviour, potentially affecting program delivery.

Effects of interventions

MULTIPLE INTERVENTIONS

Unintended pregnancy: Two individually randomized trials (858 participants) Herceg-Brown 1986, Philliber 2002, showed that risk of unintended pregnancy was lower among participants that received multiple interventions (43/397) compared with the control group (69/461); the difference approached statistical significance (RR 0.72, 95% Cl 0.51 to1.03; (Analysis 1.1).

Five cluster trials adjusted for design effect (3149 participants) (Howard 1990, Kirby 1997b, Ferguson 1998, Wight 2002, Cabezon 2005) showed lower risk of unintended pregnancy in the intervention group (71/2009) than the control group (76/1140) but the difference was not statistically significant (RR: 0.50, 95% Cl 0.23 to 1.09 (Analysis 1.2). However sensitivity analysis excluding trials with high attrition rates showed that the risk of unintended pregnancy was significantly lower in the intervention (10/314) than control groups (28/183) (RR 0.20, 95% Cl 0.10 to 0.39 (Analysis 2.1). In addition, an analysis that combined cluster-randomized trials (adjusted for design effect) with individually randomized trials (Herceg-Brown 1986, Ferguson 1998, Cabezon 2005) showed statistically significantly lower risk of unintended pregnancy in the intervention group than control (RR 0.49, 95% Cl 0.33 to 0.74). This sensitivity analysis showed a persistence of statistical heterogeneity with I^2 test of 92% (Analysis 2.2).

Table 1 shows trials with insufficient data for inclusion in meta-analyses. Based on trial authors' conclusions, three of the trials reported results in favour of the intervention groups suggesting that the intervention reduced the risk of unintended pregnancy (Smith 1994, Coyle 1999, Kirby 2004).

Initiation of sexual intercourse:

Three individually randomized trials (Jemmott III 1998, Philliber 2002, Villarruel 2006)reporting initiation of intercourse among a mixed gender sample (combined male and female) showed that participants in the intervention group (308/844) were less likely to initiate sexual intercourse during the intervention or follow up period than control (331/702); the difference was marginally statistically significant (RR: 0.86; 95% Cl 0.77 to 0.96; (Analysis 1.3)).

Two cluster randomized studies (Kirby 1997a, Wight 2002) showed no statistically significant difference in effects between intervention and control groups among males (RR: 0.97, 95% Cl 0.87 to 1.08) or females (RR: 0.99, 95% Cl 0.87 to 1.13). Five cluster trials; Howard 1990, Ferguson 1998, Morberg 1998, Fawole 1999, (1486 participants) that merged male and female participants showed no statistically significant difference in effect (RR: 0.77, 95% Cl 0.47 to 1.28; with a statistical heterogeneity of I^2 of 80% (Analysis 1.4).

Sensitivity analysis excluding trials with high attrition rates also showed no statistically significant difference in effects in one individual randomized trial (Villarruel 2006) (RR: 0.88 95% Cl 0.71 to 1.09]) and three cluster randomized trials Ferguson 1998, Morberg 1998, Fawole 1999 (RR 0.92: 0.51 to 1.65). Meta-analysis including cluster-randomized trials (adjusted for design

effects) and individually randomized trials also showed no statistically significant difference in effects between intervention and control groups (RR 0.87: 0.70 to 1.09 (Analysis 3.3)).

The summary of the results of four trials (Eisen 1990, Smith 1994, Coyle 2004, Stephenson 2004) that reported this outcome but had insufficient data to meta-analyze has been presented in Table 1. Two trials reporting effects among males (Eisen 1990, Coyle 2004) concluded that participants who had multiple interventions were less likely to initiate intercourse during the period of follow-up in comparison to the control arm. One trial (Stephenson 2004) that reported the outcome in females also showed significant effects in favour of the intervention group.

Childbirth

One study (Philliber 2002) reported that relatively fewer participants in the intervention group (10/242) than in the control group (15/242) had experienced childbirth during the period of observation; the difference was, however, not statistically significant (RR: 0.67, 95% 95% CI 0.31 to 1.45 (Analysis 1.9)).

Second unintended pregnancy

One study (Black 2006) reported a lower risk of second unintended pregnancy in the intervention group (8/70) compared to the control group; the difference in effect approached statistical significance (19/79) (RR: 0.48, 95% CI 0.22 to 1.02 (Analysis 1.10).

CONTRACEPTIVE USE

See Analysis 1.5; Analysis 1.6

Two individually studies (Shrier 2001, Philliber 2002) reported condom use at last sex in the intervention group (149/182) and in the control group (162/206) (RR: 1.03, 95% CI 0.95 to 1.13). The result was not statistically significant.

Three cluster randomized trials (Kirby 1997a, Fawole 1999, Walker 2006) showed condom use at last sex in the intervention group (686/1369) compared to the control group (304/587). The result showed no statistically significant difference (RR: 1.01, 95% CI 0.87 to 1.16).

b) *Consistent Condom use*

Three individual RCTs (Herceg-Brown 1986, Jemmott III 1998, Villarruel 2006) reported consistent condom use in the intervention group (203/473) compared with the control group (168/471) (RR: 1.10, 95% CI 0.74 to 1.64). The difference was not statistically significant.

Two cluster RCTs (Morberg 1998, Fawole 1999) measuring consistent use of condoms during sexual intercourse found a non significant difference between the intervention group (61/129) and control group (22/167) (RR: 2.78, 95% CI 0.98 to 7.84).

c) *Use of hormonal contraceptive at last sex*

Three cluster RCTs (Kirby 1997a, Wight 2002, Walker 2006) compared hormonal contraceptive use at last sex in the intervention group (594/2379) and control group (392/1608) and found no statistically significant difference (RR: 1.01, 95% CI 0.71 to 1.43). There was statistically significant heterogeneity (I^2 =84.5%).

Sexually Transmitted Diseases (STD)

One individual RCT (Shrier 2001) reported STD occurring in 5 of 30 individuals in the intervention group as compared to 11 of 34 individuals in the control group (RR: 0.52. 95% CI 0.20 to 1.31 (Analysis 1.8)

Two cluster RCTs (Kirby 1997b, Fawole 1999) measured STD reporting in the intervention group (6/801) compared with the control group (9/830) (RR: 0.72, 95% CI 0.26 to 2.02 (Analysis 1.7). Neither the individual nor cluster randomized trials showed statistically significant effects.

EDUCATIONAL INTERVENTION

Initiation of sexual intercourse

One cluster RCT (Dilorio 2006) of an educational intervention showed no statistically significant difference in the proportion of participants that initiated sexual intercourse during follow-up in the intervention group (91/350) and control (45/175); (RR: 1.02, 95% CI 0.67 to 1.54 (Analysis 4.1).

Condom use at last sex

Two cluster RCTs (Borgia 2005, Dilorio 2006) showed that condom use at last sex was statistically significantly higher in the intervention group (258/704) than control group (190/727); (RR: 1.18, CI 1.06 to 1.32) See Analysis 4.2

CONTRACEPTIVE PROMOTION

Unintended pregnancy

Two individually randomized trials (Raine 2005, Raymond 2006) (3440 participants) showed no statistically significant difference in risk of unintended pregnancy between the intervention group (133/1572) and control (155/1868); (RR: 1.01, 95% CI 0.81 to 1.26 (Analysis 5.1).

Initiation of Sexual Intercourse

One cluster RCT (Graham 2002) measured initiation of sexual intercourse. The result showed no statistically significant difference in effect between intervention and control, neither for male participants (RR: 1.02, 95% CI 0.87 to 1.21) nor female (RR: 0.89, 95% CI 0.76 to 1.04 (Analysis 5.2).

Use of birth control

See Analysis 5.3 and Analysis 5.4

a) Condom use at last sex

Two individual RCTs (Raine 2005, Raymond 2006) of contraceptive promotion showed no statistically significant difference in condom use at last sex between intervention group (457/1395) and control group (622/1696); (RR: 0.94, 95% CI 0.87 to 1.04).

b) *Consistent condom use*

One individual RCT (Raine 2005) measured the consistent use of condoms in sexual intercourse; the result showed no statistically significant difference between intervention group (99/826) and control group (149/1124); (RR: 0.90, 95% CI 0.71 to 1.15).

c) *Hormonal contraceptive use*

Two individual RCTs (Raine 2005, Raymond 2006) showed that the rate of hormonal contraceptive use was significantly higher in the intervention group (366/1395) than in the control group (279/1696); (RR: 2.22, 95% CI 1.07 to 4.62). The analysis showed a statistically significant heterogeneity (I^2 = 86%).

One cluster RCT (Graham 2002) found no statistically significant difference in use of emergency contraceptive between the intervention group (63/195) and control (79/220); (RR: 0.90, 95% Cl 0.69 to 1.18 (Analysis 5.3).

Sexually Transmitted Diseases (STD)

Two individual RCTs (Raine 2005, Raymond 2006) of contraceptive interventions showed no statistically significant difference in risk of sexually transmitted diseases between the intervention group (143/1572) and control group (193/1868); (RR: 0.92, 95% Cl 0.75 to 1,13 (Analysis 5.5).

DISCUSSION

Summary of main results

Limited information suggests that programmes that involve concurrent application of multiple interventions (educational, skill building and contraception promotion) can reduce rates of unintended pregnancies in adolescents. Reviews done by kirby 2002a; Manlove 2002; National Research Council (NRC 1987) have also highlighted the need for multiple strategies to address this public health challenge. Sensitivity analyses including trials with lower risk of bias showed that more cases of unintended pregnancy were reported in the control group than those that received multiple preventive interventions. Promoting the use of contraceptive measures alone did not appear to reduce the risk of unintended pregnancy. There was insufficient data to show whether education as a single intervention would reduce the risk of unintended pregnancy.

The possible effects of these preventive interventions on secondary outcomes such as time of initiation of sexual intercourse, risk of sexually transmitted infections and use of contraceptive measures like condoms and pills were not conclusively determined because of insufficient data and variation in methods of reporting.

Overall completeness and applicability of evidence

External validity

Some of the limitations of this review include the relatively small datasets available for the main outcomes of interest, and the likelihood of incomplete reporting of such outcomes as abortion which have the potential to affect the rate of unintended pregnancy reported.

Furthermore, most of the trials were conducted in developed countries, thus this may limit the applicability of the results in less developed countries.

Another limitation is the small number of studies with a true control group (without any intervention capable of reducing the incidence of unintended pregnancy). Because most of the trial settings already had community wide interventions (primarily in schools) aimed at improving adolescent sexual behaviours, it was difficult to find trials that had a control arm that was totally devoid of any form of educational intervention. The situation is likely to be different in low income countries where such interventions may not be as widespread making it more feasible to set up trials with true control arms.

Evidence in the practice context

The evidence provided in this review shows that concurrent application of preventive interventions such as education, skill-building and contraception promotion could lower the incidence of unintended pregnancies in adolescents but the fact that most of the trials were conducted in industrialized countries (especially the USA) and among the lower socio-economic populations raises issues about applicability. The socio-cultural context as well as cost implications of these interventions should be considered in efforts to introduce such measures in low-income countries. Many low and middle-income countries may lack the infrastructure and resources to successfully implement these interventions. Trials in such resource-poor settings would be needed to address some of these contextual and location-specific issues.

Summaries for stakeholders

Application of the findings of this review should be approached with caution given the methodological deficiencies of included trials, the substantial heterogeneity across trials in the ways programs were delivered and the frequent omission of methodological details and implementation information from primary trial reports.

Quality of the evidence

Overall, the studies had several important strengths: most had large sample sizes, long-term follow-up, described the development of data collection instruments, used techniques to promote the validity of self-reported data, controlled for baseline differences in statistical analyses, and reported the causes and possible impacts of attrition.

Methodological quality was sometimes difficult to judge due to incomplete reporting of key methodological features and it was often difficult to obtain additional information by contacting the trial authors due to data loss and non-response. Weaknesses include the underreporting of key methodological features; few of the trials specified the procedures used for assigning participants, concealed allocation, blinded outcome assessors or separated program facilitators between the intervention and control groups.

Four studies reported adequate allocation concealment using sealed, opaque envelopes (Philliber 2002, Diclemente 2004, Raine 2005, Raymond 2006). The remaining studies did not provide information on concealment of allocation.

Assessor blinding was reported in four studies (Shrier 2001, Wight 2002, Diclemente 2004, Raine 2005) and not in the remaining thirty seven studies.

Twenty four studies had insufficient or no information on ran-

domization generation method and used terms such as "assigned at random" or "randomly assigned".

Attrition at last follow-up:

Ten studies included more than 90% of randomized participants in the analysis (defined in the review methods as adequate), twenty eight had greater than 10% attrition and accounted for less than 90% of randomized participants in the data analysis (inadequate), and two studies did not mention number of participants lost to follow up. The percentage loss to follow up ranged from 0.5% to 48%. Intention-to-treat analysis was reported for all outcomes in five studies (Wight 2002, Stephenson 2004, Borgia 2005, Raymond 2006, Villarruel 2006) and was reported for the primary outcomes in three studies (Graham 2002, Black 2006, Dilorio 2006).

Missing data:

Commonly missing data across studies included the number of participants per trial arm at baseline and follow-up, means and standard deviations for continuous outcomes, percentages for dichotomous outcomes, effect sizes, and attrition analyses.

Unit of analysis problems

Of the thirty trials that used cluster randomization, twenty-two controlled for clustering in analyses and eight did not (Allen 1997, Cabezon 2005, Ferguson 1998, Kirby 1997a, Fawole 1999, Howard 1990, Morberg 1998, Aarons 2000). While one study (Kirby 1997a) explained that using individual as unit of analysis gave no significant results thus no need for adjusting for clusters. These studies are potentially vulnerable to bias due to incorrect analysis and can result in one or more statistically significant effect occurring by chance.

Limitations of outcome measures:

All outcome data in this review are vulnerable to self-report bias except for pregnancy and STDs in the following studies: Jemmott III 1998; Raine 2005; Raymond 2006. These studies used biological outcomes which are better indicators for pregnancy and STDs. Self-reported behavioural outcomes unavoidably introduce self-report bias. Most behavioural outcomes were reported in subgroups and varied greatly such as initiation of intercourse ("last sex", "sex in the last 3 months", "sex among virgins"). Follow up periods also varied greatly. Likewise the use of contraceptives; while some studies used the term "contraceptive", others differentiated it into condom use, hormonal contraceptive, pills. The results of this review highlight the need for a standardized set of outcome measures with explicit definitions, consistent follow-up times and recall periods as to enable comparisons across primary trials. Long-term follow-up data are also particularly relevant for studies of unintended pregnancy and sexual behaviour, although these studies tend to lose large numbers of study participants to follow up.

Potential biases in the review process

There are several potential biases in the review process. Our search strategy, though exhaustive may have not been enough to identify all potentially important unpublished data, thus the review is not without publication bias. Several randomized controlled trials that we included did not measure unintended pregnancy which is primary outcome in this review.

While assessing trials for inclusion, we might have omitted trials that aimed at preventing unintended pregnancy as they may not have included any of the search terms in their title or abstract which we hope to correct in future updates.

Another source of bias is our inability to obtain relevant missing data, including methodological characteristics and outcome data leading to the exclusion of a number of trials from the meta-analysis. Twenty studies were included in the meta-analysis, of which the majority had various methodological limitations capable of increasing the risk of bias and definitely compromising the strength of evidence.

We encountered some difficulty finding a reliable intra-class correlation coefficient when computing the design effect for cluster randomized trials. Using the Cochrane handbook, we were able to run a sensitivity analysis for some of the data that provided enough information to calculate average cluster size using a range of possible ICC values. This could have affected the significance of results for isolated pairwise comparisons in the direction of insignificance.

Agreements and disagreements with other studies or reviews

Evidence about the prevention of unintended pregnancy in adolescence differed from a previous systematic review carried out (DiCenso 2002) as this reported that the interventions had no effect on the incidence of unintended pregnancy. The review did not include the recent trials, which reported a reduction in the incidence of unintended pregnancy in the intervention group (Philliber 2002, Cabezon 2005). Outcomes such as the initiation of sexual intercourse and contraceptive use showed no significant difference between intervention and control irrespective of intervention, a finding consistent with the previous review.

AUTHORS' CONCLUSIONS

Implications for practice

The results of this review suggest that the concurrent use of interventions such as education, skill-building and contraception promotion reduces the risk of unintended pregnancy in adolescents but offers little evidence about the effect of each of these interventions offered alone. Overall, the evidence remains inconclusive, and could not be the basis for recommending the use or discontinuation of any of these interventions where they are already in use.

Implications for research

The trials included in this review reported outcomes in different ways and were largely based in industrialized countries. There is a need to develop a uniform approach to reporting outcomes in these types of trials to make for comparability across studies and geographical context. More trials need to be conducted in low income countries to provide a balance of evidence with regard to the obvious disparities in socio-cultural and economic situations.

ACKNOWLEDGEMENTS

The support of the Australasian Cochrane Centre in providing the grant for this review is gratefully acknowledged. Professor Alba DiCenso is gratefully acknowledged for providing technical guidance.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Aarons 2000

Methods	Cluster-randomized controlled study; Method of generating allocation sequence not mentioned in the paper. Unit of randomization: schools
Participants	582 students who enrolled in the 7th grade at the beginning of the study; enrolled in the 8th grade at the beginning of the 1996/1997 session; capable of reading and comprehending the questionnaire in English or Spanish; Not truant or suspended during the trial, mean age of 12.8 years; 52% females and 48% males; 84% African American, 13% Hispanics, 2% others, low socioeconomic status
Interventions	Intervention: Three 45 minute reproductive health education classes by health professionals, Five 45 minutes sessions on postponing sexual involvement by peer leaders in 10th and 11th grades, health risk assessment questionnaire Control: Conventional education program
Outcomes	Initiation of intercourse, use of birth control/condoms at last sex
Notes	Duration of follow up: 15 months. Loss of follow up: 19%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method used for allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	No	Randomization was carried out in clusters, individual were used as unit of analysis.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Allen 1997

Methods	Randomized controlled trial. Randomization was done at two levels; Student (75% of sample) by picking names out a hat or choosing every other name on an alphabetized list and classroom (25% of sample) by a coin toss
Participants	695 students from 25 sites in the United States, 9th-12th grade, mean age of 15.8years, 85% female and 15% male; 67% African American, 19% White, 11% Hispanics and 3% others
Interventions	Intervention: 20 hours per year of supervised community volunteer services and 1 hour per week of classroom based discussion of service experiences, future life options, developmental tasks of adolescents and sex Control: Regular curriculum offerings
Outcomes	Unintended pregnancy (women only)
Notes	Duration of follow up: 9 months Loss to follow up: 7.0% lost to follow up (5.3% among experimental students and 8.4% among control students)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Picking names out of a hat (for individual) or coin toss (for classrooms)
Allocation concealment?	No	Not done
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	3 sites were excluded from analysis. Higher attrition rate in the control groups. There exist some difference between student lost and those retained in that, student lost were more likely to have had or caused a prior pregnancy, been suspended, younger and males.
Free of selective reporting?	Unclear	Though all the stated outcomes were reported, data could not be extracted for meta-analysis
Free of other bias?	Yes	

Basen-Engquist 2001

Methods	Cluster-randomized controlled study. Method of generating allocation sequence not mentioned in the paper. Unit of randomization: schools
Participants	7614, 8319 and 9489 9 (at baseline, 19 and 31 months); grade 9-12 students in schools in California and Texas, 47% males, 53% female, 18% African American, 17% Asian, 33% Hispanic, 27% white, 5% others
Interventions	Intervention: 20 sessions of health education, skills building, contraceptive education, social norms and peer education, parent education, community linkages Control: Standard knowledge based curriculum on contraception, HIV and other STD
Outcomes	Initiation of intercourse
Notes	Duration of follow up: 31 months Loss to follow up: not clear

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Insufficient information on attrition/exclusion to permit judgement as number of participants in the study increased with each follow up.
Free of selective reporting?	Yes	
Free of other bias?	No	The sampling methods for including students not clear.

Black 2006

Methods	Randomized controlled study. Method of allocation sequence not mentioned. Unit of randomization: Individual
Participants	181 adolescent mothers in urban hospitals who were living with their mother, 13.5-17.9 years at delivery, first-time delivery, black race, no history of drugs, infants should be 37 weeks and birth weight of > 2500g with no congenital problems, chronic illnesses, or disabilities.

Black 2006 (*Continued*)

Interventions	Intervention: Home mentoring programme (home visits every week until infants birthday approximately 19 visits) Ctrl: No intervention
Outcomes	Second unintended pregnancy
Notes	Duration of follow up: 24 months Loss of follow up: 18% Evaluators were blinded to intervention status

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain
Blinding? All outcomes	Yes	Evaluators only
Incomplete outcome data addressed? All outcomes	No	Only participants with both baseline and 24-months data were included in the analysis.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Blake 2001

Methods	Cluster-randomized control study. Quarterly marking period within schools was used to generate allocation sequence Unit of randomization: schools
Participants	351 8th grade students in Rochester, New York living in middle class sub-urban communities. 48% females and 52% males. 85% were whites and non- Hispanics.
Interventions	Intervention: Enhanced intervention; Five 1-hour sessions on standard school based curriculum (Health education; skill building; abstinence;communication skills) plus five parent-child homework assignments on sexuality and sexual behaviour led by trained youth leaders Control: standard school based curriculum only
Outcomes	Initiation of intercourse, knowledge on the risk of pregnancy
Notes	Duration of follow up: 7 weeks. No mention of loss to follow up

Blake 2001 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Quarterly marking period within schools
Allocation concealment?	Unclear	No information on this item provided
Blinding? All outcomes	No	No information on this item provided
Incomplete outcome data addressed? All outcomes	Yes	Only those who completed pretest and posttest questionnaires were analyzed at baseline and end of the study. Analysis adjusted for clusters.
Free of selective reporting?	Yes	
Free of other bias?	No	Selection bias as the proportion of students who had completed no assignments was higher among black and HIspanics adolescent than among non-Hispanics whites (43%vs.18%; p<.05), was higher among males than females (27%vs9%; p<.01) and was higher among adolescents who reported recent sexual intercourse than among those who did not (63%vs17%; p<.001).

Borgia 2005

Methods	Cluster-randomized controlled study. Method of allocation concealment not mentioned. Unit of randomization: Schools
Participants	1295 students from 18 high schools in Rome, 51% male, 49% female, Mean age 18.3 years
Interventions	Intervention: HIV/AIDS education and skills building by peer Control: same intervention by teachers
Outcomes	Consistent condom use
Notes	Duration of follow up: 5 months Loss to follow up: 20% for peer-led group and 27% teacher-led group
Risk of bias	

Borgia 2005 (*Continued*)

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not mention
Allocation concealment?	Unclear	Not sufficient information provided
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	Trial authors stated they used an intention-to-treat analysis, whereby classes which did not perform the interventions were included in the outcome evaluation. Analysis adjusted for clusters
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Cabezon 2005

Methods	Cluster-randomized controlled trial. Classrooms were randomized by blindly, taking letters of the class from a bag (simple balloting). Unit of randomization: classrooms
Participants	1259 9th grade female students in San Bernardo, Chile, aged 15-16 years, white Hispanics, who had initiated high school in 1997 and 1998.
Interventions	Intervention: one 45 minutes class per week for a year on health education, contraceptive education, skills building and abstinence Control: No intervention
Outcomes	Unintended pregnancy
Notes	Duration of follow up: 4 years Loss to follow up: 19%

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Simple balloting (blindly taking letters from a bag)
Allocation concealment?	No	

Cabezon 2005 (*Continued*)

Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	Per-Protocol analysis was carried out but missing outcome data balanced in numbers across intervention groups with similar reasons for missing data across groups (change of residence and financial problems).
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Clark 2005

Methods	Cluster-randomized controlled study. Method of allocation sequence not mentioned. Unit of randomization: Class
Participants	211 African American 7th grade students, 11-14 years of age, 55% male, 45% females, low income
Interventions	Intervention: 10 sessions (once or twice per week for 6 weeks) on skills building and career mentoring Control: Standard health curriculum
Outcomes	Initiation of intercourse
Notes	Duration of follow up: 1 year Loss to follow up: 26%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Only participant the provided baseline and end of study information were included in the I year follow up analysis
Free of selective reporting?	Yes	

Free of other bias?	Yes	

Coyle 1999

Methods	Cluster-randomized controlled study. Method of allocation sequence not mentioned in this study Unit of randomization: Schools
Participants	3869 9th grade students from 20 urban high schools in Texas and California, mean age 15years, 53% females and 47% males; 31% whites, 27% Hispanics, 18% Asian or pacific islanders, 16% African-American, <1% African Indian, 7% others
Interventions	Intervention: 20 session on health education, skills building, contraceptive education, parent education, community linkages Control: Standard knowledge based HIV prevention curriculum
Outcomes	Initiation of intercourse, use of contraceptive at last sex
Notes	Duration of follow up: 7 months Loss to follow up: 3%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not described
Allocation concealment?	Unclear	Allocation concealment not mentioned
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Yes	Whereas only those with data at baseline and at follow up were included in the analysis, there were no difference in the sexual behaviours between those lost to follow up and those who remained in the study across groups.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Coyle 2004

Methods	Randomized controlled study. Method of generating allocation sequence not mentioned in the paper. Unit of randomization: Schools
Participants	2829 6th grade students with an average age of 11.5 year from 19 schools in Northern California; 50% female and 50 male; 5.2% African American, 15.9% Asian, 59.3% Latino. 16.5% White and 3.1% Others.
Interventions	Intervention: 20 session curriculum (5 lessons in 6th grade on skill building in non-sexual situations , 8 lessons in 7th grade on determining personal limits in intercourse, understanding consequences of unplanned sexual intercourse (including pregnancy and STD), skills building, 7 lessons in 8th grade on contraception education, HIV-infected speaker and refusal skills in dating) Control: Standard curriculum
Outcomes	Initiation of intercourse
Notes	Duration of follow up: 36 months; lost to follow up: 36%

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated in the study
Allocation concealment?	Unclear	Insufficient information
Blinding? All outcomes	No	No information provided on this
Incomplete outcome data addressed? All outcomes	Yes	
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Coyle 2006

Methods	Cluster-randomized controlled study. Method of generation of allocation was done using restricted randomization into matched sets. Unit of randomization: Schools
Participants	988 students, 14 - 18years or older, in community day schools located in 4 urban counties in Northern California, 63% male, 37% female, 27% African American, 15% Asian American, 30% Hispanic/Latino, 12% White, 16% others

Coyle 2006 (*Continued*)

Interventions	Intervention: 14-sessions (26hrs) on HIV/STDs/Pregnancy Education, skills building, risks related to sexual behaviour, contraception education and service learning activities (5 visits to volunteer sites) Control: Usual curriculum
Outcomes	Unintended pregnancy, Initiation of intercourse, use of contraceptives and condoms at last sex
Notes	Duration of follow up: 18 months Loss to follow up: 58%

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Restricted randomization into matched set
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	All students were included in the analysis regardless of program dose. No statistically significant difference was found in the rates of attrition across groups.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Diclemente 2004

Methods	Randomized controlled study. Table of random numbers was used to generate allocation sequence. unit of randomization: Individual
Participants	522 females between the ages of 14-18 years in four community health agencies in Southern United States, African American, reporting vaginal intercourse in the preceding 6 months.
Interventions	Intervention: 4-hour interactive group sessions on Ethnic and gender pride, health/HIV education, skills building and contraception education Control: 4-hour interactive group sessions on general health promotion condition (exercise and Nutrition)
Outcomes	Unintended pregnancy, Consistent Condom use and Sexually transmitted disease

Diclemente 2004 (*Continued*)

Notes	Duration of follow up: 12 months. Loss to follow up: 12% (12.7% for intervention and 11.1% for the control). Assessors were blinded to participants' condition assignments. allocation concealed in opaque envelopes

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Table of random numbers
Allocation concealment?	Yes	Use of sealed opaque envelopes
Blinding? All outcomes	Yes	Assessors
Incomplete outcome data addressed? All outcomes	Yes	Participants were analyzed in their groups irrespective of number of sessions attended. Missing outcome data balanced in numbers with similar reasons for missing data across groups
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Dilorio 2006

Methods	Randomized controlled study. Computer-generated random numbers was used to generate allocation sequence. Unit of randomization: Sites
Participants	582 adolescents from a community based organization and their mothers, 11-14 years, 60% male, 40% female, 98% African American
Interventions	Intervention 1: 7 sessions (2hrs) over 14 weeks (4 sessions for mother and adolescents together) on HIV education, communication skills, take home activities and sexual decision making, consequences of early sexual intercourse. Intervention 2: stress reduction exercise and specific type of at-risk behaviours including early sexual intercourse, take home assignments and community service (mothers and adolescents attended the 1st and last sessions together). Control: Mothers and adolescents had a 1-hr HIV prevention session
Outcomes	Condom use at last sex among participants who have ever had sex
Notes	Duration of follow -up: 24months. Loss to follow up: 10%

Risk of bias

Dilorio 2006 (*Continued*)

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Computer generated
Allocation concealment?	Unclear	Not mentioned
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	Trials authors stated the use of Intent to Treat Analysis; for the use of condoms, only respondents who indicated being sexually active were included in the analysis.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Dilorio 2007

Methods	Randomized controlled study. Method for generating allocation sequence not mentioned in the paper Unit of randomization: Sites
Participants	277 adolescents boys from seven sites in Atlanta, 11-14 years, 96% African American
Interventions	Intervention: 7 2-hr sessions, 6 session for fathers of participants only and the last session for both on communication parental monitoring and relationship with peer, HIV/AIDS education Control:7 session on Nutrition and exercise
Outcomes	Ever had sex without a condom among participants who have ever had sex Ever had sex among all participants
Notes	Duration of follow up: 12 months Loss to follow up: 20%

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method on allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain

Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	Intent-to-treat analysis carried out.
Free of selective reporting?	Yes	
Free of other bias?	No	Data on relevant outcomes could not be extracted for meta-analysis.

Downs 2004

Methods	Randomized controlled study. Table of random numbers was used to generate the allocation sequence. Unit of randomization: Individuals
Participants	300 females from four urban Pittsburgh area healthcare sites, who were aged 14-18 years and had reported heterosexual vaginal sexual activity in the previous 6 months, 75% were African American, 15% Whites and 10% others or mixed race
Interventions	Intervention: interactive video intervention on reproductive health/STD education, skills building and contraceptive education delivered for 30 minutes at baseline and 15 minutes on each follow up visit. Control 1: content-matched control (same intervention in a book form) Control 2: topic-matched control (same intervention using commercially available brochures)
Outcomes	Unintended pregnancy, use of condoms, sexually transmitted disease
Notes	Duration of follow up: 6 months Loss to follow up: 14% Individual were randomized to one of the three groups (Interactive video intervention, Content-matched control and Topic-matched control)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Table of random numbers
Allocation concealment?	Unclear	No information provided on this
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	No	Only participants who provided data at six months were included in the analysis.

Downs 2004 (*Continued*)

Free of selective reporting?	No	Outcomes were reported in a way that they cannot be extracted for meta-analysis
Free of other bias?	Yes	

Eisen 1990

Methods	Randomized controlled Multicentre study. Method used to generate allocation sequence not mentioned in the paper Unit of randomization: individual and classroom
Participants	1444 8th-9th grade students from 6 family planning agencies and one school in Texas and California; mean age 15.5 years; 52% females, 48% males; 15% whites, 24% African-American, 53% Hispanic and 8% Asians
Interventions	Intervention: 12-15 hours on health education (reproductive biology), skills building, contraceptive/STD education Control: usual sex education programmes which varied among sites
Outcomes	Initiation of intercourse, consistent use of contraceptives
Notes	Duration of follow up: 1 year Loss to follow up: 39% Randomization was done individually or by classroom units (71% by classroom and 29% by individual)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	Not enough information to judge
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Insufficient information to assess this
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Fawole 1999

Methods	Cluster-randomized controlled trial. Method used to generate allocation not mentioned in the paper. Unit of randomization: classrooms
Participants	450 students from 11 mixed-sex public schools in Ibadan, Nigeria; Mostly Yoruba; 55.2% females, 44.9% males. Low socioeconomic status
Interventions	Intervention: 6 weekly (each lasted between 2 and 6hr) of AIDS/HIV Education, health education and Contraceptive education Control: Standard curriculum
Outcomes	Initiation of intercourse, use of condoms at last sex, consistent use of condom, sexually transmitted disease
Notes	Duration of follow up: 6 months Loss to follow up: 3.8%

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information on this domain
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Yes	Participants lost to follow up were less than 5% of the total participants included in the study
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Ferguson 1998

Methods	Cluster-randomized controlled study. Coin toss technique was used to generate allocation sequence Unit of randomization: Neighbourhood
Participants	63 female African - American students aged 12-16 years who completed the Camp Horizon Adolescent Pregnancy Prevention Program, residing in one of the four public housing developments in Charlottesville, Virginia, not currently pregnant, had never given birth, 5-10th grade, low income

Ferguson 1998 (*Continued*)

Interventions	Intervention: 2 hours per week for 8 weeks on health education, skills building, contraceptive education, abstinence, ethnic/cultural values, family options, career counselling by peer counsellors Control: same interventions taught by usual adult staff
Outcomes	Unintended Pregnancy, initiation of intercourse, use of contraceptive at last sex
Notes	Duration of follow up: 3 month. Loss to follow up: 17%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Tossing a coin
Allocation concealment?	No	
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	No	Imbalance in numbers loss to follow up across intervention groups and reasons not stated. Per-protocol analysis done with substantial departure from one of the groups.
Free of selective reporting?	Yes	
Free of other bias?	No	Baseline differences not reported.

Graham 2002

Methods	Cluster-randomized controlled study. Computer generated random numbers was used to generate allocation sequence. Unit of randomization: Schools
Participants	3794 adolescents from secondary schools in Avon, 14-15 years, 52% male, 48% female
Interventions	Intervention: Contraception (emergency contraceptives) education Control: Usual sex education
Outcomes	use of contraceptives, initiation of intercourse
Notes	Duration of follow up: 6 months Loss to follow up: 18%

Risk of bias

Graham 2002 (*Continued*)

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Computer generated random numbers
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	
Incomplete outcome data addressed? All outcomes	Yes	
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Henderson 2007

Methods	Cluster-randomized controlled study. Method used to generate allocation sequence not mentioned in the paper. Unit of randomization: Schools
Participants	4196 female students in secondary schools in Scotland, 13-15 years,
Interventions	Intervention: SHARE (20 session package: 10 for 3rd year and 10 for 4th years of secondary school respectively) on health/sex education, skills building, contraceptive education primarily through the use of interactive video. Control: conventional sex education
Outcomes	childbirth and abortion
Notes	Duration of follow up: 4.5 years Loss to follow up: 0.5% One of the control schools demonstrated how to handle condoms (one of the lesson included in the intervention group).

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Not mentioned
Allocation concealment?	Unclear	Insufficient information provided on this item
Blinding? All outcomes	No	No information on this domain

Incomplete outcome data addressed? All outcomes	Yes	Minimal participants lost to follow up (0.5%)
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Herceg-Brown 1986

Methods	Randomized controlled study. Method used to generate allocation sequence was not mentioned in the paper. Unit of randomization: Individual
Participants	417 adolescent females aged 12-17 years from 9 family planning clinics in Philadelphia, making their first visit to the clinics, residing in the area and with a family member. 53% African American, 47% whites
Interventions	Intervention 1; Family Support group (Regular clinic services plus 50 minutes of family or individualized counselling services on sex and contraceptive education for 6 weeks) Intervention 2; Periodic Support Group (Regular clinic services plus staff supports through 2-6 telephone calls 4-6 weeks after initial clinic visit, to monitor teenage adjustment to the contraceptive received at the clinic) Control Group A and B: regular clinic services
Outcomes	Unintended pregnancy and consistent use of contraceptives
Notes	Duration of follow up: 15 months. Loss to follow up: 14% Individuals were randomly allocated to one of the four groups (family support group, periodic support group, control A and control B)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Allocation sequence generation not mentioned
Allocation concealment?	Unclear	Not mentioned
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Not enough information provided
Free of selective reporting?	Yes	

Herceg-Brown 1986 (*Continued*)

Free of other bias?	Yes	

Howard 1990

Methods	Cluster-randomized controlled study. Method used to generate allocation sequence not mentioned in the paper Unit of randomization: schools	
Participants	536 low income minority students from 53 schools in Atlanta, 99% Black	
Interventions	Intervention: 5 sessions on health/STD education, skills building, contraceptive education(first 4 sessions given fairly close together - 4 classroom periods in a week or one each week for 4 weeks; the fifth session given 1-3 months later) Control: Existing human sexuality program	
Outcomes	Unintended pregnancy , initiation of intercourse	
Notes	Duration of follow up: 2 years Loss to follow up: no mention	

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	Insuffcient information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	18 students were excluded from the results partly because their sexual status was unclear. For initiation of intercourse, outcome were analyzed for only those who had not initiated intercourse at baseline and attended the program.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Jemmott III 1998

Methods	Randomized controlled study. Computer generated random number was used to generate the allocation sequence Unit of randomization: Individual
Participants	659 African Americans students in 6th-7th grade from 3 middle schools serving low-income African American communities in Philadelphia, PA.; mean age of 11.8years; 53% female and 47% male.
Interventions	Intervention 1; Eight 1-hour modules over 2 consecutive Saturdays on Abstinence HIV intervention (health education, skills building, contraception education with emphasis on abstinence) Intervention 2: Eight 1-hour modules over 2 consecutive Saturdays on Safer Sex HIV intervention (health education, skills building, abstinence with emphasis on the use of contraceptives) Control: Health issues unrelated to sexual behaviour Each intervention consisted of an 81-hour module divided equally over 2 consecutives Saturdays.
Outcomes	Initiation of intercourse, consistent condom use (Sexual intercourse in past 3 months among all participants)
Notes	Duration of follow up :12months Loss to follow up: 7.4% Individuals were randomly allocated to one of the three conditions (abstinence HIV intervention, safer sex HIV intervention and control)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Computer generated random numbers
Allocation concealment?	No	
Blinding? All outcomes	Yes	Proctors were blinded to participants' intervention group.
Incomplete outcome data addressed? All outcomes	Unclear	Per-protocol analysis were carried out, included only patient present at the end of the study regardless of the number of intervention sessions attended.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Jemmott III 2005

Methods	Cluster-randomized controlled study. Computer-generated random numbers were used to generate allocation sequence. Unit of randomization: Schools
Participants	682 sexually experienced adolescent girls of a children's hospital, mean age 15.5 years, 68% African American, 32% Latino low income
Interventions	Intervention 1: HIV/STD education, contraceptive education. Intervention 2: Skills building, HIV/STD education, contraceptive education. Control: Health promotion intervention
Outcomes	Sexually transmitted diseases
Notes	Duration of follow up: 12 months Loss of follow up: 11.4%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Computer generated random numbers
Allocation concealment?	No	
Blinding? All outcomes	No	No information on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Attrition was low (11.4%) and did not differ by condition.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Kirby 1997a

Methods	Cluster-randomization controlled trial. Method used to generate allocation sequence not mentioned in the paper. Unit of randomization: classrooms
Participants	1657 7th grade students from 6 schools in California, mean age of 12.3 years; 54% female and 46% males; 64% Latino, 13% Asian, 9% African American, 5% non-Latino from low socio-economic status
Interventions	Intervention: 8 session for two weeks on health education, skills building, contraceptive education, risks and consequences of teen sex and community resources Control: standard curriculum
Outcomes	Unintended pregnancy , initiation of intercourse, use of condoms at last sex, sexually transmitted diseases

Kirby 1997a (*Continued*)

Notes	Duration of follow up: 17 months; Loss to follow up: 23%	
Risk of bias		
Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Not mentioned. Authors simply stated "randomly assigned"
Allocation concealment?	Unclear	Not mentioned
Blinding? All outcomes	No	No information on this domain provided
Incomplete outcome data addressed? All outcomes	No	subset of patients was assessed for certain outcomes such as initiation of intercourse (only student who had never had sex at pretest were analyzed); likewise pregnancy and Sexually Transmitted Diseases (STD) (included in the analysis only study who had never been pregnant or never had an STD respectively).
Free of selective reporting?	Yes	All pre-specified outcomes were reported.
Free of other bias?	Yes	

Kirby 1997b

Methods	Randomized controlled study. Method of allocation sequence not mentioned in this paper Unit of randomization: schools, agency, classroom, individual
Participants	10600 youths in 7th and 8th grade (mean age of 12.8years) from schools and community-based organizations in California; 58% female and 42% male; 31% Hispanic, 38% white, 9% African-American
Interventions	Intervention 1: Adult -led intervention (5 sessions, 45-50minutes in length delivered in classrooms or small group settings on health education, skills building, contraceptive education) in addition to the available standard sexuality curriculum, taught by adults Intervention 2: youth-led intervention (same intervention taught by youth) Control: Standard sexuality curriculum
Outcomes	Unintended pregnancy, initiation of intercourse, use of condoms, use of hormonal contraceptive, sexually transmitted diseases

Kirby 1997b (*Continued*)

Notes	duration of follow up: 17 months loss to follow up: 17% Five randomization was reported (random assignment by classroom to adult-led intervention, by classrooms to youth-led intervention, by schools to adult-led intervention, by individual to adult-led intervention and Control)

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Information not explicit
Free of selective reporting?	Yes	
Free of other bias?	Unclear	insufficient information

Kirby 2004

Methods	Cluster-randomized controlled study. Method used to generate allocation sequence not mentioned in the paper. Unit of randomization: schools
Participants	3869 9th grade students from 20 urban high schools in Texas and California who completed the baseline survey in the fall 1993 and officially enrolled at first follow up (spring 1994), mean age 15 years, 53% females and 47% males; 30% whites, 27% Hispanics, 18% Asian or pacific islanders, 17% Blacks and 7% others Exclusion: students who left the school during the 1993-1994 school year
Interventions	Intervention: 20 sessions on health education, skills building, contraceptive education, community linkages Control: standard knowledge based HIV prevention curriculum
Outcomes	Initiation of intercourse, use of contraceptive at last sex
Notes	Duration of follow up: 31 months Loss to follow up: 21%

Risk of bias

Kirby 2004 (*Continued*)

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	No	Analysis was carried out on the number of students observation for each outcomes.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Mitchell-DiCenso 1997

Methods	Cluster randomized controlled trial. Table of random numbers was used to generate allocation sequence Unit of randomization: schools
Participants	3289 students in Grades 7 and 8 in 21 schools in Hamilton, Ontario-Canada; mean age 12.6 years, 52% female, 48% male, most whiteExclusion: non-consent by parent or students; planning to move out of the area in the next few weeks; unable to speak or understand English, severe learning disabilities, reached 17th birthday, attendance ata private or separate school
Interventions	Intervention: Ten 1-hour sessions on health education and skills building, media and peer pressure, parenting, teenage pregnancy and responsibility in relationships. Control: Conventional sex education
Outcomes	Unintended pregnancy, initiation of intercourse, use of contraceptives
Notes	duration of follow up: 4 years loss to follow up: 44% during the study, 10 students transferred from the control to the experimental school and one student from an experimental to a control school

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Table of random numbers
Allocation concealment?	Unclear	No information provided on this domain

Mitchell-DiCenso 1997 (*Continued*)

Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	High rate of attrition at the fourth years with close to half the participant lost to follow up. Analysis for each outcome included only student who responded to that outcome.
Free of selective reporting?	Yes	
Free of other bias?	No	Contamination of intervention groups as students who completed Grade 8 moved on to high schools that drew students from a variety of schools, thereby bringing together experimental and control group students.

Morberg 1998

Methods	Cluster-randomization controlled Study. Block randomization was use to generate allocation sequence. Unit of randomization: Schools
Participants	2483 6th grade student in 21 middle schools in small cities and towns in Wisconsin; by 9th grade, participants included 48% male, 52% female, 96% white, 4% others
Interventions	Intervention 1:Age appropriate: taught 4 weeks each year over 3 years in grade 6,7, and 8: on social situations, refusal skills (skills building), parental values, media, parent relationship, contraception education, risks, responsibility and sexuality Intervention 2:Intensive; taught as a 12 weeks block in grade 7: same programme Control: Usual curriculum
Outcomes	initiation of intercourse, use of condoms
Notes	Duration of follow up: 3 years Loss to follow up: 20% Students were randomized into one of three Interventions (Control, Age Appropriate Intervention or Intensive Intervention. One of the seven schools dropped out of the intensive condition (n=590), data from these are excluded

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Randomization design nested within two self-selected treatment option
Allocation concealment?	Unclear	Not mentioned

Morberg 1998 (*Continued*)

Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	No statistical difference between conditions in attrition by ninth grade (p = .21). But high percentage of participants were lost to follow up in the tenth grade (32%) and underrepresented the Intensive subjects. Individual were used as the unit of analysis even though clusters were randomized.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

O'Donnell 2002

Methods	Cluster-randomized controlled study. Method used to generate allocation sequence not stated. Unit of randomization: Classrooms
Participants	225 seventh grade students from 18 classrooms attending a public middle school in New York, 71% non-Hispanic African-American, 26% Latino, low socio-economic status
Interventions	Intervention: 3 hours per week Community Youth Service (CYS) plus classroom curriculum (40 lessons in 7th grade and 34 lessons in 8th grade on risk related to early and unprotected sex, violence, substance use, healthy development and sexuality) Control: standard classroom curriculum
Outcomes	Pregnancy among all participants not reporting pregnancy at baseline Ever had sex among all participants
Notes	Duration of follow up: 4 years Loss to follow up: 23% After year 1 of the program, the school expanded the CYS component to more students resulting in 32 students transferring into the intervention group and 16 transferring to the control group because CYS did not fit their schedules. Analyses were divided into youth receiving 2 program years, youth receiving 1 program year (i.e., those who transferred in or out after year 1), and no-exposure controls.

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information provided on this domain

O'Donnell 2002 (*Continued*)

Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Yes	Irrespective of the crossover of participants between intervention and control groups, analysis retained participants in their previous randomized group
Free of selective reporting?	Yes	
Free of other bias?	No	Crossover of students between groups could have contaminated the different groups.

Okonofua 2003

Methods	Cluster-randomised controlled study. Method used to generate allocation sequences not mentioned. Unit of randomization: Schools
Participants	1896 students in secondary schools in Benin, Nigeria, 14-20 years, 53% female, 47% male, 33% Ishan, 36% Bini, 5% Yoruba, 10% Ibo, 16% Others
Interventions	Health education, peer education on STD, individual or group counselling by trained peer educators, training of health providers on STD diagnosis and treatment around the intervention schools Control: No intervention
Outcomes	Use of condoms
Notes	Duration of follow up: 10 months Loss to follow up: 1%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Method of allocation sequence generation not mentioned
Allocation concealment?	Unclear	Not enough information to judge
Blinding? All outcomes	No	Not mentioned in the study
Incomplete outcome data addressed? All outcomes	No	Individual were used as the unit of analysis even though clusters (classrooms) were randomized. All participants loss to follow up were from

Okonofua 2003 (*Continued*)

		the control group and per-protocol analysis used.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Philliber 2002

Methods	Randomized controlled study. Block randomization was used to generate allocation sequence. Unit of randomization: Individual
Participants	484 teenagers in New York not currently pregnant or a parent, 13-15 years, 55% female, 45% male, 56% Black, 42% Hispanic, 2% other
Interventions	Intervention: Job clubs, academic skills, family and life sexuality education, developing personal art skills, recreational activities, group/individual counselling, contraceptive education, medical care (5 days per week for a school year) Control: alternative youth program(recreational activities, homework help, art and crafts)
Outcomes	unintended pregnancy, childbirth, initiation of intercourse, use of condoms at last sex
Notes	Duration of follow up: 3 years Loss to follow up: 21% Allocation concealment by the use of opaque envelopes

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Block randomization
Allocation concealment?	Yes	Use of opaque envelopes
Blinding? All outcomes	No	Insufficient information provided
Incomplete outcome data addressed? All outcomes	No	Analysis was based number of participants present at the end of the 3 years follow up.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Raine 2005

Methods	Randomized controlled study. Computer-generated randomization sequence was used. Unit of randomization: individual
Participants	2117 women attending 4 California clinics providing family planning services, who were not desiring pregnancy, 15-24 years (mean 19.9), spoke English or Spanish, had sexual intercourse in the past 6 months., using long term hormonal contraception or requesting EC, 20% Latino, 15% Black, 31% White, 22% Asian, 12% Others
Interventions	intervention 1: Pharmacy access group(instructions for obtaining Levonorgestrel Intervention 2: (provision of 3 packets of levonorgestrel EC and its dosage) Control: clinic access (instructions to return to the clinic for EC, if needed)
Outcomes	Unintended pregnancy, contraceptive use (consistent condom use, use of hormonal contraceptives, use of condom at last sex), sexually transmitted diseases
Notes	Duration of follow up: 6 months Loss to follow up: 8% Single blinding (Research staff only)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Computer generated numbers
Allocation concealment?	Yes	use of sealed, sequential numbered boxes identical in appearance was used to conceal allocation
Blinding? All outcomes	Yes	Research staff only
Incomplete outcome data addressed? All outcomes	Yes	Use of a Modified intent-to treat where only participants who completed follow-up in their respective randomized group were analyzed. Attrition analysis showed no difference in characteristics of women lost to follow up.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Raymond 2006

Methods	Randomized controlled study. Computer generated random numbers were used in allocation sequence. Unit of randomization: Individuals
Participants	1490 sexually active women not desiring pregnancy, 14-24 years, 13% Hispanics, 70% white, 21% non-whites
Interventions	Intervention:Contraception distribution (2 packages of pills dispensed in advance with unlimited resupply at no charge) Control: Contraceptive distribution (pills dispensed when needed at usual charge)
Outcomes	Unintended pregnancy, sexually transmitted diseases
Notes	Duration of follow up: 1 year Loss to follow up: <7%

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Computer generated number
Allocation concealment?	Yes	Sealed opaque envelopes
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Yes	All randomized participants were included in the analysis
Free of selective reporting?	Yes	
Free of other bias?	No	Baseline difference: Higher proportion of persons in the increased access group had a sexually transmitted diseases

Shrier 2001

Methods	Randomized controlled trial. Table of random numbers was used to generate allocation sequence. Unit of randomization: Individuals
Participants	123 females between the ages of 13 - 22 years (median 17.2) with cervicitis or pelvic inflammatory disease in urban children's hospital, adolescent clinic and inpatient service in Boston, 49% non-Hispanics Blacks, 18% Hispanic, 14% Non-Hispanic white, 17% others Exclusion: Patient had treatment of STDs between laboratory confirmation; patient pregnant at treatment visit; patient already exposed to intervention through pilot study

Shrier 2001 (*Continued*)

Interventions	Intervention: Watch a 7 minute videotape featuring contraception education (condoms), Contraception Distribution, Individual Counselling on Risk perception, STD education, Pregnancy Prevention and Consequences of Unprotected sex and a booster session at 1, 3 and 6 months. Control: Standard STD Education and Contraceptive Education and Distribution
Outcomes	Sexually transmitted diseases
Notes	Duration of follow up: 12 months. Loss to follow up: 48% Assessors were blinded to participant allocation.

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Table of random numbers
Allocation concealment?	Unclear	Not mentioned
Blinding? All outcomes	Yes	Assessors only
Incomplete outcome data addressed? All outcomes	No	High attrition rates of over 20% though it did not differ between the intervention and control groups. As-treated analysis was done with substantial loss to follow up of the participant across groups.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Smith 1994

Methods	Randomized controlled study. Method used to generate allocation sequence not mentioned in the paper. Unit of randomization: Individuals
Participants	120 9th grade students from the 1989 class of freshmen at a high school in Queens, New York. Mean age 15.1 years;74.2% females and 25.8% males; 43.3% African American, 30.8 West Indian, 22.5% Hispanic and 3.3% Others
Interventions	Intervention: One session per week for 14 weeks on health/STD education, skills building, contraceptive education and individual counselling on career mentorship. Control: Written materials on contraception and decision making pertaining sexual and fertility related risk-taking behaviour

Smith 1994 (*Continued*)

Outcomes	Initiation of intercourse (Absolute sexual frequency - instances of completed sexual activity during past 2 months, among all participants).
Notes	Duration of follow up: 6 months. Loss to follow up: 21% (7 control condition subjects and 18 subjects experimental subjects)

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	Method of allocation sequence generation not stated
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	No	Per-protocol analysis was done with substantial departure of the intervention received from that assigned at randomization
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Stephenson 2004

Methods	Cluster-randomized controlled study. Schools were randomized within strata, using a computer-generated sequence of allocation of block size ten. Unit of randomization: Schools
Participants	8766 pupils in 19 schools in central and southern England, year 9 (aged 13-14 years),
Interventions	Intervention: Three 1-hour sessions on sexual communication, contraceptive education (condoms) HIV/STD education taught by peer leaders (16-17years). Control: Usual teacher-led sex education
Outcomes	Unintended pregnancy, initiation of intercourse, use of contraceptives
Notes	Duration of follow up: 18 months Loss to follow up: 14%

Risk of bias

Item	Authors' judgement	Description

Stephenson 2004 (*Continued*)

Adequate sequence generation?	Unclear	Computer-generated sequence of allocation of block size ten
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	No	All participants who experienced the outcome at baseline and who completed at least one follow-up questionnaire were included into the analysis for the primary outcome (initiation of intercourse). Other outcomes were based on individual pupil data
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Villarruel 2006

Methods	Randomised controlled study. Computer-generated random numbers was used to generate allocation sequence Unit of randomization: Individuals
Participants	656 8-1th grade students in Northeast Philadelphia schools and community based organization, aged 13-18 years, 45% male, 55% female, 85.4% Latino
Interventions	Intervention: Six 50minute modules on Health/HIV education, skills building, contraceptive education Control: Health promotion education
Outcomes	Initiation of intercourse in the past 3 months, consistent condom use in the past 3 months,
Notes	Duration of follow up: 12 months Loss to follow up: 13% 103 students were excluded from the analysis because they were Non-Latino

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Computer generated numbers
Allocation concealment?	Unclear	Not mentioned

Villarruel 2006 (*Continued*)

Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	No	Analysis were conducted using an intention-to-treat approach in which participants were analyzed in their original randomized groups regardless of the number of sessions attended.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Walker 2006

Methods	Cluster-randomized controlled study.Method use to generate allocation sequence not mentioned in the paper. Unit of randomization: Schools
Participants	10954 10-12th grade high schools students in Morelos, 15-18 years, 48% males, 52% female
Interventions	Intervention 1: HIV education, skills building, cultural values, contraceptive promotion (Condoms). Intervention 2: HIV education, skills building, cultural values plus contraceptive education (EC plus condoms and their access). Control: Biology based sex education
Outcomes	Initiation of intercourse, use of condom at last sex, use of hormonal contraceptive
Notes	Duration of follow up: 16 months Loss to follow up: 33.3% Two of the interventions were included in the control group because they did not teach the intervention course.

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	The statement "randomly assigned" was said but the method of allocation generation was not stated.
Allocation concealment?	Unclear	Not enough information to judge
Blinding? All outcomes	No	Not mentioned in the study

Walker 2006 (*Continued*)

Incomplete outcome data addressed? All outcomes	No	Per-protocol analysis was done. But analysis took the cluster sample design into account.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Wight 2002

Methods	Cluster-randomized controlled study. Method used to generate allocation sequence not mentioned. Unit of randomization: Schools
Participants	7616 pupils from 25 secondary schools in East Scotland, 13-15 years, 50% male, 50% female
Interventions	Intervention: SHARE (20 sessions package: 10 for 3rd year and 10 for 4th years of secondary school respectively) on health/sex education, skills building, contraceptive education primarily through the use of interactive video. Control: Conventional sex education
Outcomes	Unintended pregnancy, initiation of intercourse, use of condoms at last sex
Notes	Duration of follow up: 2 years Loss to follow up: 31% Single blinding (Assessors)

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Not mentioned
Allocation concealment?	Unclear	Not enough information to judge
Blinding? All outcomes	Yes	Assessors only
Incomplete outcome data addressed? All outcomes	No	Outcomes were analyzed based on the number of participants at the end of the 2 year follow up.
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Zabin 1986

Methods	Cluster-randomized controlled study. Method of randomization not stated Unit of randomization: School
Participants	3646 black students with low socio-economic status in Baltimore; mean age 15.6; 56% female and 44% male
Interventions	Intervention: Presentation on reproductive health education and medical services by professionals at least once a year, individual and group counselling on a daily basis, after school clinic on personal responsibility, goal-setting and parent communication, contraceptive counselling, pregnancy testing, other medical services and referrals Control: Basic sex education curriculum
Outcomes	Unintended pregnancy, initiation of intercourse, mean age of initiation ,use of contraceptives
Notes	Duration of follow up: 3 years Loss of follow up: 19% Allocation concealment not described

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	Not mentioned
Allocation concealment?	Unclear	No information provided on this domain
Blinding? All outcomes	No	No information provided on this domain
Incomplete outcome data addressed? All outcomes	Unclear	Insufficient reporting of attrition/exclusion to permit judgement
Free of selective reporting?	Yes	
Free of other bias?	Yes	

Characteristics of excluded studies *[ordered by study ID]*

Agha 2002	Did not measured any of the desired outcome
Amin 2004	Randomized controlled trial but participants were pregnant or parenting teens
Antunes 2002	Participants above the required age range
Barlow 2006	Had none of the required intervention
Bonell 2005	No specified intervention
Boyer 2005	Participants above the required age range
Buston 2007	Non randomized controlled trial
Cagampang 1997	Non randomized controlled trial
Chesney 2003	Non randomized controlled trial
Crosby 2005	None of the desired outcomes was measured
Danielson 1990	Quasi-experimental study
Di 2004	None of the desired outcomes was measured
Diclemente 2001	Non randomized controlled study
Doniger 2001	Non randomized controlled study
Dycus 1990	Non randomized controlled study
East 2003	Non randomized controlled study
Eisen 1985	Non randomized controlled study
Eisen 1987	Non randomized controlled study
El-Bassel 2003	Participants were above the required age range
Ferguson 1998	Quasi - randomized controlled study
Fitzgerald 2002	Non randomized controlled study
Harvey 2004	Randomized controlled trial but participants included couples only
Howard 1990	Non randomized controlled trial

(*Continued*)

Hutchinson 2003	None of the desired outcomes was measured
James 2005	Participant above the required age range
Jay 1984	Did not measure any of the desired outcome
Jewkes 2006	Participant above the required age range
Kaljee 2005	None of the desired outcomes was measured
Kamali 2002	Age range above the required range
Kirby 2002c	A Review
Kirby 2002d	Non randomized controlled trial
Kuroki 2008	An epidemiological study
Kyrychenko 2006	Non randomized controlled study
Legardy 2005	Participants age range was above the required range
Liberman 2000	Non randomized controlled study
Magnani 2005	Non randomized controlled trial
Martiniuk 2003	Study did not measure any of the desired outcomes
Matteson 2006	No intervention
McBride 2000	Method of randomization not adequate
Metcalf 2005	Participants were above the required age range
O'Donnell 2005	None of the desired outcomes was measured
Olsen 1991	Not a randomized controlled trial
Padian 2007	Participant above the required age range
Peipert 2008	Participants above the required age range
Peragallo 2005	Participant above the required age range
Peterson 2007	Participant above the required age range
Proude 2004	Participant above the required age range

(*Continued*)

Rickert 2007	Participant above the required age range
Robin 2004	A review
Shuey 1999	A quasi-randomized study
Silva 2002	A review
Stout 1989	A review
Thomas 2000	A review
Thomas 2004	Non randomized study
Tingle 2002	Non randomized study
Van Devanter 2002	Participants were not within the age limit
Yoo 2004	Non randomized study
Zabin 1986	Non randomized study
Zabin 1988	Non randomized study
Zimmerman 2008	Quasi-experimental study

Characteristics of studies awaiting assessment *[ordered by study ID]*

Gallegos 2008

Methods	Individual randomized controlled study;
Participants	Participants aged 14 -17 years from high schools in Mexico
Interventions	
Outcomes	
Notes	

DATA AND ANALYSES

Comparison 1. Multiple interventions

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Unintended Pregnancy [individually randomized trials]	2	858	Risk Ratio (M-H, Fixed, 95% CI)	0.72 [0.51, 1.03]
2 Unintended Pregnancy [Cluster-randomised trials]	5	3149	Risk Ratio (M-H, Random, 95% CI)	0.50 [0.23, 1.09]
3 Initiation of sexual intercourse-Individually RCT	3	1546	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.77, 0.96]
3.1 Gender mixed or not specified	3	1546	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.77, 0.96]
4 Initiation of sexual intercourse-Cluster RCT	6	7954	Risk Ratio (M-H, Random, 95% CI)	0.90 [0.77, 1.06]
4.1 Female	2	3499	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.87, 1.08]
4.2 Male	2	2969	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.87, 1.13]
4.3 Gender mixed or not specified	4	1486	Risk Ratio (M-H, Random, 95% CI)	0.77 [0.47, 1.28]
5 Use of birth control methods-Cluster RCT	5		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
5.1 condom use at last sex	3	1956	Risk Ratio (M-H, Random, 95% CI)	1.01 [0.87, 1.16]
5.2 consistent condom use	2	296	Risk Ratio (M-H, Random, 95% CI)	2.78 [0.98, 7.84]
5.3 Hormonal contraceptives	3	3987	Risk Ratio (M-H, Random, 95% CI)	1.01 [0.72, 1.43]
6 Use of birth control methods-Individually RCT	5	1332	Risk Ratio (M-H, Random, 95% CI)	1.09 [0.89, 1.34]
6.1 Condom use in last sex	2	388	Risk Ratio (M-H, Random, 95% CI)	1.03 [0.95, 1.13]
6.2 Consistent Condom use	3	944	Risk Ratio (M-H, Random, 95% CI)	1.10 [0.74, 1.64]
7 Sexually Transmitted Diseases-Cluster RCT	2	420	Risk Ratio (M-H, Fixed, 95% CI)	0.76 [0.27, 2.14]
8 Sexually Transmitted Diseases-Individually RCT	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.45 [0.18, 1.15]
9 Childbirth-Individually RCT	1	484	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.31, 1.45]
10 Second unintended pregnancy-Individually RCT	1	149	Risk Ratio (M-H, Fixed, 95% CI)	0.48 [0.22, 1.02]

Comparison 2. Sensitivity analysis [Multiple intervention]: Unintended pregnancy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Unintended Pregnancy [cluster-randomized studies]	2	497	Risk Ratio (M-H, Random, 95% CI)	0.20 [0.10, 0.39]
2 Unintended Pregnancy [cluster-adjusted+individual]	3	871	Risk Ratio (M-H, Fixed, 95% CI)	0.49 [0.33, 0.74]

Comparison 3. Sensitivity analysis [Multiple intervention]: Initiation of intercourse

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Initiation of sexual intercourse-Individually RCT	1	550	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.71, 1.09]
1.1 Gender mixed or not specified	1	550	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.71, 1.09]
2 Initiation of sexual intercourse-cluster RCT	3	1033	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.51, 1.65]
2.1 Gender mixed or not specified	3	1033	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.51, 1.65]
3 Initiation of sexual intercourse-cluster-adjusted + individual)	4	1583	Odds Ratio (M-H, Fixed, 95% CI)	0.87 [0.70, 1.09]
3.1 Gender mixed or not specified	4	1583	Odds Ratio (M-H, Fixed, 95% CI)	0.87 [0.70, 1.09]

Comparison 4. Educational intervention

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Initiation of Sexual Intercourse-Cluster RCT	1	525	Odds Ratio (M-H, Fixed, 95% CI)	1.02 [0.67, 1.54]
1.1 Gender mixed or not specified	1	525	Odds Ratio (M-H, Fixed, 95% CI)	1.02 [0.67, 1.54]
2 Use of birth control methods-Cluster RCT	2	1431	Risk Ratio (M-H, Random, 95% CI)	1.18 [1.06, 1.32]
2.1 condom use at last sex	2	1431	Risk Ratio (M-H, Random, 95% CI)	1.18 [1.06, 1.32]

Comparison 5. Contraceptive Intervention

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Unintended Pregnancy-Individually RCT	2	3440	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.81, 1.26]
2 Initiation of sexual intercourse-Cluster RCT	1	3006	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.85, 1.07]
2.1 Female	1	1446	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.76, 1.04]
2.2 Male	1	1560	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.87, 1.21]
3 Use of birth control methods-Cluster RCT	1	415	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.69, 1.18]
3.1 Hormonal contraceptives	1	415	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.69, 1.18]
4 Use of birth control methods-Individually RCT	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
4.1 Condom use in last sex	2	3091	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.87, 1.04]
4.2 Consistent condom use	1	1950	Risk Ratio (M-H, Random, 95% CI)	0.90 [0.71, 1.15]
4.3 Hormonal contraceptives	2	3091	Risk Ratio (M-H, Random, 95% CI)	2.22 [1.07, 4.62]
5 Sexually Transmitted Diseases-Individually RCT	2	3440	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.75, 1.13]

Analysis 1.1. Comparison 1 Multiple interventions, Outcome 1 Unintended Pregnancy [individually randomized trials].

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 1 Unintended Pregnancy [individually randomized trials]

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Herceg-Brown 1986	19/155	28/219		36.1 %	0.96 [0.56, 1.65]
Philliber 2002	24/242	41/242		63.9 %	0.59 [0.37, 0.94]
Total (95% CI)	**397**	**461**		**100.0 %**	**0.72 [0.51, 1.03]**

Total events: 43 (Intervention), 69 (Control)

Heterogeneity: Chi^2 = 1.80, df = 1 (P = 0.18); I^2 =45%

Test for overall effect: Z = 1.82 (P = 0.069)

Analysis 1.2. Comparison 1 Multiple interventions, Outcome 2 Unintended Pregnancy [Cluster-randomised trials].

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 2 Unintended Pregnancy [Cluster-randomised trials]

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
Cabezon 2005	10/297	28/163		0.20 [0.10, 0.39]
Ferguson 1998	0/17	0/20		0.0 [0.0, 0.0]
Howard 1990	4/334	3/119		0.48 [0.11, 2.09]
Kirby 1997a	9/160	10/152		0.86 [0.36, 2.05]
Wight 2002	48/1201	35/686		0.78 [0.51, 1.20]
Total (95% CI)	**2009**	**1140**		**0.50 [0.23, 1.09]**

Total events: 71 (Intervention), 76 (Control)

Heterogeneity: $Tau^2 = 0.44$; $Chi^2 = 12.09$, df = 3 (P = 0.01); $I^2 = 75\%$

Test for overall effect: Z = 1.73 (P = 0.083)

Analysis 1.3. Comparison 1 Multiple interventions, Outcome 3 Initiation of sexual intercourse-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

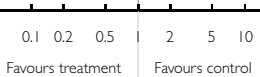
Outcome: 3 Initiation of sexual intercourse-Individually RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gender mixed or not specified					
Jemmott III 1998	62/339	40/173		15.6 %	0.79 [0.56, 1.13]
Philliber 2002	152/242	174/242		51.3 %	0.87 [0.77, 0.99]
Villarruel 2006	94/263	117/287		33.0 %	0.88 [0.71, 1.09]
Total (95% CI)	**844**	**702**		**100.0 %**	**0.86 [0.77, 0.96]**

Total events: 308 (Intervention), 331 (Control)

Heterogeneity: $Chi^2 = 0.30$, df = 2 (P = 0.86); $I^2 = 0.0\%$

Test for overall effect: Z = 2.66 (P = 0.0078)



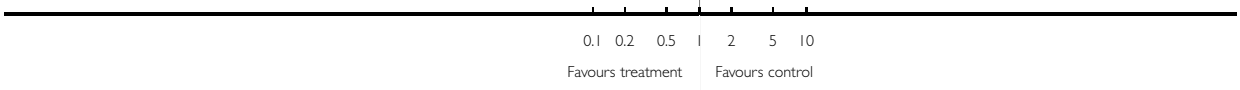
Analysis 1.4. Comparison 1 Multiple interventions, Outcome 4 Initiation of sexual intercourse-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 4 Initiation of sexual intercourse-Cluster RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Female					
Kirby 1997a	50/409	49/410		10.6 %	1.02 [0.71, 1.48]
Wight 2002	423/1330	445/1350		21.9 %	0.96 [0.86, 1.08]
Subtotal (95% CI)	**1739**	**1760**		**32.5 %**	**0.97 [0.87, 1.08]**
Total events: 473 (Intervention), 494 (Control)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.09, df = 1 (P = 0.77); I^2 =0.0%					
Test for overall effect: Z = 0.58 (P = 0.56)					
2 Male					
Kirby 1997a	61/305	60/301		12.4 %	1.00 [0.73, 1.38]
Wight 2002	263/1117	298/1246		20.3 %	0.98 [0.85, 1.14]
Subtotal (95% CI)	**1422**	**1547**		**32.7 %**	**0.99 [0.87, 1.13]**
Total events: 324 (Intervention), 358 (Control)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.01, df = 1 (P = 0.92); I^2 =0.0%					
Test for overall effect: Z = 0.18 (P = 0.85)					
3 Gender mixed or not specified					
Fawole 1999	36/157	54/147		11.0 %	0.62 [0.44, 0.89]
Ferguson 1998	3/17	3/20		1.1 %	1.18 [0.27, 5.09]
Howard 1990	52/334	36/119		10.6 %	0.51 [0.36, 0.74]
Morberg 1998	93/438	43/254		12.1 %	1.25 [0.90, 1.74]
Subtotal (95% CI)	**946**	**540**		**34.8 %**	**0.77 [0.47, 1.28]**
Total events: 184 (Intervention), 136 (Control)					
Heterogeneity: Tau^2 = 0.18; Chi^2 = 14.91, df = 3 (P = 0.002); I^2 =80%					
Test for overall effect: Z = 1.00 (P = 0.32)					
Total (95% CI)	**4107**	**3847**		**100.0 %**	**0.90 [0.77, 1.06]**
Total events: 981 (Intervention), 988 (Control)					
Heterogeneity: Tau^2 = 0.03; Chi^2 = 19.31, df = 7 (P = 0.01); I^2 =64%					
Test for overall effect: Z = 1.24 (P = 0.21)					

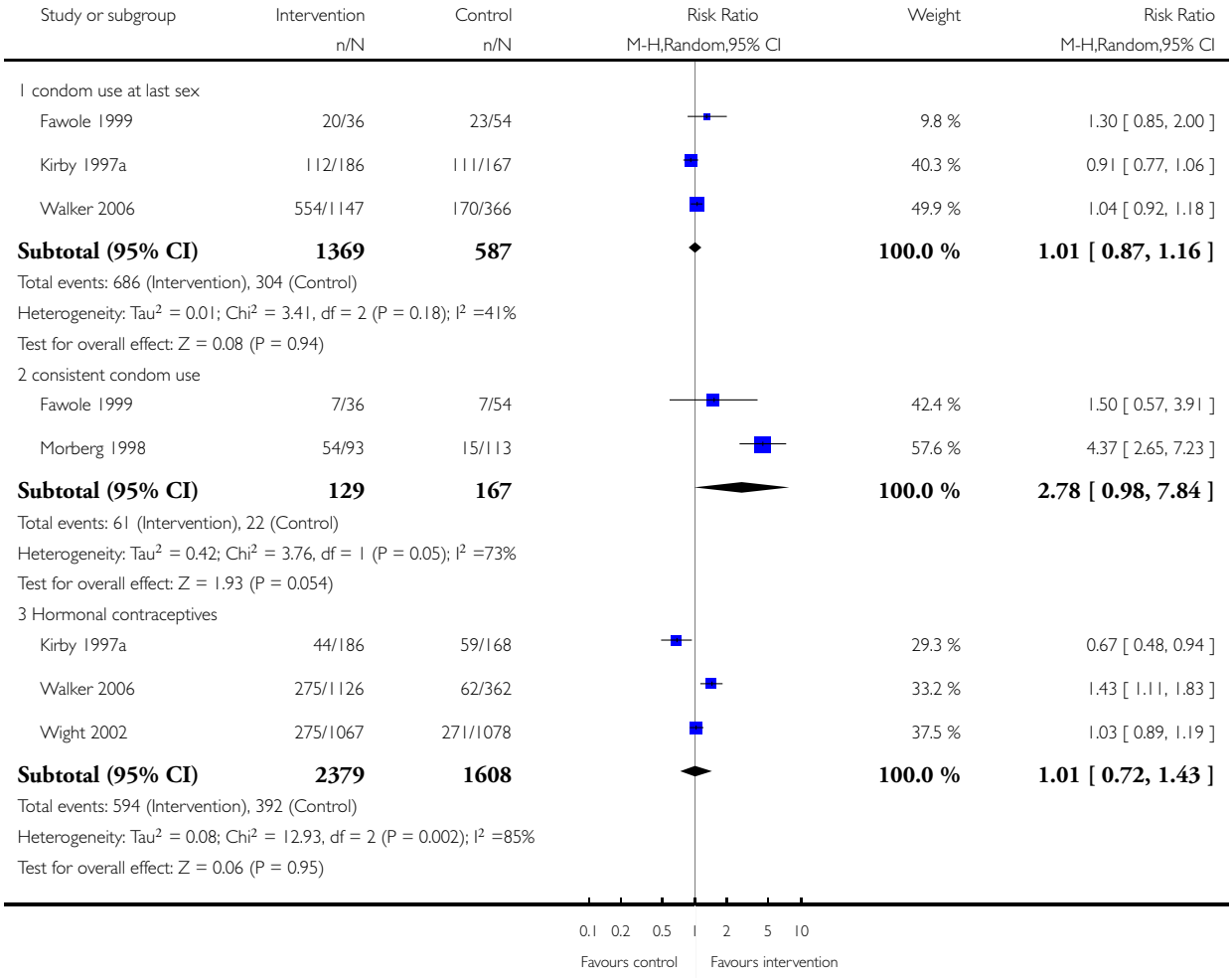


Analysis 1.5. Comparison 1 Multiple interventions, Outcome 5 Use of birth control methods-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 5 Use of birth control methods-Cluster RCT

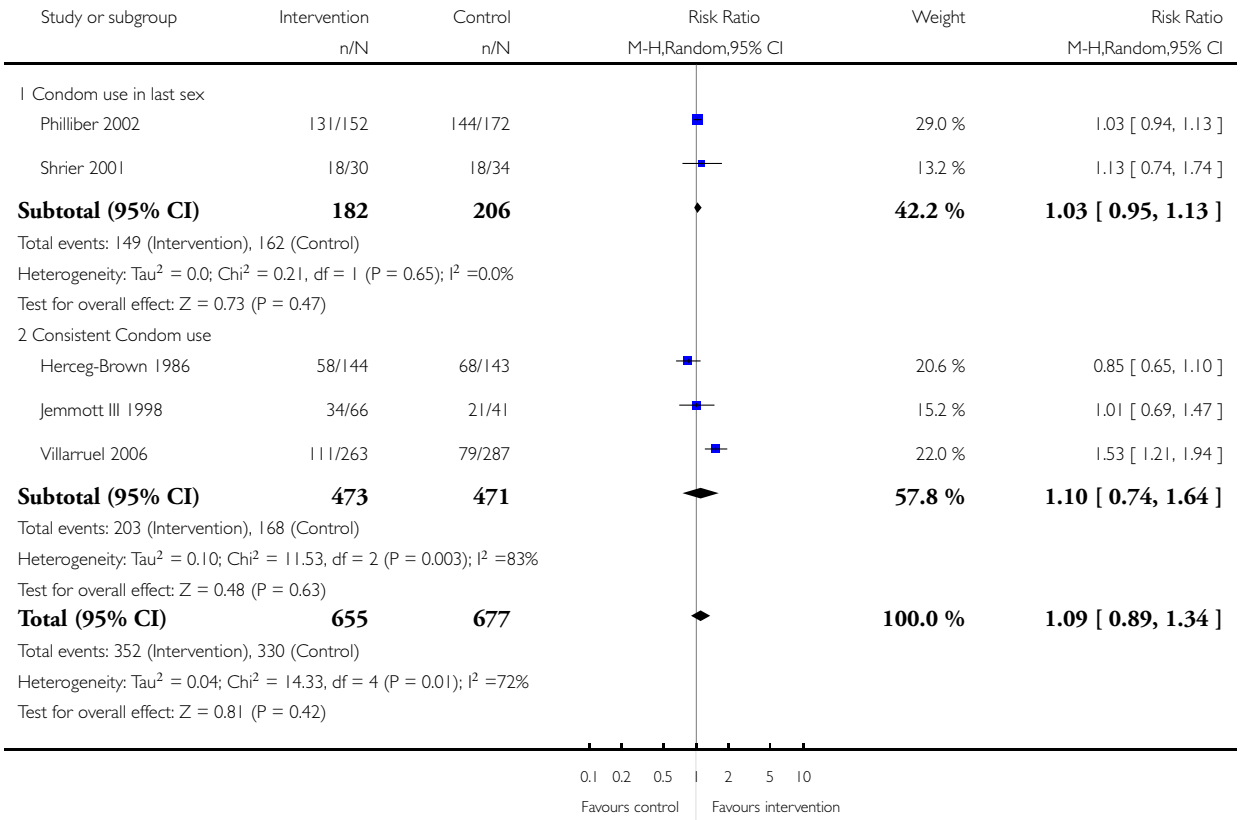


Analysis 1.6. Comparison 1 Multiple interventions, Outcome 6 Use of birth control methods-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 6 Use of birth control methods-Individually RCT



Analysis 1.7. Comparison 1 Multiple interventions, Outcome 7 Sexually Transmitted Diseases-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 7 Sexually Transmitted Diseases-Cluster RCT

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Fawole 1999	1/36	1/54		10.0 %	1.50 [0.10, 23.22]
Kirby 1997a	5/169	7/161		90.0 %	0.68 [0.22, 2.10]
Total (95% CI)	**205**	**215**		**100.0 %**	**0.76 [0.27, 2.14]**

Total events: 6 (Treatment), 8 (Control)

Heterogeneity: Chi^2 = 0.27, df = 1 (P = 0.60); I^2 =0.0%

Test for overall effect: Z = 0.51 (P = 0.61)

Analysis 1.8. Comparison 1 Multiple interventions, Outcome 8 Sexually Transmitted Diseases-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 8 Sexually Transmitted Diseases-Individually RCT

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Shrier 2001	5/30	11/30		100.0 %	0.45 [0.18, 1.15]
Total (95% CI)	**30**	**30**		**100.0 %**	**0.45 [0.18, 1.15]**

Total events: 5 (Treatment), 11 (Control)

Heterogeneity: not applicable

Test for overall effect: Z = 1.67 (P = 0.096)

Analysis 1.9. Comparison 1 Multiple interventions, Outcome 9 Childbirth-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 9 Childbirth-Individually RCT

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Phillber 2002	10/242	15/242		100.0 %	0.67 [0.31, 1.45]
Total (95% CI)	**242**	**242**		**100.0 %**	**0.67 [0.31, 1.45]**
Total events: 10 (Treatment), 15 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.02 (P = 0.31)					

Analysis 1.10. Comparison 1 Multiple interventions, Outcome 10 Second unintended pregnancy-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 1 Multiple interventions

Outcome: 10 Second unintended pregnancy-Individually RCT

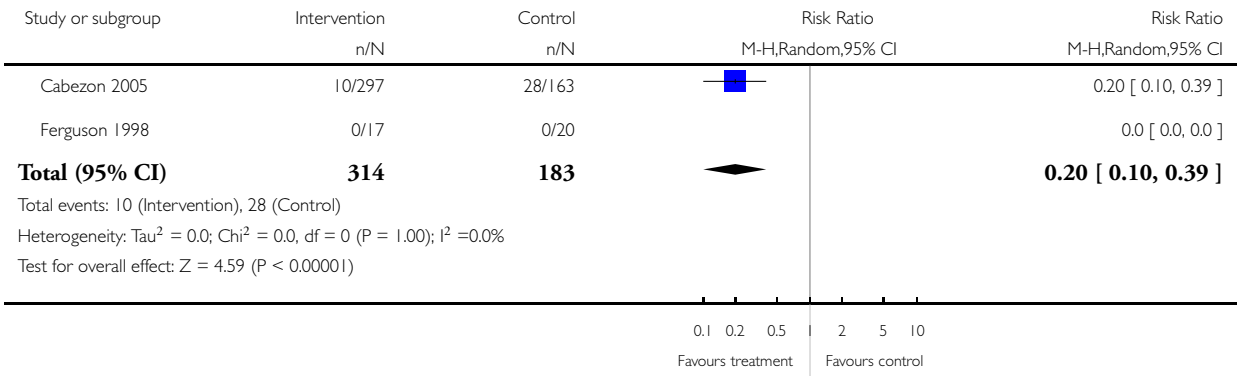
Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Black 2006	8/70	19/79		100.0 %	0.48 [0.22, 1.02]
Total (95% CI)	**70**	**79**		**100.0 %**	**0.48 [0.22, 1.02]**
Total events: 8 (Treatment), 19 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.92 (P = 0.055)					

Analysis 2.1. Comparison 2 Sensitivity analysis [Multiple intervention]: Unintended pregnancy, Outcome 1 Unintended Pregnancy [cluster-randomized studies].

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 2 Sensitivity analysis [Multiple intervention]: Unintended pregnancy

Outcome: 1 Unintended Pregnancy [cluster-randomized studies]

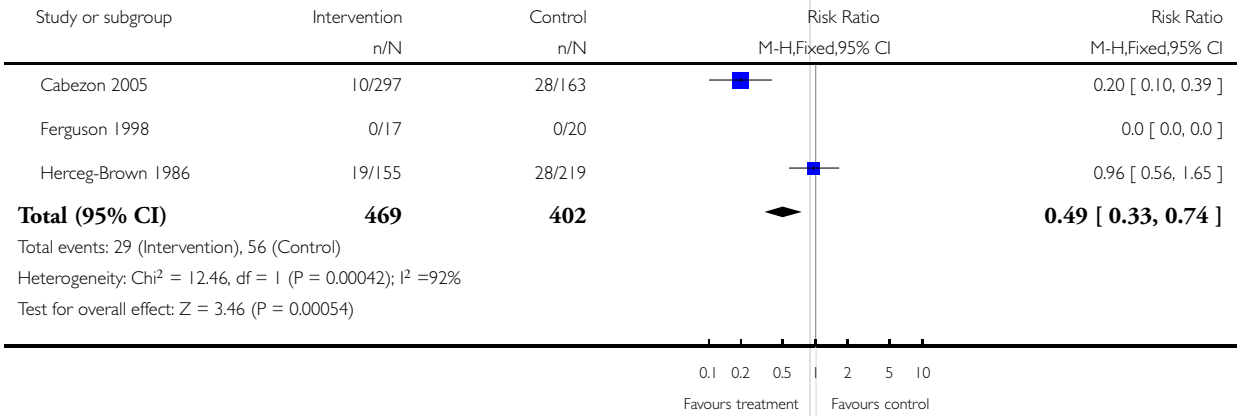


Analysis 2.2. Comparison 2 Sensitivity analysis [Multiple intervention]: Unintended pregnancy, Outcome 2 Unintended Pregnancy [cluster-adjusted+individual].

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 2 Sensitivity analysis [Multiple intervention]: Unintended pregnancy

Outcome: 2 Unintended Pregnancy [cluster-adjusted+individual]

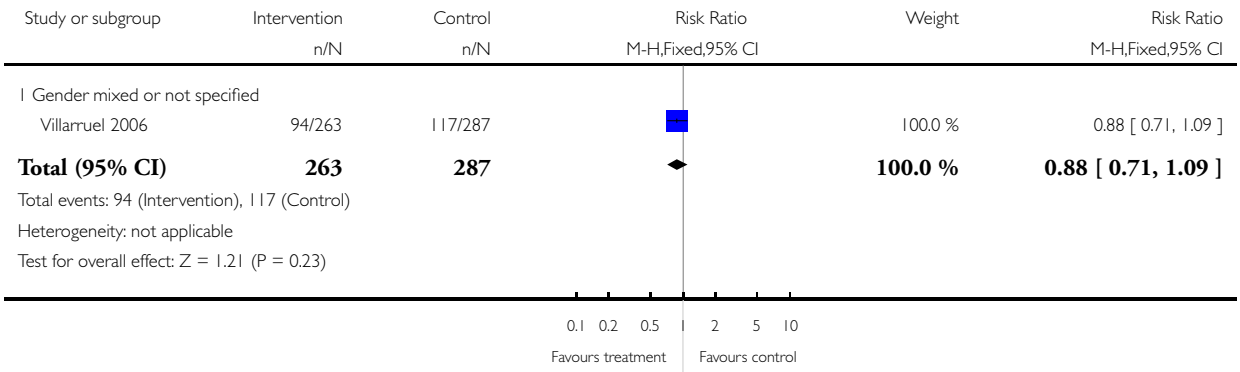


Analysis 3.1. Comparison 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse, Outcome 1 Initiation of sexual intercourse-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse

Outcome: 1 Initiation of sexual intercourse-Individually RCT

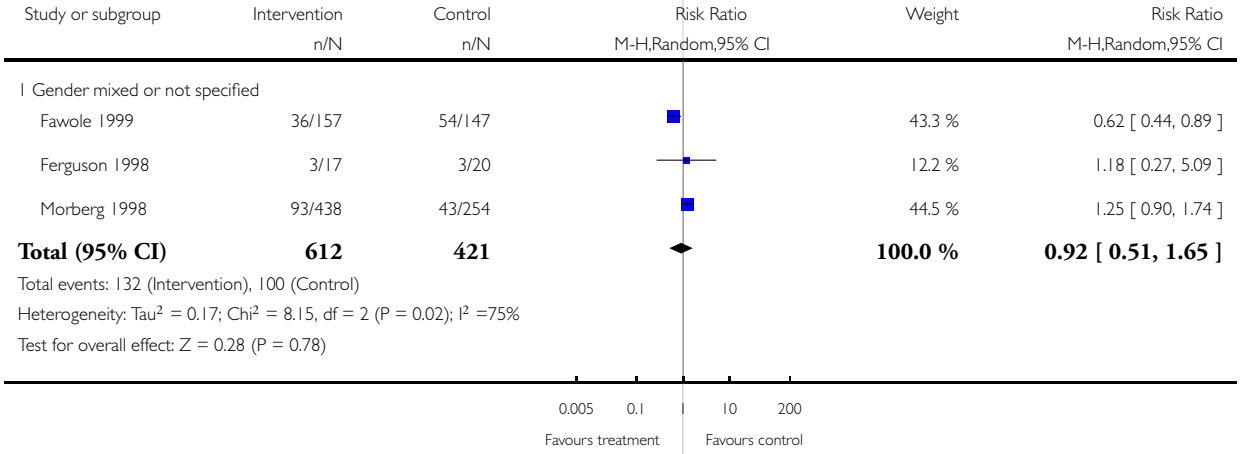


Analysis 3.2. Comparison 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse, Outcome 2 Initiation of sexual intercourse-cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse

Outcome: 2 Initiation of sexual intercourse-cluster RCT

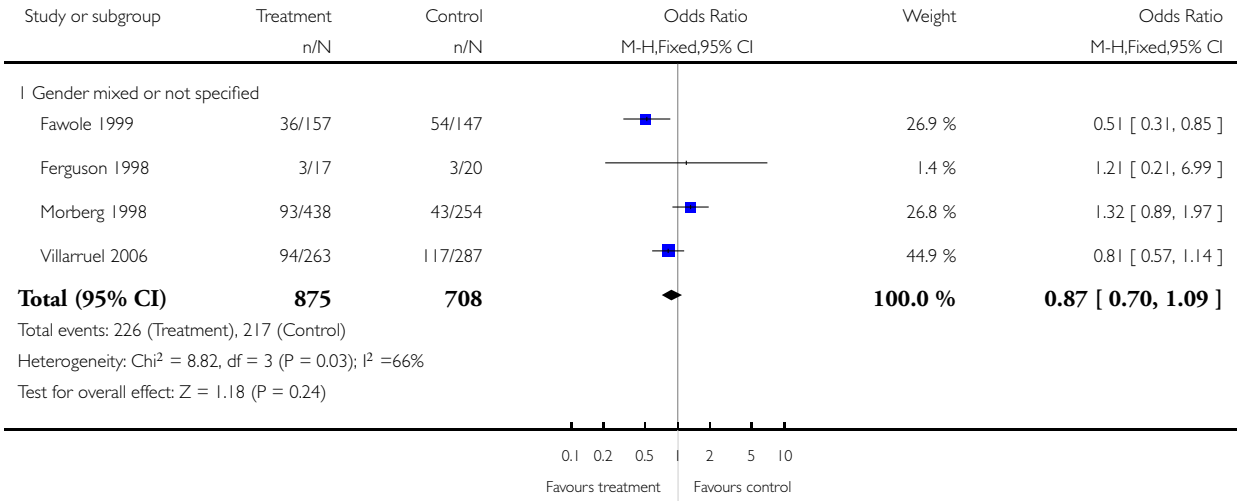


Analysis 3.3. Comparison 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse, Outcome 3 Initiation of sexual intercourse-cluster-adjusted + individual).

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 3 Sensitivity analysis [Multiple intervention]: Initiation of intercourse

Outcome: 3 Initiation of sexual intercourse-cluster-adjusted + individual)

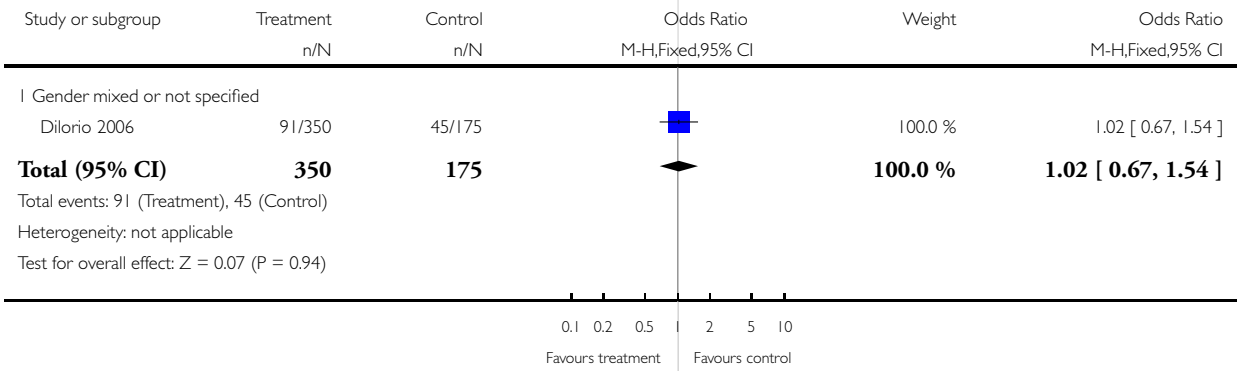


Analysis 4.1. Comparison 4 Educational intervention, Outcome 1 Initiation of Sexual Intercourse-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 4 Educational intervention

Outcome: 1 Initiation of Sexual Intercourse-Cluster RCT



Analysis 4.2. Comparison 4 Educational intervention, Outcome 2 Use of birth control methods-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 4 Educational intervention

Outcome: 2 Use of birth control methods-Cluster RCT

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 condom use at last sex					
Dilorio 2006	89/91	38/45		68.4 %	1.16 [1.02, 1.32]
Borgia 2005	169/613	152/682		31.6 %	1.24 [1.02, 1.50]
Total (95% CI)	**704**	**727**		**100.0 %**	**1.18 [1.06, 1.32]**
Total events: 258 (Treatment), 190 (Control)					
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.58$, df = 1 (P = 0.44); $I^2 = 0.0\%$					
Test for overall effect: Z = 3.08 (P = 0.0021)					

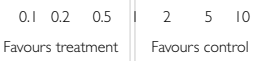
Analysis 5.1. Comparison 5 Contraceptive Intervention, Outcome 1 Unintended Pregnancy-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 5 Contraceptive Intervention

Outcome: 1 Unintended Pregnancy-Individually RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Raine 2005	66/826	85/1124		50.7 %	1.06 [0.78, 1.44]
Raymond 2006	67/746	70/744		49.3 %	0.95 [0.69, 1.31]
Total (95% CI)	**1572**	**1868**		**100.0 %**	**1.01 [0.81, 1.26]**
Total events: 133 (Intervention), 155 (Control)					
Heterogeneity: $Chi^2 = 0.20$, df = 1 (P = 0.65); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.06 (P = 0.96)					



Analysis 5.2. Comparison 5 Contraceptive Intervention, Outcome 2 Initiation of sexual intercourse-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 5 Contraceptive Intervention

Outcome: 2 Initiation of sexual intercourse-Cluster RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Female					
Graham 2002	199/699	240/747		53.4 %	0.89 [0.76, 1.04]
Subtotal (95% CI)	**699**	**747**		**53.4 %**	**0.89 [0.76, 1.04]**
Total events: 199 (Intervention), 240 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.51 (P = 0.13)					
2 Male					
Graham 2002	198/744	212/816		46.6 %	1.02 [0.87, 1.21]
Subtotal (95% CI)	**744**	**816**		**46.6 %**	**1.02 [0.87, 1.21]**
Total events: 198 (Intervention), 212 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.28 (P = 0.78)					
Total (95% CI)	**1443**	**1563**		**100.0 %**	**0.95 [0.85, 1.07]**
Total events: 397 (Intervention), 452 (Control)					
Heterogeneity: Chi^2 = 1.54, df = 1 (P = 0.21); I^2 =35%					
Test for overall effect: Z = 0.87 (P = 0.38)					

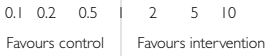
Analysis 5.3. Comparison 5 Contraceptive Intervention, Outcome 3 Use of birth control methods-Cluster RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 5 Contraceptive Intervention

Outcome: 3 Use of birth control methods-Cluster RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Hormonal contraceptives					
Graham 2002	63/195	79/220		100.0 %	0.90 [0.69, 1.18]
Total (95% CI)	**195**	**220**		**100.0 %**	**0.90 [0.69, 1.18]**
Total events: 63 (Intervention), 79 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.77 (P = 0.44)					



Analysis 5.4. Comparison 5 Contraceptive Intervention, Outcome 4 Use of birth control methods-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 5 Contraceptive Intervention

Outcome: 4 Use of birth control methods-Individually RCT

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Condom use in last sex					
Raine 2005	373/826	541/1124		89.5 %	0.94 [0.85, 1.03]
Raymond 2006	84/569	81/572		10.5 %	1.04 [0.79, 1.38]
Subtotal (95% CI)	**1395**	**1696**		**100.0 %**	**0.95 [0.87, 1.04]**
Total events: 457 (Intervention), 622 (Control)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.49, df = 1 (P = 0.48); I^2 =0.0%					
Test for overall effect: Z = 1.13 (P = 0.26)					
2 Consistent condom use					
Raine 2005	99/826	149/1124		100.0 %	0.90 [0.71, 1.15]
Subtotal (95% CI)	**826**	**1124**		**100.0 %**	**0.90 [0.71, 1.15]**
Total events: 99 (Intervention), 149 (Control)					

(*Continued* . . .)

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Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Heterogeneity: not applicable					
Test for overall effect: Z = 0.83 (P = 0.41)					
3 Hormonal contraceptives					
Raine 2005	309/826	262/1124		56.0 %	1.60 [1.40, 1.84]
Raymond 2006	57/569	17/572		44.0 %	3.37 [1.99, 5.72]
Subtotal (95% CI)	**1395**	**1696**		**100.0 %**	**2.22 [1.07, 4.62]**
Total events: 366 (Intervention), 279 (Control)					
Heterogeneity: Tau^2 = 0.24; Chi^2 = 7.24, df = 1 (P = 0.01); I^2 =86%					
Test for overall effect: Z = 2.14 (P = 0.032)					

Analysis 5.5. Comparison 5 Contraceptive Intervention, Outcome 5 Sexually Transmitted Diseases-Individually RCT.

Review: Interventions for preventing unintended pregnancies among adolescents

Comparison: 5 Contraceptive Intervention

Outcome: 5 Sexually Transmitted Diseases-Individually RCT

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Raine 2005	94/826	140/1124		69.1 %	0.91 [0.71, 1.17]
Raymond 2006	49/746	53/744		30.9 %	0.92 [0.63, 1.34]
Total (95% CI)	**1572**	**1868**		**100.0 %**	**0.92 [0.75, 1.13]**
Total events: 143 (Treatment), 193 (Control)					
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.97); I^2 =0.0%					
Test for overall effect: Z = 0.83 (P = 0.40)					

APPENDICES

Appendix 1. Search Strategy

#1explode CONTRACEPTION
#2CONTRACEPTION-BEHAVIOR
#3contracept*
#4adolescent
#5teenage
#6teenager
#7teens
#8explode FAMILY-PLANNING
#9family planning or planned parenthood or birth control
#10birth regulat* or population regulat* or fertility regulat* or birth spacing
#11population control or fertility control or reproduct* control
#12pregnan* near (prevent* or interrupt* or terminat*)
#13birth control clinic
#14sex education
#15primary prevention
#16school
#17POPULATION-CONTROL
#18FAMILY-PLANNING-POLICY
#19explode CONTRACEPTIVE-DEVICES
#20intrauterine device* or intra-uterine device* or IUD* or TCu380a or CuT-200 or Gynefix
#21barrier method* or condom* or vaginal sponge* or cervical cap*
#22explode REPRODUCTIVE-CONTROL-AGENTS
#23ovulat* near (supress* or inhibit* or prevent*)
#24ABORTION-APPLICANTS
#25explode ABORTION-INDUCED
#26abortion or abortifacient*or termination or morning after pill or RU-486 or Yuzpe
#27explode STERILIZATION-SEXUAL
#28(female or woman or women or male or man or men) near sterili*
#29vasectom*
#30SEXUAL-ABSTINENCE
#31periodic* abstinen* or sexual* abstinen* or coitus interruptus. We included the following search terms to identify additional reports on educational interventions that the above strategy may omit:
#32 (counsel* or debrief* or educat* or teach*). We scrutinized college studies to identify groups that fulfilled the review inclusion criteria.

WHAT'S NEW

Last assessed as up-to-date: 29 December 2008.

11 November 2009	Amended	by John Ehiri

HISTORY

Protocol first published: Issue 2, 2005

Review first published: Issue 4, 2009

21 July 2008	Amended	converted to new review format

CONTRIBUTIONS OF AUTHORS

JE conceived the review; JE, MM, AM contributed to the design and drafting of the protocol.

JE and MM coordinated the review, CO, EE, HE undertook searches of electronic databases (CENTRAL, PubMed, EMBASE, LILACS), carried out the email search for unpublished literature, and organized the retrieval of papers.

CO, EE and HE screened for included studies while CO and EE extracted and entered data on trial results into RevMan5.

MM and CO interpreted the data and prepared the first draft of the complete review.

All authors contributed to the drafting and editing of the review.

JM and MM secured funding for the review.

DECLARATIONS OF INTEREST

None

SOURCES OF SUPPORT

Internal sources

- University of Calabar, Calabar, Nigeria.

External sources

- Australian Cochrane Centre, Australia.

Provided the fund for this review

- Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, USA.
- Nigeria branch of the South Africa Cochrane Centre, Nigeria.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We included four trials that had a small percentage of participants aged 19 to 24 years (outside the age limit stipulated in the protocol). However, the ages of most the study population (more than 75%) in each of these four trials were within the age limit stipulated in the review protocol (10 to 19 years).

We excluded all quasi experimental and cross over trials as this was cumbersome and would have prolonged the completion of this review.

Methodological quality of included studies were assessed using "Risk of Bias tool" outlined in the Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.1, 2008 and no longer by method outlined in the 2004 Cochrane Reviewers' Handbook (Clark 2004) as previously stated.

INDEX TERMS

Medical Subject Headings (MeSH)

*Pregnancy, Unplanned; Adolescent; Health Knowledge, Attitudes, Practice; Pregnancy in Adolescence [*prevention & control]; Randomized Controlled Trials as Topic

MeSH check words

Child; Female; Humans; Male; Pregnancy; Young Adult