

Review article

Theory-based strategies for improving contraceptive use: a systematic review[☆]

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Abstract

Background: Theories and models help explain how behavior change occurs. We systematically reviewed randomized controlled trials that examined theory-based interventions for improving contraceptive use.

Study Design: We searched electronic databases for eligible trials. Primary outcomes included pregnancy and contraceptive use. We calculated the odds ratio for dichotomous outcomes and the mean difference for continuous data.

Results: Of 14 included trials, 10 showed positive results for a theory-based group: 2 of 10 studies with pregnancy or birth data, 4 of 9 addressing contraceptive use (for contraception) and 5 of 9 with condom use (to prevent HIV/sexually transmitted infections). An experimental group had favorable results for six of seven trials based on Social Cognitive Theory, two based on other social cognition models and two using motivational interviewing. Most interventions focused on adolescents and involved multiple sessions.

Conclusions: Effects were not consistent across outcomes and comparisons. The field could benefit from thorough use of single theories and better reporting on intervention implementation.

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Keywords: Systematic review; Interventions; Theory; Contraceptive use

1. Introduction

Theories and models help explain how behavior change occurs. The intentional or explicit testing of theory in research helps expand the knowledge base. Theories and models have been used extensively in prevention of HIV and sexually transmitted infections (STIs). However, many health education interventions, including those addressing contraceptive use, often have no explicit theoretical premise. The lack of guiding theory or principles for an educational or psychological intervention is akin to having no physiologic basis for a medical intervention.

Most of the commonly used theories and models in health behavior are based on a social cognition approach [1]. These include the Health Belief Model [2], Social Cognitive Theory [3], the Theory of Reasoned Action along with the later Theory of Planned Behavior [4] and Protection Motivation Theory [5]. Underlying many of the social cognition models is expectancy-value theory [1], which presumes that subjective assessments of probability (expectancy) and value (utility) are combined in a rational way for decision-making. These principles may not be sufficient to explain how individuals make decisions [1].

According to the Health Belief Model, a widely used theory, individuals will take action to prevent illness if they believe they are susceptible, if the consequences of the illness are severe and if the benefits of action outweigh the costs [2]. The Theory of Reasoned Action and the Theory of Planned Behavior [4] also assume a rational approach to engaging in new behaviors. They emphasize understanding attitudes toward the new health behavior rather than attitude toward the illness and focus on behavioral intention for predicting behavior. The Social Cognitive Theory states that

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current behaviors, thoughts and emotions, and environment all interact to affect new behavior [3]. This theory contributed the concept of self-efficacy, that is, confidence in one's ability to undertake a specific behavior. Self-efficacy has been incorporated into several theories and is sometimes used on its own. Under Protection Motivation Theory, personal and environmental factors create a health threat [5]. The perceived threat initiates appraisal of the threat and of one's ability to avoid the danger, which leads to protection motivation and potentially to action. Having drawn on several theories, the Transtheoretical Model [6] and the AIDS Risk Reduction Model [7] suggest that individuals move through different stages before they maintain complex health behaviors. Tailoring interventions could help individuals move from thinking about a new behavior, to trying it and eventually to adherence. The Information-Motivation-Behavior Skills Model [8] and the Theory of Reasoned Action include methods for eliciting information on theoretical constructs. The approaches themselves, such as motivational interviewing, have also been the basis of behavioral interventions.

Knowledge about the use and effectiveness of theory-based interventions could help inform contraceptive research and practice. Halpern et al. [9] examined strategies to improve adherence to hormonal contraceptive regimens, while Lopez et al. [10] identified the implied theories in trials of communicating contraceptive effectiveness. For interventions to reduce unintended pregnancies among adolescents, DiCenso et al. [11] abstracted the theoretical basis, but not all the strategies addressed specific contraceptive methods. This project systematically reviewed randomized controlled trials (RCTs) that examined the effect of theory-based interventions on contraceptive use.

2. Materials and methods

2.1. Study selection

Eligible RCTs tested an intervention with a theoretical basis for improving contraceptive use. This included, but was not limited to, theories or models of education, communication or behavioral change. The use of theories or models had to be explicit; that is, the theory or model had to be named in the report. In addition, the intervention description had evidence of incorporating the theoretical basis, for example, the principles or constructs used to develop a counseling program. The theory-based intervention could be compared to a different theory-based program, an intervention without an explicit theoretical base or usual practice. Studies were excluded if they focused on abstinence or postponing sexual intercourse for adolescents or if they focused on (a) high-risk groups, such as sex workers and people with a known psychiatric or substance abuse disorder; (b) people living with HIV; or (c) men who have sex with men.

Interventions addressed the use of one or more contraceptive methods. Any contraceptive could have been

studied, such as condoms, oral contraceptives or injectables. A trial could focus on preventing STIs or HIV but must have addressed the use of a contraceptive for contraception or have assessed pregnancies or births as an outcome. Included trials had to report at least one of the contraceptive outcomes: pregnancy; choice of contraceptive; initiation of, or change in, contraceptive use; adherence to contraceptive regimen; and continuation of contraception.

2.2. Sources

We searched the following electronic databases for eligible trials through April 2008: MEDLINE, POPLINE, CENTRAL, PsycINFO, EMBASE and clinical trials databases (ClinicalTrials.gov and ICTRP). We also examined reference lists of relevant articles and wrote to investigators to find other published or unpublished trials.

2.3. Data extraction and analysis

We assessed, for inclusion, all titles and abstracts identified during the searches with no language limitations. One author identified reports for inclusion or exclusion; a second author examined the reports for appropriate categorization. One author abstracted and entered the data. Another author conducted a second data abstraction and verified correct data entry. Discrepancies were resolved by discussion. We attempted to contact trial report authors for missing data.

Using the framework in Borrelli et al. [12], we extracted intervention information. The main categories were evidence of a theoretical base and treatment dose (length and number of sessions and the content). Secondary articles often provided this information; a complete list of sources is available from the corresponding author. Studies were examined for methodological quality [13], including randomization method, allocation concealment, blinding and losses to follow-up.

For most dichotomous outcomes, the Mantel–Haenszel odds ratio (OR) was calculated with 95% confidence interval (CI). The Peto OR was used when a study arm had no events, for example, for pregnancy; the Peto OR does not require correction for zero events [13]. For continuous variables, the mean difference was computed with 95% CI using the inverse variance approach [13]. To assess short- and long-term changes, we included data collected at the first and last follow-ups. While several studies used the same theoretical basis, the interventions differed in structure and emphasis. Consequently, no meta-analysis was conducted.

Six studies were cluster randomized trials for which the analysis appeared to account for the cluster effects. We calculated the design effects and the effective sample sizes for one report with the intraclass correlation coefficients [14]. The other cluster RCTs used various methods to account for the clustering, such as multilevel modeling [15–19]. We present those results as reported by the researchers.

3. Results

3.1. Description of studies

Fourteen trials met our inclusion criteria: 12 were conducted in the United States, 1 in Scotland [16] and 1 in Tanzania [19]. Table 1 describes each study, including the theoretical bases and the principles used in the intervention design. Sample sizes for the individually randomized trials ranged from 36 to 830; the cluster RCTs ranged from 817 to 9645, with the number of clusters ranging from 20 to 35.

The intervention focus varied. Four trials focused on contraception [20–23], and seven addressed preventing HIV or STIs as well as pregnancy [15–19,24,25]. Three trials emphasized reducing risk for HIV or STIs [14,26,27].

3.2. Methodological quality of included studies

Despite the recent publication of most trials, the reporting of some design issues was limited. Seven trials did not mention a sample size estimate. Of the eight individually randomized trials, five mentioned allocation concealment, of which four provided some detail [21,23,24,27]. The six cluster RCTs identified the clusters prior to randomization; all individuals meeting the inclusion criteria were eligible. Blinding was mentioned in five trials; the evaluators or interviewers were masked to the participant's assignment [16,20,23,25,27]. Losses to follow-up were greater than 20% for eight trials by the last follow-up [14–19,23,25], but differential losses were not a major issue. Six trials had similar losses across treatment arms, and one reported that the losses did not differ significantly [18]. One study did not provide loss by study arm [15]. For fidelity of implementation [12], the type and amount of information reported varied. We found information on provider credentials in 11 reports; provider training in 8 studies, with 4 noting the amount of time; standardized delivery methods for 12 trials; and delivery adherence in 8 reports.

3.3. Results of interventions

The results are grouped according to the type of theory or model that guided the experimental intervention. Social Cognitive Theory was the most frequently used basis of the intervention ($n=7$). Four trials compared a theory-based intervention to usual care (or program) [16,19,22,26]. One [26] also mentioned the Theory of Reasoned Action but provided little evidence for it. Reported condom use at last vaginal sex was more likely for the treatment group than the usual-care group at the 3-month (but not the 9-month) follow-up, but the CI was wide (OR=8.63; 95% CI=1.60–46.45). In Black et al. [22], the intervention group had multiple home visits over 2 years. The adolescents in the treatment group were less likely to have had a second birth than the usual-care group (OR=0.41; 95% CI=0.17–1.00).

The trials by Wight et al. [16] and Ross et al. [19] were cluster RCTs using school-based curricula. Besides Social Cognitive Theory, Wight et al. [16] also incorporated

methods that teachers were already using to enhance acceptability. To account for the cluster effects in the analysis, the researchers used a randomization test based on the set of the 20,000 possible allocations providing the best balance. Reported results were examined. Within gender, the study groups were reportedly similar for first intercourse without condom use, no condom use during last intercourse, use of oral contraception during last intercourse and self-reported pregnancy. Ross et al. [19] used a random-effects model to account for the cluster effects in the analysis. Reported percentages and risk ratios (RRs) are given here. The treatment group was reportedly more likely than the control group to first use a condom during follow-up within the males (RR=1.41; 95% CI=1.15–1.73) and the females (RR=1.30; 95% CI=1.03–1.63). Condom use during last intercourse was reportedly more frequent for the intervention versus control males (RR=1.47; 95% CI=1.12–1.93) but was similar between the female groups. Pregnancy prevalence was similar for the study arms.

Three trials used Social Cognitive Theory plus another theory or model [15,18,27]. The HIV prevention intervention in DiClemente et al. [27] was grounded in Social Cognitive Theory and had elements of a theory of gender and power. The four sessions were 4 h each. The HIV prevention group was more likely than the health promotion group to have reported consistent condom use in the past 30 days at 6 months (OR=2.20; 95% CI=1.48–3.26) and at 12 months (OR=2.14; 95% CI=1.45–3.18). The same pattern was evident for consistent condom use for the past 6 months: 6-month OR=2.14 (95% CI=1.48–3.09); 12-month OR=1.67 (95% CI=1.16–2.42). At both follow-ups, the HIV prevention group was also more likely to have reported using a condom during the last sexual encounter: OR=3.54 (95% CI=2.34–5.35) and OR=2.21 (95% CI=1.50–3.26), respectively. Self-reported pregnancies were similar for the two groups, however.

A 2001 trial by Coyle et al. [15] addressed prevention of HIV, STIs and pregnancy. The school-based curriculum incorporated Social Cognitive Theory, social influence theory and models of school change. The comparison group received the standard curriculum. This cluster RCT used multilevel models to account for the cluster effects in the analysis. The effect sizes were reportedly estimated from ORs for dichotomous outcomes or ratios of adjusted means; the standard errors were only available from the 31-month assessment. The intervention group reportedly had a lower frequency of sex without condom use in the past 3 months compared to the usual-program group (0.63 ± 0.23). During last intercourse, the intervention group was reportedly more likely than the comparison group to have used a condom (1.68 ± 0.25) and to have used an effective method of contraception (1.76 ± 0.29).

A 2006 trial by Coyle et al. [18] also focused on preventing HIV, STIs and pregnancy. The school-based curriculum was based on Social Cognitive Theory as well as the Theory of Reasoned Action and the Theory of Planned

Table 1
Characteristics of included studies

Study	N	Intervention focus	Experimental group	Comparison group	Theory or model	Principles or constructs
Black et al. [22]	181	Delay second births: adolescents who had given birth	Home-based curriculum; twice per month up to 19 lessons	Usual care	Social Cognitive Theory	Skills, norms, goal setting, self-efficacy, modeling, support and mentoring
Boekeloo et al. [26]	215	STD/HIV risk reduction: adolescents in managed care	Audiotaped previsit risk assessment, one session on safe-behavior pyramid	Usual care	Social Cognitive Theory; Theory of Reasoned Action	Awareness, skills, self-efficacy, social support
Boyer et al. [17]	2157; clusters: no. of platoons not reported	Prevent STIs, unplanned pregnancy: female Marine recruits	Four group sessions (2 h each) at weeks 1, 2, 4 and 12 of 13-week recruit training	Same format; addressed health promotion topics	Information-Motivation-Behavior Skills Model	Knowledge, attitudes, skills (communication and condom use), risks, decisions
Coyle et al. [15]	3869; clusters: 20 schools	Prevent HIV, STDs, pregnancy: ninth-grade students	20 lessons total in 9th and 10th grades, school organization activities, parent education and school–community linkages	Standard five-session knowledge-based curriculum plus other school activities	Social Cognitive Theory; social influence theory; models of school change	Knowledge; self-efficacy; communicate; perceived risks, barriers, norms; school environment; staff and parent education
Coyle et al. [18]	988; clusters: 24 schools	Prevent HIV, STDs, pregnancy: students in alternative day schools	Two or three times per week for 5 to 7 weeks	Usual activities related to prevention of HIV, STDs and pregnancy	Social Cognitive Theory; Theory of Reasoned Action; Theory of Planned Behavior	Knowledge, attitudes, norms, self-efficacy, sense of vulnerability, risk, skills
DiClemente et al. [27]	522	HIV prevention: female adolescents	Four sessions at 4 h each; ethnic and gender pride, HIV risk reduction, skill building (condom use and communication)	Four sessions at 4 h each; health promotion (exercise and nutrition)	Social Cognitive Theory; theory of gender and power	Knowledge, skills, ethnic and gender pride, self-actualization, self-worth
Floyd et al. [23]	830	Change risky drinking or ineffective contraceptive use: women, aged 18 to 44 years	Four motivational interviewing sessions and one contraceptive counseling visit (45 to 60 min each)	Brochures on alcohol use and women's health in general	Motivational interviewing; Transtheoretical Model	Client-centered, decisional balance, readiness to change, goal statements, plans, personalized feedback, problem solving

Ingersoll et al. [21]	228	Reduce alcohol-exposed pregnancy risk: female university students	Single session from 60 to 75 min (motivational interviewing)	Information pamphlet on women's health	Motivational interviewing	Risk behavior; exercises (decisional balance, goal statements and plans); feedback (elicit-provide-elicited strategy)
Peipert et al. [25]	542	Prevent STDs and pregnancy: women, 13 to 35 years	Three sessions over 80 days; individually tailored, computer-delivered	One standard session via computer; contraception, STD prevention	Transtheoretical Model	Stages of change; decisional balance, self-efficacy, processes of change
Petersen et al. [24]	764	Prevent pregnancy and STDs; women, 16 to 44 years	Counseling session on reproductive health; booster session in person or by telephone	Brief general counseling on preventive health care	Motivational interviewing	Empathy, self-efficacy, perceived barriers, motivation, stage of adopting, communicate
Ross et al. [19]	9645; clusters: 20 communities	Reduce incidence of HIV, STIs and unwanted pregnancy: adolescent students	Three-year school curriculum, youth-friendly health services, community activities, and condom promotion and distribution	Usual activities	Social learning theory	Knowledge and beliefs about risks, perceived susceptibility and benefits of safer behavior, self-efficacy, social support, skills
Schinke et al. [20]	36	Prevent adolescent pregnancy: high school students	14 group sessions of 50 min each	Assessment only	Cognitive and behavioral training; problem-solving schema	Decisions, worth and payoff of options, plan, communicate, coach, feedback, contracting
Stanton et al. [14]	817; clusters: 35 community sites	Multiple risk reduction, including sexual risk: African Americans, 13 to 16 years	(1) Eight group meetings on risk reduction (youth); (2) youth plus brief parent program; (3) youth plus parent plus booster sessions	Three intervention arms compared	Protection Motivation Theory	Extrinsic and intrinsic rewards, perceived severity and vulnerability; self-efficacy, response efficacy and cost
Wight et al. [16]	8430; clusters: 25 schools	Reduce unsafe sex behavior and unwanted pregnancy: students, 13 to 15 years	20 sessions (10 per year)	Usual sex education	Social Cognitive Theory plus health education principles used by teachers	Self-efficacy, intentions, behavior planning, social and communication skills, gender norms, power

Behavior. The comparison group received the usual prevention activities. This cluster RCT also used multilevel models to account for the cluster effects. Reported results are given here. At 6 months (but not 18 months), the intervention group reportedly had a lower frequency of sex without a condom in the past 3 months than the comparison group (mean difference, -1.09 ± 0.36) and was more likely to have used a condom during last intercourse (OR=2.12; 95% CI=1.24–3.56). The study groups were similar for use of effective contraception and self-reported pregnancy.

Two trials [14,20] were based on social cognition models other than Social Cognitive Theory. The pregnancy prevention program of Schinke et al. [20] was based on cognitive and behavioral training and used a problem-solving schema. Contact included 14 sessions of 50 min each. The controls only had the assessments. The report provided results of *t* tests; data were not requested due to the age of the publication. Compared to the controls at the 6-month follow-up, the students who received the training reportedly used more habitual contraception (reported $p < .05$), had greater protection at last intercourse (reported $p < .005$) and had less reliance on inadequate birth control (reported $p < .001$). The trial by Stanton et al. [14] was based on Protection Motivation Theory. This cluster RCT involved multiple intervention sessions. At the 24-month follow-up, the youth intervention group was more likely than the youth-and-parent-program group to self-report having been pregnant or gotten someone pregnant (OR=4.17; 95% CI=1.79–9.72). The latter group was less likely to self-report a pregnancy (OR=0.27; 95% CI=0.11–0.66) than a group with youth and parent programs plus booster sessions. In contrast, the study arms were similar in reported use of contraception or condoms during last sex.

With the Information-Motivation-Behavior Skills Model, Boyer et al. [17] addressed preventing STIs and unplanned pregnancies among female Marine recruits through four group sessions. The comparison was a health promotion intervention. This cluster RCT accounted for the cluster effects by calculating robust standard errors using the Huber–White sandwich estimator in regression models. At 14 months, the study groups were reportedly similar for unplanned pregnancy prevalence (6.7% vs. 7.3%) and inconsistent condom use (72.8% vs. 76.5%).

Three trials used motivational interviewing versus a minimal intervention. Ingersoll et al. [21] and Floyd et al. [23] focused on reducing risk for alcohol-exposed pregnancy; the control groups received pamphlets on women's health. Ingersoll et al. [21] had a single session. The treatment group was less likely than the control group to report using ineffective contraception at the 1-month follow-up (OR=0.49; 95% CI=0.28–0.87). Elements of the Transtheoretical Model were incorporated into the multiple sessions of Floyd et al. [23]. The intervention group was more likely than the control group to report having used effective contraception during the prior 3 months at 3 months (OR=2.12; 95% CI=1.53–2.92) and at 9 months (OR=2.04; 95% CI=1.47–

2.83). Petersen et al. [24] also used motivational interviewing for individual and booster sessions. The intervention addressed preventing pregnancy and STIs by improving the level of contraceptive use or maintaining a high level of contraceptive use. The comparison group received brief general counseling on women's health. The groups were similar in contraceptive use at the 2-month and 12-month follow-up visits and for pregnancy prevalence at 12 months.

In Peipert et al. [25], a tailored intervention based on the Transtheoretical Model was compared with enhanced standard care. The computer-delivered intervention had three tailored sessions for the experimental group and one nontailored session for the comparison group. At 24 months, the groups were similar for dual method use, consistent condom use and unplanned pregnancy prevalence. The researchers reported differences between the groups after adjusting for a propensity score that included covariates and two-way interactions.

4. Discussion

Interventions with a theoretical base help explain how people change. Usual care, or a traditional program, may focus on information transfer rather than how people learn, think and behave. Favorable results were noted for most of the theory-based strategies although not across all outcomes or comparisons. Only 2 of the 10 that assessed births or pregnancies reported lower rates for the intervention group compared to the controls. Only one trial was reportedly powered to detect a difference in pregnancy [25]. For contraceptive use other than condoms, four of nine trials reported more or better use in the intervention group. Of the nine studies with reported condom use, five showed some positive difference for a theory-based group. Trials had multiple measures of condom use; three trials had favorable results for the majority of condom comparisons.

By theory base, six of seven trials using Social Cognitive Theory had some positive results for the experimental group. All six focused on adolescents and five had multiple sessions. The comparison was either the usual program (or care) or a health promotion intervention. The experimental group had fewer second births (observed) [15,22] and more reported condom use than the comparison group [15,18,19,26,27]. The two interventions based on other social cognition models also had some favorable results. After multiple sessions for adolescents, the treatment group reported more contraceptive use than the controls [20]. The other trial [14] showed a positive effect on self-reported pregnancy for the group with both youth and parent programs, although the groups were similar in reported use of contraception or condoms. For two trials of motivational interviewing, the treatment group reported less “ineffective contraception” [21] and more “effective contraception” [23] than the controls. The single-session intervention focused on university women, and the four-session program targeted women in the community.

The primary outcomes in this review were generally from self-reports, which are often inaccurate due to social desirability bias. Pregnancy rates and STI incidence are preferable to self-reports, especially if the incidence is likely to be high enough to detect differences between groups. When semen exposure is examined by testing for prostate-specific antigens (PSA) [28], reported condom use may be inconsistent with PSA results.

Contraceptive research could benefit from testing theories and models used in other disciplines. However, effectiveness may be limited when the theory or model is partially implemented. Combining various models makes it difficult to determine what parts may have worked. More thorough use of single theories would help inform the field. In addition, some trials may have emphasized the intervention rather than any particular theory or model. Better reporting on the principles incorporated and the intervention implementation would help with interpretation.

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