

ARTICLE

Psychological interventions decrease unintended pregnancies: A meta-analysis of randomized controlled trials

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Abstract

Objective: Despite innovations in contraceptive methods, unintended pregnancies remain common. Researchers have examined psychological approaches to decrease unintended pregnancies through contraceptive use. These interventions have involved applying aspects of social cognitive theory, the health belief model and self-determination theory. Research findings on the effects of these psychological approaches show conflicting evidence. The aim of this meta-analysis was to clarify the impact of these psychological interventions on unintended pregnancies

Design: Meta-analysis of randomized controlled trials (RCTs) of psychological interventions intended to prevent unwanted pregnancies through an increase in the use of contraceptive methods

Methods: A systematic search of databases and article reference lists led to 26 relevant RCTs with a total of 31,222 participants

Results: The odds ratio for pregnancy in the psychological intervention condition = .83, 95% CI [.75, .93]. The results also showed that the longer an intervention's follow-up period was, the less the prevention effect. Quality assessment of included studies indicated that all used a treatment manual and reported attrition. It also showed that most studies reported the reasons for drop-out and assessed the facilitators' adherence to the intervention protocol. The proportion of variability due to chance amongst studies was $I^2 = 22\%$. Duval and Tweedie's Trim and Fill showed a difference between the observed and the adjusted values. The adjusted

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value, representing a conservative estimate of effect size, was $OR = .891$, 95% CI [.777, .999]

Conclusions: Altogether, these results support the efficacy of psychological interventions aimed at preventing unintended pregnancy through contraception.

KEYWORDS

contraception, efficacy, interventions, meta-analysis, pregnancy, prevention, psychological, randomized controlled trials

Statement of Contribution

Researchers have examined psychological approaches to decreasing unintended pregnancies through contraceptive use. These interventions have involved applying aspects of social cognitive theory, the health belief model and self-determination theory. Research findings on the effects of these psychological approaches show conflicting evidence. The present meta-analysis combined the results of all relevant randomized controlled trials and found that, across studies, the interventions had a significant effect in reducing the number of unintended pregnancies.

BACKGROUND

Substantial progress was made in contraception-related services in the 20th century (U.S. Center for Disease Control and Prevention, 1999), with global unintended pregnancy rates decreasing by 30% in economically developed countries and 16% in economically developing countries between 1990 and 2014 (Bearak et al., 2018). Nevertheless, nearly half of all births globally are unintended (Bearak et al., 2018; Finer & Zolna, 2011).

Unintended pregnancies are associated with an increased risk to parental psychological well-being, anxiety and depression (Barber et al., 1999; Hardee et al., 2004; Lara et al., 2006; Lau & Keung, 2007; Laukaran & Van Den Berg, 1980; Najman et al., 1991; Nakku et al., 2006). Research findings also show that unintended pregnancies are associated with maternal risk behaviours such as the use of alcohol and other drugs (Altfeld et al., 1998; Than et al., 2005; Weller et al., 1987). Further, children from unintended pregnancies are at risk of adverse outcomes. Compared to planned children, these children are more likely to develop psychological and physiological disorders, which contribute to significantly lower rates of academic success (Fogel, 2004; Hayatbakhsh et al., 2011; Sonfield et al., 2011). Children from unintended pregnancies also have higher rates of delinquent behaviours and are more likely to become involved with child protection services (Hayatbakhsh et al., 2011; Sidebotham et al., 2003).

Unintended pregnancies are preventable with effective contraceptives. The most effective contraceptives include intrauterine devices (IUDs), contraceptive implants (e.g. the rod) and oral contraceptives (Zapata et al., 2015). Though these methods are widely available, nearly half of unintended pregnancies in developed countries occur due to not using contraceptive methods during conception (Gipson et al., 2008; Ip et al., 2009).

Psychological approaches to preventing unintended pregnancy

Researchers have examined psychological approaches to preventing unintended pregnancies (Zapata et al., 2015). We focused on interventions that aimed to increase contraceptive use because contraceptives can have a major impact on the rate of unplanned pregnancy. The relevant interventions usually include

education about contraceptive use and/or individualized contraceptive counselling. Interventions based on social cognitive theory (SCT; Bandura, 1998) or the theory of planned behaviour (TPB; Ajzen, 1991) have been used in some pregnancy prevention research due to evidence for their being more effective than non-theory-based interventions (Albarracín et al., 2001; Webb et al., 2010).

Many interventions take an eclectic approach and use constructs of various psychological theories without including other elements of the theories (Armitage & Conner, 2000; Baban & Craciun, 2007; Miranda & Côté, 2017; Montanaro & Bryan, 2014; Schmiege et al., 2009). For instance, the intervention in the study of Coyle et al. (2006) included elements of social cognitive theory (Bandura, 1986), the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behaviour (Ajzen, 1991). The intervention by Oman et al. (2018) used aspects of social cognitive theory and the health belief model. Some interventions include aspects of self-determination theory, such as autonomy (Antonishak et al., 2015). One intervention used the transtheoretical model to guide the intervention (Peipert et al., 2008). Self-efficacy, which is part of social cognitive theory, and intentions to have sex, part of the theory of planned behaviour, are commonly combined constructs due to their ability to predict sexual health outcomes (Espada et al., 2015).

In general, the interventions involve suggesting the use of contraception and explaining what methods to use and how to use them (Berenson & Rahman, 2012). Some interventions provide prompts to avoid unwanted pregnancy and provide social support for using contraception (Herceg-Baron et al., 1986). Some interventions include assertion training (Kirby et al., 1997). Some interventions for school-age participants provide jobs or volunteer activities as a way to build self-confidence and hope (Philliber et al., 2002). Other interventions involve long-term goal setting (Bonell et al., 2013). Some include participants and a parent and try to promote positive relations (Brown et al., 2021). Researchers have suggested that this variety in intervention elements reflects the lack of clear direction on what constructs are best included in pregnancy prevention for it to be effective (Moos et al., 2003; Zapata et al., 2015).

Measurement in pregnancy prevention

The mainstream approach to measuring unintended pregnancies is to use self-report items that require yes or no responses. Researchers rarely provide reliability or validity evidence for these dichotomous self-reports. To increase validity, some researchers have coupled self-reported unintended pregnancies with the results of pregnancy tests or medical or birth records (Peipert et al., 2008; Shlay et al., 2003). Researchers typically do not report any reliability or validity data for these outcome measures.

Prior meta-analyses

Three previous meta-analyses examined the effect of psychological interventions on unintended pregnancies in certain populations. These interventions found no overall significant effect on unintended pregnancy rates amongst adolescents (Oringanje et al., 2016), with contraceptive counselling post-abortion (Ferreira et al., 2009), and with motivational interviewing as the intervention (Wilson et al., 2015). However, the generalisability of these findings is limited, as the meta-analyses focused on specific methods or populations and included relatively few studies.

METHOD

Aims of the current meta-analysis

With unclear evidence on the efficacy of psychological interventions intended to prevent unintended pregnancies through contraception, we set out to provide a comprehensive evaluation. A meta-analysis

can help achieve efficacy evaluations by appraising relevant interventions for quality, overall efficacy and moderators of effect size (Nordmann et al., 2012).

We aimed to evaluate the effect of contraception-based psychological interventions on unintended pregnancies. Building upon previous meta-analyses and systematic reviews, the current meta-analysis included studies using any psychological contraception-based intervention, with participants of any background. We wanted to determine whether there is an empirical basis for continuing to fund interventions intended to prevent unwanted pregnancies. We included only randomized control trials (RCTs) because of their ability to lead to causal conclusions. The research hypothesis tested was that psychological interventions would decrease the level of unintended pregnancies. We planned to search for moderators of effect size but had no hypotheses regarding moderators.

Eligibility criteria

Studies were eligible for inclusion in the meta-analysis if they met the following criteria: (i) the study was a randomized control trial (RCT) with individual or clustered randomization, (ii) the study assessed post-intervention unintended pregnancies, (iii) the study used a psychological method of reducing unintended pregnancies through contraception, (iv) the study promoted contraception that is currently and commonly advocated by healthcare professionals, is ethical and is safe, (v) participants were not pregnant or trying to become pregnant during initial measurement, (vi) the study reported results needed to compute an odds ratio and (vii) attrition rates were <50% for at least one follow-up period. We did not evaluate the level of contraceptive use as an outcome because we wanted to focus on the psychologically and socially important variable of unwanted pregnancy.

Control groups were grouped into standard care, education other than what the intervention group received, or a different type of control. Standard care refers to care that is typically received in family planning or contraceptive counselling clinics; standard care could include pharmacological interventions. Other education refers to the sexual and life skill education material typically administered through a school curriculum or community health centres. There were no restrictions on languages or publication dates.

If attrition in a study was higher than 50% at the end of the longest follow-up period, we used data from the next longest follow-up period.

Search

Studies were found by searching electronic databases, including Clinical trials.gov, Embase, Web of Science, EBSCO and Proquest databases. We searched electronic databases using the search string: randomized controlled trial AND pregnancy prevention. We also searched the reference lists examined of included studies, reviews and meta-analyses found through the formal search. We wrote to the authors of included studies to request unpublished studies. No additional studies were obtained from the authors. See the Appendix A for the full search protocol, with search terms.

Studies were screened by title and abstract and then full text. If a relevant article reported insufficient results to compute an effect size, we attempted to contact authors to acquire the needed information. We were unable to obtain the required additional data regarding the studies of Frarey et al. (2019), Kirby et al. (2010) and Petersen et al. (2007), so these studies were excluded from the analysis.

Two researchers participated in the search process, with one checking the work of the other.

Coding process

The following descriptive data items were coded: (a) study author and publication year, (b) whether the sample included females only or also males, (c) mean age of participants who completed the intervention,

(d) description of the sample used, (e) randomization method used, (f) type of control, (g) how the pregnancy was measured, (h) type of analysis (intention to treat or completer), (i) intervention setting and (j) follow-up length. We attempted to code the type of intervention by theory applied and by other characteristics, but we could never achieve satisfactory inter-rater agreement due to the use of elements of various theories in heterogeneous interventions and due to some interventions having no stated theoretical basis.

One researcher coded all study data, and another checked the entries. A third researcher independently coded effect size and moderator data from 10 randomly selected studies. The interrater agreement for independent coding was 92%. We came to a consensus regarding disagreements.

We used Comprehensive Meta-Analysis software (CMA Version 3; Borenstein et al., 2014) to analyse studies. We used an Odds Ratio (OR) for the summary effect size. OR is the most common statistic in health and is recommended for phenomena that have a low prevalence, such as unintended pregnancies (Chen et al., 2010; Cohen & Chen, 2009). Within the context of pregnancies, an OR represents the association between the likelihood of unintended pregnancies and participation in a preventive psychological intervention. In the current meta-analysis, values under 1 represent a lower likelihood of unintended pregnancies for individuals in an intervention than for individuals in the control group.

Using a random-effects model, the summary effect size was computed by calculating the odds ratio for individual studies and then accumulating effect sizes into a single outcome measure. A random-effects model is appropriate when studies vary in populations assessed and other study factors and the intent is to generalize to other populations (Borenstein et al., 2009).

Homogeneity was assessed using the Q and I^2 statistics. Q tests the null hypothesis that there is no true variance across effect sizes (Borenstein et al., 2009). The I^2 statistic measures the proportion of variance in effect sizes amongst samples that is due to true heterogeneity rather than sampling error (chance).

We registered the study protocol with the International Prospective Register of Systematic Reviews (PROSPERO) at the planning stage. The registration number is https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=245812

RESULTS

Search results

Figure 1 provides a flow diagram of the selection process that was completed in July 2021. The final data file is at <https://rune.une.edu.au/web/handle/1959.11/31934>.

Study characteristics

Table 1 shows the key characteristics of the analysed studies. The 25 studies had a total of 26 samples and a total of 31,222 participants included in the analyses we used. Participants were largely female, at-risk teenagers. The mean follow-up period was 16 months.

For Herceg-Baron et al. (1986), we ran two separate analyses as the study had two experimental conditions and two control conditions. The Periodic Support experimental condition was analysed in comparison to Control B. The Family Support experimental condition was analysed in comparison to Control A. We chose these comparisons of separate samples at random.

Table 2 provides descriptions of the interventions, their theoretical basis and the control groups. We were unable to reliably code the type of intervention, mostly because the studies used various mixes of theoretical principles, education and counselling. Some of the control conditions appear similar to the intervention, but it is difficult to tell how similar in some studies because the study report does not describe the control condition in detail.

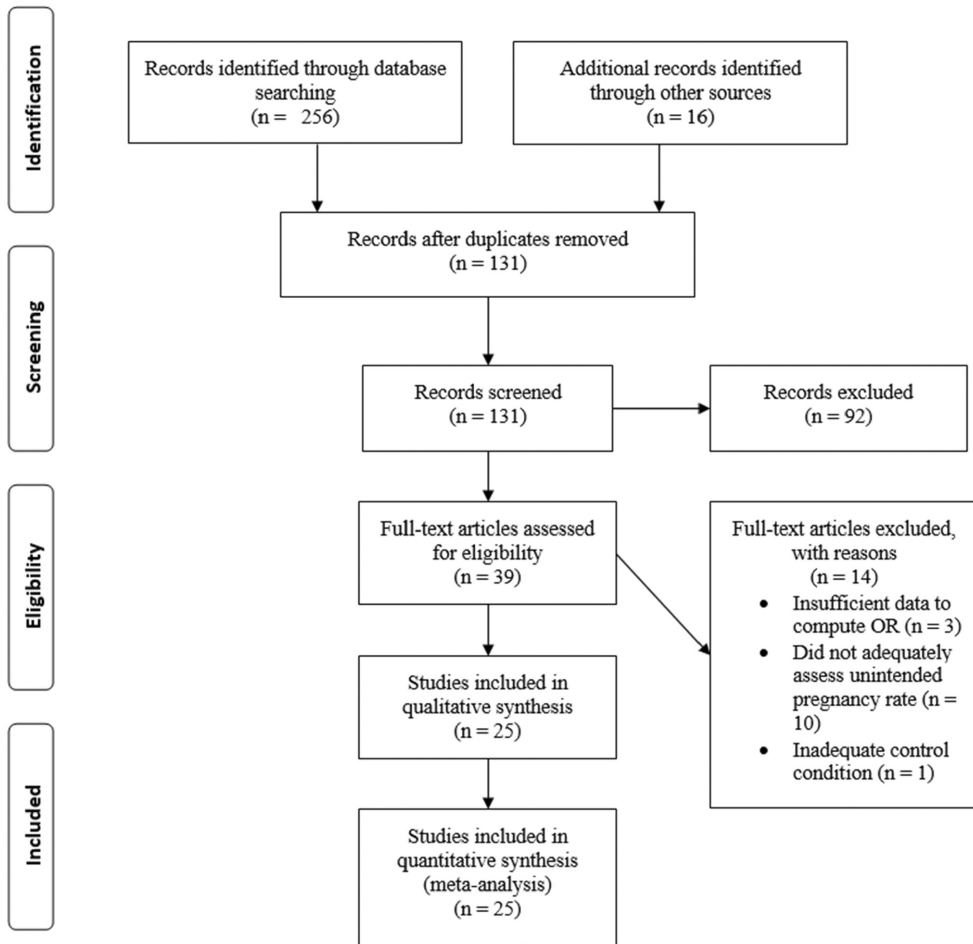


FIGURE 1 PRISMA flow diagram of the study selection process

Assessment of study quality and risk of bias in findings

In light of the significant proportion of low-quality studies reported in past reviews (Lopez et al., 2016), we evaluated the quality and risk of bias of the included studies. We included assessment criteria used in similar meta-analyses (Lopez et al., 2016), along with criteria suggested to be essential by experts in psychological research (Lieberherz et al., 2016). Table 3 shows the quality assessment criteria. Overall, most of the studies met most of our quality standards. Table 1 provides information about another study-quality factor: whether pregnancy status was evaluated with objective data as well as self-report. Most studies did not collect objective outcome data.

Overall effect

Figure 2 shows the results, including odds ratios, for each study. Overall, psychological interventions based on increasing contraception use led to significantly fewer pregnancies than control conditions, $OR = .84$, $95\% CI [.76, .93]$, $p = .001$. Heterogeneity amongst effect sizes was non-significant $Q(25) = 30.74$, $p = .20$. The proportion of variance due to true heterogeneity amongst studies instead of chance, indicated by

TABLE 1 Characteristics of included studies

Study	N	% fem	Mean age	Sample type	Intervention type	Intervention setting	Randomization type	Control type	FU length months	Pregnancy measurement	Type of attrition analysis
Antonshak et al. (2015)	1042	100	22	At-Risk Women	Educational	Online	Individual	No Treatment	12	SR	COM
Berenson and Rahman (2012)	767	100	20	At-Risk Women	Counselling and Telephone	Reproductive Health Clinic	Individual	Standard Care	12	SR and MRR	ITT
Bonell et al. (2013)	404	100	14	At-Risk Youth	Educational	School Nursery	Individual	Usual Education	12	SR	ITT
Boyer et al. (2005)	1743	100	19	Marine	Education and Motivation	At-Training	Cluster	Other Education	14	SR and PT	COM
Brown et al. (2021)	786	58	16	Parent & Youth Dyads	Educational and Telephone	Community Centres	Cluster	Standard Care	12	SR	ITT
Chernick et al. (2017)	99	100	17	At-Risk Youth	Text Messages	ED and Online	Individual	Standard Care	3	SR and MRR	ITT
Coyle et al. (2006) ^a	308	37	16	At-Risk Youth	Educational	Alternative Schools	Cluster	Usual Education	6	SR	COM
DiClemente et al. (2004)	460	100	16	At-Risk Youth	Educational	Community Health Centre	Individual	Usual Education	12	SR	ITT
Grossman and Sipe (1992) ^b	1638	52	15	At-Risk Youth	Educational	High School	Individual	Usual Education	54	SR	COM
Herceg-Baron et al. (1986)	374	100	16	At-Risk Youth	Contraceptive Support	Reproductive Health Clinic	Individual	Standard Care	15	SR	COM
Kirby et al. (1997)	1482	54	12	At-Risk Youth	Educational	Middle Schools	Cluster	Other Education	17	SR	COM
LaChausse (2016)	3490	54	15	At-Risk Youth	Educational	High Schools	Cluster	Other Education	6	SR	ITT
Manlove et al. (2021)	752	100	19	At-Risk Youth	Educational	Online	Individual	Other Education	6	SR	ITT
Oman et al. (2018)	881	21	16	At-Risk Youth	Educational	Group Homes	Cluster	Other Education	12	SR	ITT

(Continues)

TABLE 1 (Continued)

Study	N	% fem	Mean age	Sample type	Intervention type	Intervention setting	Randomization type	Control type	FU length months	Pregnancy measurement	Type of attrition analysis
Peper et al. (2008)	546	100	23	At-Risk Youth	Computer-Based Health Promotion	Reproductive Health Clinic	Individual	Other Education	24	SR and PT	ITT
Philliber et al. (2002)	484	55	14	At-Risk Youth	Educational	Youth Agencies	Individual	Other youth program	36	SR and MRR	COM
Raj et al. (2016)	1081	50	24	Married Couples	Contraceptive Counselling	Reproductive Health Clinics	Cluster	Standard Care	18	SR and PT	ITT
Schwarz et al. (2008)	265	100	30	At-Risk Women	EC Education and Supplementation	Urgent Care Clinic	Individual	Other Education	6	SR	COM
Shlay et al. (2003)	632	100	22	At-Risk Women	Contraceptive Counselling	Reproductive Health Clinic	Individual	Standard Care	12	SR, MRR and BRR	COM
Stephenson et al. (2008)	162	50	18	At-Risk Youth	Peer-Led Education	High Schools	Cluster	Other Education	54	SR	COM
Stephenson et al. (2004)	2805	49	16	At-Risk Youth	Educational	High Schools	Cluster	Other Education	18	SR	ITT
Taylor et al. (2014)	129	49	14	At-Risk Youth	Educational	High Schools	Cluster	Other Education	8	SR	COM
Walsh-Buhi et al. (2016) ^c	7976	50	15	At-Risk Youth	Educational	Reproductive Health Clinics	Cluster	Other Education	9	SR	MI ^c
Wight et al. (2002)	2117	54	14	At-Risk Youth	Educational	High Schools	Cluster	Other Education	24	SR	COM
Ybarra et al. (2021)	799	100	16	LB Youth	Text Messages	Online	Individual	Other Education	5	SR	ITT

Abbreviations: % Fem, percentage female; Attrition Analysis, type of attrition analysis; BRR, birth record review; COM, completers; EC, emergency contraception; ED, emergency department; FU length, months of follow-up; ITT, intention-to-treat analysis; LGB Youth, lesbian and bisexual youth; MI, multiple imputation; MRR, medical record review; N, sample size; PT, pregnancy test; SR, self-report.

^aWe combined data from cohorts.

^bFor Coyle, we used the results for 6 months because they were the only relevant results with less than 50% attrition.

^cWe combined results for the two cohorts.

TABLE 2 Descriptions of intervention, theoretical basis of interventions and control conditions

Study	Intervention	Stated theory applied	Control
Antonishak et al. (2015)	Entertaining information about contraception options, contraception use reminders, video models and locations for acquiring contraceptives—all online	None	No intervention
Berenson and Rahman (2012)	Women requesting oral contraception received individual contraceptive counselling for 45 min, including advice giving, practice	Health Belief	Standard care involving instructions
Bonell et al. (2013)	Playing with a young child, plus training in self-esteem, goal setting, psychological skills, sex education, contraception information, sources of sexual health support	None	Usual school “education”
Boyer et al. (2005)	Sex education, risk identification, condom practice and skills training	Information, motivations and skills	Other health education
Brown et al. (2021)	Training in communication, relationships, values and contraception; parent involvement	Social cognitive theory	No intervention
Chernick et al. (2017)	Text messages about the family planning clinic	None	Standard care, including a card about a family planning clinic
Coyle et al. (2006)	Sex education; identifying risks and relevant attitudes; skills practice, including in using condoms; service activities	Social development theory	No intervention
DiClemente et al. (2004)	Sex education, training in sexual communication and condom use, focus on ethnic and gender pride	Social cognitive and gender and power theories	Education on exercise and nutrition
Grossman and Sipe (1992)	Work placement and academic remediation; sex and life education, including how to take “sexual responsibility”	None	Work experience only
Herceg-Baron et al. (1986) ^a	Six weekly family contraceptive counselling sessions; multiple support phone calls, plus usual	None	Usual single contraception provision session
Kirby et al. (1997)	Assertion training, including role-playing; information about pregnancy prevention, including contraception	Social cognitive theory and health belief model	Health education, including pregnancy prevention

(Continues)

TABLE 2 (Continued)

Study	Intervention	Stated theory applied	Control
LaChausse (2016)	Training in communication skills, condom negotiation and use	Social cognitive theory	Usual no-sex education
Manlove et al. (2021)	Sex and reproduction app covering birth control	Planned behaviour, social cognitive, self-efficacy	Education on nonsex health topics
Oman et al. (2018)	Training in skills, goal setting, contraception, identifying psychological needs and barriers that create risks	Social cognitive theory and health belief model	No intervention
Philliber et al. (2002)	Paid employment; academic help; art education; sports; mental health and medical care; including providing contraception and counselling	None	Usual youth program, with activities and homework help
Peipert et al. (2008)	Computer-based contraception education following stages of change model	Transtheoretical model	Computer-based contraception education
Raj et al. (2016)	Family planning sessions in a clinical setting; provide contraceptives	Social cognitive and gender and power theories	Government family planning referral
Schwarz et al. (2008)	Provided emergency contraception and information about using it in advance of need	None	Information about folate
Shlay et al. (2003)	Individualized counselling about contraceptive options	None	Provided usual information about contraception options
Stephenson et al. (2004)	Peer-led sex education with condom practice and role-playing	None	Usual teacher-led sex education
Stephenson et al. (2008)	Peer-led sex education with condom practice and role-playing	None	Usual school sex education
Taylor et al. (2014)	Provided information about pregnancy prevention, including contraception; focused on attitudes and intentions	I-change model	Life skills training
Walsh-Buhi et al. (2016)	Training in communication, goal-setting and sexual decision making, plus community service guidance	None	Usual school education
Wight et al. (2002)	Active learning, including role-playing, about sex, including pregnancy prevention	Eclectic	Usual sex education
Ybarra et al. (2021)	Frequent text messages about sex information, including contraception information	None	Frequent text messages about exercise and other health matters

^aStudy had two slightly different interventions and two control conditions.

TABLE 3 Quality assessment of included studies

Study	Was attrition reported?	Were the reasons for attrition stated?	Were inclusion and exclusion criteria specified?	Were the number of excluded participants reported?	Did it have a treatment manual?	Were providers' credentials specified?	Was standardized training provided for the intervention?	Did the study assess adherence to protocol?	Did the study assess participants' knowledge related to the intervention?	Total yes
Antonishak et al. (2015)	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	7
Berenson and Rahman (2012)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	7
Bonell et al. (2013)	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	6
Boyer et al. (2005)	Yes	Yes	Yes	No	No	No	No	No	No	3
Brown et al. (2021)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Chernick et al. (2017)	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	No	5
Coyle et al. (2006) ^a	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	7
DiClemente et al. (2004)	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	7
Grossman and Sipe (1992)	Yes	No	Yes	No	Yes	No	No	No	Yes	4
Herceg-Baron et al. (1986)	Yes	No	Yes	No	Yes	Yes	Yes	No	No	5
Kirby et al. (1997)	Yes	No	No	No	Yes	Yes	Yes	No	Yes	5
LaChausse (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	8
Manlove et al., 2021	Yes	No	Yes	Yes	Yes	N/A	N/A	N/A	Yes	5
Oman et al. (2018)	Yes	No	Yes	Yes	Yes	No	Unclear	Yes	No	5
Peipert et al. (2008)	Yes	No	Yes	Yes	Yes	No	Unclear	No	No	4
Philliber et al., 2002	Yes	No	Yes	No	Yes	Yes	No	No	Yes	5
Raj et al. (2016)	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	6
Schwarz et al. (2008)	Yes	No	Yes	Yes	Yes	No	Unclear	No	Yes	5
Shlay et al. (2003)	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	6
Stephenson et al. (2008)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Stephenson et al. (2004)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Taylor et al. (2014)	Yes	Yes	No	No	Yes	No	Unclear	No	No	3

(Continues)

TABLE 3 (Continued)

Study	Was attrition reported?	Were the reasons for attrition stated?	Were inclusion and exclusion criteria specified?	Were the number of excluded participants reported?	Did it have a treatment manual?	Were providers' credentials specified?	Was standardized training provided for the intervention?	Did the study assess adherence to protocol?	Did the study assess participants' knowledge related to the intervention?	Total yes
Walsh-Buhi et al. (2016)	Yes	No	Yes	No	Yes	Yes	Yes	No	No	5
Wright et al. (2002)	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	8
Ybarra et al. (2021)	Yes	Yes	Yes	No	Yes	N/A	N/A	N/A	Yes	5

$I^2 = 19\%$, was low. Following the suggestion of Bloch (2014) that the I^2 must be over 20% to justify moderator analyses, we did not complete moderator analyses.

Publication bias

The funnel plot, shown in Figure 3, indicated evidence of publication bias, namely that smaller studies showed higher effect sizes. Duval and Tweedie's (2000) Trim and Fill showed a difference between the observed and the adjusted values. The adjusted value, representing a conservative estimate of effect size, was $OR = .89$, 95% CI [.784, .996]

DISCUSSION

The aim of this meta-analysis was to determine the efficacy of contraception-based psychological interventions intended to decrease unintended pregnancies. Across 26 randomized controlled trials with a total of 31,222 participants, psychological interventions resulted in significantly lower post-intervention pregnancy rates than control conditions, $OR = .84$, $p = .001$. Analyses for publication bias suggested a slight reduction in the effect size, leaving it smaller but still statistically significant.

The overall methodological quality of the studies was moderate. Because all the studies were randomized controlled trials, the overall results can support causal conclusions.

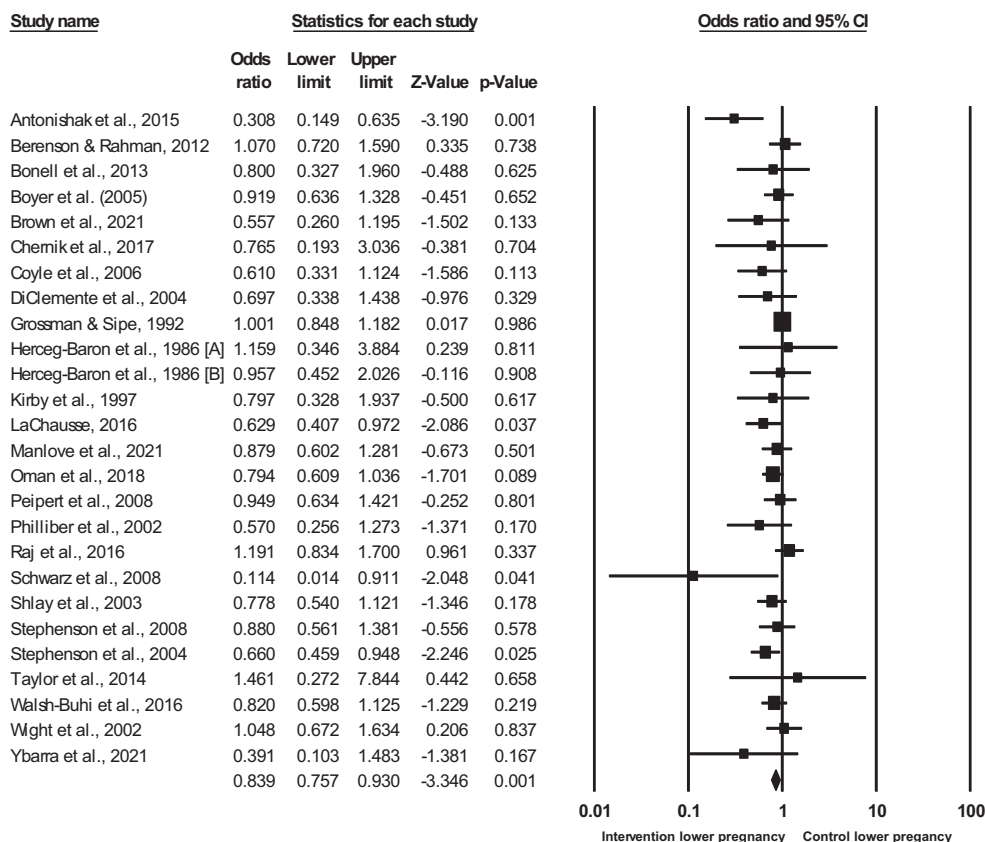


FIGURE 2 Post-intervention effects of psychological interventions intended to prevent unintended pregnancies.

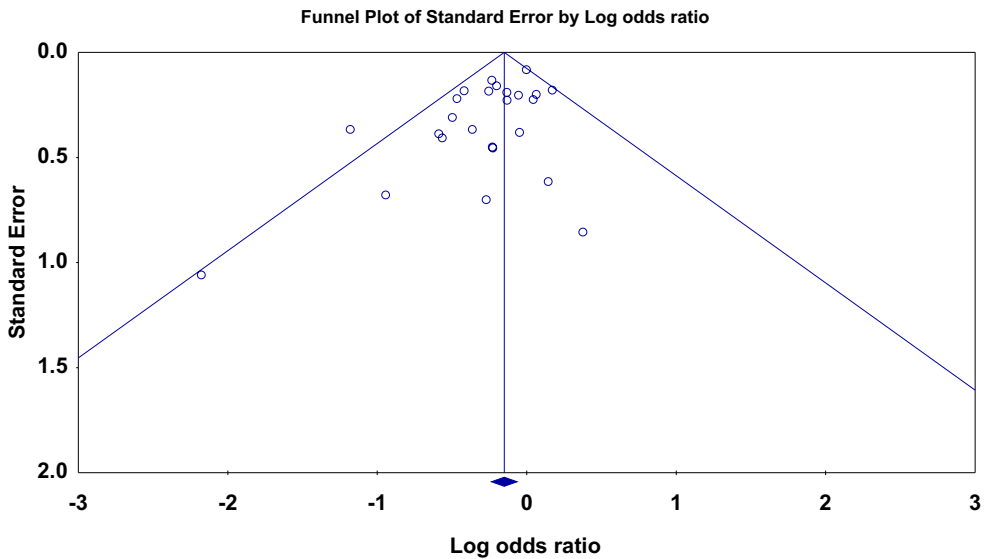


FIGURE 3 Funnel plot

The results suggest that in general interventions to prevent unplanned pregnancies are somewhat effective. The small effect size could be a reflection of the difficulty of an intervention influencing voluntary human behaviour over a substantial time period. The multilayered decision-making process involved in using contraception occurs in the context of various cognitive, emotional, biological and social influences (Ogden, 2005; Stephenson et al., 2020). Also, as Table 2 shows, some interventions were similar in content to the control conditions. In order to show a substantial effect on pregnancy rates, interventions may need to be very different from the control methods used.

The overall findings of the meta-analysis contrast with the results of previous reviews that found no overall evidence of efficacy (Ferreira et al., 2009; Wilson et al., 2015). One meta-analysis (Oringanje et al., 2016) did find a significant effect for a subgroup of interventions that incorporated contraceptive counselling and educational approaches, though that meta-analysis focused only on adolescents. It is possible that significant findings were not found in some meta-analyses due to their smaller sample of studies.

It was not feasible to categorize the psychological interventions into reliable types. Hence, the meta-analysis results could not show that one type of psychological intervention was superior to another, although the results show that the interventions as a group worked. It could be that interventions have potent common elements, as in studies of different psychological treatments for disorders (Wampold, 2015) and serve mostly as a strong prompt to use effective contraceptive methods. Alternatively, some types of interventions may be superior to others.

The intervention described by Antonishak et al. (2015) had the strongest impact on unintended pregnancies of all the included studies. Whilst this intervention used facets of the theory of planned behaviour and the social cognitive theory like some other studies, it deviated from other studies through its 'sex positive' approach. For example, the intervention stated the benefits of sex, whilst reinforcing positive behaviours related to pregnancy prevention. The impact of the study's intervention might also be attributed to its focus on participant autonomy. During the intervention, participants could engage with the intervention curriculum when the participants desired. Participants also had autonomy in choosing with which materials they interacted. Autonomy as a construct has strong motivational properties and has been supported extensively in interventions aimed at reducing various unhealthy behaviours (Patrick & Williams, 2012).

Overall, the studies included in the present meta-analysis showed reasonably good methodological characteristics. The weakest aspect of the studies was the predominant reliance on self-reports as the only pregnancy measure.

Because of the low heterogeneity across study effect sizes, we did not complete moderator analyses. The findings appear mostly consistent that there was a small intervention effect.

The strengths of this meta-analysis were that it included only RCTs, which can show causation, and that it examined various types of contraception-based interventions and controls, in various countries, with different types of participants. The studies were completed by different research teams and in total included a large number of participants. Therefore, the results of this meta-analysis may be more generalisable than those of previous meta-analytic findings.

Future research could examine theoretically pure interventions to help determine which methods work best in which situations with what types of individuals. These interventions might be based on social cognitive theory (Bandura, 1998) or the theory of planned behaviour (Ajzen, 1991), both of which follow a rational perspective of decision-making that may or may not be useful for the decision-making process associated with preventing unintended pregnancies (Conner & Norman, 2005).

Alternatively, researchers could examine the impact on unintended pregnancies of applications of motivational theories such as self-determination theory (SDT; Ryan & Deci, 2000). SDT focuses on autonomy, competence and social connection. With the efficacy of SDT applications in changing behaviours related to health (Patrick & Williams, 2012), pregnancy-prevention interventions might be more effective if they are tailored towards increasing intrinsic motivation. However, other theories of behaviour change suggest that additional intervention elements might be helpful, including providing important information and social support for use of contraception.

We recommend testing theory-based interventions in order to help advance the field of pregnancy prevention. We also recommend testing interventions that are much different from the usual sex-related education provided in the setting. For instance, simply making pregnancy-prevention education more interactive may not have a significant effect. Direct comparisons of different types of bona fide interventions, with a control group, could help clarify to what extent positive effects are due to common aspects of interventions versus intervention-specific effects.

Future meta-analytic research could examine the effect of psychological interventions on the use of a highly effective contraceptive method (see Harrington et al., 2019). Pregnancy prevention is more important as an outcome, but consistent use of a highly effective contraceptive method is an important step in the direction of prevention.

In conducting future evaluations of pregnancy-prevention interventions, it would be best for researchers to include enough participants at risk for unplanned pregnancy and follow them for long enough to have adequate power to detect effects. An a priori power analysis can aid in study planning. Using multiple methods of assessing pregnancy outcomes, including an objective indicator, could help make the results of interventions as convincing as possible. Considering the study-quality indicators listed in Table 3 might prove useful for producing meaningful results.

In conclusion, the results of the meta-analysis show that psychological interventions to prevent unintended pregnancies through contraception use have promise. Further research could help identify which types of interventions work best with which types of individuals and for how long they have an effect.

AUTHOR CONTRIBUTIONS

Le'Sa Tai'Mua Swain: Conceptualization; data curation; formal analysis; methodology; project administration. **John Michael Malouff:** Conceptualization; data curation; formal analysis; methodology; project administration; supervision; writing – review and editing. **Jai Meynadier:** Investigation; supervision; writing – review and editing. **Nicola S. Schutte:** Investigation; writing – review and editing.

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CONFLICT OF INTEREST

The authors have no conflict of interest to report.

DATA AVAILABILITY STATEMENT

The data file is available upon request at <https://rune.unc.edu.au/web/handle/1959.11/31934>.

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APPENDIX A

Search protocol and search terms

Databases we will search: EBSCO, Proquest, EMBASE, Web of Science, Clinical Trials.gov.

To be eligible, a study must: randomly assign participants to an intervention or a control group; assess unintended pregnancies or births in the future; test a psychological method of reducing unintended pregnancies through increased use of contraception.

There are no restrictions on languages, but we must be able to translate non-English articles into understandable English using Google Translate.

There are no restrictions with regard to date or any other matter.

Our search will also include searching the references of included articles and writing to corresponding authors of included studies to ask whether they have any unpublished findings that would fit the meta-analysis criteria.

Databases and searched levels for each:

EMBASE: article title, abstract.

Proquest: article title, abstract.

EBSCO: article title, abstract.

Web of Science: article title, abstract.

ClinicalTrials.gov: article title, abstract.