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Interactive video behavioral intervention to reduce adolescent females' STD risk: a randomized controlled trial

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Abstract

A longitudinal randomized design was used to evaluate the impact of a theoretically based, stand-alone interactive video intervention on 300 urban adolescent girls' (a) knowledge about sexually transmitted diseases (STDs), (b) self-reported sexual risk behavior, and (c) STD acquisition. It was compared to two controls, representing high-quality informational interventions. One used the same content in book form; the other used commercially available brochures. Following randomization, the interventions were administered at baseline, with booster sessions at 1, 3, and 6 months. Self-reports revealed that those assigned to the interactive video were significantly more likely to be abstinent in the first 3 months following initial exposure to the intervention, and experienced fewer condom failures in the following 3 months, compared to controls. Six months after enrollment, participants in the video condition were significantly less likely to report having been diagnosed with an STD. A non-significant trend in data from a clinical PCR assay of *Chlamydia trachomatis* was consistent with that finding.

Keywords: Behavioral intervention; Condoms; Randomized controlled trials; Female adolescents; Abstinence; Sexual risk taking

Introduction

Sexually transmitted diseases (STDs) are prevalent in the United States (Centers for Disease Control and Prevention [CDC], 2002; Eng & Butler, 1997) especially among low-income urban populations (Mehta, Rothman, Kelen, Quinn, & Zenilman, 2001) and adolescents (Burstein et al., 1998). STDs such as *Neisseria gonorrhea* and *Chlamydia trachomatis (Ct)*, often progressing to pelvic inflammatory disease (PID), cause increased morbidity, including chronic pelvic pain, ectopic pregnancy, and infertility (Cates & Wasserheit, 1991; Weström, 1996; World Health Organization, 1995). Genital infections increase the risk of contracting and transmitting human immunodeficiency virus (HIV) (CDC, 1998; Wasserheit, 1992). Both human papilloma virus (genital warts) and *Ct* are risk factors for cervical cancer (Bosch et al., 1995; Koskela et al., 2000; Londesborough et al., 1996).

Adolescent females face special risk factors for STD acquisition (Conard & Blythe, 2003), including age-related physiological vulnerability (Critchlow et al., 1995), limited disease knowledge (Dell, Chen, Ahmad, & Stewart, 2000), and frequent condom failures (Crosby, Sanders, Yarber, & Graham, 2003; Macaluso et al., 1999). Furthermore, young women often feel little control over sexual situations, thereby limiting their ability to act on their knowledge (Amaro, 1995; Gutierrez, Oh, & Gillmore, 2000). They may be unduly influenced by older sexual partners (Kaestle, Morisky, & Wiley, 2002) who put them at greater risk for infection (Begley, Crosby, DiClemente, Wingood, & Rose, 2003),

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or by sexual partners with whom communication is poor (Crosby, DiClemente, Wingood, Rose, & Lang, 2003). Younger adolescents are more likely to engage in "serial monogamy" (Norris & Ford, 1999), putting them at greater risk for infection (Kelley, Borawski, Flocke, & Keen, 2003). African American adolescent females are at particularly high risk for HIV (Ickovics et al., 2002) and bacterial STDs, even controlling for differences in attributes of their sexual partners (Harawa, Greenland, Cochran, Cunningham, & Visscher, 2003).

STD prevention requires behavior change, including limiting the number and overlap of sexual partners, reducing risky behaviors, improving condom use, and seeking disease screening and early treatment (Johnson, Carey, Marsh, Levin, & Scott-Sheldon, 2003; Pinkerton, Layde, DiFranceisco, & Chesson, 2003; Roper, Peterson, & Curran, 1993). Numerous interventions have sought to reduce sexual risk behavior and STD acquisition using various approaches (for reviews, see Auerbach & Coates, 2000; Fisher & Fisher, 1992; Horowitz, 2003; Johnson et al., 2003). To date, no theoretical approach has demonstrated superiority, in part because few interventions have been subjected to randomized controlled trials. Among those that have, some have shown promise in changing behavioral intentions (Jemmott, Jemmott, Spears, Hewitt, & Cruz-Collins, 1992), self-reported behaviors (DiClemente & Wingood, 1995; Fisher, Fisher, Bryan, & Misovich, 2002; Jemmott, Jemmott, & Fong, 1998; Patterson, Shaw, & Semple, 2003; St. Lawrence, Crosby, Brasfield, & O'Bannon, 2002; Shrier et al., 2001), and clinical outcomes (Baker et al., 2003; Kamb et al., 1998a; Shain et al., 1999).

Programs demonstrating successful outcomes, such as CDC-identified "Programs That Work" (Collins et al., 2002), typically involve costly facilitator-led group sessions or individual counseling, requiring extensively trained personnel to ensure consistent delivery in face-to-face intervention. Group programs involve notoriously difficult scheduling and quality control assurance. Not all educators and health professionals are comfortable discussing sex-related decisions with teens, nor are all teens comfortable with such interactions. Perhaps as a result of this complexity, elaborate interventions have not had a good record of translation from controlled trials into community settings without losing fidelity in content or administration (Maher, Peterman, Osewe, Odusanya, & Scerba, 2003; Robinson et al., 2002; Valdiserri, Ogden, & McCray, 2003).

With the advent of high-quality and user-friendly media technology, it has become possible to create stand-alone interactive media interventions capable of being consistently and widely used. Such programs would eliminate the constraints of the facilitator-led group setting, enabling easier community implementation, reduced costs, and improved fidelity. An early review found effects of video interventions mostly limited to knowledge and attitudes (Healton & Messeri, 1993), but more recent studies have shown broader promise. Dramatized video, usually incorporated into facilitator-led group discussions, has improved psychosocial outcomes such as perceived vulnerability, condom attitudes, and self-efficacy (Robinson et al., 2002), behavioral intentions (Zimmers, Privette, Lowe, & Chappa, 1999), proximal behaviors such as condom coupon redemption and HIV testing (O'Donnell, San Doval, Duran, & O'Donnell, 1995; Rothman, Kelly, Weinstein, & O'Leary, 1999; Solomon & DeJong, 1989), longer-term behaviors including self-reported condom use several months following initial intervention (Kalichman, Cherry, & Browne-Sperling, 1999), and clinical outcomes (O'Donnell, O'Donnell, San Doval, Duran, & Labes, 1998).

Of particular interest is the O'Donnell et al. (1995, 1998) evaluation of an intervention using culturally appropriate videos for high-risk populations. They found a reduction in STD acquisition (assessed through health records), with differences between video and control groups diverging over time and attaining significance 2 years after administration of the intervention. Although the effect was very small, the cost-effectiveness of preventing HIV infection is sufficient to warrant the use of this intervention in STD clinics (Sweat, O'Donnell, & O'Donnell, 2001). Given their efficiency, such interventions could be worth administering, even with modest effect sizes.

Background on formative research using the mental models approach

We sought to address this need with the *mental models* approach, which is theoretically grounded in behavioral decision research and methodologically grounded in qualitative research (Morgan, Fischhoff, Bostrom, & Atman, 2001). It has been shown to help people acquire and apply knowledge about many risks, including domestic radon, paint stripper, mammography, electromagnetic fields, HIV, *Cryptosporidium*, and breast implants (Byram, Fischhoff, Embrey, & Bruine de Bruin, 2001; Fischhoff, 1999; Fischhoff & Downs, 1997a, 1998; Morgan et al., 2001; Riley, Fischhoff, Small, & Fischbeck, 2001; Silverman et al., 2001).

Social cognitive models of behavior change, such as the health belief model (Becker & Rosenstock, 1987) and the theory of planned behavior (Ajzen, 1991), have conceptually compelling formulations. However, by their very nature such general models have limited ability to guide the detailed design of problem-specific interventions, or to generate topic-specific hypotheses that can be tested (Ogden, 2003). In effect, the mental models approach picks up where general decision-making models leave off. It identifies context-specific

aspects of behavior that are most relevant to the decisions of the target population and most in need of intervention. Iterative versions of intervention materials are extensively piloted with their intended audience to ensure that they address realistic, culturally appropriate, relevant, and useful information to help people make more informed decisions and better negotiate and implement related risk-reduction strategies (Fischhoff & Downs, 1997b; Morgan et al., 2001).

The formative research that guided the development of the intervention evaluated here started with an expert model of STD risks, informed by a panel of experts in public health, adolescent medicine, nursing, and psychology. That model summarized their knowledge regarding disease processes and behavior change (see Fischhoff, Downs, & Bruine de Bruin, 1998, for an in-depth presentation and explanation of this model). In 48 semi-structured interviews, adolescent females responded to open-ended questions regarding the main topics of this model (see Table 1). Specific prompts encouraged them to talk more about those topics they had brought up (e.g., "can you tell me more about how that happens?"). As opposed to closed-ended response modes, these open-ended questions allow people to reveal their full range of beliefs and misconceptions, in their own words, and without literacy barriers (Bruine de Bruin & Fischhoff, 2000).

The contrast between our expert model and the target audience's "mental model", as revealed in the interviews, focused the intervention content. Topics that are present in the expert model, but absent from interviewees' mental model, represent information gaps. Topics that are mentioned by interviewees, but missing from the expert model, often represent misconceptions. The overall structure of the audience's mental models suggests how the intervention can integrate new information with existing beliefs, filling in gaps and correcting misconceptions.

In addition to many specific beliefs, the mental models revealed in the interview study reflected four general trends, addressed in the intervention: (a) Respondents seldom described explicit decision-making regarding sexual behavior. Rather, they saw those behaviors as arising from situational influences, often beyond their control. Some explicitly said that sex could only be avoided by steering clear of all situations potentially triggering sex scripts (e.g., parties). (b) Many did not appreciate relative risk reduction, sometimes dismissing condoms because they were "not 100% effective". (c) They knew little about reproductive health, sometimes expressing ignorance, sometimes using terms (e.g., safe sex) without revealing a clear understanding of what they might mean. (d) They knew little about STDs other than HIV/AIDS, many believing that a routine pap smear tests for all STDs.

Overview

Based on the mental models revealed in the interview study, we designed an interactive video intervention aimed at increasing young women's ability to make less risky sexual health decisions, addressing the gaps and misconceptions identified in the interviews, and two high-quality control interventions, each of which is described in detail below. A longitudinal randomized design compared the interventions' impact on sexual behavior and STD acquisition over 6 months. Consistent with recent NIH guidance, we collected both behavioral and biological measures, recognizing that self-reported behavioral change need not ensure biological outcomes, and successful clinical outcomes may occur without presumed behavioral changes (Pequegnat et al., 2000; Peterman et al., 2000).

We anticipated that all three interventions would improve basic knowledge, reflecting the quality of the materials and teens' ability to learn from them. However, for the more critical outcomes of risky behavior and disease acquisition, we expected the interactive video intervention to be superior to controls, given a design based on the mental models interviews, the engaging nature of the video, and its interactivity. This study was designed as a preliminary evaluation with a moderate sample size, to determine whether the video intervention warrants further study with a larger sample and more extensive biological measures.

Table 1
Sample interview questions

What kinds of things do you think lead girls to have sex? *Prompt*: What are some reasons why some girls have sex?
What kinds of things do girls think about when they're deciding whether or not to have sex with someone? *Prompt*: These can be things that she may be looking forward to or worried about.
What kinds of things can happen as a result from having sex? What is the most important [bad, good] thing? *or* Other than [pregnancy, disease], what would be the next [worst, best] thing? Can you tell me more about that?

Method

Participants

We recruited 300 females from four urban Pittsburgh-area healthcare sites: a children's hospital's adolescent medicine clinic (57%), two community health centers (24%), and a women's teaching hospital (19%). Young women were asked whether they would like to participate in one of several studies; those indicating interest in this study were eligible if they were aged 14–18 and reported heterosexual vaginal sexual activity in the previous 6 months. At the two hospital sites, approximately 50% of those approached selected ours from a list of studies. At the community sites, which ran fewer studies, that rate was approximately 85%. About 30% of those interested did not meet the above-mentioned eligibility requirements, and a further 20% did not show for their first visit.

Most participants (75%) classified themselves as African American, with 15% white and 10% other or mixed race. IRB approval was obtained from all participating institutions; informed consent was obtained from participants and from parents or legal guardians for those younger than 18. Parents were generally willing to consent, with many expressing enthusiasm for their daughter's participation in such a program. Data were pooled across sites.

Interventions

Our three interventions included an *interactive video* intervention, a *content-matched* control offering the same in-depth informational content in a book form, without the video's vivid modeling, enforced structure, or interactivity, and a *topic-matched* control using commercially available brochures covering the same topics. Thus, all three interventions addressed the informational needs of their audience, as identified by the mental models formative research. In that sense, all were superior to the usual care offered in most clinical settings.

Each of the three interventions covered four content domains, corresponding to the main findings from the qualitative research. (a) The *sexual situations* section covered negotiation behaviors with sexual partners to reduce STD risk. (b) The *risk-reduction* section addressed condom efficacy as well as getting and using condoms. (c) The *reproductive health* section explained pelvic exams, female reproductive anatomy, and physiological responses to infections. (d) The *STD* section used general information about viral and bacterial STDs to frame information about eight diseases: chlamydia, genital herpes, genital warts, gonorrhea, hepatitis B, HIV, trichomoniasis, and syphilis. All three interventions were designed for stand-alone use in healthcare settings, thus limiting costs and ensuring consistent administration.

Interactive video intervention: The video begins by introducing a group of ethnically diverse adolescent girls. The *sexual situations* section focuses on Keisha, who has a boyfriend, and Caitlin, who meets someone new at a party. The context of the relationship is made explicit to address the frequent dependence of condom decisions on feelings of "love" rather than risk perceptions (Blythe, Fortenberry, & Orr, 2003). In both story lines, the intervention offers explicit choice points in sexual situations initiated by a male character, including options that could lead toward or away from unsafe sex. In the *risk-reduction* section, a third character, Brandi, learns from her older sister how and why condoms lower risk, as well as how to use them properly. In the *reproductive health* section, Brandi learns about reproductive health, STD testing and symptoms. In the *STD* section, she learns about eight key diseases, in general terms, from the doctor, and in specific terms, from a friend who is a nursing student. Throughout the intervention, condom use is explicitly presented as achieving positive outcomes (pleasure, reassurance) rather than avoiding negative ones (suspicion, disease), because perceived pleasure has been shown to be strongly associated with condom use, whereas perceived protection has not (Albarracin et al., 2000). Extensive pretests with teens from the target population sought to make the scripts realistic, compelling, and understood as intended. The final version had an hour of video, with additional still material on STDs (clips of the video can be found at www.WhatCouldYouDo.org). However, viewers did not typically watch the entire intervention. The interactive nature of the video allowed guiding viewers to the portions they selected.

Thus, the video is interactive in two ways: users select which sections to watch and how each proceeds. In order to enhance their ability to take control over sexual scenarios, which was found to be problematic in the formative research, the design emphasized the identification of choice points and behavioral alternatives. The male characters press for unsafe sex; the female characters model less risky choices. Users perform *cognitive rehearsal*, imagining what they would say or do, then "practice it in their heads" (Bandura, 2000; Maibach & Flora, 1993), while the screen freezes for 30 s. Although cognitive rehearsal cannot be observed, participants were forced to wait and were strongly encouraged to think about options and to recognize the principle of always having them (Fischhoff, 1996). Imagining the acts should increase the feasibility of executing them (Morin & Latham, 2000).

Content-matched control intervention: A 127-page book included all dialog from the video and selected images. Pages were sequenced like a "choose your own adventure" book, with specially designed tabs, colors,

paper size, and numbering. In order to encourage independent cognitive rehearsal, separate pages instructed readers to "Stop!" and think about what they could do in the situation presented. Unlike the video intervention, however, we could not force users to pause. Anecdotal reports suggest that most users read the information in the presented page order, ignoring the structured interactivity that was imposed on those watching the video.

Topic-matched control intervention: We selected 23 commercially available brochures, which closely matched the video intervention in content and length (about 15,000 words), and were also written at a very basic reading level. Finding existing materials that matched our content proved challenging, as some of the concepts identified by the formative mental models research (especially those concerning sexual situations and relationships) were largely absent from most materials. To properly match topics, we used commercial brochures and research-based ones. Family Health Council, Inc., developed the brochures that we used for the *sexual situations* section, in a CDC-funded and evaluated community-level HIV prevention project. The *risk reduction*, *reproductive health*, and *STDs* materials were written and reviewed by medical experts for ETR Associates.

Measures

The *general STD knowledge* test had 40 true/false questions about reproductive health, disease and condoms, adapted from existing measures made available by their authors (Sanderson & Jemmott, 1996) with high internal consistency (alphas ranging 0.72–0.87; alpha at baseline = 0.81). The *specific STD knowledge* test was developed with the authors' (PM, JW) medical expertise. Respondents indicated whether each of 15 statements applied to each of the eight focal STDs. Responses for each statement were weighted so that chance performance was 50%, to prevent undue credit for circling many options (alpha at baseline = 0.73 for individual responses, 0.71 for weighted responses). See Table 2 for sample questions.

Self-reported behavior questions asked about sexual behavior in the previous 3 months: (1) the number of sexual partners, with those reporting zero identified as abstinent; (2) how often they had used condoms, ranging from "never" to "every time with every partner" on a 6-point scale; (3) how many condoms had broken, leaked, or fallen off in the past 3 months, all indications of incorrect condom use. (We only belatedly recognized the high rate of condom failures, so no baseline data are available for one-third of participants on this measure.)

STD acquisition was measured in two ways. First, participants self-reported if they had been diagnosed with chlamydia, crabs, genital herpes, genital warts, gonorrhea, hepatitis B, HIV, syphilis, or trichomoniasis in the past 3 months. Given the time delay between behavior, infection and, finally, diagnosis, it is problematic to interpret diagnoses in the first 3 months following the baseline visit, where the precipitating behaviors could have occurred prior to intervention. Thus, self-reported disease acquisition is only considered for the final visit.

Second, a clinical measure of *Ct*, the most common STD in this population, used the sensitive and specific Roche *Ct* PCR assay (Battle et al., 2001; Chan, Brandt, Stoneham, Antonishyn, & Horsman, 2000; Marrazzo, 2001; Sweet, Weisenfeld, Uhrin, & Doxon, 1994). To provide a sample, participants self-administered introital swabs, a technique found to be as accurate as clinician-administered swabs (Domeika et al., 1999; Domeika & Drulyte, 2000; Ostergaard, Møller, Anderson, & Olesen, 1996; Wiesenfeld et al., 1996). Those who tested positive for *Ct* received standard single-dose treatment observed by clinic staff, and facilitation of partner notification and treatment. Given a median *Ct* reinfection period of 6.3 months after treatment in similar population (Burstein et al., 1998), the follow-up *Ct* PCR test was used at the 6-month visit, allowing participants time to acquire, or avoid, new infections.

Procedure

Participants completed the baseline measures and self-administered introital swab, and then were assigned to either the interactive *video* or one of the two controls, using a random numbers table. At the first visit, participants were required to spend 30 min alone with only the *sexual situations* and *risk-reduction* sections of their intervention. Because the three interventions contain so much material, restricting the material available at baseline ensured that participants in all groups received similar intervention doses. Pilot testing

Table 2
Sample knowledge questions

STDs that are caused by virus can be cured with antibiotics
True–Don't know–False
Which four STDs can be cured? (circle *four*)
AIDS & HIV–Chlamydia–Genital Herpes–Genital Warts–Gonorrhea–Hepatitis B–Syphilis–Trichomoniasis

confirmed that it took about 30 min in all conditions to get through the two sections we made available.

Participants returned three times, 1, 3, and 6 months after their baseline visit. At each follow-up visit, they spent at least 15 min with access to all sections to their intervention. Given the interactivity of the video and the choices available in the controls, participants in all conditions could review portions of sections they had seen previously, look at new sections, or choose some combination of old and new. Afterwards, they completed the appropriate outcome measures. At all visits, they completed the knowledge test. At 3 and 6 months, they answered the behavioral and disease acquisition questions referring to the previous 3-month period. At the final visit, they self-administered the introital swab for the clinical measure.

Participants received $10 and a trinket for each visit, with an extra $10 at the final visit. They were not informed about the nature of the other interventions until after they had completed the last visit. There was a 14.0% attrition rate from baseline to the final visit. Of those who returned for the final visit, 12.4% missed one of the two interim sessions, and 3.9% missed both. There were no differences on any of the baseline measures or between conditions for those who came to all visits and those who missed at least one. All participants who provided data at the 6-month visit were retained in analyses, whether or not they had missed interim booster sessions.

Statistical analyses

Analyses were conducted with SPSS analytical software. For binary outcomes (percentage of participants who were abstinent, reported having been diagnosed or tested positive for an STD in the previous 3 months), logistic regressions were performed to compare those in the video condition to controls, controlling for baseline measures where appropriate. For knowledge and condom use, analyses of covariance (ANCOVAs) compared those in the video condition to controls, controlling for baseline measures. All effects that are significant after controlling for baseline measures were significant in simple tests. For condom failure rates, the larger sample has greater variance, precluding use of standard analysis of variance. We use the Brown–Forsythe test (Brown & Forsythe, 1974) to allow for heterogeneity of variance, which does not allow for use of covariates. An ANCOVA controlling for existing baseline data and interpolated estimates reveals similar results as the one-way ANOVA. Repeated measures ANOVAs are conducted to reveal changes over time across the entire sample, using linear contrasts when more than two time periods are involved, and are only reported where significant. The two control groups were collapsed for simplicity of analysis, because both were informational controls and there were no significant differences between them on any variables of interest. Abstinent participants were omitted from analyses on condom use, as they had no opportunity to use condoms. Abstinent participants and those who had never used condoms in the past 3 months were omitted from analyses on condom failures, as they had no opportunity for a condom to break, leak, or fall off.

Results

Baseline data

Participants scored 65.5% correct on the test of general STD knowledge and 67.7% on the test of STD-specific knowledge, where chance performance for both was 50%. Participants had to have been sexually active in the 6 months prior to recruitment to be eligible for the study, but 7.7% of participants reported having been abstinent in the 3 months prior to baseline. On average participants who were not abstinent reported using condoms more than half the time (4.26 on the 1–6 scale), and those who had used a condom in the 3 months prior to baseline experienced on average 0.87 condoms breaking, leaking, or falling off in that time. A total of 25.6% reported having been diagnosed with an STD in the previous 3 months. *Ct* prevalence was 16%, which is consistent with other studies of sexually active urban adolescent females (10.2–27.4% in a broad review, Morse, Beck-Sagué, & Mårdh, 1999).

Success of randomization

At baseline, there were no significant differences between the intervention groups in demographic characteristics (age, race, type of school, plans to finish school, or age at first intercourse). There were also no baseline differences between conditions on any of the outcome measures except abstinence, where those in the video condition were more likely to be abstinent than controls, $\chi^2 = 5.76$, $p < 0.05$.

Effects of interventions

Knowledge: As predicted, there were no effects of intervention condition at any of the follow-ups, for general STD knowledge or for specific STD knowledge, controlling for baseline scores, all F's < 1. All means were within two percentage points across conditions. Although there were no effects of intervention, knowledge did improve across both conditions over time, with linear contrasts over the four time observations revealing significant improvements in both general STD knowledge, $F(1, 214) = 69.09$, $p < 0.001$, and for specific STD knowledge, $F(1, 214) = 58.62$, $p < 0.001$.

Self-reported behavior: Participants in the video condition were more likely to report having been completely abstinent in the time from baseline to the 3-month visit, odds ratio (OR) = 2.50, $p = 0.027$, a pattern which diminished over the time between the 3- and 6-month visits, OR = 1.45, $p = 0.344$ (see Fig. 1), both controlling for baseline abstinence. There was no significant difference between conditions in how often participants reported using condoms from baseline to 3-month visit, $F(1, 206) = 0.33$, $p = 0.57$, nor from 3- to 6-month visits, $F(1, 213) = 2.13$, $p = 0.15$, both controlling for baseline levels of condom use, although the trend is toward more condom use among those who watched the video. For condom failures, although there was not a significant difference between conditions from baseline to 3-month visit, $F(1, 150) = 0.01$, $p = 0.92$, condom failure rates improved overall among those in both conditions who used condoms at both time intervals, $F(1, 99) = 3.84$, $p = 0.05$. In the period between 3- and 6-month visits, those in the video condition reported fewer condom failures compared to controls, $F(1, 186) = 5.19$, $p = 0.02$ (see Fig. 2).

STD acquisition: As predicted, at the final visit, participants in the video condition were less likely to report having been diagnosed with an STD, with controls nearly twice as likely to report such a diagnosis, OR = 2.79, $p = 0.05$ (see Fig. 3), controlling for baseline measures. This pattern held for all nine reported diseases (sign test, $p = 0.004$). For all but one of the STDs, the number of participants reporting a diagnosis was too small for the study to have sufficient power to detect differences. The only disease with sufficient power to detect a difference was chlamydia, OR = 7.75, $p = 0.05$; all other diseases had less than 20% power so we do not report comparisons. The clinical test of *Ct* incidence was underpowered (only 12% power at alpha = 0.05), given our moderate sample size. The pattern of results is similar, but was not significant, OR = 2.79, $p = 0.56$.

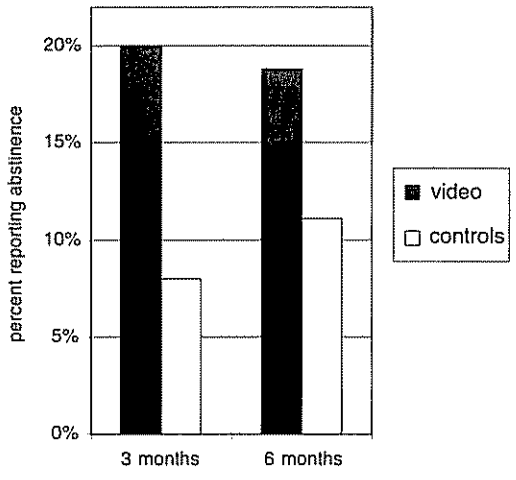

Fig. 1. Percent of participants self-reporting abstinence from sex in previous 3 months, at 3 and 6 months after baseline.

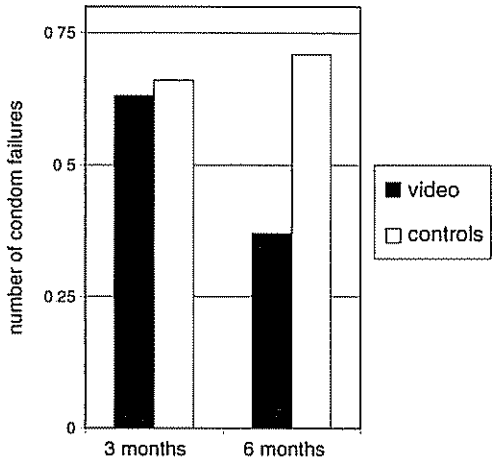

Fig. 2. Self-reported condom use failures in previous 3 months, at 3 and 6 months after baseline. Only participants who reported having had sex with a condom are included.

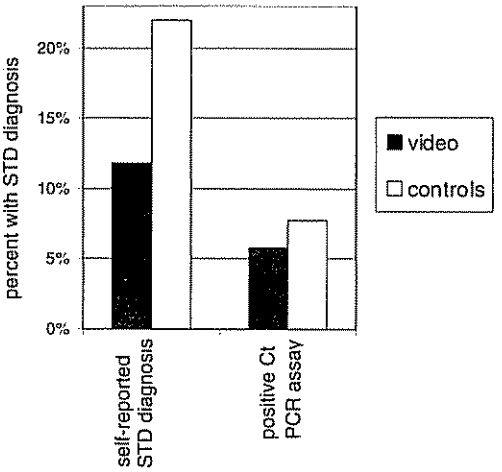

Fig. 3. Percent of participants diagnosed with an STD 6 months after baseline: self-reported diagnoses over previous 3 months, and positive results on clinical test of *Ct*.

Discussion

This preliminary evaluation suggests that our stand-alone interactive video intervention administered over a 6-month period shows promise in reducing risky behavior and STD acquisition, compared to two stringent controls. The control conditions were purposefully designed to be high quality, controlling not just for time invested, but also for specific information exposure. Performance on knowledge tests improved similarly in

all conditions, reflecting the high quality of the materials in all conditions, although the completion of these measures immediately following exposure to the intervention may undermine the ability to measure the lasting power or decay of knowledge over time. Participants were compensated for their time, which can increase enrollment and retention, but which has not been shown to affect outcome measures (Kamb et al., 1998b).

The population recruited for this evaluation represents adolescents seeking care at several community sites for varied reasons, ranging from physicals required for school or sports teams to birth control to symptomatic infection visits. Caution is warranted in generalizing these results to other settings such as schools, but the variety of sites used in this study do suggest that primary care sites may provide useful opportunities to deliver such an intervention. A pilot feasibility study revealed that the video intervention could be incorporated easily into usual clinic care, without compensation, giving patients a median time of 45 min to use it while they waited for care (Murray, Downs, White, Stubbs, & Fischhoff, 2002).

Although not all anticipated effects were significant, the pattern is consistent between measures of self-reported behavior and STD acquisition. Some effects are disadvantaged by excluding participants whose behavior makes them ineligible (e.g., abstinent individuals must be excluded from an analysis of condom use); a larger sample would allow for a more thorough investigation of these effects. Rates of abstinence among those who watched the video are only superior in the first 3 months after baseline. However, note that the lack of a statistically significant effect at 6 months is not due to a decay in abstinence among this group, but rather to (non-significant) improvement in abstinence among controls. Indeed, excluding the 10 individuals at the final visit who missed the 3-month booster session leaves abstinence levels unchanged in the video condition. This continued high rate of abstinence among young women who were previously sexually active speaks to the importance of periodic booster sessions to maintain positive effects. Interestingly, condom failure rates appear to improve steadily over time for those watching the video, compared to an apparent plateau for controls. Although all interventions addressed condom skills, the video demonstration of *how* to put a condom on and *why* doing it wrong can lead to breakage may be superior in motivating participants to keep trying and to continue improving over time.

This evaluation, with a moderate sample size for detecting behavior change and clinical outcomes, shows promise for a large-scale evaluation of the interactive video intervention. Several issues from this evaluation could be addressed in such future research. First, the self-report behavior questions did not distinguish between new and steady partners, two contexts that may involve different patterns of condom use (Ellen, Cahn, Eyre, & Boyer, 1996; Sanderson, 1999; Williams et al., 2001). Randomization should distribute participants with different partner types roughly equally across conditions, but it would be useful to measure the two types of relationships separately in future evaluations. In addition, our measure of condom use could have been more precise. A count of sex acts, protected and unprotected, and differentiating between vaginal, anal, and oral, would allow a more sensitive analysis of risk exposure. Furthermore, although the behavioral measures reveal that participants in the video condition were more likely to be abstinent, it is not known what mechanisms drove this outcome. It would be useful to know whether these participants were more adept at avoiding situations leading to sex, more likely to resist sex once in a situation, some combination of the two, or some other mechanism entirely.

In terms of evaluation design, it would be useful to disassociate the booster sessions from the evaluation sessions, so that such proximal measures as knowledge would be more representative of what is remembered in the months following the intervention rather than what was just reviewed. Comparison to a control group that received no intervention or that was truly "usual care" would reveal the effect of this video intervention compared to the traditional alternative. Alternatively, comparison to a video intervention created using a different theoretical model could provide a test of this result of the theoretical mental models approach, compared to other widely used methods.

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References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Albarracin, D., McNatt, P. S., Williams, W. R., Hoxworth, T., Zenilman, J., Ho, R. M., Rhodes, F., Malotte, C. K., Bolan,

G A., & Iatesta, M (2000) Structure of outcome beliefs in condom use *Health Psychology, 19*, 458–468

Amaro, H (1995) Love, sex and power, considering women's realities in HIV prevention *American Psychologist, 50*, 437–447

Auerbach, J D, & Coates, T J (2000) HIV prevention research: Accomplishments and challenges for the third decade of aids *American Journal of Public Health, 90*, 1029–1032

Baker, S A., Beadnell, B., Stoner, S., Morrison, D M, Gordon, J., Collier, C, Knox, K., Wickizer, L, & Stielstra, S (2003) Skills training versus health education to prevent STDs/HIV in heterosexual women: A randomized controlled trial utilizing biological outcomes *AIDS Education and Prevention, 15*, 1–14

Bandura, A (2000) Self-efficacy: The foundation of agency In W J Perrig, & A Grob (Eds), *Control of human behavior, mental processes, and consciousness Essays in honor of the 60th birthday of August Flammer* (pp 17–33) Mahwah, NJ: Lawrence Erlbaum Associates

Battle, T J, Golden, M R, Suchland, K L, Counts, J M, Hughes, J P, Stamm, W E., & Holmes, K K (2001) Evaluation of laboratory testing methods for *Chlamydia trachomatis* infection in the era of nucleic acid amplification *Journal of Clinical Microbiology, 39*, 2924–2927

Becker, M H, & Rosenstock, I M (1987) Comparing social learning theory and the health belief model In W B Ward (Ed), *Advances in health education and promotion* (pp 245–249) Greenwich, CT: JAI Press

Begley, E, Crosby, R A, DiClemente, R J, Wingood, G M, & Rose, E (2003) Older partners and STD prevalence among pregnant African American teens *Sexually Transmitted Diseases, 30*, 211–213

Blythe, M J, Fortenberry, J D, & Orr, D P (2003) *Daily sexual interest, feeling in love, and sexual activity among adolescent women* Presented at the annual meeting of the society for adolescent medicine, Philadelphia, PA, May 2003

Bosch, F X, Manos, M M, Muñoz, N, Sherman, M, Jansen, A M, Peto, J, Schiffman, M H, Moreno, V, Kurman, R, & Shah, K V (1995) Prevalence of human papillomavirus in cervical cancer: A worldwide perspective International biological study on cervical cancer (IBSCC) study group *National Cancer Institute, 87*, 796–802

Brown, M B, & Forsythe, A B (1974) The ANOVA and multiple comparisons for data with heterogeneous variances *Biometrics, 30*, 719–724

Bruine de Bruin, W, & Fischhoff, B (2000) The effect of question format on measured HIV/AIDS knowledge: Detention center teens, high school students and adults *AIDS Education and Prevention, 12*, 187–198

Burstein, G R, Gaydos, C A, Diener-West, M, Howell, M R, Zenilman, J M, & Quinn, T C (1998) Incident *Chlamydia trachomatis* infections among inner-city adolescent females *Journal of the American Medical Association, 280*, 521–526

Byram, S, Fischhoff, B, Embrey, M, & Bruine de Bruin, W (2001) Mental models of women with breast implants: Local complications *Behavioral Medicine, 27*, 4–14

Cates Jr, W, & Wasserheit, J N (1991) Genital chlamydial infections: Epidemiology and reproductive sequelae *American Journal of Obstetrics and Gynecology, 164*, 1777–1781

Centers for Disease Control and Prevention (1998) HIV prevention through early detection and treatment of other sexually transmitted diseases—United States recommendations of the Advisory Committee for HIV and STD Prevention *Morbidity and Mortality Weekly Report, 47*, 1–24

Centers for Disease Control and Prevention (2002) *Sexually transmitted disease surveillance 2001* Atlanta, GA: US Department of Health and Human Services

Chan, E L, Brandt, K, Stoneham, H, Antonishyn, N, & Horsman, G B (2000) Comparison of the effectiveness of polymerase chain reaction and enzyme immunoassay in detecting *Chlamydia trachomatis* in different female genitourinary specimens *Archives of Pathology and Laboratory Medicine, 124*, 840–843

Collins, J L, Robin, L, Wooley, S, Fenley, D, Hunt, P, Taylor, J, Haber, D, & Kolbe, L (2002) Programs-that-work: CDC's guide to effective programs that reduce health-risk behavior of youth *The Journal of School Health, 72*, 93–99

Conard, L A, & Blythe, M J (2003) Sexual function, sexual abuse and sexually transmitted diseases in adolescence *Best Practice & Research. Clinical Obstetrics & Gynaecology, 17*, 103–116

Critchlow, C W, Wölner-Hanssen, P, Eschenbach, D A, Kiviat, N B, Koutsky, L A, Stevens, C E, & Holmes, K K (1995) Determinants of cervical ectopia and of cervicitis—age, oral contraception, specific cervical infection, smoking, and douching *American Journal of Obstetrics and Gynecology, 173*, 534–543

Crosby, R A, DiClemente, R J, Wingood, G M, Rose, E, & Lang, D (2003) Correlates of continued risky sex among pregnant African American teens: Implications for STD prevention *Sexually Transmitted Diseases, 30*, 57–63

Crosby, R, Sanders, S, Yarber, W L, & Graham, C A (2003) Condom-use errors and problems A neglected aspect of studies assessing condom effectiveness *American Journal of Preventive Medicine, 24*, 367–370

Dell, D L, Chen, H, Ahmad, F, & Stewart, D E (2000) Knowledge about human papillomavirus among adolescents *Obstetrics and Gynecology, 96*, 653–656

DiClemente, R J, & Wingood, G M (1995) A randomized controlled trial of an HIV sexual risk-reduction intervention for young African-American women *Journal of the American Medical Association, 274*, 1271–1276

Domeika, M, Bassiri, M, Butrimiene, I, Venalis, A, Ranceva, J, & Vasjanova, V (1999) Evaluation of vaginal introital sampling as an alternative approach for the detection of genital *Chlamydia trachomatis* infection in women *Acta Obstetricia et Gynecologica Scandinavica, 78*, 131–136

Domeika, M, & Drulyte, O (2000) Use of PCR for the detection of genital *Chlamydia trachomatis* infection on self-obtained mailed vaginal samples *Acta Obstetricia et Gynecologica Scandinavica, 79*, 570–575

Ellen, J M, Cahn, S, Eyre, S L, & Boyer, C B (1996) Types of adolescent sexual relationships and associated perceptions about condom use *The Journal of Adolescent Health, 18*, 417–421

Eng, T., & Butler, W. T. (Eds.), (1997) Committee on prevention and control of sexually transmitted disease. *The hidden epidemic. Confronting sexually transmitted diseases* Washington, DC: National Academy Press

Fischhoff, B. (1996) The real world: What good is it? *Organizational Behavior and Human Decision Processes, 65*, 232–248.

Fischhoff, B. (1999) Why (cancer) risk communication can be hard *Journal of the National Cancer Institute. Monographs, 25*, 7–13

Fischhoff, B., & Downs, J. S. (1997a) Decision-making theory and HIV disease *Focus, 12*, 1–4

Fischhoff, B., & Downs, J. S. (1997b) Accentuate the relevant. *Psychological Science, 8*, 154–158

Fischhoff, B., & Downs, J. S. (1998) Communicating foodborne disease risk *Emerging Infectious Disease, 3*, 489–495

Fischhoff, B., Downs, J., & Bruine de Bruin, W. (1998) Adolescent vulnerability: A framework for behavioral interventions. *Applied and Preventive Psychology, 7*, 77–94

Fisher, J. D., & Fisher, W. A. (1992) Changing AIDS-risk behavior. *Psychological Bulletin, 111*, 455–474.

Fisher, J. D., Fisher, W. A., Bryan, A. D., & Misovich, S. J. (2002) Information–motivation–behavioral skills model-based HIV risk behavior change intervention for inner-city high school youth. *Health Psychology, 21*, 177–186.

Gutierrez, L., Oh, H. J., & Gillmore, M. R. (2000) Toward an understanding of (em)power(ment) for HIV/AIDS prevention with adolescent women *Sex Roles, 42*, 581–611.

Harawa, N. T., Greenland, S., Cochran, S. D., Cunningham, W. E., & Visscher, B. (2003) Do differences in relationship and partner attributes explain disparities in sexually transmitted disease among young white and black women? *The Journal of Adolescent Health, 32*, 187–191.

Healton, C. G., & Messeri, P. (1993) The effect of video interventions on improving knowledge and treatment compliance in the sexually transmitted disease clinic setting. *Sexually Transmitted Diseases, 20*, 70–76

Horowitz, S. M. (2003). Applying the transtheoretical model to pregnancy and STD prevention: A review of the literature. *American Journal of Health Promotion, 17*, 304–328.

Ickovics, J. R., Beren, S. E., Grigorenko, E. L., Morrill, A. C., Druley, J. A., & Rodin, J. (2002) Pathways of risk: Race, social class, stress, and coping as factors predicting heterosexual risk behaviors for HIV among women *AIDS & Behavior, 6*, 339–350.

Jemmott III, J. B., Jemmott, L. S., & Fong, G. T. (1998). Abstinence and safer sex HIV risk-reduction interventions for African American adolescents *Journal of the American Medical Association, 279*, 1529–1536.

Jemmott III, J. B., Jemmott, L. S., Spears, H., Hewitt, N., & Cruz-Collins, M. (1992) Self-efficacy, hedonistic expectancies, and condom-use intentions among inner-city black adolescent women: A social cognitive approach to aids risk behavior. *The Journal of Adolescent Health, 13*, 512–519.

Johnson, B. T., Carey, M. P., Marsh, K. L., Levin, K. D., & Scott-Sheldon, L. A. (2003) Interventions to reduce sexual risk for the human immunodeficiency virus in adolescents, 1985–2000: A research synthesis *Archives of Pediatrics & Adolescent Medicine, 157*, 381–388.

Kaestle, C. E., Morisky, D. E., & Wiley, D. J. (2002) Sexual intercourse and the age difference between adolescent females and their romantic partners. *Perspectives on Sexual and Reproductive Health, 34*, 304–309

Kalichman, S. C., Cherry, C., & Browne-Sperling, F. (1999). Effectiveness of a video-based motivational skills-building HIV risk-reduction intervention for inner-city African American men. *Journal of Consulting and Clinical Psychology, 67*, 959–966

Kamb, M. L., Fishbein, M., Douglas, J. M., Rhodes, F., Rogers, J., Bolan, G., Zenilman, J., Hoxworth, T., Malotte, C. K., Iatesta, M., Kent, C., Lentz, A., Graziano, S., Byers, R. H., & Peterman, T. A. (1998a) Efficacy of risk-reduction counseling to prevent human immunodeficiency virus and sexually transmitted diseases: A randomized controlled trial Project RESPECT Study Group. *Journal of the American Medical Association, 280*, 1161–1167

Kamb, M. L., Rhodes, F., Hoxworth, T., Rogers, J., Lentz, A., Kent, C., MacGowen, R., & Peterman, T. A. (1998b) What about money? Effect of small monetary incentives on enrollment, retention, and motivation to change behaviour in an HIV/STD prevention counselling intervention. The Project RESPECT Study Group. *Sexually Transmitted Infections, 74*, 253–255

Kelley, S. S., Borawski, E. A., Flocke, S. A., & Keen, K. J. (2003). The role of sequential and concurrent sexual relationships in the risk of sexually transmitted diseases among adolescents. *The Journal of Adolescent Health, 32*, 296–305.

Koskela, P., Anttila, T., Bjørge, T., Brunsvig, A., Dillner, J., Hakama, M., Hakulinen, T., Jellum, E., Lehtinen, M., Lenner, P., Luostarinen, T., Pukkala, E., Saikku, P., Thoresen, S., Youngman, L., & Paavonen, J. (2000) *Chlamydia trachomatis* infection as a risk factor for invasive cervical cancer *International Journal of Cancer, 85*, 35–39

Londesborough, P., Ho, L., Terry, G., Cuzick, J., Wheeler, C., & Singer, A. (1996) Human papillomavirus genotype as a predictor of persistence and development of high-grade lesions in women with minor cervical abnormalities. *International Journal of Cancer, 69*, 364–368.

Macaluso, M., Kelaghan, J., Artz, L., Austin, H., Fleenor, M., Hook III, E. W., & Valappil, T. (1999). Mechanical failure of the latex condom in a cohort of women at high STD risk. *Sexually Transmitted Diseases, 26*, 450–458.

Maher, J. E., Peterman, T. A., Osewe, P. L., Odusanya, S., & Scerba, J. R. (2003). Evaluation of a community-based organization's intervention to reduce the incidence of sexually transmitted diseases: A randomized, controlled trial. *Southern Medical Journal, 96*, 248–253

Maibach, E., & Flora, J. A. (1993). Symbolic modeling and cognitive rehearsal: Using video to promote aids prevention self-efficacy. *Communication Research Special Issue. The Role of Communication in Health Promotion, 20*, 517–545.

Marrazzo, J. M. (2001). Impact of new sexually transmitted disease diagnostics on clinical practice and public health policy. *Current Infectious Disease Reports, 3*, 147–151

Mehta, S. D., Rothman, R. E., Kelen, G. D., Quinn, T. C., & Zenilman, J. M. (2001). Unsuspected gonorrhea and chlamydia in patients of an urban adult emergency department: A critical population for STD control intervention. *Sexually Transmitted Diseases, 28*, 33–39.

Morgan, M G, Fischhoff, B, Bostrom, A, & Atman, C (2001). *Risk communication: The mental models approach*. New York: Cambridge University Press

Morin, L, & Latham, G P (2000). The effect of mental practice and goal setting as a transfer of training intervention on supervisors' self-efficacy and communication skills: An exploratory study. *Applied Psychology. An International Review Special Issue: Work Motivation: Theory Research and Practice., 49*, 566–578.

Morse, S A, Beck-Sagué C M, & Mårdh, P A (1999). Issues in the laboratory diagnosis of STDs. In: K K Holmes, P F Sparling, & P Mårdh (Eds), *Sexually transmitted diseases* (3rd ed) (pp 723–734). New York, NY: McGraw-Hill.

Murray, P J, Downs, J S, White, J, Stubbs, M L, & Fischhoff, B (2002). *Feasibility of clinic-based intervention to reduce reproductive risk*. Presented at the annual meeting of the North American Society for Pediatric and Adolescent Gynecology, Miami, FL.

Norris, A E, & Ford, K (1999). Sexual experiences and condom use of heterosexual, low-income African American and Hispanic youth practicing relative monogamy, serial monogamy, and nonmonogamy. *Sexually Transmitted Diseases, 26*, 17–25.

O'Donnell, C R, O'Donnell, L, San Doval, A, Duran, R, & Labes, K (1998). Reductions in STD infections subsequent to an STD clinic visit. Using video-based patient education to supplement provider interactions. *Sexually Transmitted Diseases, 25*, 161–168.

O'Donnell, L N, San Doval, A, Duran, R, & O'Donnell, C (1995). Video-based sexually transmitted disease patient education: Its impact on condom acquisition. *American Journal of Public Health, 85*, 817–822.

Ogden, J (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychology, 22*, 424–428.

Ostergaard, L F, Møller, J K, Andersen, B, & Olesen, F (1996). Diagnosis of urogenital *Chlamydia trachomatis* infection in women based on mailed samples obtained at home: Multipractice comparative study. *British Medical Journal, 313*, 1186–1189.

Patterson, T L, Shaw, W S, & Semple, S J (2003). Reducing the sexual risk behaviors of HIV+ individuals: Outcome of a randomized controlled trial. *Annals of Behavioral Medicine, 25*, 137–145.

Pequegnat, W, Fishbein, M, Celentano, D, Ehrhardt, A, Garnett, G, Holtgrave, D, Schachter, J, & Zenilman, J (2000). NIMH/APPC workgroup on behavioral and biological outcomes in HIV/STD prevention studies: A position statement. *Sexually Transmitted Diseases, 27*, 127–132.

Peterman, T A, Lin, L S, Newman, D R, Kamb, M L, Bolan, G, Zenilman, J, Douglas Jr, J M, Rogers, J, & Malotte, C K (2000). Does measured behavior reflect STD risk? An analysis of data from a randomized controlled behavioral intervention study. Project RESPECT Study Group. *Sexually Transmitted Diseases, 27*, 446–451.

Pinkerton, S D, Layde, P M, DiFranceisco, W, & Chesson, H W (2003). All STDs are not created equal: An analysis of the differential effects of sexual behaviour changes on different STDs. *International Journal of STD & AIDS, 14*, 320–328.

Riley, D M, Fischhoff, B, Small, M, & Fischbeck, P (2001). Evaluating the effectiveness of risk-reduction strategies for consumer chemical products. *Risk Analysis, 21*, 357–369.

Robinson, B E, Uhl, G, Miner, M, Bockting, W O, Scheltema, K E, Rosser, B R, & Westover, B (2002). Evaluation of a sexual health approach to prevent HIV among low income, urban, primarily African American women: Results of a randomized controlled trial. *AIDS Education & Prevention, 14*, 81–96.

Roper, W L, Peterson, H B, & Curran, J W (1993). Commentary: Condoms and HIV/STD prevention—clarifying the message. *American Journal of Public Health, 83*, 501–503.

Rothman, A J, Kelly, K M, Weinstein, N D, & O'Leary, A (1999). Increasing the salience of risky sexual behavior: Promoting interest in HIV-antibody testing among heterosexually active young adults. *Journal of Applied Social Psychology, 29*, 531–551.

Sanderson, C A (1999). Role of relationship context in influencing college students' responsiveness to HIV prevention videos. *Health Psychology, 18*, 295–300.

Sanderson, C A, & Jemmott III, J B (1996). Moderation and mediation of HIV-prevention interventions: Relationship status, intentions, and condom use among college students. *Journal of Applied Social Psychology, 26*, 2076–2099.

Shain, R N, Piper, J M, Newton, E R, Perdue, S T, Ramos, R, Champion, J D, & Guerra, F A (1999). A randomized controlled trial of a behavioral intervention to prevent sexually transmitted disease among minority women. *New England Journal of Medicine, 340*, 93–100.

Shrier, L A, Ancheta, R, Goodman, E, Chiou, V M, Lyden, M R, & Emans, S J (2001). Randomized controlled trial of a safer sex intervention for high-risk adolescent girls. *Archives of Pediatrics & Adolescent Medicine, 155*, 73–79.

Silverman, E, Woloshin, S, Schwartz, L M, Byram, S J, Welch, H G, & Fischhoff, B (2001). Women's views of breast cancer risk and screening mammography: A qualitative interview study. *Medical Decision Making, 21*, 231–240.

Solomon, M Z, & DeJong, W (1989). Preventing AIDS and other STDs through condom promotion: A patient education intervention. *American Journal of Public Health, 79*, 453–458.

St Lawrence, J S, Crosby, R A, Brasfield, T L, & O'Bannon III, R E (2002). Reducing STD and HIV risk behavior of substance-dependent adolescents: A randomized controlled trial. *Journal of Consulting & Clinical Psychology, 70*, 1010–1021.

Sweat, M, O'Donnell, C, & O'Donnell, L (2001). Cost-effectiveness of a brief video-based HIV intervention for African American and Latino sexually transmitted disease clinic clients. *AIDS, 15*, 781–787.

Sweet, R L, Wiesenfeld, H C, Uhrin, M, & Dixon, B (1994). Comparison of EIA, culture, and polymerase chain reaction for *Chlamydia trachomatis* in a sexually transmitted disease clinic. *The Journal of Infectious Diseases, 170*, 500–501.

Valdiserri, R O, Ogden, L L, & McCray, E (2003). Accomplishments in HIV prevention science: Implications for stemming the epidemic. *Nature medicine, 9*, 881–886.

Wasserheit, J N (1992). Epidemiological synergy: Interrelationships between human immunodeficiency virus infection

and other sexually transmitted diseases. *Sexually Transmitted Diseases, 19*, 61–77

Weström, L. (1996) Chlamydia and its effect on reproduction. *Journal of the British Fertility Society, 1*, 23–32

Wiesenfeld, H. C., Heine, R. P., Rideout, A., Macio, I., DiBiasi, F., & Sweet, R. L. (1996). The vaginal introitus: A novel site for *Chlamydia trachomatis* testing in women. *American Journal of Obstetrics and Gynecology, 174*, 1542–1546.

Williams, M., Ross, M. W., Bowen, A. M., Timpson, S., McCoy, H. V., Perkins, K., Saunders, L., & Young, P. (2001). An investigation of condom use by frequency of sex. *Sexually Transmitted Infections, 77*, 433–435

World Health Organization Task Force on the Prevention and Management of Infertility. (1995). Tubal infertility: Serologic relationship to past chlamydial and gonococcal infection. *Sexually Transmitted Diseases, 22*, 71–77.

Zimmers, E., Privette, G., Lowe, R. H., & Chappa, F. (1999). Increasing use of the female condom through video instruction. *Perceptual and Motor Skills, 88*, 1071–1077