THEORETICALLY MOTIVATED CURRICULA FOR REDUCING SEXUAL RISK TAKING IN ADOLESCENCE: A RANDOMIZED CONTROLLED TRIAL

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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August 2009

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Recent theoretical developments in our understanding of developmental trends in adolescent memory, judgment, and decision-making suggest ways in which existing risk reduction programs for adolescents can be improved. Using fuzzy-trace theory, these developments were applied to a validated and evidence-based program, *Reducing the Risk* (RTR) in a randomized controlled trial. Following a baseline assessment, 734 participants aged 14-19 were randomly assigned to one of three 16 hour interventions – RTR, a modified RTR program (RTR+), or a control condition about improving communication skills. Upon completing the intervention, participants completed a post-survey and were then followed up at three, six, and 12 months later. Primary outcome measures included sexual behavior (initiation, number of partners) and prophylactic behavior (e.g., condom use at last sexual encounter and number of unprotected sexual partners). Discrete time survival analysis revealed that participants assigned to RTR+ were significantly less likely to initiate sexual activity one year after the intervention was administered, and random effects models suggested that RTR+ also decreased the sexual partners across all time points. In addition, RTR+ had significant positive effects on measures of knowledge, intentions, attitudes, perceived norms, self efficacy, perceived behavioral control, as well as on several measures of risk perception suggested by the study's theoretical framework. Among 23 domains of outcome variables assessed, positive effects of either curriculum were found in 18 domains. Positive effects of RTR+ were found in 16 domains, and positive effects of RTR were found in 12. RTR+ outperformed RTR in 9 of 18 domains (including sexual behavior), and RTR outperformed RTR+ in two domains. The results demonstrate that simple, theory-driven manipulations can be used to improve upon existing evidence-based programs for reducing adolescent sexual risk taking.

BIOGRAPHICAL SKETCH

Britain Ashley Mills was born to Joe and Dottie Mills in Charlotte, North Carolina on October 7, 1976. He attended Weatherford High School in Weatherford, Texas and received a B.S. in neuroscience from Texas Christian University in Ft. Worth, Texas. In 2003, he joined the Laboratory for Rational Decision-making to pursue a doctoral degree in Human Development. He has published on topics such as false memory, risk perception, rationality, and adolescent behavioral change. In 2009, he accepted a faculty position at the Dallas regional campus of the University of Texas at Houston.

ACKNOWLEDGMENTS

To Brady and Sarah.

Work on this dissertation was supported by a grant (R01 MH061211) from the National Institute of Mental Health to Valerie F. Reyna

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CHAPTER 1

INTRODUCTION

Despite recent declines, sexually transmitted infections (STIs) and adolescent pregnancy remain a significant public health problem in the United States. Rates of pregnancy and STIs are substantially higher in the United States than in other developed nations (Kirby, 2007; National Campaign to Prevent Teen Pregnancy, 2006). Recent estimates of teen pregnancy in the United States have shown overall yearly rates of pregnancy of 7.5% for adolescent females between 15 and 19 years of age, with even higher rates for African American (13.4%) and Hispanic females (13.2%; Guttmacher Institute, 2006). Over 30% of females in the United States become pregnant before the age of 20 (National Campaign to Prevent Teen Pregnancy, 2006), and as many as 82% of those pregnancies were unintended (Finer & Henshaw, 2006). Recent data has also shown that the percentage of births to unmarried girls under 20 years of age has risen to 83 percent in 2005 (Kirby, 2007), a particularly sobering statistic given that births to unmarried woman typically have more negative consequences for mothers and their children. A similar picture has emerged regarding STI rates. Young people between 15 and 24 years of age represent 25% of the sexually active population of the United States, and yet are involved in roughly half of all new STI cases (STI; Weinstock, Berman, & Cates, 2004). Approximately one third of sexually active youth were infected with an STI by 24 years of age (Kaiser Family Foundation, 1998) and as with pregnancy, rates of STI tend to be higher among African-Americans and Hispanic adolescents.

The prevalence of adolescent pregnancy and STI infection is due directly to adolescents engaging in risky sexual behavior, and the tendency to take sexual risk increases with age. In 2005, percentages of adolescents who had initiated sexual behavior were 34% and 63% for 9th and 12th graders, respectively (Centers for Disease Control and Prevention, 2006). Furthermore, prophylactic behavior among adolescents (pregnancy-specific – such as oral contraceptives – or generalized measures such as condoms) is plagued by inconsistent or incorrect use (Abma, Chandra, Mosher, Peterson, & Piccinino, 1997; Suellentrop, 2006), nullifying the reductions in risk such measures offer. These statistics reflect substantial costs to individuals and society as a whole. Monetary costs alone have been estimated at $9.1 billion for adolescent childbearing in 2004 and $8.4 billion per year for STIs in the United States, and negative effects on individual education, cognitive development, incarceration, health, and psychological well-being are well documented (Kirby, 2007).

Kirby, Barth, Leland, and Fetro (1991) identified four major generations of intervention approaches that have been used to curb adolescent sexual risk taking over the last three decades. Initial attempts, grounded in the assumption that the primary governing factor of adolescent risk behavior involved informational deficits, focused heavily on increasing adolescents' knowledge of various fact related to sexuality, pregnancy, and STIs. By rectifying these knowledge deficits, behavior, according to this approach, could be changed. The second generation placed less emphasis on knowledge and more emphasis on values clarification and cognitive/communicative skills training. Combining the knowledge based approach with content that taught students how to reason about sexual decisions and communicate that reasoning effectively produced slight improvements over the first generation approaches, but the overall impact remained inconsistent. Abstinence-only education, the third generation, evolved in conjunction with perceptions that previous approaches were "value free." Studies based on these approaches, which typically do not discuss contraception at all, have suffered from methodological limitations and to date have shown no consistent efficacy in delaying the onset of sexual intercourse or the frequency of sexual intercourse (Christopher & Roosa, 1990; Kirby, 2007; Roosa & Christopher, 1990).

The fourth generations of approaches synthesize effective elements of their predecessors. Importantly, they combine approaches with proven effectiveness in other health areas (e.g., substance abuse). Three of those major theoretical approaches are social learning theory, social inoculation theory, and cognitive behavior theory. With respect to STI prevention, approaches grounded in social learning theory suggest four major factors underly a behavior such as condom use: An understanding of what must be done to avoid risk, a belief that one is able to perform the action, a belief that the action will prevent STIs, and the anticipated benefit of performing the action. Observational learning (role playing) and experience (practicing actions required for the behavior) play a key role in the acquisition of these skills. Social inoculation refers to the ability to recognize social pressure and become motivated and capable of resisting it, and practice in developing strategies to resist social pressure is offered in these types of programs. Finally, cognitive behavior theory, similar in many respects to the other two major theoretical approaches, involves personalizing information about sexuality and risk, training in decision-making and communication skills, and practice applying these skills. Fourth generation approaches have shown the most consistent patterns of effects, but as with prior approaches, they depend heavily on the use of proper methodological techniques such as the use of an appropriate control group, as effects are often fleeting and specific only to particular subpopulations.

Among methodologically sound fourth generation studies reporting effects on sexual risk behavior, most have targeted African-American adolescents given their higher baseline prevalence of sexual risk behavior. An AIDS risk reduction intervention implemented by Jemmott, Jemmott, and Fong (1992, 1998) produced decreases in the frequency of intercourse and the number of sexual partners, and increases in the use of condoms in separate samples of African-American adolescents. A program reported by Stanton, Li, Ricardo, Galbraith, Feigelman, and Kaljee (1996) produced increases in condom use intentions and behaviors through six, but not 12 months for a sample of 383 adolescents. Similarly, in a comparison of education plus behavior skills training with an education-only control condition among 225 African-Americans, St. Lawrence et al. (1995) reported sustained effects on several measures through 12-month follow-up for skills-trained adolescents relative to their education-only peers.

Among programs targeting adolescents in general, a quasi-experimental design implementing an intervention with a heavy focus on behavioral skills training (Main et al., 1994) found the intervention to result in fewer sexual partners, greater frequency of using condoms, and greater perceived vulnerability to HIV infection, although at 6 months, intervention and comparison students did not differ in onset or the frequency of intercourse. Also with a quasi-experimental design, and like the St. Lawrence et al. (1995) study, Kirby, Barth, Leland, and Fetro (1991) demonstrated a sustained effect on initiation of sexual activity in their *Reducing the Risk* (RTR) program in a sample of 758 adolescents in California. Hubbard, Giese, and Rainey (1998) replicated many of the findings for RTR in a rural sample. Finally, *Safer Choices* (Coyle et al., 2001; Coyle et al., 1998), a program that links efforts to stimulate school-wide changes in adolescents' daily environment with other fourth generation theoretical approaches, increased condom use and reduced unprotected sex over a 31 month period in a quasi-experimental design involving 31 high schools.

Kirby and Laris (2009) reviewed the impact of curriculum-based sex and STI/HIV education programs (including most of the programs discussed above) since 1990 on a variety of outcome measures. Of 55 studies that met specific criteria for inclusion in the review (e.g., sufficient sample size, strong experimental or quasi-experimental design, at least one follow-up assessment, etc.), 16 reported delayed initiation of sex, eight reported reduced frequency of sex, 11 reported a reduced number of partners, 15 reported increased condom use, four reported increased contraceptive use, and 15 reported reductions in some other measure of sexual risk taking. Although the percentages seem low, not all studies collected data on all outcome measures, and roughly two out of every three studies reported an effect on at least one behavioral outcome. Nevertheless, the number of studies finding significant positive effects on outcome measures they collected data on exceeded 50% for only the latter, general measure of sexual risk taking. Although the findings are higher than what would be expected by chance, there is clearly much room for improvement with respect to behavioral outcomes. For psychosocial mediators of behavior (e.g., knowledge, attitudes, self-efficacy, etc.; Kirby, Lepore, & Ryan, 2005), roughly half of the 55 studies reviewed by Kirby and Laris reported positive effects.

In summary, programs that reduce sexual risk behaviors are based on theories with established effectiveness in other health domains, are multi-component approaches addressing both risk avoidance (by delaying initiation of intercourse) and risk reduction, and have been rigorously evaluated. Effects on both behavior and psychosocial mediators of behavior have been found, but the effects are typically restricted to a subset of the outcome variables analyzed or are not sustained for a majority of programs. At least one curriculum, RTR, has been successfully implemented in two populations, and for that reason, RTR is used as one of three curricula in the present study. Literature reviews in this area call for studies that build on efficacious and theory-driven interventions that involve random assignment, large sample sizes, long-term follow-up, and behavioral measures, and each of these attributes have been incorporated into the present study.

Shortcomings of existing interventions

Studies implementing fourth generation intervention programs suffer from a series of specific and addressable problems. Since it is used in this study, examples from the RTR program are given, but it is important to note that these issues have been common problems throughout the history of studies attempting to measure change over time. On the methodological front, effective contemporary programs appear to have learned from many mistakes of the past: Basic design flaws such as a lack of or an inappropriate control group (to control for Hawthorne effects) were not a problem among the published studies reviewed above. The primary methodological shortcoming among current programs is the lack of purely experimental designs, with a substantial portion of effective programs having been evaluated in quasi-experimental frameworks.

Instead, the major source of problems that continue to plague contemporary intervention programs occurs at the analytical stage, although at least one problem lies at the intersection of methodological and analytic aspects of the research design. In their classic article, Cronbach and Furby (1970) noted that to reliably assess the effect of a manipulation on change over time, data should be collected on the relevant measure for a minimum of three assessments. Many current programs employ pre-post designs, collecting data on baseline measures prior to the intervention and administering one follow-up assessment immediately after or several months later. The initial implementation of RTR used a total of three assessments (Kirby et al., 1991), but the subsequent replication (Hubbard et al., 1998) used a pre-post design, with the final follow-up at 18 months after the intervention. The present study addresses this shortcoming by administering assessments at a total of five time points, with four occurring after the intervention.

The second major group of problems lies at the analytical stage itself. First, among studies that employ more than two assessments, separate analyses are often conducted by time point or on change scores between pairs of assessments. Both approaches were employed in previous assessments of RTR (and many other programs), and both can result in a substantial loss of statistical power (as sample sizes are lower), and as also noted by Cronbach and Furby (1970) the use of change scores is accompanied by a set of problematic implications. First, taking the difference between two unreliable measures removes the component that is common to each, and what is left is a difference of error terms: that is, change scores can be very unreliable. Second, change scores tend to be correlated with pretest scores. A person who scores high on a bounded measure initially has less room to improve than a person who scores low. Artifacts arising from regression to the mean are likely, especially when coupled with subpopulation analyses on risk groupings defined by pretest scores, a feature of previous analyses on RTR (Kirby et al., 1991). Cronbach and Furby (1970) recommended “base-free” measures of change, which are provided in regression frameworks where the actual pretest score is statistically controlled for. This is the approach used in the present study.

The third and fourth major groups of problems have a common symptom but at least two underlying causes. First, longitudinal studies almost always suffer from some form of attrition, with participants dropping out of the study as time progresses. A common approach to dealing with the complexities of such unbalanced data is to use complete case analysis, where only participants with data at all assessments are analyzed. For example, in the replication study for the RTR program, over half of the original sample was dropped from analyses because of attrition. Many commonly employed statistical routines in standard statistical packages – such as repeated measures analysis of variance or covariance – require completely balanced data, and cases with missing observations are automatically dropped. The problem is that for the resulting estimates of effects from such an analysis to be valid, highly restrictive assumptions about the cause of the missing data are required. Specifically, it must be assumed that the values of the missing data points are uncorrelated with anything (that they are missing completely at random). Statistical methods exist for validly imputing data points (multiple imputation) under less restrictive assumptions, or for validly analyzing all data points regardless of attrition patterns (via direct maximum likelihood estimation; for a review, see Jeličić et al., 2009) under the same flexible assumptions. Both methods are used in this study. Second, the use of such models, even when attrition is not a problem, imposes additional restrictive assumptions about the correlation between observations over time. This problem is touched on in more detail in the methods chapter, but for now it will suffice to say that more flexible methods exist for modeling correlated data, and those techniques are employed in this study.

Theoretical background

In the present study, recent advances in research on developmental trends in adolescent memory, judgment, and decision-making (for overviews, see Reyna, 2008; Reyna & Farley, 2006) are applied to existing intervention in an effort to improve upon its effects. The guiding theoretical principles of the effort are found in fuzzy-trace theory, which is based on evidence showing that decision making becomes more gist-based with development and experience. According to this approach, developmental differences in risk taking arise from developmental differences in inhibition and reasoning (Reyna & Rivers, 2008). Inhibition/cognitive control (Reyna & Mills, 2007) corresponds to the ability to inhibit inappropriate thoughts or actions in favor of goal-directed ones, and its use increases throughout adolescence. In conjunction with changes in the use of cognitive control, there are parallel changes in the reliance on gist and verbatim modes of reasoning. Beginning with an initial focus on quantitative differences in outcomes (trading off risk and benefits), decision-makers eventually shift to an all-or-none focus on qualitative differences (e.g., ignoring temporary benefits when the risks, however small, involve catastrophic outcomes). This stands in contrast to traditional theories of cognitive development, which predict that decision-makers progress from intuitive (gist-based) to computational (verbatim) thinking. Evidence supporting the former position has come from a wide range of studies with children, adolescents, and adults (e.g., Reyna, 1996, 2004; Reyna & Brainerd, 1991a, 1993, 1994, 1995; Reyna & Ellis, 1994; Reyna & Farley, 2006; Reyna, Lloyd, & Brainerd, 2003). The finding that inconsistencies and biases in decision making, such as framing effects (e.g., Tversky & Kahneman, 1986), also emerge with development and experience is a key prediction of the theory, as such findings reflect a shift away from rationality narrowly characterized as involving compensatory trade-offs between risks and benefits, and towards a form of rationality characterized by an increasing tendency to rely on simplified representations of information, a shift *towards* qualitative and intuitive processing, and *away* from quantitative, “analytic” tendencies to rely on the verbatim facts of experience. It is the latter sort of mature thinking that characterizes adults, experts, and groups at lower risk (Mills, Reyna, & Estrada, 2008), and it is that type of thinking that was encouraged in the modified RTR program of this study.

According to fuzzy-trace theory, people encode multiple representations of information at varying levels of precision. Verbatim representations preserve the “facts” of experience, such as exact quantities of numerical information. At the other end of the continuum, gist representations preserve basic meaning and patterns, such as qualitative numerical information, whether or not a quantity is present (categorical distinctions), and relative numerosity (ordinal distinctions). Alongside the principle of task calibration (the level of precision required in the response constrains the level of representation recruited; Reyna & Brainerd, 1989, 1994, 1995), the availability of several representations at varying degrees of precision explains a number of paradoxical inconsistencies between choice, which requires categorical or dichotomous response formats, and judgment, which requires finer grained distinctions in responses (e.g., Hogarth 1980; Payne, Bettman, & Johnson 1992; Tversky 1969).

Evidence suggests that reasoning operates on the lowest (or least precise) level of gist necessary for the task at hand (Reyna & Brainerd, 1995; Reyna, Lloyd, & Brainerd, 2003. For example, making a choice requires at least a dichotomous representation of preference, whereas making a judgment requires a finer grained level of representation; in each case, people tend to adopt representations that parallel these response constraints. This fuzzy-processing preference has advantages for reasoning, because gist representations are more stable over time and easier to think about compared to verbatim representations (e.g., Reyna & Brainerd, 1991a; 1992). After delay of several months, the verbatim memory of material learned has dissipated. At that point, adolescents recall the gist of educational interventions (which is filtered through their experience, culture, and worldview), and if the interventions did not focus explicitly on cultivating specific types of gist representations, the memory of material learned may differ substantially from what was initially communicated (Brainerd, Reyna, & Mojardin, 1999; Brainerd, Stein, & Reyna, 1998; Reyna & Brainerd, 1995; Reyna & Titcomb, 1997). Therefore, encouraging adolescents to recognize the gist of common risky situations has the potential for longer-lasting effects on behavior than standard interventions that place more emphasis on communicating facts. Because gist representations are more durable than verbatim representations (Reyna & Brainerd, 1995), encouraging memory for risks in a form that will endure and be more likely to be applied in actual decision making should enhance the ability of the modified intervention to produce effects that are significant for a broader ranger of outcome measures and that are more long-lasting.

Research has also demonstrated that values or principles relied upon in decision-making contexts are vaguely represented in long-term memory as simple, qualitative gists (e.g., Reyna & Brainerd, 1991a,b), and these simple “decision heuristics” have been shown to relate to HIV risk behaviors (Holtgrave, Tinsley, & Kay, 1994; Misovich, Fisher, & Fisher, 1996, 1997). For example, endorsement of decision principles such as “monogamous relationships are safe” and “known partners are safe” predicts unsafe sexual practices among heterosexual college students and adults, and the present study covered such values but placed more emphasis on values that should correlate negatively with risk behavior, such as “Avoid risk.” By encouraging the representation of *all* decision information at a gist level (e.g., information about risk as well as values relevant to acting on that information), the modified curriculum should foster adolescents’ ability to map risk information and decisions onto comparably vague gist-level values and decision heuristics.

Overview of the present study

The goal of the present study is to apply these recent theoretical advances to the RTR program in an effort to produce a curriculum with larger and more sustained effects on adolescent sexual behavior. Following a baseline assessment, participants were randomly assigned to one of three 16 hour interventions – RTR, a modified RTR program (RTR+), or a control condition that did not discuss adolescent sexuality – and were followed up at four additional points for one year. Although evaluations of Reducing the Risk have incorporated large sample sizes (N=758), appropriate comparison groups, and long-term follow-up, the present study represents the first randomized control trial to evaluate the program (as opposed to quasi-experimental designs). In addition, the present study has several other advantages over previous implementations of RTR. First, it uses two comparison groups – the original RTR curriculum in addition to a control curriculum that is not about sexuality. Second, personnel delivering the interventions in the present study were trained members of the laboratory, as opposed to volunteers outside of the research team (such as teachers at local schools). This enabled senior research personnel to closely monitor adherence to curriculum content, eliminating dosage effects (health educators maintained a checklist of covered material, and coverage of all topics was mandatory). Third, the present study employs statistical methods in analyzing the data that properly account for correlations between time points and for missing data, ensuring that estimated effects are valid, reproducible, and generalize to the population as a whole.

CHAPTER 2

METHOD

This chapter outlines all methodological details of the study. As discussed in the introduction, the general objective of the study was to evaluate a theoretically-motivated HIV-prevention intervention by comparing it with an established intervention and a control intervention about improving communication skills (which lacked any discussion of sexuality). Also as discussed previously, a longitudinal design was employed and follow-up surveys were administered at five time points: Participants took a presurvey followed by one of three 16 hour interventions, then completed a follow-up survey (postsurvey) immediately after the intervention and at three, six, and twelve months after the postsurvey. In section one (Participants) of this chapter, characteristics of the study participants, recruitment, consent, and compensation are discussed. The following section, Materials, includes two major subsections: In the first, details of the two treatment interventions and the control intervention are presented, and in the second, measures of self-reported behavior, psychosocial constructs, and other sociodemographic items of interest to the study's goals are described. Psychometric properties of all multi-item scales appear in Appendix A. In the third section, procedural details related to training of health educators, randomization, intervention administration, and participant follow-up are described. Finally, the chapter concludes with a section describing the four primary types of statistical analyses used in this dissertation: discrete time survival analysis, random effects regression, logistic regression, and multinomial logistic regression.

Participants

The study was conducted from June 2003 to April 2008. Institutional Review Boards (IRB) at the University of Arizona, the University of Texas at Arlington, and Cornell University approved the study protocol prior to implementation from any of those sites. Participants aged 14-19 were recruited from high schools and local youth organizations in or within a 30 mile radius of Tucson, Arizona, Arlington, Texas, and Ithaca, New York, and 734 participants agreed to participate in the full intervention and follow-up surveys. In Tuscan, Arizona, participants were recruited from Marana high school, Mountain view high school, and Salpoint Catholic high school. In Dallas, Texas, participants were recruited from the Dallas Boys & Girls Club. In the Arlington, Texas area, participants were recruited from Arlington, Lamar, Martin, Juan Seguin, Sam Houston, Bowie, Cedar Hill, O.D. Wyatt, Barnett, Gateway, Grand Prairie, Turning Point, Hutcheson, and Venture high schools as well as Gospel Light Baptist School. In Ithaca, New York, participants were recruited from Ithaca high school.

Participants were selected for recruitment if they were between the ages of 14 and 19 and could speak and understand English (all participants contacted met these criteria). In order to maintain participation and minimize attrition at the follow-up assessments, participants were paid a graduated amount, with the largest follow-up payment for completion of the last (12-month) survey. For completion of the presurvey, the full intervention (16 hours), and the postsurvey (which occurred immediately after the intervention), participants were paid a total of $75. Participants received $15 for completing the 3 month follow-up, $30 for the 6 month follow-up, and $45 for the 12 month follow-up, for a total of $165 if the full class and all follow-ups were attended.

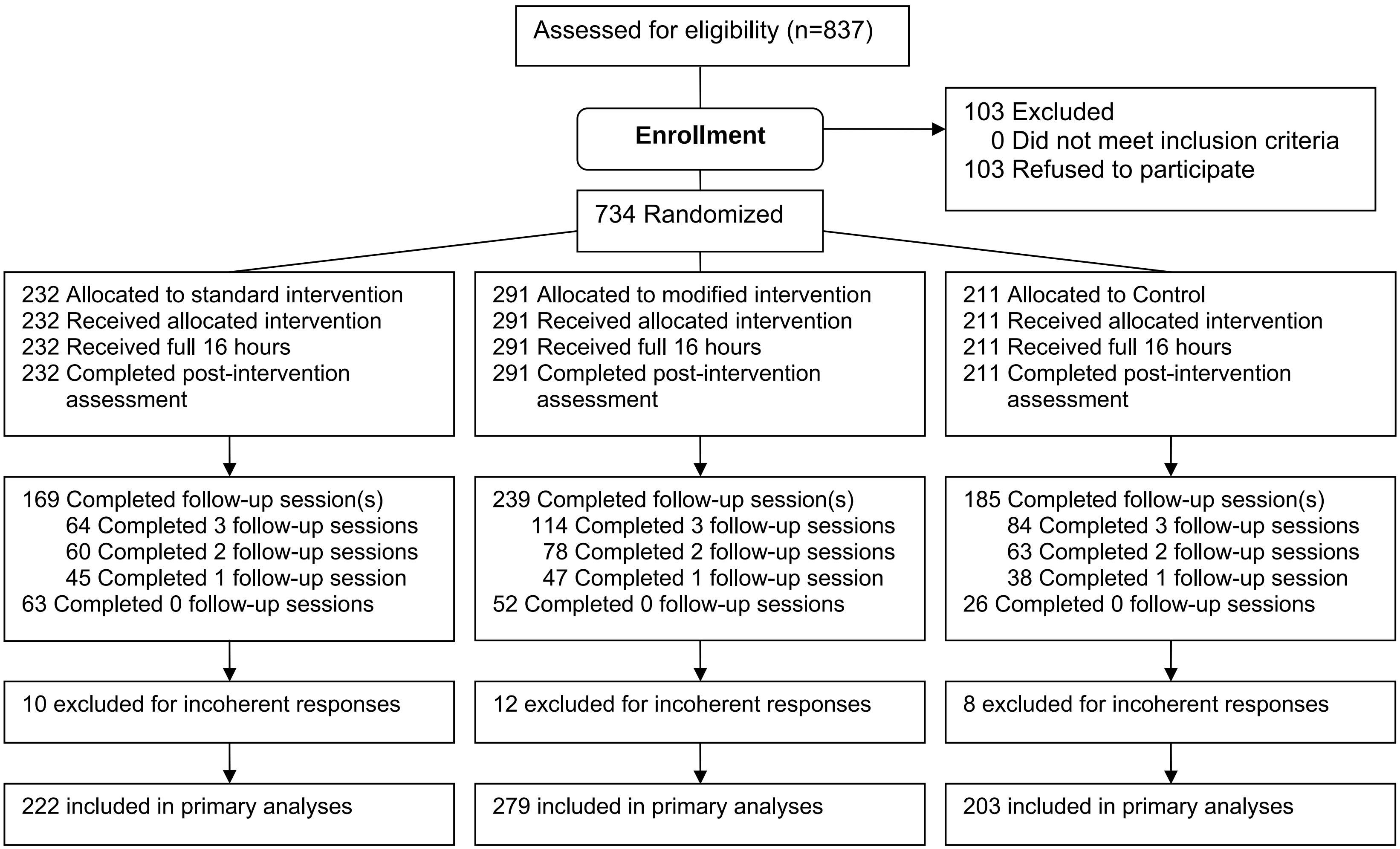

Figure 2.1. Flow of study participants.

Given approximate times to complete the survey and the length of the classes, this corresponds to a reimbursement rate of $6 to $7 per hour.

A flowchart of participant attendance throughout the study can be found in Figure 2.1. Of 837 initially contacted participants, 87.7% completed the intervention and the immediate follow-up assessment. Of 734 participants who completed the intervention and the immediate follow-up assessment, 80.8% completed a follow-up survey. Although fairly prevalent in clinical trial research, current recommendations (“Consolidated Standards," 2007) advise against the use of statistical methods that only use data from participants who never dropped out of the study (e.g., complete case analyses; see discussion of statistical methodology below), and statistical methods employed in this dissertation make use of all data from eligible participants. However, to compare with methods of attrition reporting for complete case analyses, the total number of eligible participants (734) to complete the final assessment at 12 months was 450 (61.3%). This corresponds to a per-assessment attrition rate of 15% if calculated over the three assessments after the postsurvey (734 participants), and to a rate of 14% if calculated over the four assessments following the presurvey (837 participants). Both rates are within the 10-20%

Table 2.1. Attendance patterns at 12 months, by intervention.

	Intervention			
Attended 12 month assessment?	RTR	RTR+	CONTROL	Total
No	97	117	70	284
Yes	135	174	141	450
Total	232	291	211	734

Note. $\chi^2(2) = 3.94$, p=.14

Table 2.2. Comparability of control, standard, and modified interventions at the initial assessment.

Characteristics	Control (n=211)	RTR (n=232)	RTR+ (n=291)
Sociodemographic variables			
Age, mean (sd)	16.05 (1.1)	16.07 (.99)	15.86 (.99)
Female	117 (55.5)	125 (53.9)	180 (61.9)
Hispanic	33 (15.6)	32 (13.8)	56 (19.2)
African American	57 (27.0)	69 (29.7)	76 (26.1)
Caucasian	105 (49.8)	100 (43.1)	123 (42.3)
Grades in school, mean (SD)	1.94 (.86)	1.99 (.83)	2.04 (.87)
Receives free lunch	45 (21.3)	62 (26.7)	87 (29.9)
Hours without adult supervision, mean (SD)	2.99 (1.0)	3.08 (1.0)	2.92 (1.0)
Lives with both parents	111 (52.6)	106 (45.7)	146 (50.2)
Lives with one parent	55 (26.1)	55 (23.7)	72 (24.7)
Parental education, mean,(SD)	2.82 (.83)	2.87 (.91)	2.72 (.93)
Psychosocial mediators, mean (SD)			
Intentions to have sex	2.10 (1.2)	2.34 (1.1)	2.14 (1.2)
Intentions to use Prophylaxis	3.17 (.73)	3.13 (.80)	3.12 (.78)
Sexual attitudes	1.65 (.98)	1.80 (.99)	1.69 (.99)
Prophylactic attitudes	3.01 (.41)	3.01 (.43)	2.98 (.43)
Pregnancy attitudes	1.75 (.55)	1.79 (.57)	1.75 (.58)
Perceived sexual norms	1.79 (.75)	1.88 (.71)	1.82 (.72)
Perceived parental sexual norms	0.91 (.87)	0.93 (.91)	0.78 (.86)
Perceived prophylactic norms	3.10 (.60)	3.10 (.62)	3.08 (.62)
Perceived behavioral control (Prophylaxis)	2.85 (.66)	2.80 (.68)	2.81 (.69)
Self-efficacy in using prophylaxis	2.93 (.67)	2.96 (.69)	2.89 (.70)
Self-efficacy in "saying no" to sex	2.91 (.71)	2.79 (.71)	2.83 (.74)
Specific risk perception	.37 (.54)	.36 (.53)	.43 (.59)
Quantitative risk perception	6.33 (14.1)	8.27 (15.9)	10.03 (19.6)
Categorical risk perception	2.94 (.58)	2.90 (.52)	2.92 (.56)
Perceived global benefits of sex	1.32 (.93)	1.38 (.98)	1.26 (.95)

Table 2.2 (Continued).

Characteristics	Control (n=211)	RTR (n=232)	RTR+ (n=291)
Perceived global risks of sex	1.85 (1.1)	1.83 (1.0)	1.81 (1.1)
Gist principle endorsement	10.79 (3.5)	10.58 (3.3)	11.03 (3.3)
Absolute principle endorsement, No. (%)	160 (75.8)	166 (71.6)	220 (75.6)
Relative principle endorsement, No. (%)	115 (54.5)	120 (51.7)	138 (47.4)
Knowledge	2.82 (.43)	2.87 (.42)	2.77 (.44)
Reasons to have sex	1.71 (.71)	1.74 (.68)	1.70 (.72)
Reasons to not have sex	2.79 (.57)	2.77 (.57)	2.83 (.59)
Recognition of warning signals	1.93 (.76)	1.85 (.72)	1.92 (.78)
Delinquency	.46 (.60)	0.48 (.57)	.48 (.54)
Religiosity	3.44 (1.3)	3.47 (1.3)	3.45 (1.3)
Index of peer relations	1.94 (.69)	1.88 (.65)	1.95 (.70)
Marlowe-Crowne index (short form)	.46 (.21)	0.44 (.21)	.44 (.21)
Sexual/prophylactic behavior			
Had sex in the last 30 days	41 (19.4)	57 (24.6)	50 (17.2)
Ever had sex	88 (41.7)	100 (43.1)	102 (35.1)
Ever had vaginal sex	70 (33.2)	80 (34.5)	86 (29.6)
Ever had anal sex	18 (8.5)	19 (8.2)	19 (6.5)
Ever had oral sex	76 (36.0)	82 (35.3)	84 (28.9)
# of sexual partners, mean (sd)	1.27 (3.3)	1.29 (3.2)	0.88 (2.0)
Currently dating someone	82 (38.9)	92 (39.7)	126 (43.3)
Prophylactic risk index (PRI), mean (sd)	.81 (.36)	.82 (.35)	.85 (.32)
# of unprotected encounters, mean (sd)	2.92 (11.2)	3.06 (9.6)	1.92 (10.9)

Note 1. Data are expressed as No. (%) of participants unless otherwise noted.

Note 2. "Grades in school" was measured on a scale coded 1 to 5 with lower scores reflecting higher grades; hours without adult supervision and parental education were measured on scales coded 1 to 4 with higher scores reflecting less supervision and higher education, respectively; delinquency was coded on a 0 to 4 scale with higher scores reflecting more delinquent behavior; religiosity and the index of peer relations were coded on scales ranging from 1 to 5, where higher scores reflecting more religiosity and poorer relations, respectively.

range typically desired for randomized clinical trials. Furthermore, differential attrition was not observed: The number of participants to drop out of the study before the final assessment did not vary by intervention (Table 2.1).

Participants assigned to the three interventions also did not differ in baseline characteristics collected prior to the interventions by more than chance levels. Table 2.2 lists means and frequencies of measures used in this dissertation. Of the 47 measures listed, only 2 (4.3%) differed significantly across interventions, which is roughly what would be expected by chance alone. Those measures were age – participants assigned to RTR+ were slightly younger than participants assigned to RTR [$F(2, 732) = 3.5$, $p = .03$] – and knowledge – participants assigned to RTR+ had slightly lower knowledge scores than participants assigned to RTR [$F(2, 732) = 3.7$, $p = .02$]. Details about the measures listed in this table appear in the materials section of this chapter.

Participants were recruited through mass mailing campaigns or, after obtaining permissions from appropriate site administrators, on-site recruitment via face to face meetings and by posting recruitment flyers. Prior to any recruitment, school/organizational and district-level officials were contacted, fully informed, and provided permission to disseminate information to teachers, youth leaders, parents, and potential participants in Arizona, New York, and the Dallas Boys and Girls Club in Dallas, Texas. Additionally, in Arlington, Texas, a list containing names and mailing addresses of high school students who had declared themselves eligible for research was purchased from Arlington Independent School District and used to mail recruitment materials to potential participants and their parents. For all recruitment methods, recruitment packets were assembled that contained a letter to parents describing the study and instructions for participation, parental consent forms, participant assent forms, contact information for additional inquiries, a schedule of upcoming sessions, and (for mailed materials) self-addressed stamped envelopes. Participants who returned the relevant forms or who called with an interest in participating were informed of dates and times of upcoming sessions, and were enrolled after all signed consent and assent materials were received.

On-site recruitment was used in Tucson, Arizona, Ithaca, New York, and Dallas, Texas. Between or after their normal classes, students were approached and given general details about the study, and if interested, were provided with the recruitment packet. Flyers containing general details of the study, compensation information, and contact information were also posted in heavy traffic areas in the high schools. Information about the study was also provided – and questions answered – at various parent and teacher meetings, such as parent-teacher organizations and local meetings of school administration officials, and to youth leaders (such as coaches) and teachers in one on one meetings. For all recruitment methods, information about dates and times of upcoming sessions were provided and students were enrolled after turning in signed parental consent and participant assent forms. In Texas and Arizona, Spanish versions of all consent materials were available for Hispanic participants, and back-translation was performed on the consent and assent forms to ensure consistency between the language versions.

In Tucson, Arizona and Ithaca, New York, interventions were administered at participating high schools and follow-up surveys were administered at participating high schools or – for a subset of participants in

Ithaca – at Cornell University. In Arlington, interventions and follow-up surveys were administered at the University of Texas at Arlington or at the facilities of the Dallas Boys and Girls Club, and additional follow-up surveys were administered at the Arlington public library. Transportation was not arranged for participants, but contact was maintained with students who indicated an inability to attend a session because of a transportation issue and those students were kept informed of later sessions as they were scheduled.

Materials

Interventions

The contents of RTR, RTR+, and the control curriculum are described fully in Reyna (1999). As discussed in the introduction, RTR is a multi-component intervention grounded in social learning theory, social inoculation theory, and cognitive behavior theory. It emphasizes abstinence as an option to eliminate risk, as well as prophylactic measures that can be taken to reduce risk.

Aspects of RTR incorporating perspectives from social learning theory included role-playing activities and homework activities where the participants practiced behavioral skills taught during the class sessions. For example, one role-playing activity in RTR involved addressing misconceptions about the birth control pill. Following a class discussion about such misconceptions, two volunteer participants read a partially scripted, casual conversation between two hypothetical friends. One friend's statements were entirely scripted and included misconceptions about the pill, such as "the pill will make you fat." The other participant's lines were not scripted: Instead, the participant responded to those misconceptions using points covered during the preceding class discussion. Following the role-playing activity, the health educator led a follow-up discussion on how the misconceptions were addressed and possible alternative ways they could have been addressed. An example of behavioral skills training in RTR included a homework assignment that followed a class discussion of important factors to consider when purchasing condoms. For the assignment, participants were required to visit or call a local store that sold condoms, ask questions about key attributes discussed in class (latex versus animal skin, spermicidal vs. non-spermicidal, price, etc,), and to report on what they learned at the next class session, where the health educator lead a discussion encouraging the students to reflect on what they learned.

Social inoculation theory's emphasis on recognizing social pressure and having the motivation and capability to resist that pressure is also incorporated in class discussions and activities in RTR. Lessons and activities targeted participants' ability to recognize "warning signals" that suggest unsafe sex may be imminent (e.g., being home alone with a significant other, lights low and soft music playing, the presence of alcohol, etc.), and lessons covering multiple ways to "say no" to sex were practiced in role-playing scenarios. For example, following a discussion of refusal tactics – ways to get out of a situation where risky sex is imminent – participants role-played a partially scripted scenario where they employed the verbal tactics discussed in the previous lesson to avoid the hypothetical sexual advances of someone else (e.g., suggesting they are hungry and should go get something to eat, etc.). The lesson and follow-up discussion addressed salient concerns of dating teenagers, such as tactful ways to defuse such situations without offending their partner.

Finally, the personalization of information about sexual risk, one of the unique components of cognitive behavior theory, is also incorporated in RTR (there are several other components that overlap with social learning and social inoculation approaches, such as training in decision-making and communication skills). For example, one activity involved simulating pregnancy probability: Given the probability of becoming pregnant for one act of unprotected sex, and assuming one such act per month, participants in the class drew cards from a hat representing whether or not they became pregnant. Participants who became pregnant remained standing, and the activity continues for one simulated year. The activity was structured so that by the end of the year, all of the participants became pregnant (or had gotten someone pregnant). The activity was accompanied by an interactive class discussion about when exactly they became pregnant in the exercise, when they would have the baby, and what the pregnancy would mean to the participant. For example, participants discuss how the pregnancy and baby would affect their own plans for the future (such as going to college) and how it would affect their life in the short-term (such as involvement in extracurricular activities). Comparable discussions and activities were presented for STI infections.

RTR+ is an adapted version of RTR and therefore shares much of its content. Like RTR, it emphasizes abstinence as an option to eliminate risk in addition to prophylactic measures to reduce risk. The key difference between the two interventions is that in RTR+, additional attention is devoted to “framing” the types of sexual decisions adolescents are faced with in ways that should promote risk avoidance, according to recent theoretical advances in research on developmental trends in memory and decision-making.

Specifically, RTR+ accomplishes this by promoting gist extraction, automatic retrieval of values, and automatic application of values to gist representations. One modification of RTR+ that should facilitate the storage and long-term retention of key pieces of information was made by providing short, “bottom-line” summaries of important points of the day’s lesson at the end of each class. As discussed in the introduction, manipulations that target adolescents’ decision-making process at any of several stages were employed and are discussed next.

One such stage involves manipulating the differential saliency of competing representations of information at the time the information is encoded: detailed, quantitative, and verbatim versus qualitative, categorical, and gist-based. For example, RTR included a discussion of quantitative probabilities of various consequences associated with single unprotected and protected sexual acts. RTR+ had a similar discussion, but it also expanded on those quantitative numbers by emphasizing the cumulative probability of experiencing those consequences when repeatedly engaging in the behavior over time. By emphasizing the risk of the behavior *in the limit*, focus was redirected from the quantitative value of the risk (which carries little meaning for both adolescents and adults) to a categorical contrast between a potentially catastrophic event occurring with certainty versus not occurring with certainty.

Two other important stages involve encouraging the storage of relevant risk-avoidant values and importantly, facilitating participants’ ability to retrieve those values at the time a decision must be made. For example, RTR+ included an ongoing activity where participants continually updated a checklist of relevant values they endorsed throughout the class. The checklist was provided in an early session, and as the classes progressed, participants were encouraged to revise the checklist as they reconsidered the values that were important to them. The values were listed simply (e.g., “Avoid risk.”) and endorsements were requested in a categorical manner (either you endorse it or you do not), in line with keeping memorial representations of those values as simple and “gist-based” as possible. RTR+ health educators were trained to find ways to relate discussions of sexual risks in any session to values that were potentially important to adolescents and to encourage interactive discussions of those values. The categorical framing of the values on the checklist and the ongoing discussions throughout the classes (continually relating presented information and participant comments back to those values) encouraged differential storage of gist-based versions of those values. The ongoing nature of the activity provided repeated “reminders” of those values to participants, and the repeated discussions helped to cement and strengthen their storage in memory, facilitating participants’ ability to retrieve the values – and combine them with relevant risk representations – at the time a decision needed to be made in the months following the intervention.

Since many of the modifications of RTR+ involved providing the same information in RTR in addition to expanding on or summarizing that information, to keep the interventions at the same total duration, certain parts of RTR had to be cut in forming RTR+. All material that was cut in the creation of RTR+ was in keeping with principles that guided its formulation. For example, in an HIV risk activity where students categorized behaviors under green, yellow, and red lights (representing no, medium, and high risk), discussion of less relevant behaviors such as breast feeding (which appears in RTR) were cut from RTR+. Likewise, in class discussions about mistakes that can be made in using condoms, instead of discussing all the possible mistakes that could be made, RTR+ emphasizes the five most common and dangerous mistakes. When information needed to be removed, things that were deemed to have only a superficial relevance to the topic at hand were removed.

The control group received a curriculum that sought to improve participants' communication skills and contained no discussion of issues pertaining to adolescent sexuality. Examples of topics relevant to effective communication in adolescence that were touched on in the control curriculum included how to communicate displeasure without putting someone on the defensive, bullying and how to deal with it, and characteristics that are valued in a friend. For example, one class discussion focused on "you" versus "I" methods of communicating displeasure. "You" methods are accusatory and focus on directing blame towards someone else, whereas "I" methods emphasize how someone else's behavior impacts you and your feelings. A session on bullying involved the presentation of a taxonomy of bullying types, including a discussion of what types of bullying were more common in males versus females. Following this, students participated in interactive discussions where they reflected on the taxonomy and discussed hypothetical bullying scenarios and how they would deal with them. The control curriculum contained a comparable number of interactive activities as RTR and RTR+, and its total duration was the same as RTR and RTR+ (16 hours).

Measures

To enhance the reliability of all data collected, participants were reminded at multiple points throughout the class sessions that any information they provided – during the classes or on the surveys – was confidential. Participants were again reminded that their survey responses were confidential prior to each survey administration. Finally, participants and parents were made aware that a certificate of confidentiality was obtained from the National Institutes of Health for this study, which provided additional guarantees of participant confidentiality. Unless otherwise noted, all items and multi-item measures in this dissertation are coded in a direction reflecting more or more favorable assessments of the attribute or behavior in question. For example, higher scores on intentions scales reflect higher intentions to engage in the behavior, and higher scores on attitudinal scales reflect more favorable attitudes towards the behavior. Reliability analyses and item level statistics for all multi-items scales analyzed appear in Appendix A.

Sociodemographic variables.

Data were collected on several sociodemographic variables, including age, gender, ethnicity, and site of survey administration (Arizona, New York, and Texas), which were planned covariates for all analyses. For ethnicity, participants were asked "Which of the following groups best describes you?": Caucasian/White, Mexican-American/Chicano, Central American/South American/Puerto Rican/Cuban, African-American/Black, Asian-American, Native-American, or mixed ethnicity. Responses of White/Caucasian, some Hispanic response, or African-American comprised over 88% of the sample. For all analyses reported in this dissertation, Mexican-American/Chicano, Central American/South American/Puerto Rican/Cuban and mixed ethnicities with Hispanic origin are grouped into one Hispanic category. In addition, because a) Asian responses were the most frequently reported other ethnicity, and b) Asian response profiles in preliminary analyses closely paralleled those of White/Caucasian participants, White/Caucasian, Asian, and other responses are grouped together into one Caucasian/other category. Information on additional variables was requested and was used in building the imputation models discussed later in this chapter. These variables were: "What kind of grades do you usually get in school?" with "A's," B's," "C's," "D's," and "F's" as response options; "Do you get a free school lunch?" with "No," "Yes," and "Don't know" as response options; "Where do you live right now?" with "I live with both parents," "I live with a single parent," "I live with a parent and step-parent," "I live part time with both families (both parents have custody)," "I live with other relatives (not my parents)," "I live in a group home," "I live with a foster family," and "I live on my own or with friends" as response options (collapsed into a trichotomous "lives with" one, both, or no parents variable for the imputation models); "How important would you say religion is to you? (religiosity) with five response options ranging from "Not at all" to "Very; "In general, how many hours per day are you without any adult supervision?" with "Less than 1 hour," "1-2 hours," "3-4 hours," and "More than 4 hours" as response options; "What is the highest level your [parent] completed in school?" (asked separately for mother and father and averaged for a single parental education measure; "Don't know" responses were treated as missing and the answered item for the other parent – if present – was used for the overall score).

Behavioral measures

Primary outcome measures fall into two major groups: sexual behavior and prophylactic behavior. For sexual behavior, the first variable analyzed was the initiation status for participants who were sexually abstinent at presurvey (whether a participant initiated oral, anal, or vaginal sex during the study). Initiation status was determined in four steps. First, responses to the question “Have you ever had sex?” were consulted for an initial estimate of initiation status. Second, intermittent missed responses to this question were extended when logically appropriate. For example, a participant who missed the three month survey but provided a “no” response to the question above at presurvey, postsurvey, and six months could not have initiated in the interval between the postsurvey and three month follow-up, and likewise, a participant who said “yes” to the question at three months could not have initiated in later intervals. Third, participants who skipped the question “Have you ever had sex?” but provided “no” responses to the questions “Have you ever had vaginal sex?”, “Have you ever had anal sex?”, and “Have you ever had oral sex?” were treated as not initiating during the corresponding interval, and participants who answered “yes” to any of those latter three questions were treated as initiating during the corresponding interval. If participants showed a longitudinally inconsistent pattern of responses to these three questions (e.g., they said “yes” to “Have you ever had vaginal sex?” at presurvey but “no” at a later time point), these three questions were not consulted to update initiation status. Nonstandard definitions of sex – saying “yes” to “Have you ever had sex?” and “no” to specific questions about vaginal, anal, and oral sex – were treated as not initiating. Definitions of sex that excluded oral sex – saying “no” to “Have you ever had sex?” and “yes” to “Have you ever had oral sex?” – were treated as initiating.

Fourth, for participants who skipped the question “Have you ever had sex?”, responses to the question “How old were you the first time you had sex?”, if present at any time point, were cross referenced with dates of survey administrations to infer the participant’s initiation status at the time of the missed follow-up survey. For example, suppose a participant attended all sessions but the six month follow-up, answered “no” to “Have you ever had sex?” at presurvey, postsurvey, and three months, but said “yes” at the 12 months. In addition, at the 12 month follow-up the participant’s reported age of initiation was 16, but given their birthday, they would have been 15 at the time of the six month follow-up. This participant could not have initiated in the interval between the three and six month surveys, and their initiation time would be set to the period between the six and 12 month surveys. Seven additional participants reported an age of initiation that was close to the time of the missed follow-up survey, making inferences about initiation status at the missed survey point probable, as opposed to certain. For example, one participant who missed the three and six month follow-ups reported an age of initiation of 16 at 12 months, but turned 16 only three days before h/she would have taken the three month survey. With approximately 30.4 days in a month and 9 months between the three and 12 month surveys, the odds against that participant initiating in those three days are over 91:1. Five participants reported ages of initiation that fell within two weeks of the follow-up survey missed, and two participants reported ages that fell within 29 days. Analyses reported below show similar patterns regardless of how these participants are treated.

The second sexual behavior to be analyzed was the total number of sexual partners. Participants were separately asked questions about the total number of male and female sexual partners they had ever had. Skipped responses to these questions were cross-referenced with responses to the question “Have you ever had sex?” and values of zero were substituted if the participants answered “no” to the latter question and showed no pattern of inconsistencies in responses to that question. Gender-typical response patterns were assumed in cases where the participant provided one response to one of the questions and did not provide a response to the other: e.g., if a male indicated that they had some valid number of female partners (0, 1, 2, etc.) and left the number of male partners blank, a value of zero was substituted for the response to the number of male partners. Responses to each of these questions were then summed to create an overall number of partners variable. After summing, longitudinal inconsistencies in the responses were checked by subtracting responses at later time points from earlier time points. If this difference was negative, the response at the previous assessment was carried forward. For additional analyses, a trichotomized version of this variable was created that grouped responses of 2 or more into one category.

For prophylactic behavior, three measures of prophylaxis were analyzed in this dissertation. First, a prophylactic risk index (PRI) was calculated from questions about the types of prophylaxis used in the last three months and the total number of sexual encounters in the last three months. First, the total number of vaginal, oral, or anal sexual episodes in the last three months was calculated by summing responses to the write-in items “In the last three months, I had vaginal (regular) sex ____ times,” “In the last three months, I had oral sex ____ times,” and “In the last three months, I had anal (rectal) sex ____ times.” If the participant omitted responses to these specific questions but answered “No” to the general question “In the last three months, have you ever had vaginal, oral, and or anal sex?” the value of the summed variable was set to zero for that assessment. Second, the total number of prophylactic behaviors involving a condom in the last three months was calculated by summing responses to the questions “If you used contraception in the last three months, how many times did you use condoms (rubbers)?” and “If you used contraception in the last three months, how many times did you use condoms (rubbers) and foam?” Third, the proportion of protected sexual episodes was calculated by dividing the latter total (number of protected episodes) by the former (number of sexual episodes). Ratios greater than one (indicating more uses of prophylaxis than total sexual encounters) were set to one after the ratio was calculated. Scores of one and zero on PRI indicate maximum and minimum proportions of prophylactic behavior, respectively. Since participants who did not engage in sexual activity in the last three months are not less risk averse than participants who used prophylaxis at all occasions, those inactive participants were assigned a score of one on the PRI.

The second measure of prophylaxis analyzed was whether the participant used a condom the last time they had sex. Participants checked off one or more of six options to the question “If you have had sex, what method(s) of birth control did you and your partner use to prevent pregnancy the last time you had sex? ” The available options were “I have never had sex,” “No method was used,” “Birth control pill,” “Condom (rubber),” “Some other method (ex. Diaphragm, IUD),” and “I am not sure.” Affirmative “condom” responses at the 12 month assessment, or negative “condom” responses accompanied by no affirmative response to the item “I have never had sex” at the 12 month assessment, identified the eligible subject pool. Affirmative responses to both “Condom” and “No method was used” were excluded from analysis.

For the third measure of prophylaxis, the cumulative number of unprotected sexual encounters was calculated by subtracting the sum of the responses to the variables “If you used contraception in the last three months, how many times did you use condoms (rubbers)?” and “If you used contraception in the last three months, how many times did you use condoms (rubbers) and foam?” from the sum of the responses to the variables “In the last three months, I had vaginal (regular) sex ____ times,” “In the last three months, I had oral sex ____ times,” and “In the last three months, I had anal (rectal) sex ____ times.” Values on this new variable less than zero, indicating more protected sexual encounters than total sexual encounters, were set to zero. For analyses, a cumulative version of the variable was calculated by summing responses of the current time point with all previous time points. For additional analyses, a trichotomized version of this variable was created that grouped responses of 2 or more into one category.

Intentions

A measure of future sexual intentions was constructed from responses to five Likert-type items such as “Do you think you will have sex (or have sex again) during the next year?” Likewise, a prophylactic intentions scale was created from six Likert-type items such as “Do you intend to use a condom (rubber) when you have sex?” Individual items on both aggregated measures consisted of a five point scale ranging from *very unlikely* to *very likely* (scored from 0 to 4), and responses to each item were averaged for an overall score on each scale. On both aggregated intentions measures, higher scores imply higher intentions to engage in the respective behavior. A complete listing of items on the sexual and prophylactic intentions scales can be found in Tables A.1 and A.2 of Appendix A.

Attitudes

A measure of sexual attitudes was constructed from ratings of three Likert-type items such as “I believe it's OK for people to have sex with a steady boy/girlfriend,” and a prophylactic attitudes scale was created from 24 Likert-type items such as “I believe condoms should always used if a person my age has sex, even if the two people know each other very well.” In addition, a scale representing participants’ attitudes towards the consequences of pregnancy (Unger, Molina, & Teran, 2000) was created from 17 Likert-type items such as “It wouldn't be all that bad at this time in my life [if I had a baby]”. Individual items on each aggregated measure consisted of a five point scale ranging from *strongly disagree* to *strongly agree* (scored from 0 to 4), and responses to each item were averaged for an overall score on each scale. On each aggregated attitudinal measure, higher scores imply more favorable attitudes towards the respective behavior/consequences. A complete listing of items on these three attitudinal measures can be found in Tables A.3-A.5 of Appendix A.

Norms

Three scales composed of aggregated normative Likert-type items were constructed. A measure of perceived sexual norms was constructed from ratings of six items such as “Most of my friends have not had sex yet,” and “Most of my friends believe it's OK for people my age to have sex with a steady boyfriend or girlfriend.” Items included both descriptive and injunctive content for both peers and important adults. A measure of perceived parental sexual norms was constructed from four items reflecting the perceived sexual norms of participants' parents, such as "How would your mother feel about your having sex at this time in your life?" Items included only injunctive content. For prophylaxis, a measure of perceived prophylactic norms was constructed from ratings of eight Likert-type items such as "Most adults who are important to me believe condoms (rubbers) should always be used if a person my age has sex, even if the two people know each other very well," and "Most of my friends believe condoms (rubbers) should always be used if a person my age has sex, even if the girl uses birth control pills." Items included only injunctive content. Individual items on each aggregated measure consisted of a five point scale ranging from *strongly disagree* to *strongly agree* (scored from 0 to 4), and responses to each item were averaged for an overall score on each scale. On each aggregated normative measure, higher scores imply more permissive norms in the respective domain. A complete listing of items on these three normative measures can be found in Tables A.6-A.8 of Appendix A.

Perceived behavioral control/self-efficacy

A measure of perceived behavioral control was constructed from ratings of five Likert-type items such as "It is easy for me to get birth control." Likewise, a measure of self-efficacy in the ability to "say no" to sex was constructed from ratings of four Likert-type items such as "I feel comfortable refusing to have sex," and a measure of self-efficacy in using prophylaxis was constructed from ratings of six Likert-type items such as "I could succeed in using a condom (rubber) when I have sex." Individual items on each aggregated measure consisted of a five point scale ranging from *strongly disagree* to *strongly agree* (scored from 0 to 4), and responses to each item were averaged for an overall score on each scale. On each aggregated measure, higher scores imply higher perceived control/self-efficacy. A complete listing of items on these three measures can be found in Tables A.9-A.11 of Appendix A.

Risk/benefit perception

With the exception of global benefit perception, all measures discussed in this section were used previously in Mills, Reyna, & Estrada (2008). Gist-based risk perception was assessed on the survey in three ways. The first scale (categorical risk) contained nine items that measured categorical thinking about risk (e.g., ‘‘Even low risks happen to someone’’). Ratings were made on 5-point scales ranging from strongly disagree to strongly agree (scored from 0 to 4 and then averaged). The second scale (gist principles) contained 15 principles (e.g., ‘‘Avoid risk’’) that participants endorsed (or not) by checking off all items that applied to them; the number of endorsements was summed. A complete listing of items on these two measures can be found in Tables A.12 and A.13 of Appendix A. The third gist measure (global risk) simply asked participants to rate the personal risk of having sex as “none,” ‘‘low,’’ ‘‘medium,’’ or ‘‘high.’’ Similarly, a global benefit measure asked participants to rate the personal benefit of having sex on the same scale.

Verbatim-based risk perception was assessed with two measures. First, a specific-risks scale contained five items that mentioned concrete consequences of risky sexual behavior (e.g., pregnancy, HIV-AIDS) and required personal risk estimates of those consequences on 5-point scales ranging from strongly disagree to strongly agree (scored from 0 to 4 and then averaged). A complete listing of items on this measure can be found in Table A.14 of Appendix A. A second verbatim-based measure of risk perception required participants to quantify their risk of having a sexually transmitted disease (STD) on a subjective probability scale from 0 to 100.

Additional psychosocial mediators

Questions concerning several additional psychosocial mediators were also administered. Participants provided ratings of 27 items assessing knowledge about prophylaxis, sexual risk taking, pregnancy, and sexually transmitted infections (e.g., “Latex condoms prevent HIV better than animal skin condoms”) on five point scales ranging from “It is false” to “It is true” (scored from 0 to 4 and then averaged). Participants also provided ratings to three Likert-type items assessing the extent to which the participant recognized common warning signals of sex, such as “Being pressured or controlled in any way is a warning signal for unwanted sex,” on five point scales ranging from “Strongly disagree” to “Strongly agree” which were averaged. Third, participants rated the extent to which they agreed to 20 statements about the reasons to have – or to not have – sex, such as “I do not want to be a teen parent” and “I feel mature enough to make this decision,” on five point scales ranging from “Strongly disagree” to “Strongly agree,” which were averaged separately for reasons for and against sex, resulting in two 10-item scales: reasons to have sex and reasons to not have sex. A complete listing of items on these four scales can be found in Tables A.15-A.18 of Appendix A. Other psychosocial mediator variables used in building the imputation models included delinquent behavior, which was assessed with seven items (e.g., “How often in the last 6 months have you stolen something?”) on five point scales ranging from “Never” to “Almost every day” (scored from 0 to 4 and then averaged; α=.79), and the extent to which the participant is accepted by his or her peers was assessed with the Index of peer relations (Nurius, Hudson, Daley, & Newsome, 1988), a 25 item scale with items such as “I get along very well with my peers”, rated on five point scales ranging from “Rarely or none of the time” to “Most or all of the time” (scored from 1 to 5 and averaged; α=.94). A short form of the Marlowe-Crowne social desirability index (Reynolds, 1982) was also administered. Participants provided “True” or “False” responses to 13 items such as “No matter who I'm talking to, I'm always a good listener” (responses were coded 0 or 1 and averaged; α=.66).

Procedure

Peer Health Educator Training

The interventions were administered by undergraduate or graduate research assistants (RAs) trained in one of the health education or control curricula. Using educators only a few years older than the participants helped to establish a rapport with the classes, which facilitated interactive class discussions of sensitive topics. Prior to training, these RAs were randomly assigned to deliver one of the two treatment interventions (RTR or RTR+) or the control intervention, but to avoid contaminating the delivery of either intervention with material from the other, RAs were never assigned to both RTR and RTR+. Some RA’s assigned to one of the two treatment interventions were also cross-trained in the control curriculum. Over the course of the study, a total of 25 RAs successfully completed the training and delivered at least one of the three interventions to participants.

Each peer health educator received over 16 hours of training in their assigned intervention. First, training began by giving the trainee a notebook containing a complete copy of the curriculum, detailed timelines for discussion topics in each class session, protocols for managing all aspects of their interaction with participants, access to audio recordings of delivered by trained health educators to actual classes, and (for the two treatment interventions) literature on topics covered in the classes (e.g., covering different methods of prophylaxis and types of sexually transmitted infections). Trainees used this notebook to study the material on their own and reviewed the audio recordings outside of formal training sessions. Second, trainees sat in on formal training sessions with other peer health educators, allowing them to see how more advanced trainees were handling common questions, managing time, and directing class discussions. Third, trainees were required to formally deliver each session that would be administered to participants to a group of mock participants (consisting of other undergraduate and/or graduate laboratory members) to a criterion level of performance. This criterion was determined by monitoring a checklist of covered material to ensure that all content was covered, and by judging if the trainee demonstrated an ability to appropriately handle the typical classroom dynamics of a group of high school students (including disruptive behaviors). In between training sessions, trainees received feedback on their performance and repeated the session at other times until criterion performance was achieved. Throughout training and delivery of actual classes to participants, peer health educators consulted with each other and with senior research personnel to ensure new questions and discussion topics that participants raised during classes were being handled correctly and in a manner consistent with the content of the curricula.

Randomization

Participants were informed prior to enrollment that they would be randomized to one of three interventions. After parental consent and participant assent were received and once a sufficient number of volunteers (a minimum of five per intervention) had been recruited for classes at a site, computer-generated random numbers were used by research personnel (excluding health educators) to allocate enrolled participants to one of the three interventions, and for any participants who enrolled at the time of the presurvey (they did not enroll previously but arrived on the scheduled date with all consent materials signed), allocation was determined by drawing numbers from a bag. While participants were completing the presurvey, health educators were notified of intervention assignments and provided with class rosters so that the educator could notify students about times and locations of classes once participants completed the presurvey. There was no master allocation list for the entire study: Random numbers used for allocation were only generated once a set of classes were ready to run, after enrollment. Because of overlap in the responsibilities of research personnel (individuals involved in generating the random number sequence were involved in participant recruitment), this method was determined to be consistent with the goal of allocation concealment ("Consolidated Standards," 2007) in preventing foreknowledge of upcoming condition assignments during participant enrollment. Also noteworthy in this regard is that no participant was refused enrollment in the study (except for participants who arrived without signed consent forms): Consent materials distributed to potential participants contained all information about inclusion criteria, and participants effectively screened themselves prior to volunteering to participate.

During class sessions, health educators took attendance to ensure that random assignments were maintained and that dosage effects could be eliminated by scheduling makeup sessions with students who missed a class or a portion of a class. School personnel were not involved in the random assignment process. Final numbers across interventions are uneven for two reasons. First, an error was made late in the study and the allocation of 46 participants was not properly minimized (assignment was random but no constraints based on the current group sizes were placed on the assignments). Second, also late in the study covering the same subset of participants, two health educators trained in the control intervention were unable to continue working on the project. With the project nearing its end, rather than divert resources to training additional health educators and potentially under-enroll participants, the decision was made to distribute those participants randomly across the two treatment conditions. Two considerations suggest that these events are not threats to the validity of the random assignment: 1) Peer health educators were randomly assigned to interventions, making the loss of the control educators a random occurrence, and 2) as illustrated in Table 2, participants in each intervention group showed a high degree of consistency across a wide range of variables at presurvey, indicating that random assignment was effective.

Intervention delivery

Upon arrival to the first scheduled session, participants completed the presurvey (1-2 hours) before beginning one of the three interventions. Upon completion of the presurvey, participants were informed who their peer health educator would be, and details about where and when meetings would take place were provided. Participants were then led to their designated location (e.g., another classroom) by their peer health educator and the intervention began. When the schedule for a given set of classes prevented administration of anything other than the presurvey on the first day, participants were simply informed of the location and meeting time for the next class.

All participants in each condition received 16 hours of contact time in their intervention. Due to scheduling constraints of individual health educators, participants, and schools (e.g., school and participant schedules vary throughout the year due to seasonal changes in things such as active extracurricular activities), there was variability in how these 16 hours were scheduled. A typical short schedule would involve meeting for two hours each weekday, after school hours, for a period of two weeks. A typical longer schedule would involve meeting for two hours on Mondays, Wednesdays, and Fridays, after school hours, for three weeks. In each intervention, curriculum content was grouped into individual sessions of approximately two-hour duration, and class durations were therefore scheduled in multiples of two hours to ensure that classes did not abruptly end in the middle of a lesson. The shortest time-frame over which the full 16 hours was delivered was two days (23 of 734 participants), and the longest time-frame was 40 days (eight of 734 participants). The average duration during which the 16-hour interventions were delivered was 15.2 days. 83.7% of participants received their full 16 hour intervention in 21 days or less.

To ensure an appropriate balance between interactivity and participation/individual attention, a minimum of five participants and a maximum of 15 were enrolled in any set of 16-hour classes. Any missed sessions were made up by the peer health educator by scheduling an additional meeting time to cover the missed content with the participant. In addition, if a participant arrived 15 minutes late to a class or left in the middle of a class for over 15 minutes, the participant was required to either stay late to cover the missed content or to come in early for the next class to cover it. No participant was allowed to complete the postsurvey until they had received all curriculum content.

Intervention fidelity was monitored in three ways. First, when administering the intervention, peer health educators used the same checklists they were trained with. The checklists included curriculum content (e.g., discussion topics) and amounts of time to spend discussing each topic. As each item was covered, it was checked off. Educators were therefore able to consult the checklist at the end of a session to ensure that all content was covered, and if anything wasn't, they covered it at that time. Second, sessions delivered by health educators were recorded on digital audio recorders, and these recordings were monitored by senior research personnel at regular intervals to ensure all content was being covered and to provide feedback to educators, when necessary. Third, educators met periodically with investigators and senior research personnel to discuss any new questions or topics of discussion that arose during classes that the training did not prepare them for. For example, detailed questions about specific conditional probabilities, such as the chances of specific types of STI transmission given anal versus vaginal intercourse, occasionally arose, and health educators consulted with senior personnel after the class and delivered an answer at the next session. Finally, one potential threat to the validity of the study involves possible communication about the curriculum's topics among members of the treatment and control groups. Given the sizes of the target schools, potential contamination was unlikely. Contamination was further diminished by the administration of the curricula outside of the normal class periods, reducing immediate opportunities for discussion with peers. Thus, the potential bias was small, but if it existed, it would operate to diminish differences among groups, providing a more conservative estimate of intervention efficacy.

Survey administration and data collection

At the beginning of each survey administration, survey administrators made several scripted reminders to participants. Once participants were all seated, the payments that would be received for completion of each survey and how much they would receive for the current survey was discussed, and participants were reminded that their answers were confidential. Administrators also reminded participants to respect the privacy of their peers and to not share answers or look at other participants' surveys. Requests were made to complete the entire survey, but it was noted that if a participant did not feel like answering any question, they did not have to. Finally, participants were asked to notify survey administrators if their address or contact information had changed or if it would be changing, and to provide updated contact information if so. After all reminders were discussed, survey administrators distributed pens and surveys to all participants and wrote the date on a chalkboard at the front of the class or – if a chalkboard was not available –provided it directly to participants. Participants then filled this date in on an initial item on the survey's first page. To protect their privacy, participants were also reminded not to enter their full name, only their initials. Next, participants were instructed to turn to a specific page of the survey with commonly misunderstood questions, and instructions on how to answer those questions were provided (instructions also appeared on the survey). The specific items were questions that required specific numbers to be written in as responses, not X's or checkmarks (e.g., "In the last three months, I had vaginal (regular) sex ___ times"). After this, they were instructed to begin.

Participants were allotted as much time as they needed to complete the survey, which consisted of 314 sociodemographic, psychosocial, and behavioral questions. Students typically completed the survey in less than 90 minutes. As participants handed in their surveys, they were placed in a manilla envelope and cash or check payments for completion ($75 at postsurvey, $15 at three months, $30 at six months, and $45 at 12 months) were handed to the participant. The participant was then reminded of their next survey administration date. Survey administrators monitored the survey administration until all participants were finished, and brought lists with definitions of common terms (e.g., methods of prophylaxis, STI's) so that answers to any potential questions could be quickly provided.

Surveys were stored behind at least two locked doors in filing cabinets in the investigators' laboratories. Surveys were printed on non-scantron forms through January of 2005, during which time data were hand-entered directly into SPSS. From that point on, scantron versions of the survey were created with Autodata Scannable Office software. Completed surveys were scanned with a Panasonic high-speed scanner, and the software stored the data in Microsoft Access databases. These Access databases were imported into SPSS, SAS, or STATA for analysis. The use of scannable forms drastically facilitated data entry, but it was not fully automated: The software was programmed to query the person scanning the survey on any item requiring a handwritten character response (such as dates, initials, or numerical responses), and the person had to confirm that the software's optical character recognition routine had correctly read the item. Research personnel entering data also visually confirmed the correct entry of all other items on the survey (Likert-type items requiring marking a bubble): The entry of no data point was left up to the software alone. Both scannable and non-scannable surveys were periodically pulled and cross-referenced with corresponding entries in the databases to ensure data were entered correctly.

Special procedures were instituted to minimize participant attrition. As noted previously, a graduated payment schedule was employed that placed higher incentives on attending survey sessions participants were more likely to miss (namely, the time-intensive interventions and after that, sessions further removed in time). Second, a meaningful and engaging control group was used to minimize both differential attrition of control group members and Hawthorne effects. Third, tracking and locator information was obtained at the first session, including multiple additional phone numbers (if available), email addresses, and the names, phone numbers, and addresses of three "personal contacts" (such as cousins, grandparents) who could locate the participant if research personnel were unable to make contact through direct methods. Fourth, initial reminders of upcoming survey sessions were made at least three weeks in advance. If verbal contact was not made, a voice message was left (if the participant had an answering machine) and additional contact attempts were made daily until the participant was reached or until the participant returned the call to confirm the scheduled appointment.

Finally, peer health educators aggressively pursued the scheduling of make-up sessions for missed classes and missed surveys, and made multiple attempts to accommodate any scheduling conflicts of participants. When a participant indicated they could not attend a session at the university because of a transportation issue, an alternative survey session with that participant was scheduled at or within walking distance of a location the participant frequented (e.g., at their high school). Attempts to reschedule specific survey sessions continued until participants stated they were no longer interested in participating, or until the scheduled time fell closer to a subsequent survey session, whereupon the participant was confirmed as missing for the past session and attempts to schedule the participant for upcoming sessions began.

Statistical Analyses

Analyses and data management were performed using STATA SE statistical software, version 10 (Stata Corp, College Station, TX), SAS, version 9 (SAS Institute Inc, Cary, NC) and SPSS, version 15 (SPSS Inc, Chicago, IL). Analyses were performed using an intent-to-treat protocol in which participants were analyzed in their assigned intervention regardless of the number of follow-up sessions attended (Piantadosi, 1997; Pocock, 1993). Baseline descriptive statistics were calculated to characterize initial sociodemographic, psychosocial, and behavioral variables across conditions (Table 2). Differences between conditions were examined with ANOVA and χ^2 analyses for continuous and categorical variables, respectively. As discussed previously, five percent of these baseline variables would be expected to differ between conditions based on chance alone. The observed percentage of variables that differed was 4.3%. Following recent recommendations advising against the inclusion of variables as covariates in planned analysis simply because of detected differences at baseline (Altman, 1998; Assmann, Pocock, Enos, & Kasten, 2000), these variables were not adjusted for in analyses. Instead, standard demographic variables – age, gender, ethnicity, and site – were included as covariates in all analyses for theoretical reasons and to facilitate comparisons with other intervention studies. Effectiveness was assessed over the entire 12 month period; because the largest effects for many of the variables should occur immediately post-intervention, and because differences in content between the treatment interventions theoretically imply differential long-term effects, particular attention was directed to intervention efficacy at postsurvey and at the 12 month follow-up assessment.

The repeated measures on participants in this study produce observations that are not independent. Although the use of statistical procedures that ignore this correlation between observations is fairly common (as many as 63% of published analyses apply inappropriate statistical techniques to longitudinal data; Gøtzsche, 1989; "Consolidated Standards," 2007), key assumptions about independence or about the nature of the correlation between the repeated measurements – such as the sphericity assumption of repeated measures analysis of variance (RMANOVA) – are violated. More generally, error terms in standard linear regression models (which underlie the ANOVA approaches) are assumed to be normally and independently distributed, an unlikely scenario when outcomes are repeatedly observed from the same individuals. In addition, in such models restrictive assumptions are made about the starting points (intercepts) for individual subjects, and change over time (slopes) are assumed to be constant for individuals. That is, the variances and the covariances of the repeated observations are assumed to be equal, and this assumption of compound symmetry is a sufficient – but not necessary – condition for RMANOVA (the less restrictive sphericity assumption – which concerns equality of the covariances of *differences* between the repeated observations – is a necessary and sufficient condition). The sphericity assumption – and by implication, the compound symmetry assumption – is usually untenable for longitudinal data: Measurements closer in time tend to be more highly correlated than measurements separated by longer intervals, and variances of the responses often change over time. Statistical analyses of repeated observations reported in this dissertation – such as multilevel models and the use of sandwich estimators for standard error calculations – take the correlated nature of the data into account by explicitly modeling the factors that give rise to the correlations or by using variance estimators that are robust to alternative covariance structures. Modeling the correlations in a regression framework confers other advantages as well: Since time is treated as a continuous variable, participants do not have to be measured at the same time points, and the use of direct maximum likelihood estimation permits valid inference under more flexible assumptions about the underlying mechanisms that generate attrition patterns.

Unless noted otherwise, in all analyses time was coded in months, age (at presurvey) in years, the reference group for ethnicity was Caucasian/other, the reference group for gender was male, the reference group for site was Texas, and the reference group for intervention was the control group. Age at presurvey was used because age throughout the study is collinear with month of assessment. The remaining subsections in this section discuss specific analytic techniques that were used, beginning with how missing observations were addressed.

Multiple imputation of missing data

A wide variety of techniques are available for handling missing observations, and a formal framework for understanding and dealing with missing data patterns was provided by Rubin (1976). Three types of underlying processes, or missing data mechanisms, could generate a set of response patterns in a database, and available analytical methods vary with respect to which mechanism they are valid under. First, if missing observations are *missing completely at random* (MCAR), the probability of an observation being missing has no relation to observed or unobserved values. Second, the less restrictive *missing at random* (MAR) assumption states simply that this probability has no relation to unobserved values: Given the observed data, the process that generated the missing data pattern – and the probability a data point is missing – does not depend on values that were not observed. Finally, when neither MCAR nor MAR holds, the data are *missing not at random* (MNAR), and the process that generated the missing data pattern is *non-ignorable* in the sense that valid inference requires specifying a joint mechanism of both the data and the missingness mechanism. For example, MNAR would hold if the chance that a participant left a clinical trial depended upon how they responded to the treatment. Specifying an appropriate model for a non-ignorable missing data mechanism is often impossible.

As with methods of handling correlated observations, many commonly employed methods for dealing with missing data require assumptions about the missing data mechanism that are not likely to hold true. For example, complete case analysis – only analyzing participants that have observations at all time points – is required for analysis of variance methods but produces valid inferences only under the restrictive MCAR assumption. Complete case analysis is also highly inefficient in that high proportions of participants can be excluded, even if the probability that any individual item is missing is low. Molenberghs et al. (2006) have shown that the commonly used method of *last observation carried forward* (LOCF) – extending the last observed response through later missing responses – produces invalid estimates even under MCAR. Like LOCF, other single imputation methods suffer from similar drawbacks: Mean substitution can artificially deflate variances and relations with other variables, point regression predictions artificially inflate those relations, and all single imputation methods treat imputed values the same as observed values, ignoring the uncertainty inherent in the original pattern of missing data (Allison, 2002; Graham, Cumsille, & Elek-Fisk, 2003; Peugh & Enders, 2004; Schafer & Graham, 2002; Wothke, 2000).

In contrast, multiple imputation (Rubin, 1976) offers an alternative that combines information about how the variable relates to other variables in the database while factoring in – and quantifying – the uncertainty arising from the fact that the data point was originally missing. Imputation models for relevant variables are specified (e.g., regression models for continuous variables, logistic models for dichotomous, variables, and multinomial logistic models for categorical variables with more than two levels), and the imputations are repeated a certain number of times (there are diminishing returns on increasing numbers of imputed datasets, and the number required to generate reliable point estimates is surprisingly small; Rubin, 1987). Datasets are simultaneously analyzed and coefficient estimates are combined. Resulting standard errors of estimates incorporate both within imputation variance and between imputation variance, and resulting analyses are valid under the MAR assumption.

For the present analyses, standard recommendations were followed for building the imputation models (Schafer & Olsen, 1998). First, variables designated to appear as predictors in final models across all dependent measures – intervention and the demographic covariates age, gender, ethnicity, and site – were automatically included in all imputation models. This ensures that relationships between these variables and the dependent variables to be analyzed are preserved in the imputed values (e.g., analyzing the relation between Y and X without including Y in X's imputation model – or vice versa – would underestimate Y's effect).

Second, variables were identified that predicted patterns of missingness observed in the data. To do this, a nominal variable was created with levels corresponding to the types of attendance patterns present in the data. Each variable in the database was used to predict the observed value of this pattern variable in separate multinomial logistic regression analyses. Variables that significantly predicted one or more of these patterns were site (missed sessions were less likely in Arizona), whether the participant lived with both parents (living with both parents was linked to a decreased chance of missing a subsequent session), parental education (more education was linked to an increased chance of later attendance), and how frequently the participant used marijuana (more frequent use was negatively related to subsequent attendance). Site was already designated as a variable to include, and each of the remaining variables were added to the imputation models for all variables. This ensured that imputed values incorporated information about missingness patterns.

Third, additional variables of direct theoretical relevance to the study were added to all imputation models. These variables were gist principles, categorical risk perception, perception, global benefit perception, and relative and absolute risk perception, two items in the gist principles section of the survey (participants provided dichotomous endorse/do not endorse responses to the items "Less risk is better than more risk" and No risk is better than some risk"). This ensured that observed relations between theoretical and dependent variables were preserved in the imputed data.

Fourth, key behavioral variables and variables immediately proximal to those behavioral variables (intentions) were added to all imputation models. This ensured that relations with these key outcome variables were preserved in the imputed data.

Fifth, for each variable to be imputed, correlation matrixes were inspected to identify any additional potential predictors of that variable, and once identified, those variables were also added to the relevant imputation model. This ensured that any other possible relation that existed in the raw data was preserved in the imputed data.

Once the sets of predictor variables had been determined for all variables, appropriate models were assigned to each variable: Continuous variables were imputed via multiple regression, dichotomous variables via logistic regression, polytomous variables via multinomial logistic regression, and interval-censored variables via interval regression. Since Poisson or negative binomial models are not available as imputation models in current software packages supporting multiple imputation, ordinal logistic regression models were specified for count outcomes. STATA's ICE routine (Carlin, Galati, & Royston, 2008; Royston, 2007) was used to impute 10 datasets, and STATA's MIM prefix was used in subsequent analyses to instruct STATA to analyze all imputed datasets and produced combined parameter estimates, standard errors, confidence intervals, and associated significance tests.

Discrete time survival analysis

Like survival analysis, discrete time survival analysis (DTSA) allows the researcher to assess how the incidence of some behavior varies with time and other variables. The discrete form is typically used when point estimates of the time of "death" (or initiation of sexual behavior) are unavailable. For example, if the timing of initiation must be collected through retrospective reports, such reports may be untrustworthy and researchers may opt instead to have participants provide information pertaining to whether they initiated since the last time they were assessed. Such data are interval censored, and initiation times of sexual activity in the present data have this characteristic. Discrete time survival analysis was used to assess the effect of the interventions on the likelihood of initiating sexual activity at various times throughout the study.

734 participants completed the intervention and constituted the initial pool of participants eligible for inclusion in intervention efficacy analyses. Following extensions of the values discussed in the *Measures* section of this

chapter (e.g., if a participant missed one session but continued to report lifetime abstinence at later sessions, they were set to abstinent at the missing session, etc.), 269 participants were excluded from the DTSA because they were sexually active at presurvey (the only things known about such participants' initiation interval is that it occurred prior to the beginning of the study, and hence cannot be included). Next, an additional 30 participants who provided a pattern of logically inconsistent responses that precluded determination of their initiation time were excluded from the analysis. 25 of these participants provided a longitudinally inconsistent pattern of responses to the question "Have you ever had sex?" (e.g., reporting past sexual activity at one session and lifetime abstinence at a later session), and five of these participants provided an age of initiation that was inconsistent with their age at the time they reported initiating (e.g., providing an age at which they first had sex of 15 years old, but providing a "yes" response to the question "Have you ever had sex?" that implied initiating during an interval when they were 16 years old throughout the entire interval). Possible alternative explanations involving time-varying definitions of sex were explored before removing a participant. For example, suppose a participant reported initiating between the postsurvey and three month survey ("yes" to the question "Have you ever had sex?"), and a check on responses to questions about specific types of sexual behavior (vaginal, oral, and anal) revealed that the participant had only had oral sex. If that participant then reported lifetime abstinence at the 12 month survey ("no" to "Have you ever had sex?"), responses to the question "Have you ever had oral sex?" would be checked at 12 months to ensure that the participant's definition of sex had not changed. If they still responded "yes" to the oral sex question and had not had vaginal or anal sex, their definition of sexual activity now excluded oral sex. Such a participant would be marked as initiating between the postsurvey and three month survey and would remain in the analysis. In contrast, if the same participant responded "no" to the oral sex question at 12 months, they were deemed to have an incoherent response pattern and were excluded. To ensure that the same subset of participants was being analyzed across all relevant dependent variables, the same 30 participants were excluded from all other analyses reported in this dissertation. For the discrete time survival models, this left a total of 435 participants who a) were sexually abstinent at presurvey, and b) had an identifiable time at which sexual activity was initiated (or not), and these participants where therefore eligible for inclusion.

Extended values of responses to the question "Have you ever had sex?" identify whether the participant initiated in previous intervals. These responses were used to calculate an initiation status variable, defined as whether the participant had initiated sexual activity in the interval immediately following the corresponding assessment. This reoriented the analytical question to whether predictor variables assessed at a given time (e.g., month of follow-up survey) would be associated with the probability of initiating in the interval that immediately followed (as opposed to the interval that immediately preceded). Finally, values were imputed according to the procedures outlined in the previous subsection. Since survival analysis properly accounts for right-censored cases at any time, only intermittent-missed response patterns were imputed. A total of 15 participants showed such patterns, and therefore only 3.4% of the eligible pool of 435 participants had data imputed for this analysis.

The DTSA was run with STATA's logit command combined with the mim prefix to combine analyses on all imputed datasets according to Rubin's

(1987) rules. A logistic regression was run on a long-form (or stacked form, where each subject is represented by multiple rows corresponding to each observation) database, predicting the probability that a participant's initiation status was one (initiated) or zero (had not initiated) from a set of covariates. Output from such a model is identical to that from logistic regression. Several sets of models were examined. As a discrete-time model, no constraints are imposed on the form of the hazard function over time: Time was treated categorically with dummy-codes representing the four intervals during which sexual activity could be initiated (presurvey to postsurvey, postsurvey to 3 months, 3 months to 6 months, and 6 months to 12 months). Within all models, interval 1 was the reference group for the set of interval dummy codes. As with subsequent analyses, the control intervention was the reference group for the two intervention dummy variables, Caucasian/other ethnicity was the reference group for the ethnicity variable, male was the reference group for gender, and Texas was the reference group for site. A baseline model restricted to effects of time was compared with a second model that added demographic covariates (age, gender, ethnicity, and site). A third model added intervention main effects, and a fourth model relaxed the proportional odds assumption – which states that the effect of a covariate is similar across levels of other covariates – for intervention by adding its interaction with each dummy-coded interval. A final reduced-interaction model was assessed that retained theoretically important components of the interaction effect (as is common in discrete-time models; see Willett & Singer, 1993). In all models, odds ratios, standard errors, confidence intervals for estimates, and model hazard and survival probabilities were calculated.

Random effects models

For continuous dependent measures such as multi-item scales (sexual/prophylactic intentions, knowledge, attitudes, etc.), PRI, and the number of sexual partners/unprotected sexual encounters, random effects regression models, implemented with the STATA command xtmixed, were used to analyze data from 704 participants. Such models (which are also referred to as hierarchical linear models, multilevel models, growth curve models, or linear mixed models) account for the correlated nature of longitudinal data by assuming that intercepts and possibly the slopes of estimated regression lines have a random component. For example, for a given continuous dependent variable measured over time in a specific subject, the regression line relating time to that dependent variable consists of a set of predicted values, and the residuals for those predictions are the deviations from observed values. In a standard multiple regression framework, those residuals consist of a pure subject and occasion-specific error term. In a random effects framework, that residual is separated into a subject specific random component (the random intercept) that is constant over time points and a subject and occasion-specific component unique to each subject-occasion combination. The estimated random intercepts observed in the sample therefore correspond to random variation (or individual differences) in the vertical height of the regression lines (hence, a random intercept) for individual subjects that are not due to model covariates. Since it is constant for individual subjects – it contributes the same amount to all observations from a given subject – it is a source of correlation between observations. Similar considerations apply to random slopes: e.g., we could assume that there are random individual differences in the slope of the regression lines over time that have nothing to do with model covariates, and such differences would also contribute to the correlation between responses over time. The important point is that random effects models provide ways of explicitly testing whether these random components are necessary, and if so, they provide means of explicitly estimating them so that the overall model takes the correlation between the responses into account. Key output from random effects regression models includes fixed effect parameter estimates for model covariates, which are interpreted in the same way that regression parameters are interpreted in standard multiple regression: For a unit increase in the predictor, the dependent changes by an amount equal to the value of the parameter, holding all other covariates constant. Also provided are random effect parameter estimates, which are in the form of variances: The variance of the intercept and, if necessary, the variance of the random slope is estimated.

For all analyses, up to three phases of model testing proceeded in a hierarchical manner. The first phase involved tests of the necessity of a random slope. If a random slope was deemed necessary, alternative covariance structures were compared next (note that if a random slope is not included, there is only one random effect, and therefore there is no covariance matrix of those random effects). Finally, the effect of adding various groups of fixed predictor variables was assessed (e.g., baseline models, covariate-adjusted models, and interaction models). The need for a random slope was tested by comparing a full model with a random effect for time (the time trend is assumed to be a random variable – hence, a random slope) and a subject-specific random intercept (the adjusted starting point – the intercept – for each subject is assumed to be a random variable) with a model that excluded a random slope. If a likelihood ratio test suggested that removing the random slope did not significantly degrade model fit, a random intercept model was retained and comparisons between different sets of fixed predictor variables began.

If the removal of the random slope significantly degraded model fit according to a likelihood ratio test, a random coefficient model (one that includes both a random intercept and a random slope) was retained and alternative covariance structures of those two random effects were then assessed. Hierarchical comparisons of covariance structures were compared with likelihood ratio tests by imposing constraints of typical covariance structures on a completely general (or unstructured) covariance matrix. For a random coefficient model with one random intercept and one random slope, an unstructured covariance matrix involves estimating three parameters of a 2 X 2 covariance matrix: two variances and one covariance. An independent structure, nested in the general structure, involves the estimation of two variances and assumes the covariance to be zero. An exchangeable structure, also nested in the general structure (but not in the independent structure) involves estimating two parameters as well: one common variance parameter and one covariance parameter. Finally, whereas the exchangeable structure imposes equality on the variances and assumes a non-zero covariance, an identity structure, nested in all aforementioned structures, estimates one parameter by assuming equal variances and zero covariance. Given the pattern of nesting, likelihood ratio tests were used to compare the independent and exchangeable structures with the general structures, and if both significantly degraded model fit, the identity structure was also compared with the general structure. If either the independent or exchangeable structure fit the data as well as the general structure, an identity structure was compared with the independent/exchangeable structure. As with testing both a random intercept and a random slope, the general purpose of testing alternative covariance structures was to ensure that the correlated nature of the data was being appropriately modeled so that point estimates of effects generalize beyond this sample of participants. Given that there are no theoretical reasons to expect random intercepts and slopes to have the same degree of variability or to be correlated in this data, an independent structure was anticipated for all models. As discussed in the results chapter, this was observed for the vast majority of dependent variables examined.

Once an appropriate set of random effects and, if necessary, a covariance structure had been determined, alternative sets of fixed covariate effects were examined. Three different models were initially compared. In all models, the presurvey score on the dependent measure was entered as a covariate (unless noted otherwise), and the time trend was modeled from postsurvey to the 12 month assessment. First, a baseline model including only the effects of intervention, month of assessment, and the presurvey score on the dependent measure was fit to the data. Second, a covariate model including all baseline variables plus effects of age, gender, ethnicity, and site was fit. Third, the interaction between time and intervention was added in a variable time trend model (effects of time are allowed to vary by intervention: hence, variable time trend). Likelihood ratio tests were used to compare the baseline to the covariate model, and the covariate to the variable time trend model. Because it is typical in this field of research to present effects adjusted for the common covariates of age, gender, and ethnicity, the covariate model was always accepted at minimum (however, to examine the potential confounding influence of those covariates on intervention effects, coefficients and likelihood ratio tests involving the baseline model are also presented in the results chapter).

For psychosocial mediator variables, upon accepting the covariate or variable time trend model, the boundaries of those effects were probed by separately examining intervention interactions with age, gender, and ethnicity (referred to as the extended model in later sections). For the covariate/variable time trend and extended models, linear combinations of coefficients were estimated to test hypotheses not explicitly provided by the present model parameterization (see Appendix B).

Models for other categorical dependent variables

Analysis of whether condoms were used at the last sexual encounter was conducted by using logistic regression implemented with STATA's logit command. In addition to random effects analyses on the number of sexual partners and the number of unprotected sexual encounters, trichotomized versions of these variables were created and analyzed with multinomial logistic regression. Whereas probabilistic models such as logistic regression allow a dichotomy to be predicted from a set of covariates, the multinomial extension of these models allows category membership for a polytomous variable to be predicted from a set of covariates. Key output from a multinomial logistic model parallels that of other regression approaches, including parameter estimates, standard errors, confidence intervals, and associated significance tests. A key difference however is that separate sets of parameter estimates are produced for k-1 levels of a polytomous dependent variable with k levels, with one level serving as a reference category. Exponentiated parameter estimates correspond to relative risk ratios: the effect of a unit change in the corresponding predictor on the ratio of the risk of falling into category k of the dependent variable versus the risk of falling into the reference level of the dependent variable. Like odds ratios, a relative risk ratio of one means that the predictor does not change the risk, a relative risk ratio greater than one means the risk increases with a unit increase in the predictor, and a relative risk ratio less than one means the risk decreases with each unit increase in the predictor. STATA's mlogit command combined with the mim prefix was used to fit these models on data from 704 participants for both the cumulative number of sexual partners and the cumulative number of unprotected sexual encounters. Since random effects versions of multinomial models are less well developed, correlations between responses were handled by using the Huber-White sandwich estimator (Huber, 1967; Long & Ervin, 2000; White, 1980) to estimate standard errors, implemented with the cluster option of STATA's mlogit command (with subject as the cluster).

CHAPTER 3
RESULTS

Sexual Behavior

Intervention efficacy for sexual behavior was assessed by analyzing two primary outcome variables: time to initiation and the number of sexual partners. The former variable was analyzed with a set of discrete time survival models and the latter with random effects regression and multinomial logistic regression.

For the discrete time survival analysis, raw hazards for each intervention – representing the conditional probability of initiating sexual activity in a specific interval, given sexual abstinence in previous intervals – can be found in Table 3.1. Overall, hazards show an increasing trend across intervention groups: Hazards are unsurprisingly low during the first interval –

Table 3.1. Raw hazard rates for initiating sexual activity, by intervention.

	Intervention		
Interval	Control	RTR	RTR+
1 (Presurvey to Postsurvey)	.016	.054	.044
2 (Postsurvey to 3 months)	.039	.072	.046
3 (3 months to 6 months)	.064	.082	.083
4 (6 months to 12 months)	.189	.159	.095

Note. Values represent the probability of initiating sexual activity given no sexual activity in previous intervals, and are not adjusted for demographic background variables.

which represents the time during which the intervention was administered (on average, two weeks) – and show a monotonically increasing trend for all groups throughout the study. During the final interval, just under one in five participants in the control condition initiated sexual activity, compared to roughly one in ten participants in the modified intervention. The standard

Table 3.2. Odds ratios from discrete-time survival analysis of sexual initiation times.

	Model				
Variable	Baseline	Covariate	Intervention	Full	Reduced
Interval 2	1.32	1.36	1.36	2.50	1.37
Interval 3	2.04*	2.13*	2.13*	4.28	2.15
Interval 4	4.11‡	4.34‡	4.33‡	15.31‡	9.12‡
Arizona		0.81	0.84	0.83	0.83
New York		1.53	1.50	1.52	1.51
Age		1.07	1.06	1.06	1.06
Hispanic		1.29	1.29	1.30	1.30
African-American		1.81*	1.78*	1.81*	1.80*
Female		0.83	0.84	0.84	0.84
RTR			1.16	3.20	1.69
RTR+			0.94	2.75	1.52
Interval 2 X RTR				0.54	
Interval 2 X RTR+				0.43	
Interval 3 X RTR				0.36	
Interval 3 X RTR+				0.49	
Interval 4 X RTR				0.21	0.40
Interval 4 X RTR+				0.16*	0.29*

Note. Reference for interval 2-4: interval 1; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other; reference for intervention = RTR and RTR+: Control.
*$p<.05$, ‡$p<.001$

intervention fell in between these two groups during the final interval.

As noted in the methods, model testing proceeded in several steps. A summary of estimated coefficients from baseline, covariates, intervention, and full and reduced interaction models can be found in Table 3.2. Detailed summary statistics for latter three models can be found in Tables D.1-D.3 of Appendix D.

Odds ratios for time effects show a consistent trend across models, even after adjusting for baseline covariates and intervention effects. In each of these first three models, the odds of initiating sexual activity – relative to the odds during the first interval (presurvey to postsurvey) – are approximately twice as high during the third interval (three months to six months) and over four times as high during the fourth interval (six months to 12 months). The odds of initiating sexual activity during the second interval (postsurvey to three months) are 32-36% higher than in the first interval, but this increase did not reach statistical significance.

Across all relevant models, demographic covariates showed similar trends as well, but only the effect of being African-American reached statistical significance. Among the non-significant effects, a one year increase in participants' age at presurvey was associated with a six to seven percent increase in the odds of initiating sexual activity, being Hispanic (relative to Caucasian/other) was linked to a 29-30% increase, and being female (relative to male) decreased the odds of initiating by 16-17%. Being African-American, however, was linked to a significant 78-81% increase in the odds of initiating sexual activity (relative to being Caucasian/other).

The overall effect of intervention across time points – adjusting for demographic covariates – was assessed in the "intervention" model. Odds ratios reveal that relative to participants assigned to the control intervention, participants assigned to the standard intervention (RTR) were 16% more likely to initiate sexual activity over the course of the study, while participants assigned to the modified intervention (RTR+) were six percent less likely to initiate. Neither effect reached statistical significance.

However, a qualification to that finding is revealed by inspecting changes in the effect of intervention assignment over time – also adjusting for demographic covariates – in the full and reduced interaction models. Before a discussion of those effects, some comments on the interpretation of odds ratios in models containing categorical interaction terms are warranted. First, it is important to note that the principles of interpreting interaction effects in regression models (discussed in Appendix C) are exactly the same; there is simply the additional complication of a transformation of the dependent variable when modeling a dichotomous variable. In a model containing no interaction terms, the effect of a variable is interpreted as the effect of a unit change in the covariate on the criterion (here, the logit transformation of the probability of initiating sexual activity), holding all other variables constant. However, when a variable participates in an interaction with another variable, it is no longer possible to hold other terms in the regression equation constant while varying the covariate of interest, because that covariate is also a component in the term representing the interaction. As a result, "main effect" terms in an interaction model take on a different meaning than in models where they do not participate in an interaction effect: They now represent the effect of the covariate at the reference level of the variable they interact with. For example, in a model with main effects A, B, and their interaction, A*B, the coefficient for A corresponds to the effect of a unit change in A on the criterion *when B is at zero*.

In the full interaction model of Table 3.2, odds ratios for the intervention effects indicate that participants in the two treatment groups had odds of initiating that were 3.20 and 2.75 times as high as participants in the control group, *during the first interval*. Neither effect reached statistical significance. This (nonsignificant) effect during the initial interval can also be seen in Table 3.3 and Figure 3.1, which plots estimated hazards for the full interaction

Table 3.3. Estimated hazard rates for initiating sexual activity in the full model, by intervention.

	Intervention		
Interval	RTR	RTR+	Control
1 (Presurvey to Postsurvey)	0.046	0.040	0.015
2 (Postsurvey to 3 months)	0.061	0.043	0.036
3 (3 months to 6 months)	0.069	0.079	0.060
4 (6 months to 12 months)	0.136	0.091	0.187

Note. Values represent the probability of initiating sexual activity given no sexual activity in previous intervals, and are estimated for the baseline profile on demographic variables (Age=16, male, ethnicity = Caucasian/other, site=Texas) in the full interaction model.

model (although hazards are probabilities, they approximate their corresponding odds when the event is infrequent). Raw parameter estimates from logit models are in log-odds form, and exponentiating those coefficients provides odds ratios. After exponentiation, categorical interaction terms in logit models represent relative changes in the odds ratios across levels of another variable: They are ratios of odds ratios. Recall from Appendix C

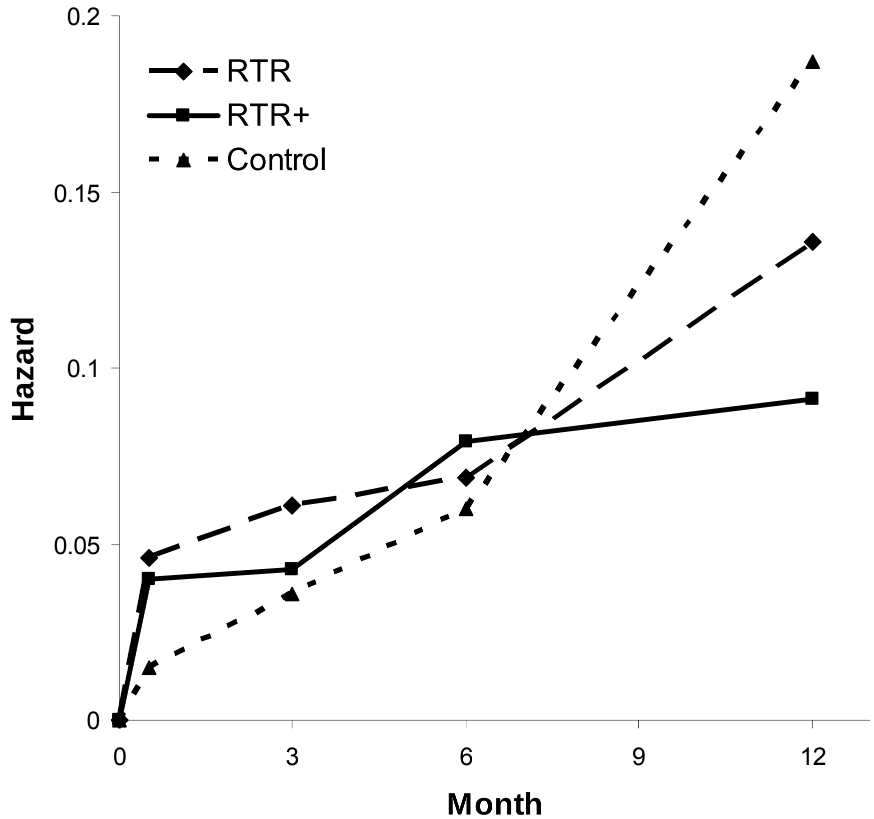

Figure 3.1. Estimated hazard functions from the full interaction discrete-time survival model, by intervention.

that interaction effects involving dichotomous terms in simple linear regression can be thought of as estimates of "differences of differences." Precisely the same concept is involved in probability models such as logistic regression, but since logarithms are used, the algebra of logarithms can be used to interpret those estimates in the language of the exponentiated coefficients. In other words, since ln(a/b) = ln(a) - ln(b), a "difference of differences" corresponds directly to a ratio.

For example, in Table 3.3, the estimated hazards from the full interaction model during the fourth interval for RTR+ and Control groups are .091 and .187, respectively. In the first interval, the same hazards are .040

and .015, respectively. Dividing by their complements transforms these values to odds:

RTR+, Fourth interval:	.091/(1-.091) = .100
Control, Fourth interval:	.187/(1-.187) = .230
RTR+, First interval:	.040/(1-.040) = .042
Control, First interval:	.015/(1-.015) = .015

The odds ratio for RTR+ in the fourth interval is therefore .100/.230 = .435, and the odds ratio for RTR+ in the first interval is therefore .042/.015 = 2.80. As can be seen in the full interaction model in Table 3.2, within rounding error, the coefficient for the interval 4 by RTR+ interaction term is a ratio of these odds ratios: .435/2.80 = .16. Put differently, the odds ratio for the final interval among RTR+ participants is .100/.042=2.38, and the odds ratio for the final interval among control participants is .230/.015=15.3. Within rounding error, a ratio of these odds ratios (2.38/15.3) is equal to the same number, .16.

With this in mind, the significant interval 4 by RTR+ interaction effect in the full interaction model of Table 3.2 becomes clear: The odds ratio of .16 indicates that the interval 4 odds of initiating sexual activity in RTR+ (relative to the interval 4 odds for the Control group), are 84% lower than the ratio of the same odds during the first interval. Alternatively, between interval 1 and interval 4, participants in RTR+ have 84% less of an increase in the odds of initiating sexual activity than the control group. That is, over the full course of the study, participants in RTR+ become significantly less likely to initiate sexual activity than participants in the control group: The overall risk of initiating in the final interval is cut in half for participants in RTR+ (estimated hazards of 0.091 vs. 0.187, Table 3.3). No interaction at other time points reached statistical significance. The form of this interaction can also be seen in the hazard functions plotted in Figure 3.1 and the survival functions plotted in Figure 3.2 (survival probabilities represent the cumulative probability of *not* initiating sexual activity in a specific interval, given sexual abstinence in previous intervals; they can be derived directly from the hazards and depict how trends in the absorbing event accumulate over time).

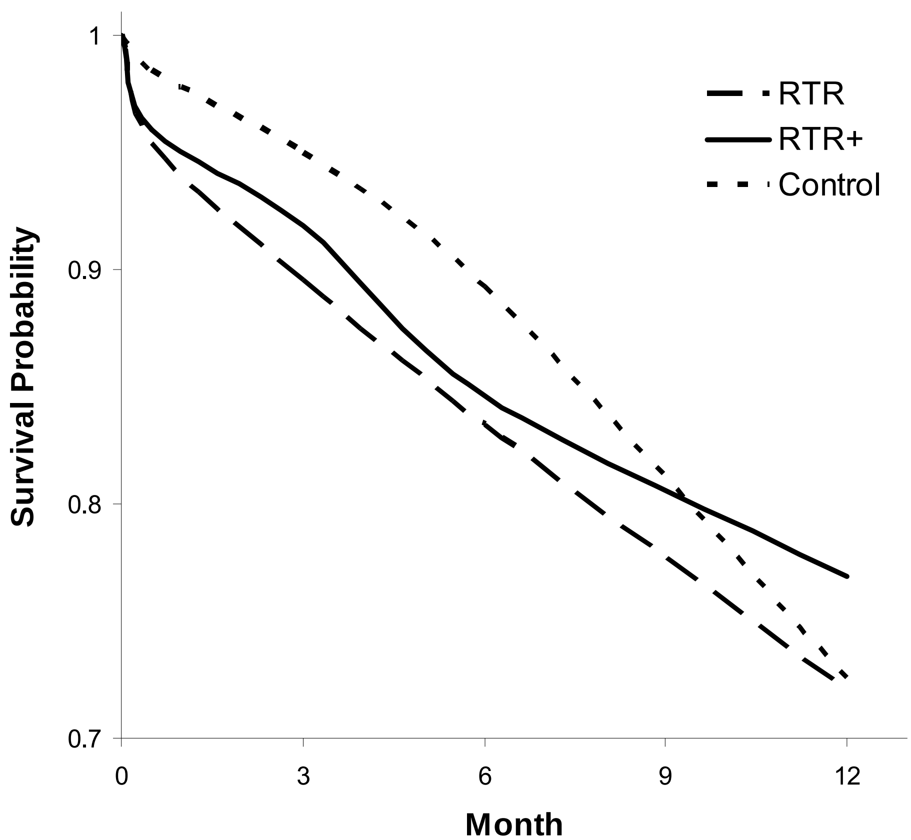

Figure 3.2. Estimated survival functions from the full discrete-time survival model, by intervention.

In a final model that adjusted for baseline covariates (the reduced interaction model of Table 3.2), non-significant interaction terms were dropped and the model refitted. Figures 3.3 and 3.4 give hazard and survival functions for the reduced model, respectively. With all interaction terms involving the second and third intervals dropped, reference groups for the remaining interaction terms have changed, and the significant value of .29 indicates that during the fourth interval, participants in RTR+ have a reduction in the odds of initiating sexual activity of approximately 71%, relative to control participants *across all other intervals*. The corresponding odds-reduction for participants in RTR during the same interval was 60%, which did not reach statistical significance.

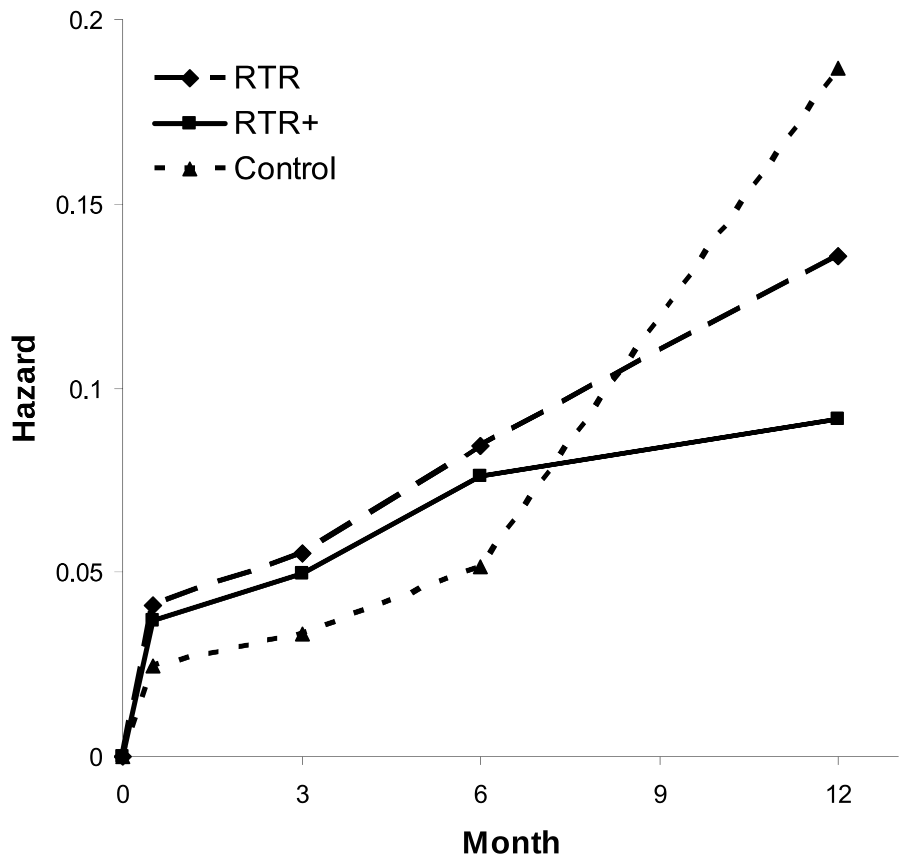

Figure 3.3. Estimated hazard functions from the reduced interaction discrete-time survival model, by intervention.

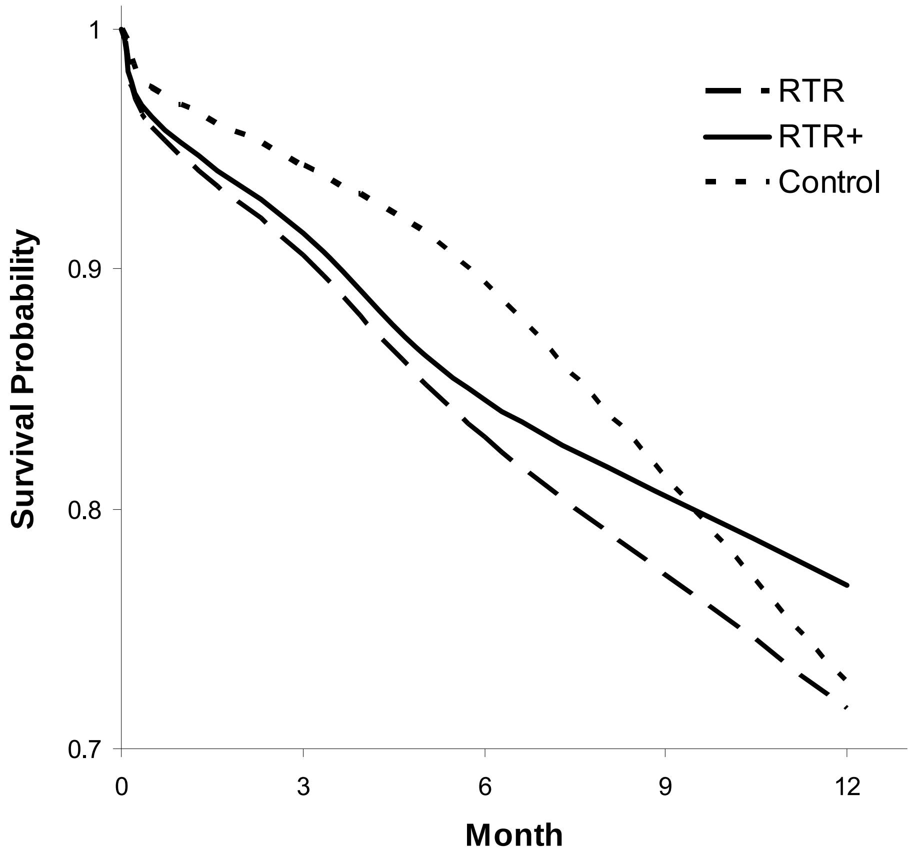

Figure 3.4. Estimated survival functions from the reduced interaction discrete-time survival model, by intervention.

For a second set of analyses on sexual behavior, linear random effects regression models and multinomial logistic regression were used to test effects of intervention assignment on the total number of sexual partners reported by participants, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure significantly degraded model fit relative to an unstructured covariance matrix; and 3) an identity matrix significantly degraded model fit relative to the general structure. Therefore, the general structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.4.

Table 3.4. Hierarchical comparisons of random effect models and covariance structures for number of sexual partners.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	7188.5	7284.9	17			
Random intercept	7888.4	7973.4	15	703.89	2	0.000
Covariance structure of random effects						
Unstructured	7188.5	7284.9	17			
Exchangeable	8291.5	8382.2	16	1105.06	1	0.000
Independent	7195.8	7286.5	16	9.29	1	0.002
Identity	8511.7	8596.7	15	1327.21	2	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.

Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity covariates made a marginal improvement in fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model (Table 3.5). In the covariate

Table 3.5. Comparison of baseline, covariate, and variable time trend models for number of sexual partners.

	Model		
Variable	Baseline	Covariate	Variable Time Trend
Presurvey	1.13***	1.13***	1.13***
RTR	-0.289	-0.284	-0.289
RTR+	-0.337*	-0.345*	-0.348*
Month	0.073***	0.074***	0.082***
Arizona		0.157	0.157
New York		0.091	0.090
Age		-0.072	-0.072
Female		-0.357**	-0.357**
Hispanic		0.203	0.203
African-American		0.115	0.115
Month X RTR			-0.016
Month X RTR+			-0.009
Intercept	0.338**	1.591	1.595
Slope (sd)	0.171***	0.171***	0.171***
Intercept (sd)	1.69***	1.68***	1.68***
Correlation	0.176**	0.176**	0.177**
Residual (sd)	0.633	0.635	0.634
Difference df		6	2
Difference G^2		10.77	0.58
p		0.0957	0.7491

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; full model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

model, there was a significant positive effect of the number of partners reported at presurvey: More reported partners before the interventions were associated with higher reports over all time points after the interventions. In addition, participants in RTR+ reported significantly fewer partners overall than did participants in the control group. There was also a positive effect of

Table 3.6. Estimated means for the covariate model for number of sexual partners.

	Month			
Intervention	0	3	6	12
CONTROL	1.61 (.16)	1.83 (.16)	2.05 (.17)	2.49 (.19)
RTR	1.32 (.16)	1.54 (.16)	1.77 (.17)	2.21 (.19)
RTR+	1.26 (.16)	1.48 (.16)	1.70 (.17)	2.15 (.19)

Note 1. Means estimated at the following covariate values: Pretest=1.03, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

month – the reported number of partners tended to increase over time – and females reported significantly fewer partners than males. Linear contrasts revealed no overall differences between RTR+ and RTR (χ^2 (1)=0.14, p=.71), Arizona and New York participants (χ^2 (1)=0.04, p=.83), or between African-Americans and Hispanics (χ^2 (1)=0.14, p=0.71). Detailed summary statistics for the covariate and variable time trend models can be found in Tables D.4 and D.5 of Appendix D. Estimated means from the covariate model can be found in Table 3.6 and Figure 3.5.

As a count variable, the number of sexual partners is positively skewed, with most participants reporting zero, one or two partners and a smaller number of participants reporting higher numbers that are free to take on any positive integer value. To address this positive skew, in a separate analysis

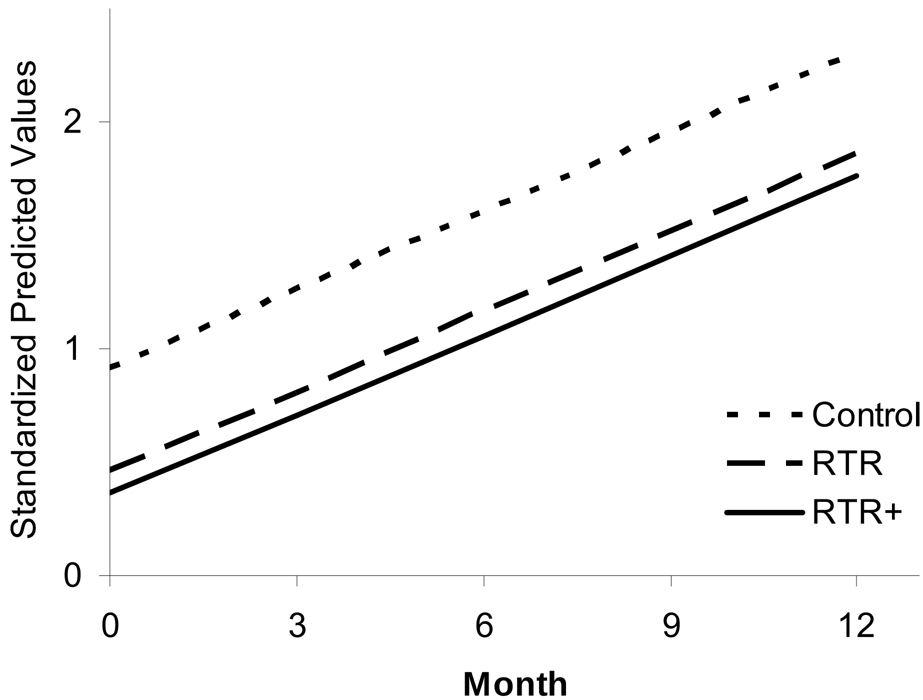

Figure 3.5. Fitted fixed-effect regression lines for number of sexual partners, covariate model.

responses of two or more were grouped together and multinomial logistic regression was used to model the probability that a participant reported none, one, or two or more partners over time. As discussed in the methods section, exponentiated coefficients from multinomial logistic models are in the form of relative risk ratios, which are interpreted much like odds ratios. Separate sets of coefficients are produced for k-1 levels of the dependent variable with k levels, excluding a designated reference group. For a given covariate, its coefficient represents the effect of a unit change in its value on the ratio of the risk that a participant falls in the designated group of the dependent variable versus the risk that it falls in the reference group of the dependent variable. The results of separate logistic regressions on all pairwise combinations of the polytomous dependent variable produce similar estimates. For example, with gender coded 0=male 1=female and the reference of the dependent set to zero partners, the one-partner coefficient for gender corresponds to how much more (or less) likely females are to fall into the one partner category relative to the zero partner category. A value greater than one would indicate that females have a higher one-partner to zero-partner risk ratio than males: Females would be at relatively higher risk of falling into the one-partner category than males.

Correlation between responses of individual participants due to the repeated measures design were handled by using the sandwich estimator (Huber, 1967; Long & Ervin, 2000; White, 1980) for standard error calculations, which yield estimates that are robust to violations of model assumptions (e.g., that the data are independently and identically distributed). Initial models adjusting for the response to the trichotomized dependent variable at presurvey produced perfect prediction errors for that parameter, indicating that some combination of covariates including that variable was always associated with a specific response on the dependent variable. Sexual intentions at presurvey – which should also capture variation in baseline rates of sexual behavior – was therefore used as a presurvey covariate.

Tests of time by intervention interactions did not reach significance. In the covariate model (Table 3.7), there were positive effects of presurvey sexual intentions and month on the risk of having either one or two or more sexual partners (relative to zero unprotected encounters), which means that higher initial sexual intentions increase the relative chances of reporting one versus zero and two versus zero partners overall, and over time each of those chances increases as well. For example, the coefficient of 1.17 for month in the 2+ partner section of Table 3.7 indicates that for each unit increase in

Table 3.7. Multinomial logistic regression estimates for the number of sexual partners.

Variable	RRR	SE	t	p	95% CI for RRR	
One Partner						
Presurvey	3.01	0.33	9.96	0.000	2.42	3.74
RTR	1.04	0.28	0.13	0.896	0.61	1.77
RTR+	1.10	0.28	0.39	0.698	0.67	1.80
Month	1.11	0.01	7.87	0.000	1.08	1.14
Arizona	0.52	0.15	-2.21	0.027	0.29	0.93
New York	0.49	0.18	-1.91	0.057	0.24	1.02
Age	1.57	0.16	4.35	0.000	1.28	1.93
Female	1.78	0.36	2.84	0.005	1.19	2.65
Hispanic	1.87	0.56	2.08	0.038	1.04	3.38
African-American	1.08	0.27	0.3	0.763	0.66	1.76
2+ Partners						
Presurvey	6.16	0.91	12.3	0.000	4.59	8.26
RTR	0.90	0.24	-0.38	0.705	0.53	1.53
RTR+	0.81	0.22	-0.8	0.423	0.47	1.37
Month	1.17	0.01	14.94	0.000	1.15	1.19
Arizona	0.63	0.20	-1.46	0.145	0.34	1.17
New York	0.33	0.13	-2.73	0.007	0.15	0.73
Age	1.87	0.21	5.51	0.000	1.50	2.34
Female	1.77	0.39	2.62	0.009	1.15	2.72
Hispanic	1.04	0.36	0.12	0.907	0.53	2.06
African-American	1.73	0.46	2.08	0.039	1.03	2.92

Note 1. RRR = Relative risk ratio; Presurvey = Presurvey score on sexual intentions.
Note 2. Reference for outcome: zero sexual partners; reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

month (a change of one month), the ratio of the risk of reporting two or more partners versus zero partners increases by 17%.

For one partner to zero partner risk ratios, other significant findings included: Participants from Arizona were significantly lower than participants from Texas, older participants were significantly higher than younger participants, females were significantly higher than males, and Hispanics were significantly higher than Caucasians. Specifically, the one partner to zero partner ratio was 48% lower for Arizona participants than Texas participants: Arizona participants were relatively less likely than Texas participants to report having one partner. A unit increase in age (one year) was linked to 57% increase in the relative risk of reporting one partner. Females had a risk ratio that was 78% higher than males, and Hispanics were 87% higher than Caucasians. In other words, females were relatively more likely to report one partner than males, and Hispanics were relatively more likely to report one partner than Caucasians.

For two partner to zero partner risk ratios, other significant findings included: significantly higher risk ratios for older participants (relative to younger participants), females (relative to males), and African-Americans, and significantly lower risk ratios for New York participants (relative to Texas participants). Specifically, each unit increase in age (one year) was linked to a 17% increase in the relative risk of reporting two or more versus zero encounters: Older participants become relatively more likely to report two or more partners. Females had a relative risk that was 77% higher than that for males, meaning that females were relatively more likely to report two or more partners than males. New York participants had a relative risk that was 67% lower than Texas participants, meaning that New York participants were relatively less likely to report two or more partners than Texas participants. Finally, the coefficient of 1.73 for African-Americans indicates that they had 73% more relative risk than Caucasians: They were relatively more likely to report two or more partners than Caucasians.

Table 3.8. Estimated relative risks for the covariate model of number of sexual partners.

	Month			
	0	3	6	12
One Partner				
CONTROL	0.136	0.185	0.250	0.460
RTR	0.141	0.191	0.259	0.477
RTR+	0.150	0.204	0.276	0.507
2+ Partners				
CONTROL	0.130	0.208	0.333	0.854
RTR	0.118	0.188	0.301	0.772
RTR+	0.105	0.168	0.269	0.688

Note 1. Means estimated at the following covariate values: Presurvey sexual intentions=2.15, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values represent the risk of having one (or two or more) sexual partners relative to the risk of zero sexual partners.

In contrast to the random effects framework, intervention effects did not reach significance, although as seen in Table 3.8, effects of RTR+ are trending in the same direction for two or more unprotected encounters: A coefficient of .81 (Table 3.7) indicates that the relative risk of reporting two or more unprotected encounters is 19% lower overall for RTR+ participants than for control participants. This finding suggests that the significant effect of

RTR+ in the random effects model is due to additional variation in the reported number of partners in the two or more category that is eliminated upon trichotomizing the variable.

Prophylactic Behavior

Intervention efficacy for sexual behavior was assessed by analyzing three outcome variables. Random effects regression was used to model the ratio of protected sexual encounters to total sexual encounters (PRI), and logistic regression was used to model whether or not condoms were used at the last sexual encounter. In a final set of analyses, the total number of unprotected sexual encounters was analyzed with random effects regression, and a variation on that analysis was run by trichotomizing that variable and predicting category membership with multinomial logistic regression.

For the PRI, linear random effects regression models were used to test effects of intervention assignment, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure significantly degraded model fit relative to an unstructured covariance matrix; and 3) an identity matrix significantly degraded model fit relative to the general structure. Therefore, the general structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.9.

Table 3.9. Hierarchical comparisons of random effect models and covariance structures for PRI.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	347.70	443.46	17			
Random intercept	457.35	541.84	15	113.65	2	0.000
Covariance structure of random effects						
Unstructured	347.70	443.46	17			
Exchangeable	430.50	520.63	16	84.81	1	0.000
Independent	353.91	444.04	16	8.22	1	0.004
Identity	445.41	529.91	15	101.72	2	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.

Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity covariates made a significant improvement in fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model (Table 3.10). In the covariate model, there was a significant positive effect of the PRI at presurvey: A higher PRI before the interventions were associated with a higher PRI over all time points after the interventions. In addition, the PRI tended to decrease over time and older participants reported a significantly lower PRI than younger participants. Linear contrasts revealed no overall differences between RTR+

Table 3.10. Comparison of baseline, covariate, and variable time trend models for PRI.

	Model		
Variable	Baseline	Covariate	VTT
Presurvey	0.608***	0.590***	0.590***
RTR	-0.028	-0.035	-0.034
RTR+	-0.002	-0.007	-0.003
Month	-0.005**	-0.005**	-0.004
Arizona		-0.018	-0.018
New York		0.028	0.028
Age		-0.026**	-0.026**
Female		-0.017	-0.017
Hispanic		0.015	0.015
African-American		0.026	0.026
Month X RTR			-0.001
Month X RTR+			-0.001
Intercept	0.340***	0.774***	0.772***
Slope (sd)	0.025***	0.025***	0.025***
Intercept (sd)	0.162***	0.161***	0.161***
Correlation	-0.287**	-0.308***	-0.308***
Residual (sd)	0.201***	0.202***	0.202***
Difference df		6	2
Difference G^2		15.35	0.16
p		0.0177	0.9248

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; full model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

and RTR (χ^2 (1)=2.15, p=.14), Arizona and New York participants (χ^2 (1)=1.64, p=.20), or between African-Americans and Hispanics (χ^2 (1)=0.15, p=.69).

Table 3.11. Estimated means for the covariate model for PRI.

	Month			
Intervention	0	3	6	12
CONTROL	0.85 (.02)	0.83 (.02)	0.82 (.02)	0.79 (.02)
RTR	0.81 (.02)	0.80 (.02)	0.78 (.02)	0.76 (.02)
RTR+	0.84 (.02)	0.83 (.02)	0.81 (.02)	0.78 (.02)

Note 1. Means estimated at the following covariate values: Pretest=0.82, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

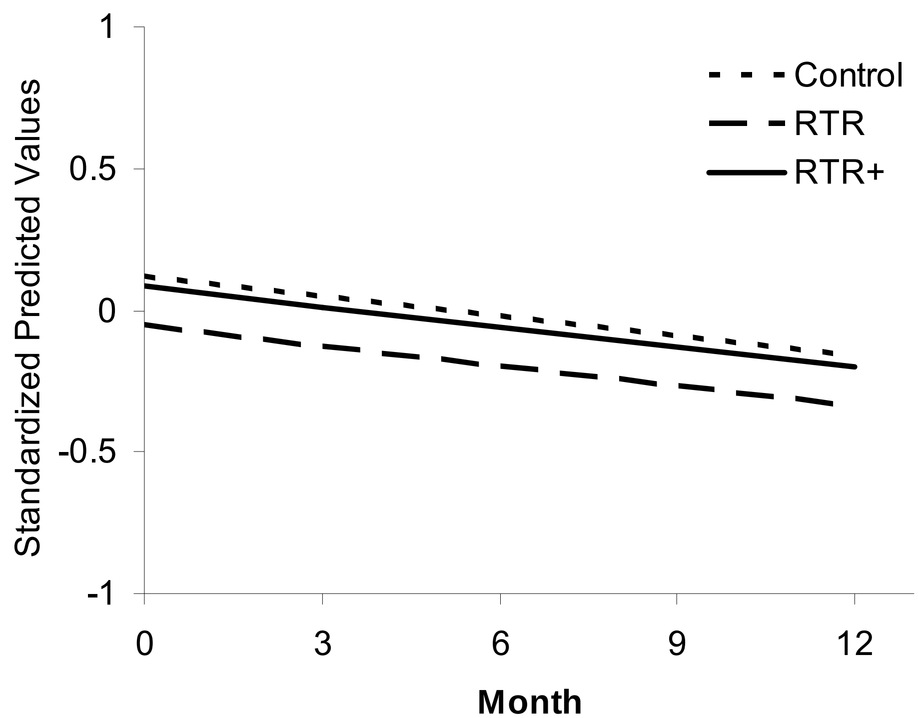

Figure 3.6. Fitted fixed-effect regression lines for PRI, covariate model.

Detailed summary statistics for the covariate and variable time trend models can be found in Tables D.6 and D.7 of Appendix D. Estimated means from the covariate model can be found in Table 3.11 and Figure 3.6.

An additional analysis on the effects of the interventions on prophylactic behavior was conducted by analyzing the probability that condoms were used at the last sexual encounter. Logistic regression was used to test effects of intervention assignment, adjusting for covariates discussed in the methods section. The initial model had errors of perfect prediction resulting from covarying the presurvey response on the dependent measure (some

Table 3.12. Estimated coefficients from logistic regression predicting condom use at last sexual encounter.

Covariate	Odds Ratio	SE	t	p	95% CI for b	
Presurvey	2.505	0.490	4.69	0.000	1.706	3.677
RTR	0.981	0.377	-0.05	0.961	0.461	2.090
RTR+	0.612	0.218	-1.38	0.168	0.304	1.232
Arizona	1.297	0.549	0.61	0.540	0.565	2.978
New York	2.629	1.773	1.43	0.152	0.700	9.879
Age	0.955	0.140	-0.31	0.755	0.716	1.275
Female	0.859	0.249	-0.52	0.600	0.487	1.517
Hispanic	0.808	0.336	-0.51	0.608	0.358	1.826
African-American	1.866	0.643	1.81	0.071	0.948	3.671

Note 1. Presurvey = Presurvey score on prophylactic intentions.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

combination of covariate values was always associated with a specific value on the dependent variable when the presurvey response on the dependent measure was included in the model). Therefore, a comparable covariate – prophylactic intentions at presurvey – was used that should also capture variation in the baseline tendency to use prophylaxis. Estimates from the model appear in Table 3.12. There was a significant effect of presurvey prophylactic intentions: Participants with higher initial intentions to use prophylaxis were more likely to use a condom at the last sexual encounter. In addition, African-Americans were marginally more likely to use prophylaxis than Caucasians. No effects of intervention assignment were detected.

A final set of analyses on prophylactic behavior was conducted by analyzing the cumulative number of unprotected sexual encounters using random effects regression and multinomial logistic regression, adjusting for covariates discussed in the methods section. In the random effects models, the removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure significantly degraded model fit relative to an unstructured covariance matrix; and 3) an identity matrix significantly degraded model fit relative to the general structure. Therefore, the general structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.13.

Table 3.13. Hierarchical comparisons of random effect models and covariance structures for number of unprotected sexual encounters.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	13499.9	13594.4	17			
Random intercept	15367.6	15451.0	15	1871.8	2	0.000
Covariance structure of random effects						
Unstructured	13499.9	13594.4	17			
Exchangeable	13524.2	13613.1	16	26.31	1	0.000
Independent	13505.3	13594.3	16	7.46	1	0.006
Identity	13538.6	13622.0	15	42.77	2	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity covariates did not significantly improve fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model (Table 3.14). In the covariate model, there was a significant positive effect of the number of unprotected sexual encounters at presurvey: More unprotected encounters before the interventions predicted more unprotected encounters over all time points after the interventions. In addition, unprotected encounters tended to increase over time. Although coefficients for both RTR and RTR+ indicated that treatment effects are trending in a theoretically sensible direction, neither effect reached statistical significance. Linear contrasts revealed no overall differences between RTR+ and RTR ($\chi^2(1)=0.10$, p=.75), Arizona and New

Table 3.14. Comparison of baseline, covariate, and variable time trend models for number of unprotected sexual encounters.

	Model		
Variable	Baseline	Covariate	VTT
Presurvey	1.846***	1.844***	1.844***
RTR	-0.299	-0.287	-0.302
RTR+	-0.570	-0.458	-0.454
Month	0.675***	0.672***	0.666***
Arizona		-0.465	-0.470
New York		-0.770	-0.766
Age		0.368	0.368
Female		0.011	0.009
Hispanic		0.515	0.518
African-American		0.362	0.368
Month X RTR			0.244
Month X RTR+			-0.143
Intercept	0.648	-5.303	-5.299
Slope (sd)	2.096***	2.096***	2.096***
Intercept (sd)	3.935***	3.896***	3.896***
Correlation	0.262*	0.261*	0.269*
Residual (sd)	4.855***	4.855***	4.855***
Difference df		6	2
Difference G^2		5.24	2.28
p		0.5131	0.3197

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; full model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

York participants ($\chi^2(1)=0.09$, p=.77), or between African-Americans and Hispanics ($\chi^2(1)=0.04$, p=.85). Detailed summary statistics for the covariate

Table 3.15. Estimated means for the number of unprotected sexual encounters.

	Month			
Intervention	0	3	6	12
CONTROL	4.31 (.53)	6.33 (.61)	8.34 (.81)	12.37 (1.3)
RTR	4.02 (.52)	6.04 (.60)	8.05 (.81)	12.08 (1.3)
RTR+	3.85 (.52)	5.87 (.60)	7.88 (.80)	11.91 (1.3)

Note 1. Means estimated at the following covariate values: Pretest=2.01, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

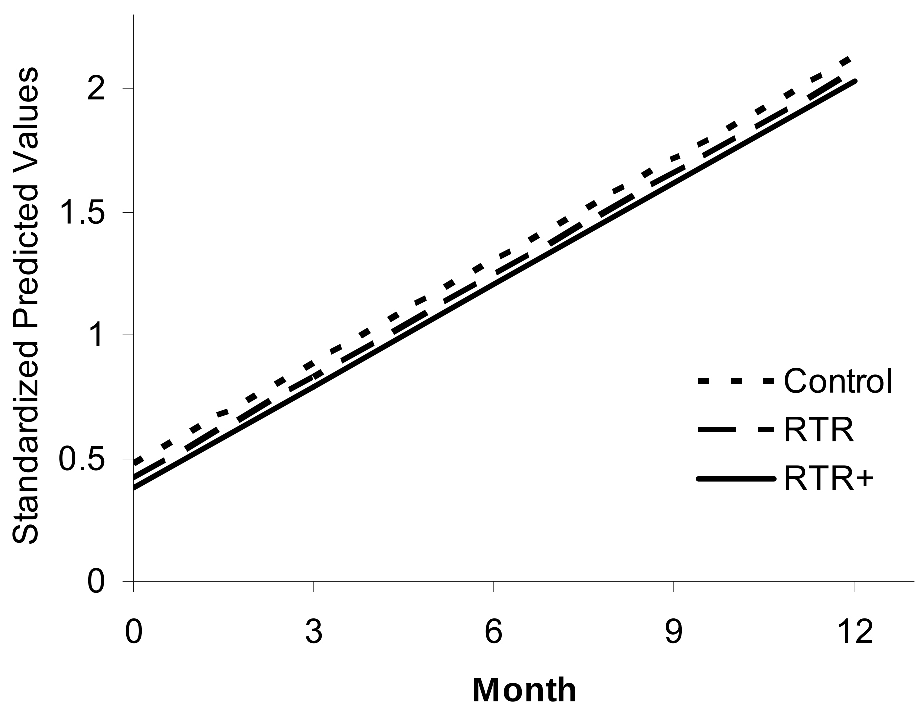

Figure 3.7. Fitted fixed-effect regression lines for the number of unprotected sexual encounters, covariate model.

and variable time trend models can be found in Tables D.8 and D.9 of Appendix D. Estimated means from the covariate model can be found in Table 3.15 and Figure 3.7.

As illustrated in Table 3.15, the number of unprotected encounters seems surprisingly high immediately after the interventions: Adjusting for the average number of unprotected encounters reported at presurvey (2.01), estimated responses to that question increase to approximately four only two weeks later at the postsurvey assessment. Shifts in how sex is defined could be partly responsible (participants may be more likely to include oral sex in the definition after the interventions), but comparable increases for the control group seem to rule that explanation out. Respondents with a high number of unprotected encounters may simply be more forthcoming about their sexual history once time has been spent with representatives of the study. Across all time points, 80.2% of responses to this variable are two or less, and 1% of the responses range from 112 to 277.

To address this positive skew, responses of two or more were grouped together and multinomial logistic regression was used to model the probability that a participant reported none, one, or two or more unprotected sexual encounters over time. Again, the correlation between responses of individual participants due to the repeated measures design was handled by using the sandwich estimator (Huber, 1967; Long & Ervin, 2000; White, 1980) for standard error calculations. Initial models adjusting for the response to the trichotomized dependent variable at presurvey produced perfect prediction errors for that parameter, indicating that some combination of covariates including that variable was always associated with a specific response on the dependent variable. Surprisingly, prophylactic intentions – which should also

Table 3.16. Multinomial logistic regression estimates for the number of unprotected sexual encounters.

Variable	RRR	SE	t	p	95% CI for RRR	
One Unprotected Encounter						
Presurvey	3.52	0.68	6.48	0.000	2.40	5.14
RTR	1.17	0.57	0.31	0.754	0.45	3.05
RTR+	1.17	0.54	0.35	0.728	0.47	2.90
Month	1.05	0.02	2.07	0.039	1.00	1.09
Arizona	0.47	0.29	-1.21	0.228	0.14	1.61
New York	0.27	0.19	-1.89	0.059	0.07	1.05
Age	1.30	0.26	1.30	0.196	0.87	1.93
Female	1.63	0.62	1.29	0.198	0.77	3.44
Hispanic	0.67	0.41	-0.65	0.518	0.20	2.25
African-American	0.67	0.28	-0.95	0.340	0.30	1.53
2+ Unprotected Encounters						
Presurvey	4.12	0.48	12.03	0.000	3.27	5.19
RTR	1.23	0.31	0.82	0.411	0.75	2.02
RTR+	0.82	0.20	-0.80	0.422	0.50	1.34
Month	1.11	0.01	11.05	0.000	1.09	1.13
Arizona	0.85	0.25	-0.56	0.577	0.48	1.51
New York	0.27	0.10	-3.49	0.001	0.13	0.56
Age	1.66	0.16	5.27	0.000	1.37	2.00
Female	2.11	0.41	3.87	0.000	1.45	3.09
Hispanic	0.50	0.15	-2.25	0.025	0.27	0.92
African-American	0.47	0.12	-2.91	0.004	0.28	0.78

Note 1. RRR = Relative risk ratio; Presurvey = Presurvey score on sexual intentions.
Note 2. Reference for outcome: no unprotected sexual encounters; reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

capture variation in the baseline rates of unprotected sexual behavior – did not significantly predict membership in any of the three categories of the dependent variable, and therefore the participants' baseline score on sexual intentions, which did, was used as a presurvey covariate.

Tests of time by intervention interactions did not reach significance. In the covariate model (Table 3.16), there were positive effects of presurvey sexual intentions and month on the risk of having either one or two or more unprotected encounters (relative to zero unprotected encounters), which means that higher initial sexual intentions increase the relative chances of reporting one versus zero and two versus zero unprotected encounters overall, and over time each of those chances increases as well. For example, the coefficient of 1.11 for month in the 2+ unprotected encounter section of Table 3.16 indicates that for each unit increase in month (a change of one month), the ratio of the risk of reporting two or more unprotected encounters versus zero unprotected encounters increased by 11%. In addition, the relative chance of reporting two unprotected encounters versus one unprotected encounter was significantly higher for older participants and females, and it was significantly lower for participants from New York (relative to Texas participants), Hispanics, and African-Americans (relative to Caucasians). Specifically, each unit increase in age (one year) was linked to a 66% increase in the relative risk of reporting two or more versus zero encounters: Older participants become more likely to report two or more unprotected encounters. Females had a relative risk that was twice as high (111%) as males, meaning that females were relatively more likely to report two or more unprotected encounters than males. New York participants had a relative risk that was 73% lower than Texas participants: New York participants were relatively less likely to report two or more unprotected encounters than Texas participants. And finally, the relative risk of two or more versus zero unprotected encounters for Hispanics and African-Americans was 50% and 53%, respectively, lower than for Caucasians: Hispanics and African-Americans were relatively less likely to report two or more unprotected encounters than Caucasians. As with the random effects framework, intervention effects did not reach significance, although as seen in Table 3.17, effects of RTR+ are trending in the correct direction for two or

Table 3.17. Estimated relative risks for the covariate model for number of unprotected sexual encounters.

	Month			
	0	3	6	12
One Unprotected Encounter				
CONTROL	0.031	0.036	0.041	0.054
RTR	0.036	0.042	0.048	0.063
RTR+	0.036	0.042	0.048	0.063
2+ Unprotected Encounters				
CONTROL	0.183	0.248	0.336	0.617
RTR	0.226	0.306	0.414	0.760
RTR+	0.150	0.203	0.275	0.505

Note 1. Means estimated at the following covariate values: Presurvey sexual intentions=2.15, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values represent the risk of having one (or two or more) unprotected sexual encounters relative to the risk of zero unprotected encounters.

more unprotected encounters: A coefficient of .82 (Table 3.16) indicates that the overall relative risk of reporting two or more unprotected encounters is

18% lower for RTR+ participants than for control participants.

Also apparent from Table 3.17, the relative risk of reporting one versus zero unprotected encounters is fairly low across all groups and all time points. For participants who are having unprotected sex, many more are having unprotected sex more than once.

Sexual Intentions

Linear random effects regression models were used to test effects of intervention assignment on participants' intentions to have sex in the future, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing.

Table 3.18. Hierarchical comparisons of random effect models and covariance structures for sexual intentions.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3985.17	4080.02	17			
Random intercept	4084.95	4168.64	15	103.77	2	0.000
Covariance structure of random effects						
Unstructured	3985.17	4080.02	17			
Exchangeable	4043.42	4132.69	16	60.25	1	0.000
Independent	3984.96	4074.23	16	1.78	1	0.182
Identity	4066.18	4149.87	15	83.22	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. AIC = Aikake information criterion, BIC = Bayesian information criterion, Diff = Difference.

Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.18.

Addition of site, age, gender, and ethnicity covariates did not significantly improve fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model (Table 3.19). In the covariate model, there was a significant positive effect of presurvey sexual intentions: Higher sexual intentions before the interventions were associated with higher sexual intentions over all time points after the interventions. In addition, there was a positive effect of month: Sexual intentions tend to increase over time. Linear contrasts suggested a marginally significant overall difference between RTR+ and RTR ($\chi^2(1)=2.68$, p=.10), with RTR+ having lower overall intentions than RTR, no overall difference between Arizona and New York ($\chi^2(1)=0.65$, p=.42), and no overall difference between African-Americans and Hispanics ($\chi^2(1)=0.08$, p=0.78). In the variable time trend model, there was a significant negative RTR+ effect, indicating that RTR+ produces a significant initial decrease in sexual intentions relative to the control group. Although this effect should be considered tentative since the

Table 3.19. Comparison of baseline, covariate, and variable time trend models for intentions to have sex.

	Model		
Variable	Baseline	Covariate	Variable time trend
Presurvey	0.812***	0.808***	0.808***
RTR	0.025	0.007	-0.013
RTR+	-0.055	-0.072	-0.105*
Month	0.018***	0.018***	0.011
Arizona		0.048	0.048
New York		0.121	0.121
Age		0.009	0.009
Female		-0.054	-0.054
Hispanic		0.017	0.017
African-American		-0.003	-0.003
Month X RTR			0.008
Month X RTR+			0.013
Intercept	0.425***	0.318	0.334
Slope (sd)	0.052***	0.053***	0.052***
Intercept (sd)	0.358***	0.349***	0.349***
Residual	0.531***	0.529***	0.529***
Difference df		6	2
Difference G^2		5.37	2.16
p		0.4971	0.3393

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

**p<.05 **p<.01 ***p<.001*

omnibus test of the interaction did not reach significance, as can be seen from Table 3.20 and Figure 3.8, the effect is trending in the theoretically anticipated

Table 3.20. Estimated means for the covariate model for intentions to have sex.

	Month			
Intervention	0	3	6	12
CONTROL	2.20 (.05)	2.25 (.05)	2.30 (.05)	2.41 (.06)
RTR	2.20 (.05)	2.26 (.05)	2.31 (.05)	2.42 (.06)
RTR+	2.12 (.05)	2.18 (.05)	2.23 (.05)	2.34 (.06)

Note 1. Means estimated at the following covariate values: Pretest=2.15 Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other.
Note 2. Cell values are: estimated mean (standard error).

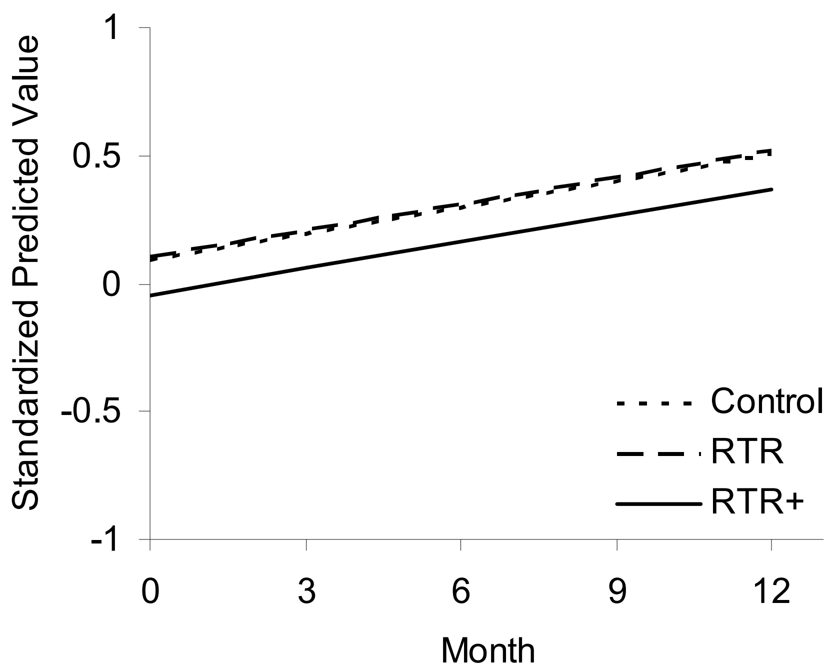

Figure 3.8. Fitted fixed-effect regression lines for intentions to have sex, covariate model.

direction and is consistent with effects of RTR+ on sexual attitudes (discussed below), a direct theoretical precursor of sexual intentions. Detailed summary statistics for the covariate and variable time trend models can be found in Tables D.10 and D.11 of Appendix D. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance.

Prophylactic Intentions

Linear random effects regression models were used to test effects of intervention assignment on participants' intentions to use prophylaxis in the future, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept. However, fit statistics (AIC and BIC) were ambiguous, and the estimated slope variance in the random coefficient model was close to zero. Furthermore, inspections of residuals for the random coefficient model revealed 47 level-2 slope outliers greater than 4 absolute standard deviations from the mean residual (47 subjects had random slope deviations that differed substantially from the estimated fixed slope for the sample). A random intercept model was therefore used in all subsequent model fitting. With only one random effect (an intercept), there is no covariance matrix of random effects and alternative covariance structures were not assessed. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.21.

Table 3.21. Hierarchical comparisons of random effect models for prophylactic intentions.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random slope	3657.63	3752.48	17			
Random intercept	3665.28	3748.97	15	11.65	2	0.003

Note 1. Tests of random slope model assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

The covariate model differed from the baseline model, but the variable time trend model did not differ from the covariate model (Table 3.22). In the covariate model, there was a significant positive effect of presurvey prophylactic intentions: Higher prophylactic intentions before the interventions were associated with higher prophylactic intentions over all time points after the interventions. There was an overall positive effect of RTR on prophylactic intentions, and females had higher prophylactic intentions than males. Linear contrasts showed there was no overall difference between RTR+ and RTR (χ^2 (1)=2.15, p=.14), New York participants had significantly higher prophylactic intentions than Arizona participants (χ^2 (1)=6.37, p=.01), and there was no overall difference between African-Americans and Hispanics (χ^2 (1)=0.33, p=0.57). As with sexual intentions, in the variable time trend model there was a significant positive RTR+ "main" effect, indicating that RTR+ produces a significant initial increase in prophylactic intentions relative to the control group. Again, this effect should be considered tentative since the omnibus test of the interaction did not reach significance, but as can be seen from Table 3.23 and Figure 3.9, the effect is trending in the theoretically anticipated direction and is consistent with effects of RTR+ on prophylactic attitudes (discussed below), a direct theoretical precursor of prophylactic intentions.

Table 3.22. Comparison of baseline, covariate, and variable time trend models for intentions to use prophylaxis.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.618***	0.606***	0.606***
RTR	0.195***	0.160**	0.159**
RTR+	0.111*	0.088	0.124*
Month	0.001	0.001	0.004
Arizona		-0.095	-0.094
New York		0.134	0.133
Age		0.015	0.015
Female		0.117**	0.118**
Hispanic		-0.039	-0.039
African-American		-0.080	-0.081
Month X RTR			0.001
Month X RTR+			-0.008
Intercept	1.131***	0.916**	0.911**
Intercept (sd)	0.418***	0.408***	0.408***
Residual (sd)	0.515***	0.515***	0.514***
Difference df		6	2
Difference G^2		18.43	2.6
p		0.0052	0.2729

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

Detailed summary statistics for the covariate and variable time trend models can be found in Tables D.12 and D.13 of Appendix D. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance.

Table 3.23. Estimated means for the covariate model for intentions to use prophylaxis.

	Month			
Intervention	0	3	6	12
CONTROL	3.08 (.05)	3.08 (.05)	3.08 (.05)	3.09 (.05)
RTR	3.24 (.05)	3.24 (.05)	3.24 (.05)	3.25 (.05)
RTR+	3.16 (.05)	3.17 (.05)	3.17 (.05)	3.18 (.05)

Note 1. Means estimated at the following covariate values: Pretest=3.16, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

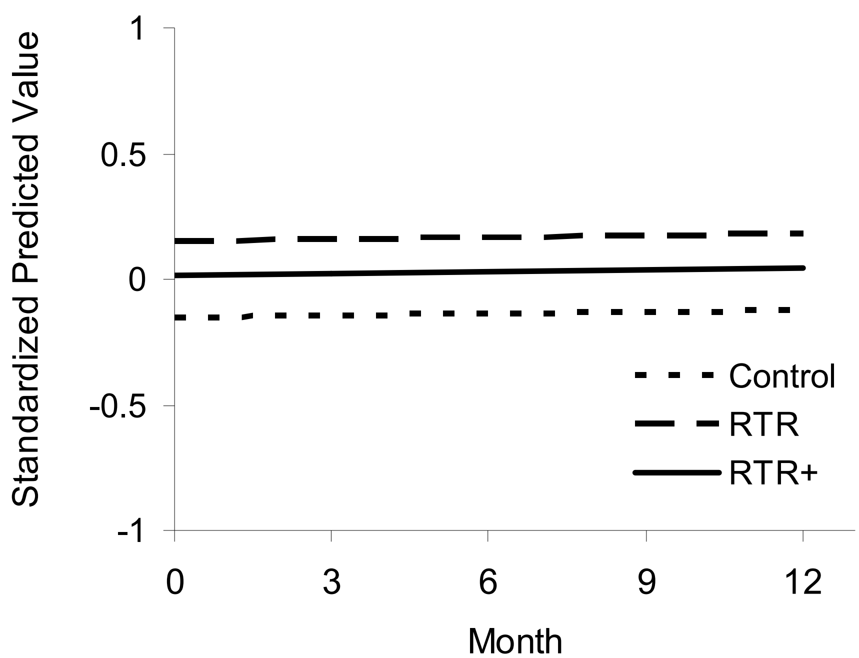

Figure 3.9. Fitted fixed-effect regression lines for intentions to use prophylaxis, covariate model.

Knowledge

Linear random effects regression models were used to test effects of intervention assignment on participants' knowledge, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was used in subsequent model testing (Table 3.24). Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure (Table 3.24). Therefore, an

Table 3.24. Random effect and covariance structure comparisons for knowledge.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	1649.45	1744.25	17			
Random intercept	1661.27	1744.92	15	15.82	2	0.000
Covariance structure of random effects						
Unstructured	1649.45	1744.25	17			
Exchangeable	2033.85	2123.07	16	386.4	1	0.000
Independent	1649.38	1738.60	16	1.93	1	0.165
Identity	2084.75	2168.40	15	437.38	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Table 3.25. Comparison of baseline, covariate, variable time trend, and extended models for knowledge.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.857***	0.824***	0.825***	0.831***
RTR	0.350***	0.342***	0.390***	0.412***
RTR+	0.457***	0.443***	0.498***	0.549***
Month	-0.003*	-0.003*	0.008**	0.008**
Arizona		-0.065	-0.064	-0.049
New York		0.024	0.026	0.0273
Age		-0.007	-0.007	-0.007
Female		0.057*	0.057*	0.050
Hispanic		-0.041	-0.042	-0.133
African-American		-0.179***	-0.179***	-0.024
Month X RTR			-0.015***	-0.015***
Month X RTR+			-0.017***	-0.017***
Hispanic X RTR				0.216*
Af. Amer. X RTR				-0.188*
Hispanic X RTR+				0.067
Af. Amer. X RTR+				-0.232**
Intercept	0.331***	0.574*	0.547*	0.499*
Slope (sd)	0.018***	0.017***	0.016***	0.016***
Intercept (sd)	0.321***	0.311***	0.313***	0.308***
Residual (sd)	0.271***	0.272***	0.271***	0.270***
Difference df		6	2	4
Difference G^2		30.38	21.35	15.99
p		0.000	0.000	0.003

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, VTT vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

independent structure was used in all subsequent model testing.

The covariate model differed from the baseline model, and the variable time trend model differed from the covariate model (Table 3.25). In the variable time trend model, there was a significant positive effect of presurvey knowledge: Higher knowledge before the interventions was associated with higher knowledge over all time points after the interventions. Coefficients for RTR and RTR+ were significant and positive, suggesting that relative to the control group, both interventions produce initial increases in knowledge. A significant positive effect was also found for month, implying that knowledge increases over time for participants in the control group. In addition, females had significantly higher overall knowledge than males, and African-Americans had significantly lower overall knowledge than Caucasian/other ethnicities. Linear contrasts testing additional hypotheses revealed that there were no

Table 3.26. Tests of additional hypotheses for the variable time trend model for knowledge.

Comparison	$\chi^2(1)$	p
RTR vs. Control @ 3mo	88.17	0.000
RTR vs. Control @ 6mo	60.68	0.000
RTR vs. Control @ 12mo	16.56	0.000
RTR+ vs. Control @ 3mo	172.92	0.000
RTR+ vs. Control @ 6mo	125.22	0.000
RTR+ vs. Control @ 12mo	38.94	0.000
RTR+ vs. RTR @ Postsurvey	8.94	0.003
RTR+ vs. RTR @ 3mo	9.12	0.003
RTR+ vs. RTR @ 6mo	7.34	0.007
RTR+ vs. RTR @ 12mo	3.17	0.075

overall differences between Arizona and New York participants ($\chi^2(1)=1.93$, $p=.16$), and Hispanics had higher overall knowledge than African-Americans ($\chi^2(1)=7.61$, $p=.01$). Linear contrasts probing the nature of the interaction

Table 3.27. Estimated means for the variable time trend model for knowledge.

	Month			
Intervention	0	3	6	12
CONTROL	2.78 (.03)	2.80 (.03)	2.82 (.03)	2.87 (.04)
RTR	3.17 (.03)	3.14 (.03)	3.12 (.03)	3.08 (.04)
RTR+	3.27 (.03)	3.25 (.03)	3.22 (.03)	3.17 (.04)

Note 1. Means estimated at the following covariate values: Pretest=2.85, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

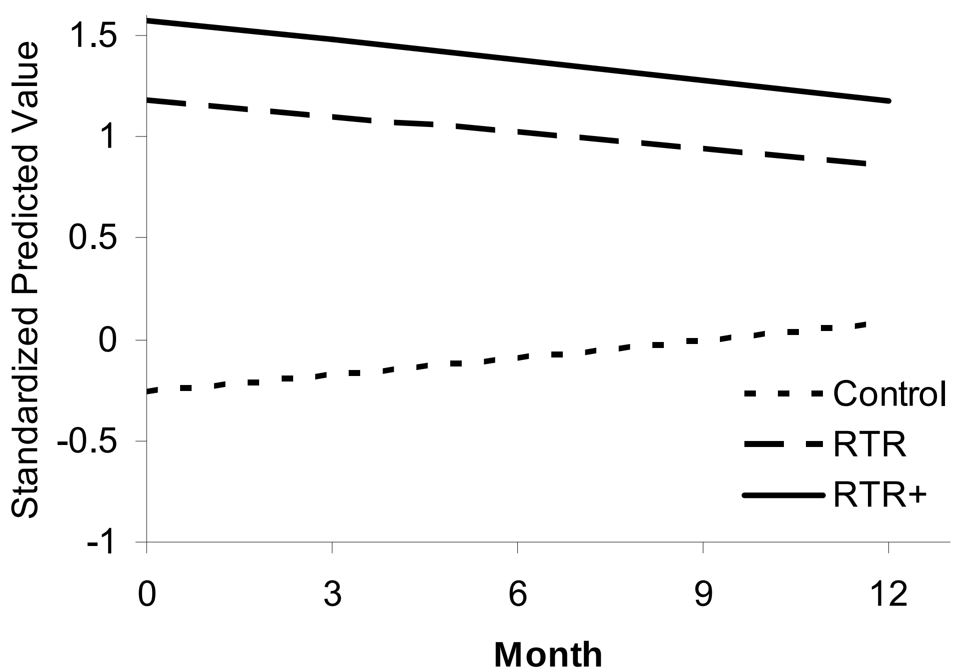

Figure 3.10. Fitted fixed-effect regression lines for knowledge, variable time trend model.

between intervention and month (Table 3.26) revealed that effects of both RTR+ and RTR (relative to the control group) remained significant at 12 months, and participants in RTR+ maintained significantly higher knowledge than participants in RTR through six months and had marginally higher knowledge than RTR participants at 12 months. As illustrated in Table 3.27 and Figure 3.10, the negative coefficients for the significant month by intervention interaction terms reflect levels of knowledge that are boosted initially by the interventions and then approach convergence with levels of knowledge seen in the control group over time.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table 3.25). Relative to Caucasians, RTR was more effective for Hispanics (the "Hispanic X RTR" term in Table 3.25), and both RTR and RTR+ were less effective for African-Americans (the two African-American by intervention terms in Table 3.25). Table 3.28 provides linear contrasts testing intervention effects not provided in Table 3.25 by both ethnicity and month, and Table 3.29 provides the corresponding means. Although there is no three-way interaction

Table 3.28. Tests of additional hypotheses for the extended model for knowledge.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Caucasian/Other @ 3mo	59.29	0.000
RTR vs. Control, Caucasian/Other @ 6mo	43.03	0.000
RTR vs. Control, Caucasian/Other @ 12mo	14.67	0.000
RTR vs. Control, Hispanics @ postsurvey	41.73	0.000
RTR vs. Control, Hispanics @ 3mo	36.60	0.000
RTR vs. Control, Hispanics @ 6mo	30.58	0.000
RTR vs. Control, Hispanics @ 12mo	18.66	0.000
RTR vs. Control, Af. Americans @ postsurvey	10.43	0.001

Table 3.28 (continued).

Comparison	$\chi^2(1)$	p
RTR vs. Control, African-Americans @ 3mo	6.76	0.009
RTR vs. Control, African-Americans @ 6mo	3.57	0.059
RTR vs. Control, African-Americans @ 12mo	0.25	0.616
RTR+ vs. Control, Caucasian/Other @ 3mo	54.02	0.000
RTR+ vs. Control, Caucasian/Other @ 6mo	36.24	0.000
RTR+ vs. Control, Caucasian/Other @ 12mo	10.82	0.001
RTR+ vs. Control, Hispanics @ postsurvey	56.55	0.000
RTR+ vs. Control, Hispanics @ 3mo	48.86	0.000
RTR+ vs. Control, Hispanics @ 6mo	39.82	0.000
RTR+ vs. Control, Hispanics @ 12mo	22.18	0.000
RTR+ vs. Control, Af. Americans @ postsurvey	22.00	0.000
RTR+ vs. Control, African-Americans @ 3mo	15.76	0.000
RTR+ vs. Control, African-Americans @ 6mo	9.86	0.002
RTR+ vs. Control, African-Americans @ 12mo	2.10	0.148
RTR+ vs. RTR, Caucasian/Other @ Postsurvey	8.94	0.003
RTR+ vs. RTR, Caucasian/Other @ 3mo	8.88	0.003
RTR+ vs. RTR, Caucasian/Other @ 6mo	7.67	0.006
RTR+ vs. RTR, Caucasian/Other @ 12mo	4.16	0.041
RTR+ vs. RTR, Hispanics @ postsurvey	0.02	0.882
RTR+ vs. RTR, Hispanics @ 3mo	0.05	0.829
RTR+ vs. RTR, Hispanics @ 6mo	0.08	0.780
RTR+ vs. RTR, Hispanics @ 12mo	0.14	0.702
RTR+ vs. RTR, African-Americans @ postsurvey	2.04	0.153
RTR+ vs. RTR, African-Americans @ 3mo	1.85	0.174
RTR+ vs. RTR, African-Americans @ 6mo	1.54	0.213
RTR+ vs. RTR, African-Americans @ 12mo	0.90	0.343

ethnicity that takes into account the two-way interaction between month and intervention. The contrasts reveal that relative to the control group, both RTR and RTR+ produce sustained increases in knowledge through 12 months, but between month, intervention, and ethnicity in the extended model (the interaction between ethnicity and intervention does not depend on month), the full set of contrasts provides a useful summary of the moderating effect of those increases last only through three months for African-Americans and are marginally sustained through six months. A similar pattern is seen for RTR+

Table 3.29. Estimated means for the extended model for knowledge.

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	2.75 (.04)	2.77 (.04)	2.80 (.04)	2.85 (.04)
RTR	3.16 (.04)	3.14 (.04)	3.12 (.04)	3.07 (.05)
RTR+	3.30 (.04)	3.27 (.04)	3.24 (.04)	3.19 (.04)
Hispanic				
CONTROL	2.62 (.07)	2.64 (.07)	2.66 (.07)	2.71 (.08)
RTR	3.25 (.07)	3.22 (.07)	3.20 (.07)	3.16 (.08)
RTR+	3.23 (.06)	3.20 (.06)	3.18 (.06)	3.12 (.06)
African-American				
CONTROL	2.73 (.06)	2.75 (.05)	2.77 (.05)	2.82 (.06)
RTR	2.95 (.05)	2.93 (.05)	2.91 (.05)	2.86 (.06)
RTR+	3.04 (.05)	3.02 (.05)	2.99 (.05)	2.93 (.06)

Note 1. Means estimated at the following covariate values: Pretest=2.85, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

versus control, although in that case the effect extends unambiguously through six months for African-Americans. RTR+ produces significantly more increases in knowledge than RTR through 12 months for Caucasians, but no differences were found between RTR+ and RTR for Hispanics or African-Americans. It is important to note that since explicit comparisons between these ethnic groups were not a factor in the design of the study, inferences involving ethnicity should be viewed as tentative because hypothesis tests of effects involving smaller subgroups (African-Americans and Hispanics) are underpowered. Detailed summary statistics for the covariate, variable time trend, and extended models can be found in Tables D.14 and D.15 of Appendix D.

Attitudes towards sex

Linear random effects regression models were used to test effects of intervention assignment on participants' attitudes towards having sex, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a

Table 3.30. Random effect and covariance structure comparisons for attitudes towards sex.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3392.34	3487.17	17			
Random intercept	3442.83	3526.50	15	54.49	2	0.000
Covariance structure of random effects						
Unstructured	3392.34	3487.17	17			
Exchangeable	3535.05	3624.30	16	144.71	1	0.000
Independent	3390.57	3479.82	16	0.23	1	0.634
Identity	3564.95	3648.62	15	176.38	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.30.

Addition of site, age, gender, and ethnicity covariates significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of presurvey sexual attitudes: More favorable attitudes before the interventions were associated with more favorable attitudes over all time points after the interventions. Participants assigned to RTR+ had significantly less favorable attitudes towards having sex overall than participants in the control group, sexual attitudes tended to become more favorable over time, and participants from New York had more favorable sexual attitudes overall than participants from Texas. Linear contrasts assessing additional hypotheses showed that RTR+ produced significantly less favorable sexual attitudes overall than RTR ($\chi^2(1)=7.06$, $p=.01$), and New York participants had significantly more favorable attitudes overall than Arizona participants ($\chi^2(1)=5.66$, $p=.02$). Hierarchical comparisons of the

Table 3.31. Comparison of baseline, covariate, and variable time trend models for attitudes towards sex.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.735***	0.725***	0.725***
RTR	0.058	0.025	0.004
RTR+	-0.070	-0.0952*	-0.115*
Month	0.018***	0.018***	0.013*
Arizona		0.069	0.069
New York		0.272***	0.271***
Age		-0.001	-0.001
Female		-0.057	-0.057
Hispanic		-0.104	-0.104
African-American		-0.023	-0.024
Month X RTR			0.007
Month X RTR+			0.007
Intercept	0.375***	0.459	0.471
Slope (sd)	0.039***	0.038***	0.038***
Intercept (sd)	0.379***	0.363***	0.363***
Residual (sd)	0.445***	0.445***	0.445***
Difference df		6	2
Difference G^2		21.49	1.32
p		0.0015	0.5171

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.31, and predicted means can be found in Table 3.32 and Figure 3.11. Tests of intervention by age, intervention by gender,

Table 3.32. Estimated means for the covariate model for attitudes towards sex.

	Month			
Intervention	0	3	6	12
CONTROL	1.65 (.04)	1.71 (.04)	1.76 (.05)	1.87 (.05)
RTR	1.68 (.04)	1.73 (.04)	1.78 (.04)	1.89 (.05)
RTR+	1.56 (.04)	1.61 (.04)	1.66 (.04)	1.77 (.05)

Note 1. Means estimated at the following covariate values: Pretest=1.67, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

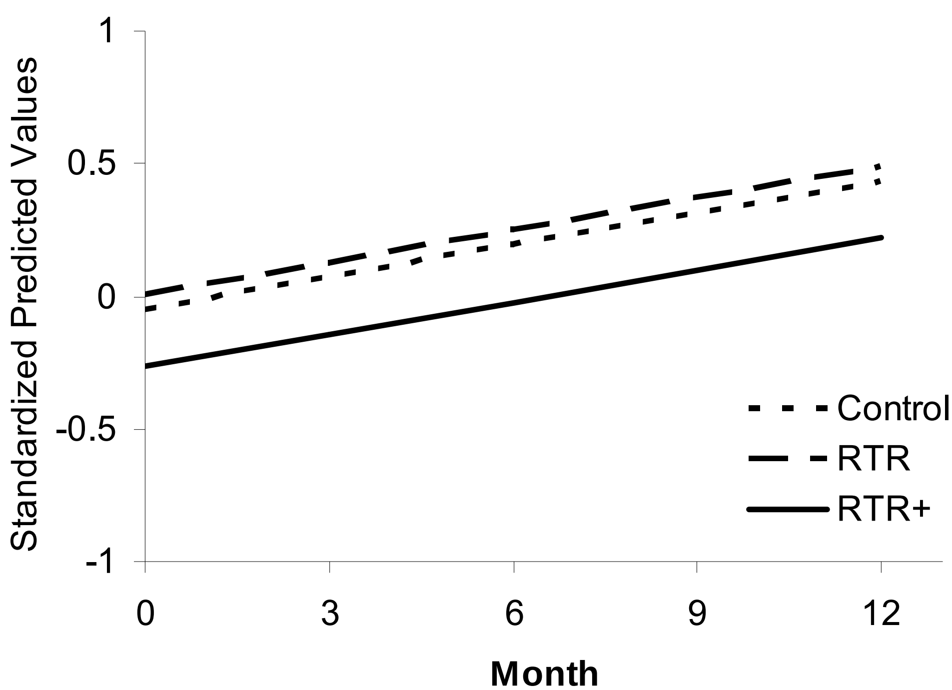

Figure 3.11. Fitted fixed-effect regression lines for attitudes towards sex, covariate model.

and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.16 of Appendix D.

Prophylactic Attitudes

Linear random effects regression models were used to test effects of intervention assignment on participants' prophylactic attitudes, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was used in subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable

Table 3.33. Random effect and covariance structure comparisons for attitudes towards prophylaxis.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	1246.18	1341.02	17			
Random intercept	1286.47	1370.15	15	44.28	2	0.000
Covariance structure of random effects						
Unstructured	1246.18	1341.02	17			
Exchangeable	1633.15	1722.41	16	388.97	1	0.000
Independent	1244.36	1333.62	16	0.18	1	0.673
Identity	1685.70	1769.38	15		1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.33.

The covariate model differed from the baseline model, and the variable time trend model differed from the covariate model (Table 3.34). In the variable time trend model, there was a significant positive effect of presurvey prophylactic attitudes: More favorable attitudes before the interventions were associated with more favorable attitudes over all time points after the interventions. Coefficients for RTR and RTR+ were significant and positive, suggesting that relative to the control group, both interventions produce significantly more favorable attitudes towards prophylaxis immediately after the intervention (at postsurvey). Tests of the model coefficients also suggest that females have significantly more favorable prophylactic attitudes than males and that African-Americans have significantly lower prophylactic attitudes than Cauasian/other ethnicities. Linear contrasts testing additional hypotheses revealed that there were no overall differences between Arizona and New York participants ($\chi^2(1)=2.35$, p=0.13), and Hispanics had more favorable overall attitudes towards prophylaxis than African-Americans ($\chi^2(1)=6.89$, p=0.01). Linear contrasts probing the nature of the interaction between intervention and month revealed that effects of RTR (relative to the control group) remained significant through 12 months, effects of RTR+

Table 3.34. Comparison of baseline, covariate, variable time trend, and extended models for attitudes towards prophylaxis.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.793***	0.756***	0.756***	0.759***
RTR	0.149***	0.138***	0.151***	0.156***
RTR+	0.193***	0.181***	0.210***	0.221***
Month	0.000	0.000	0.005	0.005*
Arizona		-0.067	-0.067	-0.049
New York		0.022	0.023	0.0266
Age		0.022	0.022	0.0214
Female		0.125***	0.125***	0.118***
Hispanic		-0.021	-0.021	-0.132
African-American		-0.138***	-0.139***	-0.051
Month X RTR			-0.004	-0.004
Month X RTR+			-0.010**	-0.011**
Hispanic X RTR				0.250**
Af. Amer. X RTR				-0.14
Hispanic X RTR+				0.092
Af. Amer. X RTR+				-0.095
Intercept	0.591***	0.341	0.332	0.318
Slope (sd)	0.021***	0.020***	0.020***	0.020***
Intercept (sd)	0.296***	0.282***	0.283***	0.280***
Residual (sd)	0.235***	0.235***	0.235***	0.235***
Difference df		6	2	4
Difference G^2		44.2	8.05	13.38
p		0.0000	0.0179	0 .0096

Note 1. VTT = Variable time trend, Presurvey = Presurvey score on the dependent measure, Af. Amer. = African American.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, VTT vs. Extended

* p<0.05, ** p<0.01, *** p<0.001

remained significant through six months (marginally significant through 12 months), and RTR did not differ from RTR+ at any time point (Table 3.35).

Table 3.35. Tests of additional hypotheses for the variable time trend model for prophylactic attitudes.

Comparison	$\chi^2(1)$	p
RTR vs. Control @ 3mo	17.22	0.000
RTR vs. Control @ 6mo	12.32	0.000
RTR vs. Control @ 12mo	4.08	0.043
RTR+ vs. Control @ 3mo	33.64	0.000
RTR+ vs. Control @ 6mo	20.07	0.000
RTR+ vs. Control @ 12mo	3.53	0.060
RTR+ vs. RTR @ Postsurvey	3.35	0.067
RTR+ vs. RTR @ 3mo	1.74	0.186
RTR+ vs. RTR @ 6mo	0.45	0.502
RTR+ vs. RTR @ 12mo	0.09	0.762

As illustrated in Table 3.36 and Figure 3.12, the negative coefficients for the significant month by RTR+ interaction term (Table 3.34) reflect prophylactic attitudes that are highly favorable for RTR+ participants immediately post-intervention, and then approach convergence with prophylactic attitudes seen in the control group over time. Although the coefficient for the month by RTR term was not significant, its time trend is slightly shallower than the control group and therefore suggests a similar pattern of convergence.

Table 3.36. Estimated means for the variable time trend model for attitudes towards prophylaxis.

	Month			
Intervention	0	3	6	12
CONTROL	2.95 (.03)	2.96 (.03)	2.98 (.03)	3.01 (.04)
RTR	3.10 (.03)	3.10 (.03)	3.11 (.03)	3.11 (.04)
RTR+	3.16 (.03)	3.14 (.03)	3.13 (.03)	3.10 (.04)

Note 1. Means estimated at the following covariate values: Pretest=3.00, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

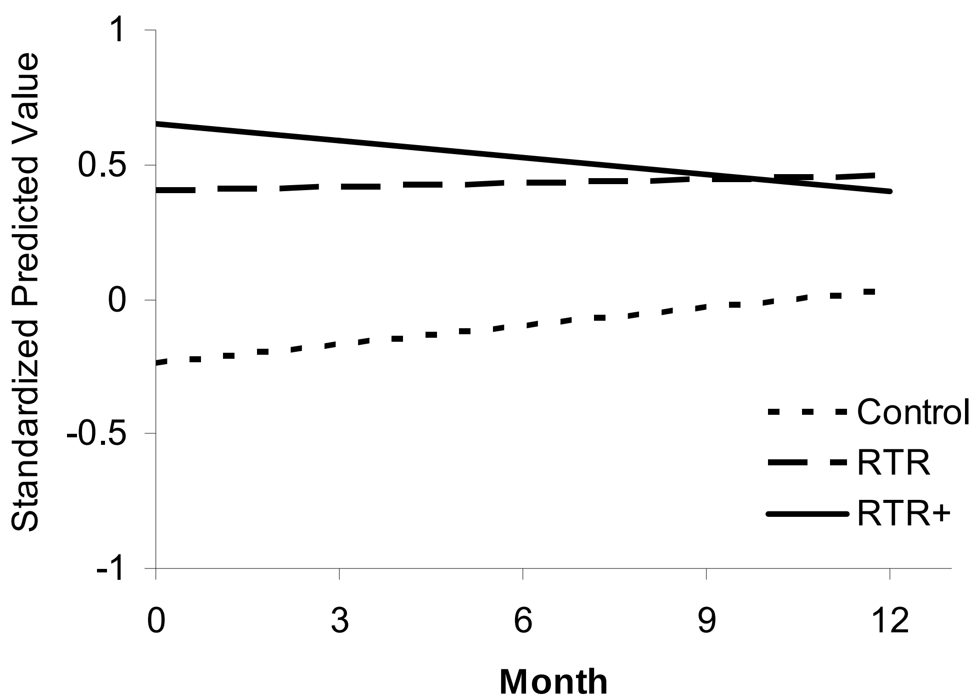

Figure 3.12. Fitted fixed-effect regression lines for attitudes towards prophylaxis, variable time trend model.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table

Table 3.37. Tests of additional hypotheses for the extended model for attitudes towards prophylaxis.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Caucasian/Other @ 3mo	11.09	0.001
RTR vs. Control, Caucasian/Other @ 6mo	8.41	0.004
RTR vs. Control, Caucasian/Other @ 12mo	3.39	0.066
RTR vs. Control, Hispanics @ postsurvey	21.34	0.000
RTR vs. Control, Hispanics @ 3mo	20.25	0.000
RTR vs. Control, Hispanics @ 6mo	18.49	0.000
RTR vs. Control, Hispanics @ 12mo	13.91	0.000
RTR vs. Control, African-Americans @ postsurvey	0.07	0.794
RTR vs. Control, African-Americans @ 3mo	0.00	0.962
RTR vs. Control, African-Americans @ 6mo	0.03	0.869
RTR vs. Control, African-Americans @ 12mo	0.26	0.609
RTR+ vs. Control, Caucasian/Other @ 3mo	7.95	0.005
RTR+ vs. Control, Caucasian/Other @ 6mo	4.00	0.046
RTR+ vs. Control, Caucasian/Other @ 12mo	0.27	0.600
RTR+ vs. Control, Hispanics @ postsurvey	17.81	0.000
RTR+ vs. Control, Hispanics @ 3mo	14.75	0.000
RTR+ vs. Control, Hispanics @ 6mo	11.42	0.001
RTR+ vs. Control, Hispanics @ 12mo	5.43	0.020
RTR+ vs. Control, African-Americans @ postsurvey	4.28	0.039
RTR+ vs. Control, African-Americans @ 3mo	2.43	0.118
RTR+ vs. Control, African-Americans @ 6mo	1.04	0.309
RTR+ vs. Control, African-Americans @ 12mo	0.00	0.998
RTR+ vs. RTR, Caucasian/Other @ Postsurvey	2.46	0.116
RTR+ vs. RTR, Caucasian/Other @ 3mo	1.37	0.244
RTR+ vs. RTR, Caucasian/Other @ 6mo	0.46	0.498
RTR+ vs. RTR, Caucasian/Other @ 12mo	0.02	0.879
RTR+ vs. RTR, Hispanics @ postsurvey	1.42	0.233
RTR+ vs. RTR, Hispanics @ 3mo	2.07	0.151
RTR+ vs. RTR, Hispanics @ 6mo	2.72	0.099
RTR+ vs. RTR, Hispanics @ 12mo	3.80	0.051
RTR+ vs. RTR, African-Americans @ postsurvey	3.53	0.061
RTR+ vs. RTR, African-Americans @ 3mo	2.50	0.115
RTR+ vs. RTR, African-Americans @ 6mo	1.51	0.219
RTR+ vs. RTR, African-Americans @ 12mo	0.29	0.590

3.34). Relative to Caucasians, RTR was more effective for Hispanics (the "Hispanic X RTR" term in Table 3.34). Table 3.37 provides linear contrasts testing intervention effects not provided in Table 3.34 by both ethnicity and month.

The contrasts reveal that for Caucasians, relative to the control group RTR produces increases in favorable prophylactic attitudes that are sustained through six months and marginally sustained through 12 months, and RTR+ produces increases that are sustained through six months. For Hispanics, increases in favorable prophylactic attitudes produced by both RTR and RTR+

Table 3.38. Estimated means for the extended model for attitudes towards prophylaxis.

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	2.94 (.03)	2.96 (.03)	2.98 (.03)	3.01 (.04)
RTR	3.10 (.03)	3.10 (.03)	3.10 (.04)	3.11 (.04)
RTR+	3.16 (.03)	3.15 (.03)	3.13 (.03)	3.10 (.04)
Hispanic				
CONTROL	2.81 (.07)	2.83 (.07)	2.84 (.07)	2.88 (.07)
RTR	3.22 (.07)	3.22 (.07)	3.22 (.07)	3.23 (.07)
RTR+	3.12 (.05)	3.11 (.05)	3.09 (.05)	3.06 (.06)
African American				
CONTROL	2.89 (.05)	2.91 (.05)	2.92 (.05)	2.96 (.06)
RTR	2.91 (.04)	2.91 (.04)	2.91 (.05)	2.92 (.05)
RTR+	3.02 (.04)	3.00 (.04)	2.99 (.05)	2.96 (.05)

Note 1. Means estimated at the following covariate values:
Note 2. Cell values are: estimated mean (standard error).

(again, relative to the control group) are sustained through 12 months, and for African-Americans, RTR produces no effect and RTR+ produces an initial positive effect that dissipates by the time of the three month assessment. Direct comparisons of RTR and RTR+ do not show differences for any ethnic group. Estimated means from the extended model can be found in Table 3.38 and detailed summary statistics for the variable time trend and extended models can be found in Tables D.17 and D.18 of Appendix D.

Perceived Sexual Norms

Linear random effects regression models were used to test effects of intervention assignment on participants' perceived sexual norms, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.39.

Table 3.39. Random effect and covariance structure comparisons for perceived sexual norms.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	2419.15	2513.99	17			
Random intercept	2440.44	2524.12	15	25.29	2	0.000
Covariance structure of random effects						
Unstructured	2419.15	2513.99	17			
Exchangeable	2603.62	2692.88	16	186.47	1	0.000
Independent	2419.47	2508.74	16	2.32	1	0.127
Identity	2640.09	2723.78	15	222.62	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates and significance tests, appear in Table 3.40. Addition of site, age, gender, and ethnicity did not significantly improve fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of perceived sexual norms at presurvey: Participants who perceive more favorable sexual norms among their peers and important adults tend to perceive more favorable norms among those people over all time points after the interventions. Participants assigned to RTR+ perceived significantly less favorable sexual norms overall than participants in the control group, and perceived norms tended to become more favorable over time.

Table 3.40. Comparison of baseline, covariate, and variable time trend models for perceived sexual norms.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.692***	0.691***	0.692***
RTR	-0.004	-0.011	-0.016
RTR+	-0.0873*	-0.0877*	-0.069
Month	0.020***	0.020***	0.022***
Arizona		0.018	0.018
New York		0.041	0.041
Age		0.014	0.013
Female		-0.032	-0.032
Hispanic		-0.040	-0.040
African-American		-0.027	-0.028
Month X RTR			0.002
Month X RTR+			-0.006
Intercept	0.501***	0.314	0.314
Slope (sd)	0.023***	0.023***	0.023***
Intercept (sd)	0.301***	0.300***	0.300***
Residual (sd)	0.352***	0.352***	0.352***
Difference df		6	2
Difference G^2		4.21	2.57
p		0.6479	0.277

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.

* p<0.05, ** p<0.01, *** p<0.001

Linear contrasts assessing additional hypotheses showed that RTR+ produced significantly lower perceived sexual norms overall than did RTR ($\chi^2(1)=4.56$, p=.03). Table 3.41 and Figure 3.13 show predicted means for the

Table 3.41. Estimated means for the covariate model for perceived sexual norms.

	Month			
Intervention	0	3	6	12
CONTROL	1.76 (.04)	1.82 (.04)	1.88 (.04)	2.00 (.04)
RTR	1.75 (.04)	1.81 (.03)	1.87 (.04)	1.99 (.04)
RTR+	1.68 (.04)	1.74 (.03)	1.80 (.04)	1.92 (.04)

Note 1. Means estimated at the following covariate values: Pretest=1.78, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

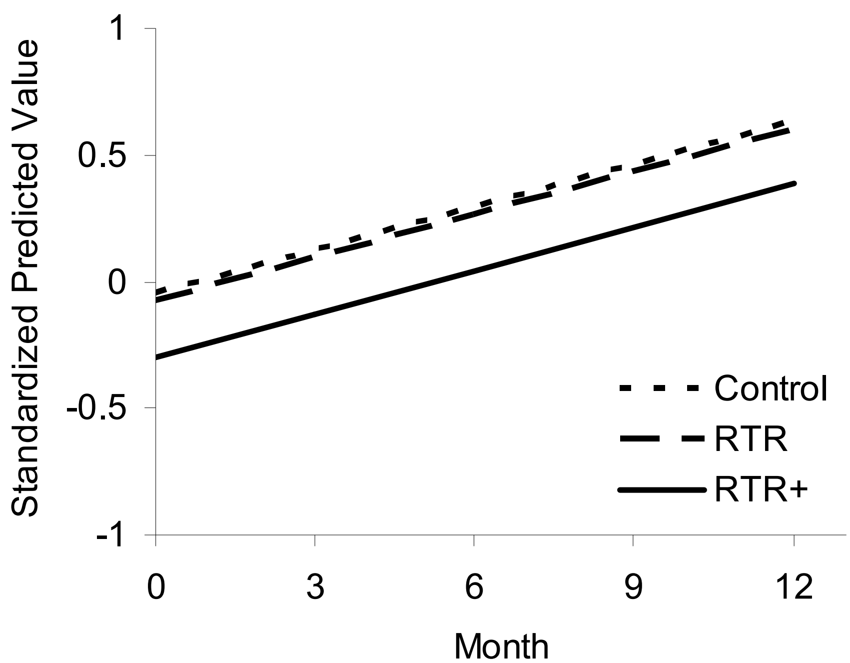

Figure 3.13. Fitted fixed-effect regression lines for perceived sexual norms, covariate model.

covariate model. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.19 of Appendix D.

Perceived Parental Sexual Norms

Linear random effects regression models were used to test effects of intervention assignment on participants' perceived sexual norms, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for

Table 3.42. Random effect and covariance structure comparisons for perceived parental sexual norms.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3240.09	3334.57	17			
Random intercept	3260.16	3343.53	15	24.07	2	0.000
Covariance structure of random effects						
Unstructured	3240.09	3334.57	17			
Exchangeable	3475.23	3564.16	16	237.14	1	0.000
Independent	3239.78	3328.71	16	1.70	1	0.193
Identity	3517.25	3600.62	15	279.47	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.42.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of perceived parental sexual norms at presurvey: Participants who perceive their parents to have more favorable sexual norms initially tend to perceive more favorable norms among their parents over all time points after the interventions. Perceived parental norms tended to become more favorable over time, and females perceived less favorable norms among their parents than did males. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.43.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=0.29$, p=.59), but participants from New York perceived more favorable sexual norms among their parents than did participants in Arizona ($\chi^2(1)=6.88$, p=0.01). As can be

Table 3.43. Comparison of baseline, covariate, variable time trend, and extended models for perceived parental sexual norms.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.689***	0.672***	0.672***	0.678***
RTR	0.046	0.000	0.002	0.0263
RTR+	-0.015	-0.026	-0.047	0.050
Month	0.011***	0.011***	0.009	0.011***
Arizona		-0.099	-0.100	-0.101
New York		0.134	0.135	0.119
Age		0.007	0.007	0.0116
Female		-0.140***	-0.140***	-0.132***
Hispanic		-0.023	-0.023	0.215*
African-American		-0.030	-0.029	-0.036
Month X RTR			-0.001	
Month X RTR+			0.007	
Hispanic X RTR				-0.11
Af. Amer. X RTR				-0.014
Hispanic X RTR+				-0.445***
Af. Amer. X RTR+				0.024
Intercept	0.249***	0.277	0.278	0.158
Slope (sd)	0.029***	0.029***	0.029***	0.029***
Intercept (sd)	0.413***	0.403***	0.403***	0.396***
Residual (sd)	0.433***	0.433***	0.433***	0.432***
Difference df		6	2	4
Difference G^2		22.44	1.90	15.78
p		0.001	0.3863	0.0033

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

Table 3.44. Estimated means for the covariate model for perceived sexual norms.

	Month			
Intervention	0	3	6	12
CONTROL	1.76 (.04)	1.82 (.04)	1.88 (.04)	2.00 (.04)
RTR	1.75 (.04)	1.81 (.03)	1.87 (.04)	1.99 (.04)
RTR+	1.68 (.04)	1.74 (.03)	1.80 (.04)	1.92 (.04)

Note 1. Means estimated at the following covariate values: Pretest=1.78, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

seen in the estimated means from the covariate model in Table 3.44 and Figure 3.14, perceived parental norms were fairly similar across all experimental groups.

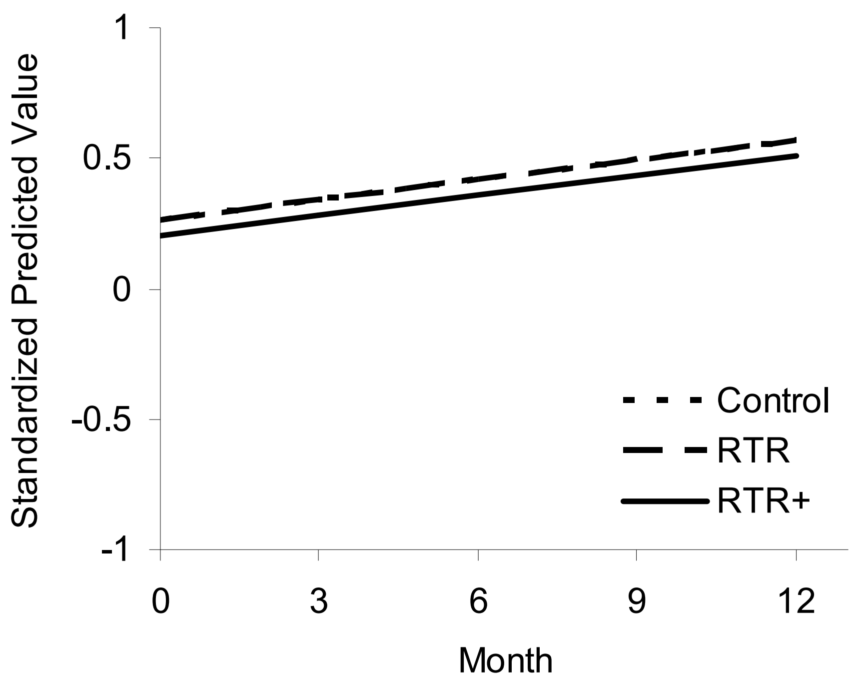

Figure 3.14. Fitted fixed-effect regression lines for perceived parental sexual norms, covariate model.

Table 3.45. Tests of additional hypotheses for the extended model for perceived parental sexual norms.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Hispanics	0.40	0.530
RTR+ vs. Control, Hispanics	12.60	0.000
RTR+ vs. RTR, Hispanics	6.92	0.009
RTR vs. Control, African-Americans	0.02	0.898
RTR+ vs. Control, African-Americans	0.62	0.427
RTR+ vs. RTR, African-Americans	0.48	0.492
RTR+ vs. RTR, Caucasian/Other	0.15	0.699

Table 3.46. Estimated means for the extended model for perceived parental sexual norms.

	Month			
	0	3	6	12
Caucasian/Other				
RTR	0.94 (.05)	0.97 (.05)	1.00 (.05)	1.08 (.06)
RTR+	0.96 (.05)	1.00 (.05)	1.03 (.05)	1.10 (.06)
CONTROL	0.91 (.05)	0.95 (.05)	0.98 (.05)	1.05 (.06)
Hispanic				
RTR	1.05 (.10)	1.08 (.10)	1.11 (.10)	1.18 (.10)
RTR+	0.73 (.08)	0.77 (.08)	0.80 (.08)	0.87 (.08)
CONTROL	1.13 (.10)	1.16 (.10)	1.20 (.10)	1.26 (.10)
African-American				
RTR	0.89 (.07)	0.92 (.07)	0.96 (.07)	1.03 (.07)
RTR+	0.95 (.07)	0.99 (.07)	1.02 (.07)	1.09 (.07)
CONTROL	0.88 (.08)	0.91 (.08)	0.95 (.08)	1.01 (.08)

Note 1. Means estimated at the following covariate values: Pretest=0.84, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table 3.43). Linear contrasts (Table 3.45) revealed that Hispanics in RTR+ perceived significantly less favorable parental norms overall than did Hispanics in RTR or the control group, but no such differences were found for Caucasians or African-Americans. These trends can be seen in the estimated means from the extended model in Table 3.46. Detailed summary statistics for the covariate and extended models can be found in Tables D.20 and D.21 of Appendix D.

Perceived Prophylactic Norms

Linear random effects regression models were used to test effects of intervention assignment on participants' perceived sexual norms, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.47.

Table 3.47. Random effect and covariance structure comparisons for perceived prophylactic norms.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	2876.7	2971.6	17			
Random intercept	2889.3	2973.0	15	16.61	2	0.000
Covariance structure of random effects						
Unstructured	2876.7	2971.6	17			
Exchangeable	3143.4	3232.7	16	268.66	1	0.000
Independent	2874.8	2964.1	16	0.08	1	0.784
Identity	3180.3	3264.0	15	307.53	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of perceived prophylactic norms at presurvey: Participants who perceive more favorable prophylactic norms initially tended to perceive more favorable norms over all later time points. There was also a significant positive effect of both interventions: Relative to the control group, participants in RTR+ and RTR perceived more favorable prophylactic norms among peers and important adults at all later time points. Participants from Arizona perceived less favorable norms overall than did participants from Texas, Females perceived more favorable norms than males overall, and African-

Table 3.48. Comparison of baseline, covariate, variable time trend, and extended models for perceived prophylactic norms.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.558***	0.544***	.545***	0.551***
RTR	0.128**	0.092*	0.066	0.119*
RTR+	0.107*	0.088*	0.079	0.080
Month	0.002	0.002	-0.001	0.002
Arizona		-0.132**	-0.132**	-0.109*
New York		0.112	0.110	0.108
Age		0.025	0.025	0.025
Female		0.140***	0.140***	0.131***
Hispanic		-0.077	-0.077	-0.186*
African-American		-0.154***	-0.154***	-0.074
Month X RTR			0.008	
Month X RTR+			0.002	
Hispanic X RTR				0.258
Af. Amer. X RTR				-0.212*
Hispanic X RTR+				0.084
Af. Amer. X RTR+				-0.012
Intercept	1.28***	0.928**	0.940**	0.907**
Slope (sd)	0.025***	0.024***	0.023***	0.023***
Intercept (sd)	0.395***	0.377***	0.376***	0.373***
Residual (sd)	0.385***	0.386***	0.386***	0.386***
Difference df		6	2	4
Difference G^2		40.66	2.1	11.79
p		0.0000	0.3500	0.0190

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.

Americans perceived less favorable norms than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.48.

Table 3.49. Estimated means for the covariate model for perceived prophylactic norms.

	Month			
Intervention	0	3	6	12
CONTROL	3.02 (.04)	3.03 (.04)	3.03 (.04)	3.04 (.05)
RTR	3.11 (.04)	3.12 (.04)	3.12 (.04)	3.14 (.05)
RTR+	3.11 (.04)	3.11 (.04)	3.12 (.04)	3.13 (.05)

Note 1. Means estimated at the following covariate values: Pretest=3.10, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

Note 2. Cell values are: estimated mean (standard error).

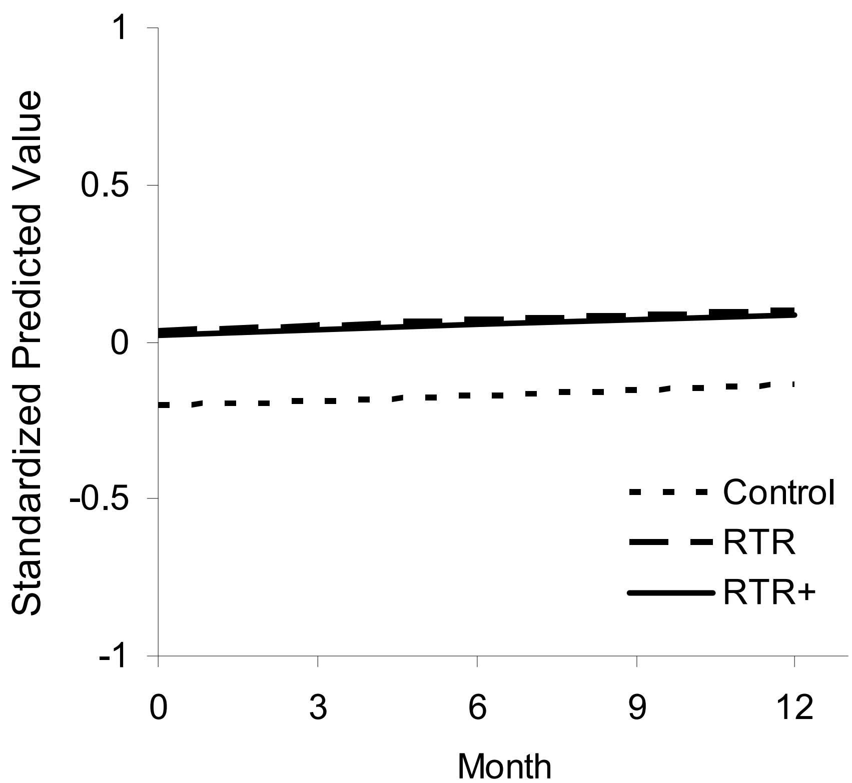

Figure 3.15. Fitted fixed-effect regression lines for perceived prophylactic norms, covariate model.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=0.01$, $p=.91$), participants from New York perceived more favorable norms than did participants in Arizona ($\chi^2(1)=8.98$, $p<0.01$), and African-Americans did not differ significantly from Hispanics ($\chi^2(1)=1.49$, $p=.22$). Estimated means from the covariate model can be found in Table 3.49 and Figure 3.15.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table 3.48). Linear contrasts (Table 3.50) and parameter estimates (Table 3.48) revealed that although the effect of RTR (versus Control) was positive for Caucasians, it was non-significant for African-Americans. However, African-Americans in RTR+ perceived significantly more favorable prophylactic norms overall than African-Americans in RTR. These trends can be seen in the estimated means from the extended model in Table 3.51. Detailed summary statistics for the covariate and extended models can be found in Tables D.22 and D.23 of Appendix D.

Table 3.50. Tests of additional hypotheses for the extended model for perceived prophylactic norms.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Hispanics	9.49	0.002
RTR+ vs. Control, Hispanics	2.62	0.106
RTR+ vs. RTR, Hispanics	3.76	0.052
RTR vs. Control, African-Americans	1.14	0.283
RTR+ vs. Control, African-Americans	0.64	0.426
RTR+ vs. RTR, African-Americans	3.88	0.049
RTR+ vs. RTR, Caucasian/Other	0.48	0.493

Table 3.51. Estimated means for the extended model for perceived prophylactic norms.

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	3.01 (.05)	3.02 (.05)	3.03 (.05)	3.04 (.05)
RTR	3.13 (.05)	3.14 (.05)	3.15 (.05)	3.16 (.05)
RTR+	3.09 (.05)	3.10 (.05)	3.11 (.05)	3.12 (.05)
Hispanic				
CONTROL	2.83 (.09)	2.84 (.09)	2.84 (.09)	2.86 (.09)
RTR	3.21 (.09)	3.21 (.09)	3.22 (.09)	3.23 (.10)
RTR+	2.99 (.07)	3.00 (.07)	3.01 (.07)	3.02 (.08)
African-American				
CONTROL	2.94 (.07)	2.95 (.07)	2.95 (.07)	2.97 (.07)
RTR	2.85 (.06)	2.85 (.06)	2.86 (.06)	2.87 (.07)
RTR+	3.01 (.06)	3.02 (.06)	3.02 (.06)	3.04 (.07)

Note 1. Means estimated at the following covariate values: Pretest=3.10, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

Self-efficacy in "Saying No" to Sex

Linear random effects regression models were used to test effects of intervention assignment on participants' self-efficacy, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.52.

Table 3.52. Random effect and covariance structure comparisons for self-efficacy in "saying no".

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3518.24	3613.06	17			
Random intercept	3522.36	3606.02	15	8.12	2	0.017
Covariance structure of random effects						
Unstructured	3518.24	3613.06	17			
Exchangeable	3733.14	3822.38	16	216.90	1	0.000
Independent	3518.61	3607.86	16	2.38	1	0.123
Identity	3765.78	3849.45	15	249.17	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of self-efficacy at presurvey: Participants with higher initial self-efficacy tend to have higher self-efficacy over all later time points. There was also a significant positive effect of both interventions: Relative to the control

Table 3.53. Comparison of baseline, covariate, and variable time trend models for self-efficacy in “saying no”.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.474***	0.441***	0.441***
RTR	0.225***	0.190***	0.207***
RTR+	0.264***	0.244***	0.243***
Month	-0.006*	-0.006*	-0.004
Arizona		-0.128*	-0.128*
New York		0.081	0.082
Age		0.049*	0.049*
Female		0.171***	0.171***
Hispanic		-0.028	-0.028
African-American		-0.136**	-0.136**
Month X RTR			-0.005
Month X RTR+			0.000
Intercept	1.491***	0.789*	0.781*
Slope (sd)	0.022***	0.021***	0.021***
Intercept (sd)	0.427***	0.409***	0.409***
Residual (sd)	0.476***	0.477***	0.477***
Difference df		6	2
Difference G^2		35.15	0.81
p		0.0000	0.6684

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.

* p<0.05, ** p<0.01, *** p<0.001

group, participants in RTR+ and RTR have higher self-efficacy at all later time points. In addition, self-efficacy showed a decreasing time trend, participants from Arizona had lower overall self-efficacy than participants from Texas, and older participants had higher overall self-efficacy than younger participants. Females had higher self-efficacy than males overall, and African-Americans had lower self-efficacy than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.53.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=1.23$, p=0.27), participants from Arizona had lower overall self-efficacy than participants from New York ($\chi^2(1)= 5.34$, p=0.02), and African-Americans did not differ significantly from Hispanics ($\chi^2(1)=1.49$, p=.22). Estimated means from the covariate model can be found in Table 3.54 and Figure 3.16. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach

Table 3.54. Estimated means for the covariate model for self-efficacy in "saying no".

	Month			
Intervention	0	3	6	12
CONTROL	2.83 (.05)	2.81 (.05)	2.79 (.05)	2.76 (.05)
RTR	3.02 (.05)	3.00 (.05)	2.98 (.05)	2.95 (.05)
RTR+	3.07 (.05)	3.05 (.05)	3.04 (.05)	3.00 (.05)

Note 1. Means estimated at the following covariate values: Pretest=2.85, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

significance. Detailed summary statistics for the covariate model can be found in Tables D.24 of Appendix D.

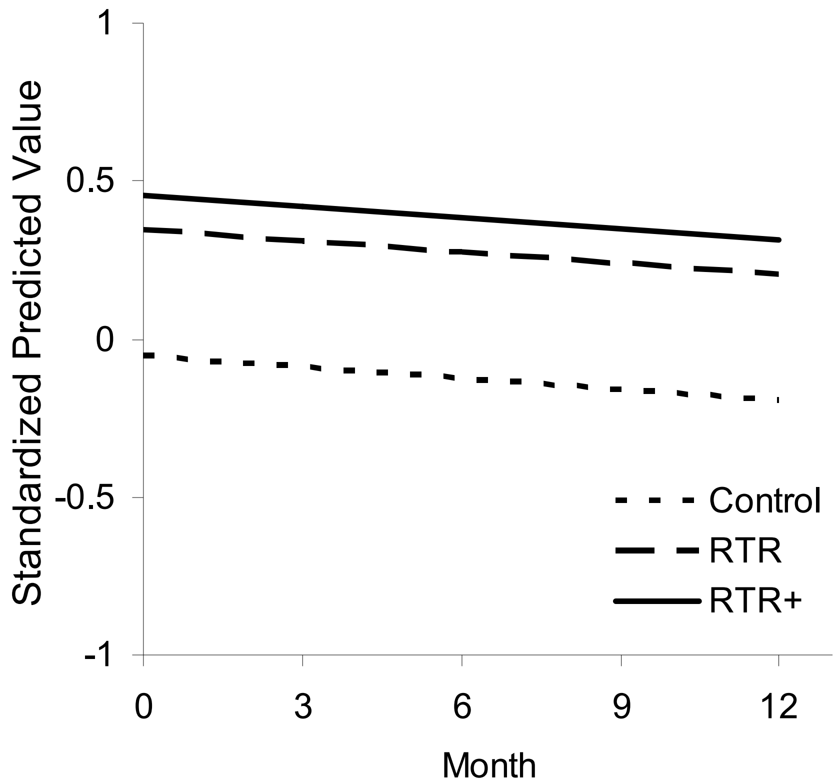

Figure 3.16. Fitted fixed-effect regression lines for self-efficacy in saying no to sex, covariate model.

Prophylactic Self-efficacy

Linear random effects regression models were used to test effects of intervention assignment on participants' prophylactic self-efficacy, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.55.

Table 3.55. Random effect and covariance structure comparisons for prophylactic self-efficacy.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3166.81	3261.63	17			
Random intercept	3173.48	3257.14	15	10.66	2	0.005
Covariance structure of random effects						
Unstructured	3166.81	3261.63	17			
Exchangeable	3417.53	3506.77	16	252.72	1	0.000
Independent	3165.74	3254.98	16	0.93	1	0.336
Identity	3449.35	3533.02	15	285.61	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of prophylactic self-efficacy at presurvey: Participants with higher initial prophylactic self-efficacy tend to have higher prophylactic self-efficacy at all later time points. There was also a significant positive effect of

Table 3.56. Comparison of baseline, covariate, variable time trend, and extended models for prophylactic self-efficacy.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.566***	0.551***	0.551***	0.553***
RTR	0.131**	0.101*	0.127*	0.111
RTR+	0.204***	0.177***	0.195***	0.238***
Month	0.004	0.004	0.008	0.004
Arizona		-0.119*	-0.119*	-0.103*
New York		0.134	0.136	0.138
Age		0.014	0.014	0.017
Female		0.187***	0.187***	0.180***
Hispanic		-0.001	-0.001	-0.047
African-American		-0.129**	-0.129**	0.006
Month X RTR			-0.008	
Month X RTR+			-0.005	
Hispanic X RTR				0.247
Af. Amer. X RTR				-0.158
Hispanic X RTR+				-0.042
Af. Amer. X RTR+				-0.206
Intercept	1.23***	1.01***	0.995**	0.935**
Slope (sd)	0.023***	0.022***	0.022***	0.023***
Intercept (sd)	0.403***	0.388***	0.388***	0.384***
Residual (sd)	0.426***	0.427***	0.427***	0.426***
Difference df		6	2	4
Difference G^2		38.53	1.53	9.71
p		0.000	0.4664	0.0457

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

both interventions: Relative to the control group, participants in RTR+ and RTR had higher prophylactic self-efficacy at all later time points. Participants from Arizona were lower overall in prophylactic self-efficacy than participants from Texas, females were higher than males overall, and African-Americans had lower overall prophylactic self-efficacy than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.56.

Linear contrasts assessing additional hypotheses showed that participants in RTR+ also had marginally higher overall prophylactic self-efficacy than participants in RTR ($\chi^2(1)= 2.88$, p=0.09), participants from Arizona also had lower self-efficacy than participants from New York ($\chi^2(1)=8.95$, p<.01), and African-Americans had lower self-efficacy than Hispanics ($\chi^2(1)=3.73$, p=0.05). Estimated means from the covariate model can be found in Table 3.57 and Figure 3.17.

Table 3.57. Estimated means for the covariate model for prophylactic self-efficacy.

	Month			
Intervention	0	3	6	12
CONTROL	2.84 (.05)	2.85 (.04)	2.87 (.04)	2.89 (.05)
RTR	2.94 (.04)	2.95 (.04)	2.97 (.04)	2.99 (.05)
RTR+	3.02 (.04)	3.03 (.04)	3.04 (.04)	3.07 (.05)

Note 1. Means estimated at the following covariate values: Pretest=2.91, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

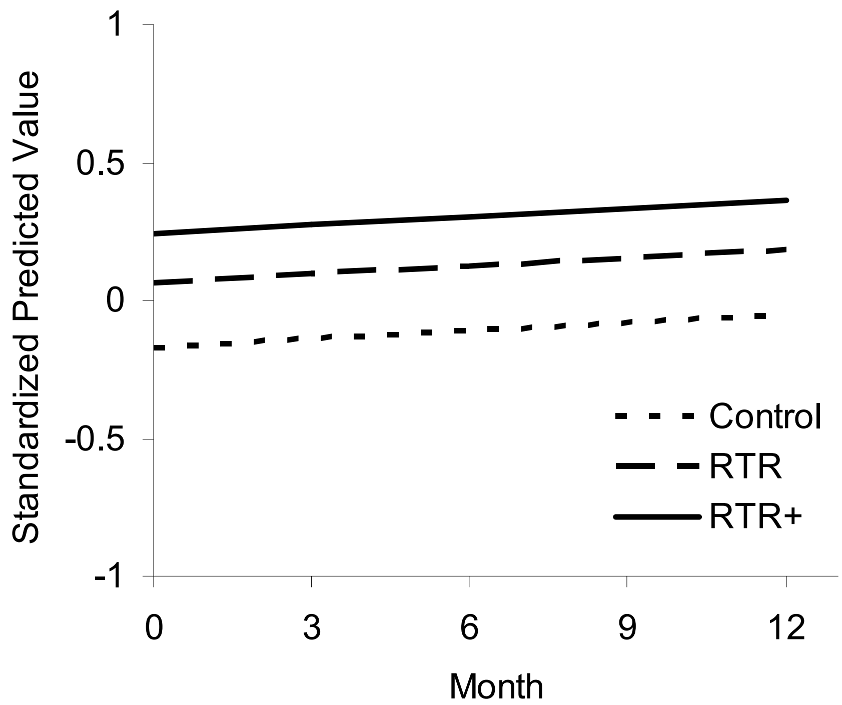

Figure 3.17. Fitted fixed-effect regression lines for prophylactic self-efficacy, covariate model.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table 3.56). Inspection of parameter estimates from Table 3.56 and subsequent linear contrasts (Table 3.58) revealed that for Caucasians, RTR+ produced higher prophylactic self-efficacy than both RTR and the control group, whereas for Hispanics, RTR produced higher self-efficacy than the control group, RTR+ produced marginally higher self-efficacy than the control group, and RTR+ and RTR did not differ. For African-Americans, the three treatment conditions did not differ. These trends can be seen in the estimated means from the extended model in Table 3.59. Detailed summary statistics for the covariate and extended models can be found in Tables D.25 and D.26 of Appendix D.

Table 3.58. Tests of additional hypotheses for the extended model for prophylactic self-efficacy.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Hispanics	7.73	0.005
RTR+ vs. Control, Hispanics	3.46	0.063
RTR+ vs. RTR, Hispanics	1.96	0.162
RTR vs. Control, African-Americans	0.26	0.609
RTR+ vs. Control, African-Americans	0.14	0.714
RTR+ vs. RTR, African-Americans	0.86	0.355
RTR+ vs. RTR, Caucasian/Other	4.71	0.030

Table 3.59. Estimated means for the extended model for prophylactic self-efficacy.

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	2.81 (.05)	2.83 (.05)	2.84 (.05)	2.87 (.05)
RTR	2.92 (.05)	2.94 (.05)	2.95 (.05)	2.98 (.05)
RTR+	3.05 (.05)	3.07 (.05)	3.08 (.05)	3.10 (.05)
Hispanic				
CONTROL	2.77 (.09)	2.78 (.09)	2.79 (.09)	2.82 (.10)
RTR	3.13 (.10)	3.14 (.10)	3.15 (.10)	3.18 (.10)
RTR+	2.96 (.08)	2.98 (.08)	2.99 (.08)	3.02 (.08)
African-American				
CONTROL	2.82 (.07)	2.83 (.07)	2.85 (.07)	2.87 (.08)
RTR	2.77 (.07)	2.79 (.07)	2.80 (.07)	2.83 (.07)
RTR+	2.85 (.07)	2.87 (.07)	2.88 (.07)	2.91 (.07)

Note 1. Means estimated at the following covariate values: Pretest=2.91, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

Perceived Behavioral Control

Linear random effects regression models were used to test effects of intervention assignment on participants' perceived behavioral control (in using prophylaxis), adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent

Table 3.60. Random effect and covariance structure comparisons for perceived behavioral control.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3095.41	3190.23	17			
Random intercept	3117.79	3201.45	15	26.38	2	0.000
Covariance structure of random effects						
Unstructured	3095.41	3190.23	17			
Exchangeable	3332.61	3421.85	16	239.2	1	0.000
Independent	3094.23	3183.48	16	0.82	1	0.364
Identity	3366.91	3450.57	15	274.67	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.60.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of perceived behavioral control at presurvey: Higher control initially was linked to higher control at all later time points. There was also a significant positive effect of both interventions: Relative to the control group, participants in RTR+ and RTR had higher perceived behavioral control at all later time points. Participants from New York had higher perceived behavioral control overall than participants from Texas, females had higher control than males overall, and African-Americans perceived themselves to have lower control than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.61.

Table 3.61. Comparison of baseline, covariate, variable time trend, and extended models for perceived behavioral control.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.587***	0.569***	0.569***	0.574***
RTR	0.165***	0.133**	0.120*	0.158*
RTR+	0.152***	0.129**	0.102*	0.182**
Month	0.007**	0.007**	0.003	0.007**
Arizona		-0.064	-0.065	-0.045
New York		0.153*	0.153*	0.154*
Age		0.031	0.032	0.032

Table 3.61 (Continued).

	Model			
	Baseline	Covariate	VTT	Extended
Female		0.146***	0.145***	0.138***
Hispanic		-0.038	-0.038	-0.127
African-American		-0.106*	-0.106*	0.060
Month X RTR			0.004	
Month X RTR+			0.008	
Hispanic X RTR				0.215
Af. Amer. X RTR				-0.203
Hispanic X RTR+				0.064
Af. Amer. X RTR+				-0.253*
Intercept	1.18***	0.703*	0.714*	0.654*
Slope (sd)	0.029***	0.028***	0.028***	-3.552***
Intercept (sd)	0.399***	0.386***	0.386***	-0.964***
Residual (sd)	0.407***	0.408***	0.408***	-0.899***
Difference df		6	2	4
Difference G^2		29.13	2.02	10.17
p		0.0001	0.3634	0.0377

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

Linear contrasts assessing additional hypotheses showed that RTR+ and RTR produced comparable increases in perceived behavioral control (χ^2(1)= 0.01, p=.92), New York participants also had higher control than participants from Arizona (χ^2(1)= 6.65, p=.01), and African-Americans did not differ from Hispanics overall ($\chi^2(1)$ =1.08, p=.30). Estimated means from the covariate model can be found in Table 3.62 and Figure 3.18.

Table 3.62. Estimated means for the covariate model for perceived behavioral control (for prophylaxis).

	Month			
Intervention	0	3	6	12
CONTROL	2.81 (.04)	2.83 (.04)	2.85 (.04)	2.90 (.05)
RTR	2.94 (.04)	2.96 (.04)	2.99 (.04)	3.03 (.05)
RTR+	2.94 (.04)	2.96 (.04)	2.98 (.04)	3.03 (.05)

Note. Means estimated at the following covariate values: Pretest=2.82, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

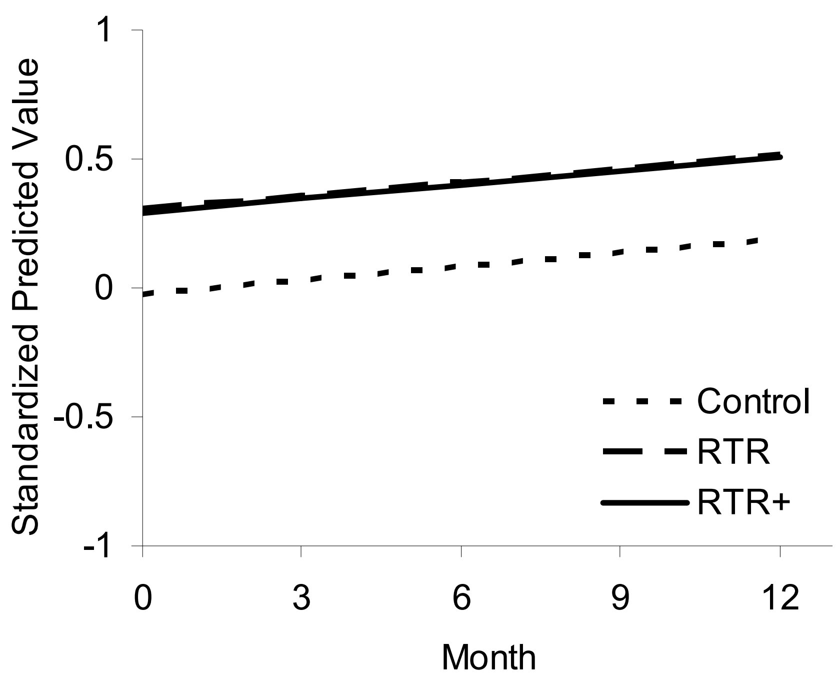

Figure 3.18. Fitted fixed-effect regression lines for perceived behavioral control (for prophylaxis), covariate model.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity and is reflected by the significant African-American by RTR+ component of the interaction in Table 3.61. Inspection of parameter estimates from Table 3.61 and subsequent linear contrasts (Table 3.63) revealed that for Caucasians and Hispanics, both RTR+ and RTR produced significantly higher perceived behavioral control than did the control group, whereas for African-Americans, no differences were detected. These trends can be seen in the estimated means from the extended model in Table 3.64. Detailed summary statistics for the covariate and extended models can be found in Tables D.27 and D.28 of Appendix D.

Table 3.63. Tests of additional hypotheses for the extended model for perceived behavioral control.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Hispanics	8.58	0.003
RTR+ vs. Control, Hispanics	5.43	0.020
RTR+ vs. RTR, Hispanics	1.25	0.265
RTR vs. Control, African-Americans	0.25	0.618
RTR+ vs. Control, African-Americans	0.62	0.427
RTR+ vs. RTR, African-Americans	0.08	0.768
RTR+ vs. RTR, Caucasian/Other	0.18	0.671

Table 3.64. Estimated means for the extended model for perceived behavioral control (for prophylaxis).

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	2.78 (.05)	2.80 (.05)	2.83 (.05)	2.87 (.05)
RTR	2.94 (.05)	2.96 (.05)	2.98 (.05)	3.03 (.05)
RTR+	2.96 (.05)	2.99 (.05)	3.01 (.05)	3.05 (.05)
Hispanic				
CONTROL	2.66 (.09)	2.68 (.09)	2.70 (.09)	2.74 (.10)
RTR	3.03 (.10)	3.05 (.10)	3.07 (.10)	3.12 (.10)
RTR+	2.90 (.08)	2.92 (.08)	2.95 (.08)	2.99 (.08)
African-American				
CONTROL	2.84 (.07)	2.86 (.07)	2.89 (.07)	2.93 (.08)
RTR	2.80 (.07)	2.82 (.07)	2.84 (.07)	2.89 (.07)
RTR+	2.77 (.06)	2.79 (.06)	2.82 (.07)	2.86 (.07)

Note 1. Means estimated at the following covariate values: Pretest=2.82, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

Recognition of Warning Signals

Linear random effects regression models were used to test effects of intervention assignment on participants' self-efficacy, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.65.

Table 3.65. Random effect and covariance structure comparisons for warning signals.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	4180.09	4274.90	17			
Random intercept	4205.02	4288.68	15	28.94	2	0.000
Covariance structure of random effects						
Unstructured	4180.09	4274.90	17			
Exchangeable	4395.26	4484.50	16	217.18	1	0.000
Independent	4179.51	4268.75	16	1.43	1	0.232
Identity	4427.27	4510.93	15	249.76	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) significantly improved upon the covariate model. In the variable time trend model, there was a significant positive effect of warning signal recognition at presurvey: Recognizing warning signals at presurvey was linked to their recognition at all later time points. There was also a significant positive initial effect of both interventions: Relative to the control group, participants in RTR+ and RTR were more likely to recognize warning signals at postsurvey. In addition, Arizona

Table 3.66. Comparison of baseline, covariate, and variable time trend models for warning signals.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.434***	0.432***	0.432***
RTR	0.562***	0.545***	0.604***
RTR+	0.830***	0.847***	0.932***
Month	-0.0107**	-0.0102**	0.006
Arizona		-0.206**	-0.204**
New York		-0.138	-0.137
Age		0.087***	0.086***
Female		0.090	0.091
Hispanic		-0.068	-0.068
African-American		-0.170**	-0.171**
Month X RTR			-0.018*
Month X RTR+			-0.027***
Intercept	0.991***	-0.331	-0.367
Slope (sd)	-3.273***	-3.246***	-3.275***
Intercept (sd)	-0.677***	-0.719***	-0.718***
Residual (sd)	-0.601***	-0.605***	-0.607***
Difference df		6	2
Difference G^2		36.95	11.84
p		0.0000	0.0027

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

participants were less likely to recognize warning signals overall than participants from Texas, older participants were more likely overall, and African-Americans were less likely overall to recognize warning signals than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.66.

Linear contrasts assessing additional hypotheses (Table 3.67) showed that both RTR+ and RTR participants were significantly more likely to recognize warning signals than control participants through 12 months, and RTR+ participants recognized significantly more warning signals than RTR participants through 12 months. Arizona participants did not differ from New York participants ($\chi^2(1)=0.37$ p=.54), and African-Americans did not differ from Hispanics ($\chi^2(1)=1.47$, p=.22).

Table 3.67. Tests of additional hypotheses for the variable time trend model for warning signals.

Comparison	$\chi^2(1)$	p
RTR vs. Control @ 3mo	77.26	0.000
RTR vs. Control @ 6mo	53.88	0.000
RTR vs. Control @ 12mo	15.29	0.000
RTR+ vs. Control @ 3mo	217.86	0.000
RTR+ vs. Control @ 6mo	154.26	0.000
RTR+ vs. Control @ 12mo	44.09	0.000
RTR+ vs. RTR @ Postsurvey	27.67	0.000
RTR+ vs. RTR @ 3mo	27.04	0.000
RTR+ vs. RTR @ 6mo	18.84	0.000
RTR+ vs. RTR @ 12mo	5.43	0.020

As illustrated by Table 3.68 and Figure 3.19, the negative coefficients for the interaction terms in Table 3.66 suggest that the initial increases in the recognition of warning signals for RTR+ and RTR approach convergence with the control group over time. Tests of intervention by age, intervention by

Table 3.68. Estimated means for the variable time trend model for warning signals.

	Month			
Intervention	0	3	6	12
CONTROL	1.82 (.06)	1.83 (.06)	1.85 (.06)	1.89 (.08)
RTR	2.42 (.06)	2.38 (.06)	2.35 (.06)	2.27 (.08)
RTR+	2.75 (.06)	2.68 (.06)	2.62 (.06)	2.49 (.07)

Note. Means estimated at the following covariate values: Pretest=1.88, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

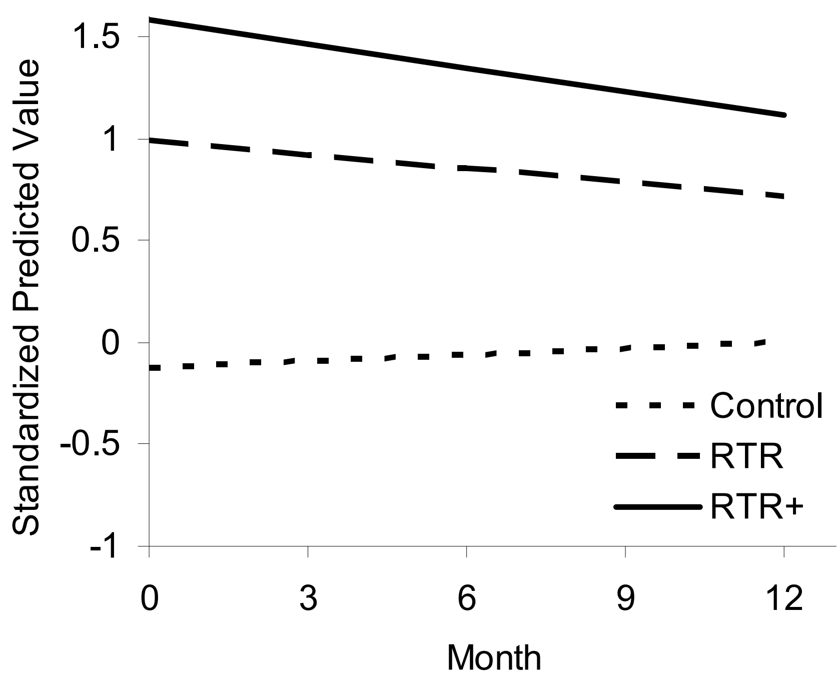

Figure 3.19. Fitted fixed-effect regression lines for warning signals, variable time trend model.

gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the variable time trend model can be found in Table D.29 of Appendix D.

Categorical Risk Perception

Linear random effects regression models were used to test effects of intervention assignment on participants' categorical risk perception, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed

Table 3.69. Random effect and covariance structure comparisons for categorical risk perception.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	2357.02	2451.86	17			
Random intercept	2372.31	2456.00	15	19.3	2	0.000
Covariance structure of random effects						
Unstructured	2357.02	2451.86	17			
Exchangeable	2600.06	2689.33	16	245.04	1	0.000
Independent	2356.02	2445.28	16	1.00	1	0.317
Identity	2638.37	2722.06	15	284.35	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.69.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of categorical risk perception at presurvey: Higher categorical risk perception initially was linked to higher categorical risk perception at all later time points. There was also a significant positive effect of both interventions: Relative to the control group, participants in RTR+ and RTR had higher categorical risk perception at all later time points. Participants from Arizona had lower categorical risk perception overall than participants from Texas, and females had higher categorical risk perception than males overall. In addition, older participants perceived more categorical risk than younger participants overall, and African-Americans perceived lower categorical risk overall than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.70.

Table 3.70. Comparison of baseline, covariate, and variable time trend models for categorical risk perception.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.539***	0.525***	0.524***	0.525***
RTR	0.126**	0.104**	0.120**	0.129*
RTR+	0.292***	0.282***	0.311***	0.297***
Month	-0.005*	-0.005*	0.000	-0.004*
Arizona		-0.107*	-0.106*	-0.089*
New York		0.038	0.038	0.037
Age		0.048**	0.047**	0.048**
Female		0.130***	0.131***	0.123***
Hispanic		-0.015	-0.015	-0.123
African-American		-0.101**	-0.101**	0.018
Month X RTR			-0.005	
Month X RTR+			-0.009	
Hispanic X RTR				0.218
Af. Amer. X RTR				-0.202*
Hispanic X RTR+				0.105
Af. Amer. X RTR+				-0.126
Intercept	1.31***	0.572*	0.562*	0.558*
Slope (sd)	0.022***	0.021***	0.021***	0.021***
Intercept (sd)	0.339***	0.324***	0.325***	0.320***
Residual (sd)	0.339***	0.339***	0.339***	0.339***
Difference df		6	2	4
Difference G^2		39.43	326	11.01
p		0.0000	0.1962	0.0265

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

Linear contrasts assessing additional hypotheses showed that participants in RTR+ had higher overall categorical risk perception than participants in RTR ($\chi^2(1)=22.72$, $p<.01$), New York participants perceived

Table 3.71. Estimated means for the covariate model for categorical risk perception.

	Month			
Intervention	0	3	6	12
CONTROL	2.88 (.04)	2.87 (.04)	2.85 (.04)	2.83 (.04)
RTR	2.99 (.04)	2.97 (.04)	2.96 (.04)	2.93 (.04)
RTR+	3.16 (.04)	3.15 (.04)	3.14 (.04)	3.11 (.04)

Note 1. Means estimated at the following covariate values: Pretest=2.95, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

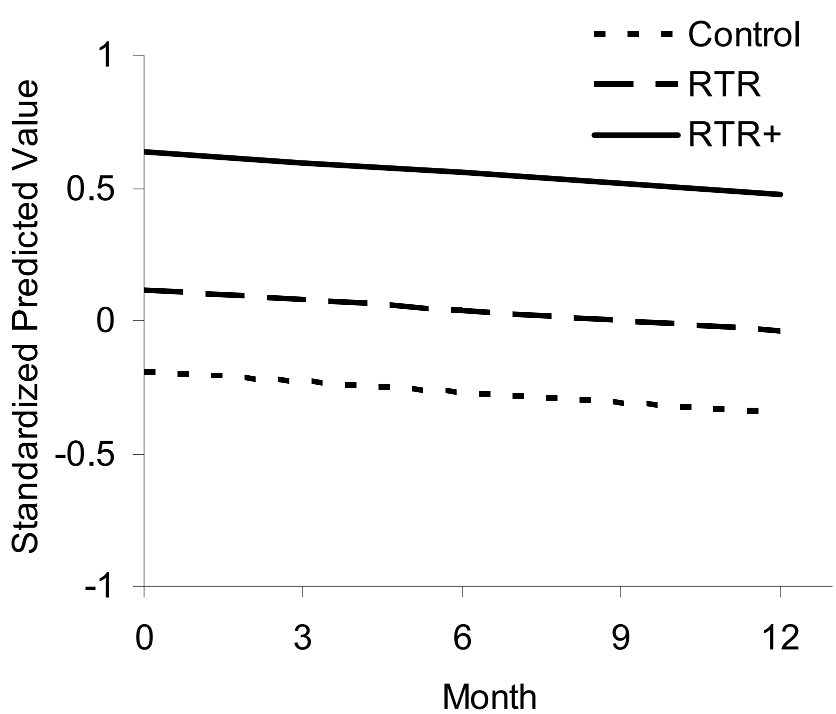

Figure 3.20. Fitted fixed-effect regression lines for categorical risk perception, covariate model.

more categorical risk than participants from Arizona (χ^2(1)=4.25, p=0.04), and African-Americans did not differ from Hispanics overall (χ^2(1) =2.48, p=0.12). Estimated means from the covariate model can be found in Table 3.71 and Figure 3.20.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by ethnicity (Table 3.70). Inspection of parameter estimates from Table 3.70 and subsequent linear contrasts (Table 3.72) revealed that 1) for Caucasians and Hispanics, both RTR+ and RTR produced significantly higher overall categorical risk perception than did the control group, 2) for Caucasians and African-Americans (but not Hispanics), RTR+ produced significantly higher categorical risk perception than RTR, and 3) RTR+, but not RTR, produced higher categorical risk perception than the control group for African-Americans. These trends can be seen in the estimated means from the extended model in

Table 3.72. Tests of additional hypotheses for the extended model for categorical risk perception.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Hispanics	11.63	0.001
RTR+ vs. Control, Hispanics	23.43	0.000
RTR+ vs. RTR, Hispanics	0.52	0.471
RTR vs. Control, African-Americans	0.58	0.446
RTR+ vs. Control, African-Americans	6.76	0.009
RTR+ vs. RTR, African-Americans	12.39	0.000
RTR+ vs. RTR, Caucasian/Other	12.67	0.000

Table 3.73. Estimated means for the extended model for categorical risk perception.

	Month			
	0	3	6	12
Caucasian/Other				
CONTROL	2.87 (.04)	2.85 (.04)	2.84 (.04)	2.81 (.04)
RTR	3.00 (.04)	2.98 (.04)	2.97 (.04)	2.94 (.05)
RTR+	3.17 (.04)	3.15 (.04)	3.14 (.04)	3.11 (.04)
Hispanic				
CONTROL	2.74 (.08)	2.73 (.08)	2.72 (.08)	2.69 (.08)
RTR	3.09 (.08)	3.08 (.08)	3.07 (.08)	3.04 (.08)
RTR+	3.15 (.06)	3.13 (.06)	3.12 (.06)	3.09 (.07)
African-American				
CONTROL	2.89 (.06)	2.87 (.06)	2.86 (.06)	2.83 (.06)
RTR	2.81 (.06)	2.80 (.05)	2.79 (.06)	2.76 (.06)
RTR+	3.06 (.056)	3.04 (.05)	3.03 (.05)	3.00 (.06)

Note 1. Means estimated at the following covariate values: Pretest=2.95, Site=Texas, Age=16, Gender=Male.
Note 2. Cell values are: estimated mean (standard error).

Table 3.73. Detailed summary statistics for the covariate and extended models can be found in Tables E30 and E31 of Appendix D.

Global Risk Perception

Linear random effects regression models were used to test effects of intervention assignment on participants' global risk perception, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.74.

Table 3.74. Random effect and covariance structure comparisons for global risk perception.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	5179.74	5274.43	17			
Random intercept	5182.19	5265.74	15	6.45	2	0.040
Covariance structure of random effects						
Unstructured	5179.74	5274.43	17			
Exchangeable	5345.23	5434.35	16	167.49	1	0.000
Independent	5179.90	5269.02	16	2.16	1	0.142
Identity	5363.48	5447.03	15	185.58	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant

Table 3.75. Comparison of baseline, covariate, and variable time trend models for global risk perception.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.449***	0.433***	0.432***
RTR	-0.081	-0.099	-0.063
RTR+	-0.028	-0.008	-0.024
Month	-0.012**	-0.012**	-0.010
Arizona		-0.152	-0.153
New York		-0.065	-0.062
Age		0.031	0.031
Female		-0.103	-0.103
Hispanic		-0.110	-0.111
African-American		-0.129	-0.128
Month X RTR			-0.010
Month X RTR+			0.004
Intercept	0.994***	0.682	0.670
Slope (sd)	0.031***	0.03***	0.03***
Intercept (sd)	0.587***	0.578***	0.579***
Residual (sd)	0.757***	0.759***	0.758***
Difference df		6	2
Difference G^2		13.21	2.13
p		0.0398	0.3449

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

positive effect of global risk perception at presurvey: Participants who perceived higher global risk perceived higher global risk over all later time points. There was also a significant negative effect of month. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.75.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=1.63$, p=.20), participants from Arizona did not differ from New York participants ($\chi^2(1)=0.42$, p=.52), and

Table 3.76. Estimated means for the covariate model for global risk perception.

	Month			
Intervention	0	3	6	12
CONTROL	1.98 (.07)	1.94 (.07)	1.91 (.07)	1.84 (.08)
RTR	1.88 (.07)	1.84 (.07)	1.81 (.07)	1.74 (.08)
RTR+	1.97 (.07)	1.94 (.07)	1.90 (.07)	1.83 (.08)

Note. Means estimated at the following covariate values: Pretest=1.86, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

African-Americans did not differ significantly from Hispanics ($\chi^2(1)=0.03$, p=.86). Estimated means from the covariate model can be found in Table 3.76 and Figure 3.21. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.32 of Appendix D.

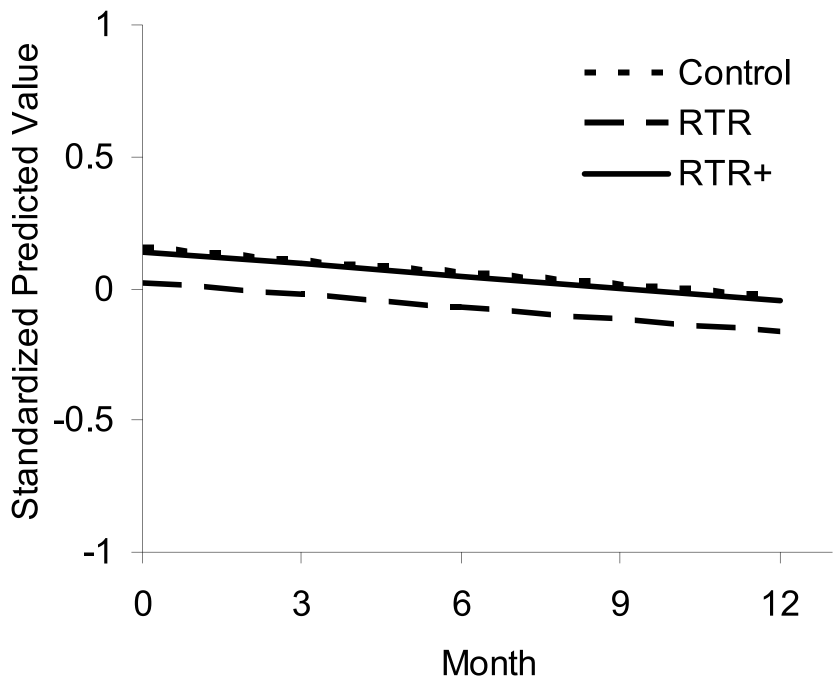

Figure 3.21. Fitted fixed-effect regression lines for global risk perception, covariate model.

Global Benefit Perception

Linear random effects regression models were used to test effects of intervention assignment on participants' global benefit perception, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix

Table 3.77. Random effect and covariance structure comparisons for global benefit perception.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	5179.74	5274.43	17			
Random intercept	5182.19	5265.74	15	6.45	2	0.040
Covariance structure of random effects						
Unstructured	5179.74	5274.43	17			
Exchangeable	5345.23	5434.35	16	167.49	1	0.000
Independent	5179.90	5269.02	16	2.16	1	0.142
Identity	5363.48	5447.03	15	185.58	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.77.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of global benefit perception at presurvey: Higher benefit perception initially was linked to higher perceived benefits at all later time points. There were also significant effects of age, gender, and ethnicity: Older participants perceived more overall benefits than younger participants,

Table 3.78. Comparison of baseline, covariate, variable time trend, and extended models for global benefit perception.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.564***	0.524***	0.524***	0.523***
RTR	0.110	0.081	0.106	0.081
RTR+	0.001	0.009	-0.003	0.014
Month	0.004	0.004	0.005	0.004
Arizona		-0.070	-0.071	-0.061
New York		0.134	0.136	0.140
Age		0.071**	0.071**	0.007
Female		-0.159**	-0.159**	-0.153**
Hispanic		-0.089	-0.090	-0.107
African-American		-0.216***	-0.215***	-0.220***
Month X RTR			-0.008	
Month X RTR+			0.003	
Age X RTR				0.033
Age X RTR+				0.139*
Intercept	0.576***	-0.326	-0.335	0.807***
Slope (sd)	0.033***	0.031***	0.032***	0.032***
Intercept (sd)	0.515***	0.498***	0.499***	0.494***
Residual (sd)	0.602***	0.602***	0.601***	0.600***
Difference df		6	2	2
Difference G^2		35.84	1.77	6.36
p		0.000	0.4118	0.0415

Note 1. VTT = Variable time trend; Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
Note 4. Age was centered prior to evaluating the extended model.
* p<0.05, ** p<0.01, *** p<0.001

females perceived less benefits overall than males, and African-Americans perceived less overall benefits than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.78.

Linear contrasts assessing additional hypotheses showed that RTR+

Table 3.79. Estimated means for the covariate model for global benefit perception.

	Month			
Intervention	0	3	6	12
CONTROL	1.50 (.06)	1.51 (.06)	1.52 (.06)	1.55 (.07)
RTR	1.58 (.06)	1.59 (.06)	1.60 (.06)	1.63 (.07)
RTR+	1.50 (.06)	1.52 (.06)	1.53 (.06)	1.56 (.07)

Note 1. Means estimated at the following covariate values: Pretest=1.32, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

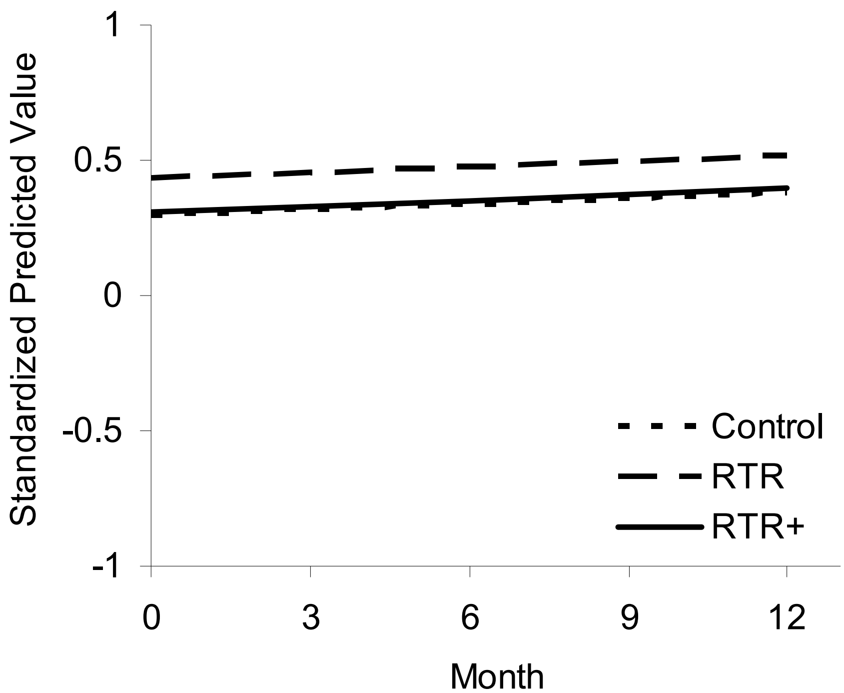

Figure 3.22. Fitted fixed-effect regression lines for global benefit perception, covariate model.

and RTR did not significantly differ overall (χ^2(1)=1.42, p=.23), New York participants did not differ overall from Arizona participants (χ^2(1)=3.18, p=0.07), and African-Americans did not differ from Hispanics overall (χ^2(1)=2.06, p=0.15). Estimated means from the covariate model can be found in Table 3.79 and Figure 3.22.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by age (Table 3.78). Inspection of parameter estimates from Table 3.78 and subsequent linear contrasts (Table 3.80) revealed that effects of RTR+ depended on the initial age of the participant: For younger participants, RTR+ produced decreases in perceived benefits relative to the control group (14 year olds) and relative to

Table 3.80. Tests of additional hypotheses for the extended model of perceived global benefits.

Comparison	$\chi^2(1)$	p
RTR vs. Control, 14 year olds	0.01	0.915
RTR+ vs. Control, 14 year olds	4.20	0.040
RTR+ vs. RTR, 14 year olds	4.24	0.040
RTR vs. Control, 15 year olds	0.26	0.609
RTR+ vs. Control, 15 year olds	2.31	0.128
RTR+ vs. RTR, 15 year olds	4.08	0.044
RTR+ vs. RTR, 16 year olds	1.21	0.270
RTR vs. Control, 17 year olds	1.66	0.195
RTR+ vs. Control, 17 year olds	3.31	0.068
RTR+ vs. RTR, 17 year olds	0.23	0.634
RTR vs. Control, 18 year olds	1.12	0.291
RTR+ vs. Control, 18 year olds	4.97	0.026
RTR+ vs. RTR, 18 year olds	1.19	0.276

RTR (14 and 15 year olds). For older participants (18 year olds), perceived benefits were higher for RTR+ participants than for control participants. These trends can be seen in the estimated means from the extended model in Table 3.81.

Table 3.81. Estimated means for the extended model for global benefit perception.

	Month			
	0	3	6	12
Age at -1 SD				
CONTROL	1.49 (.08)	1.5 (.07)	1.52 (.08)	1.54 (.08)
RTR	1.54 (.08)	1.55 (.08)	1.56 (.08)	1.59 (.08)
RTR+	1.36 (.07)	1.38 (.07)	1.39 (.07)	1.42 (.07)
Mean Age				
CONTROL	1.5 (.06)	1.51 (.06)	1.52 (.06)	1.55 (.07)
RTR	1.58 (.06)	1.59 (.06)	1.6 (.06)	1.63 (.07)
RTR+	1.51 (.06)	1.52 (.06)	1.54 (.06)	1.56 (.07)
Age at +1 SD				
CONTROL	1.5 (.07)	1.52 (.07)	1.53 (.07)	1.55 (.08)
RTR	1.62 (.07)	1.63 (.07)	1.64 (.07)	1.67 (.08)
RTR+	1.66 (.07)	1.67 (.07)	1.68 (.07)	1.71 (.08)

Note 1. Means estimated at the following covariate values: Pretest=1.32, Site=Texas, Gender=Male, Ethnicity = Caucasian/Other.
Note 2. Cell values are: estimated mean (standard error).

Detailed summary statistics for the covariate and extended models can be found in Tables D.33 and D.34 of Appendix D.

Gist Principle Endorsement

Linear random effects regression models were used to test effects of intervention assignment on participants' rate of gist principle endorsement, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent

Table 3.82. Random effect and covariance structure comparisons for gist principles.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	8774.08	8868.90	17			
Random intercept	8813.45	8897.12	15	43.37	2	0.000
Covariance structure of random effects						
Unstructured	8774.08	8868.90	17			
Exchangeable	9024.24	9113.48	16	252.16	1	0.000
Independent	8772.68	8861.92	16	0.60	1	0.438
Identity	9070.26	9153.92	15	299.58	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Table 3.83. Comparison of baseline, covariate, and variable time trend models for gist principles.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.721***	0.700***	0.700***
RTR	0.578**	0.529*	0.712**
RTR+	0.118	0.113	0.288
Month	-0.059***	-0.056***	-0.014
Arizona		-0.565*	-0.563*
New York		-0.425	-0.418
Age		-0.063	-0.064
Female		0.572***	0.572***
Hispanic		-0.148	-0.148
African-American		0.064	0.065
Month X RTR			-0.064*
Month X RTR+			-0.060*
Intercept	3.031***	4.095**	3.985**
Slope (sd)	0.14***	0.138***	0.136***
Intercept (sd)	1.716***	1.672***	1.675***
Residual (sd)	1.707***	1.709***	1.707***
Difference df		6	2
Difference G^2		24.71	6.82
p		0.0004	0.0331

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.

* p<0.05, ** p<0.01, *** p<0.001

model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.82.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) significantly improved upon the covariate model. In the variable time trend model, there was a significant positive effect of gist principle endorsement at presurvey: Endorsing more gist principles at presurvey was linked to more endorsement at all later time points. There was also a significant positive initial effect of RTR relative to the control group, where participants in RTR endorsed significantly more gist principles at postsurvey. In addition, Arizona participants endorsed fewer gist principles than Texas participants, and females endorsed more gist principles than males. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.83.

Linear contrasts assessing additional hypotheses (Table 3.84) showed that the initial effect of RTR (relative to control) extended through three months, and RTR also was significantly higher than RTR+ through three months. Arizona participants did not differ from New York participants ($\chi^2(1)=0.16$, $p=0.69$), and African-Americans did not differ from Hispanics ($\chi^2(1)=0.57$, $p=0.45$).

As illustrated by Table 3.85 and Figure 3.23, the negative coefficients for the interaction terms in Table 3.83 suggest that the initial increases (relative to the control group) in gist principle endorsement for RTR (and the

Table 3.84. Tests of additional hypotheses for the variable time trend model for gist principles.

Comparison	$\chi^2(1)$	p
RTR vs. Control @ 3mo	6.20	0.013
RTR vs. Control @ 6mo	2.10	0.146
RTR vs. Control @ 12mo	0.03	0.876
RTR+ vs. Control @ 3mo	0.32	0.572
RTR+ vs. Control @ 6mo	0.11	0.739
RTR+ vs. Control @ 12mo	1.96	0.161
RTR+ vs. RTR @ Postsurvey	4.24	0.040
RTR+ vs. RTR @ 3mo	4.54	0.033
RTR+ vs. RTR @ 6mo	3.53	0.060
RTR+ vs. RTR @ 12mo	1.44	0.231

Table 3.85. Estimated means for the variable time trend model for gist principles.

	Month			
Intervention	0	3	6	12
CONTROL	10.61 (.20)	10.57 (.19)	10.53 (.20)	10.45 (.26)
RTR	11.32 (.20)	11.09 (.19)	10.86 (.20)	10.39 (.27)
RTR+	10.90 (.19)	10.68 (.19)	10.46 (.19)	10.02 (.25)

Note 1. Means estimated at the following covariate values: Pretest=10.92, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

Note 2. Cell values are: estimated mean (standard error).

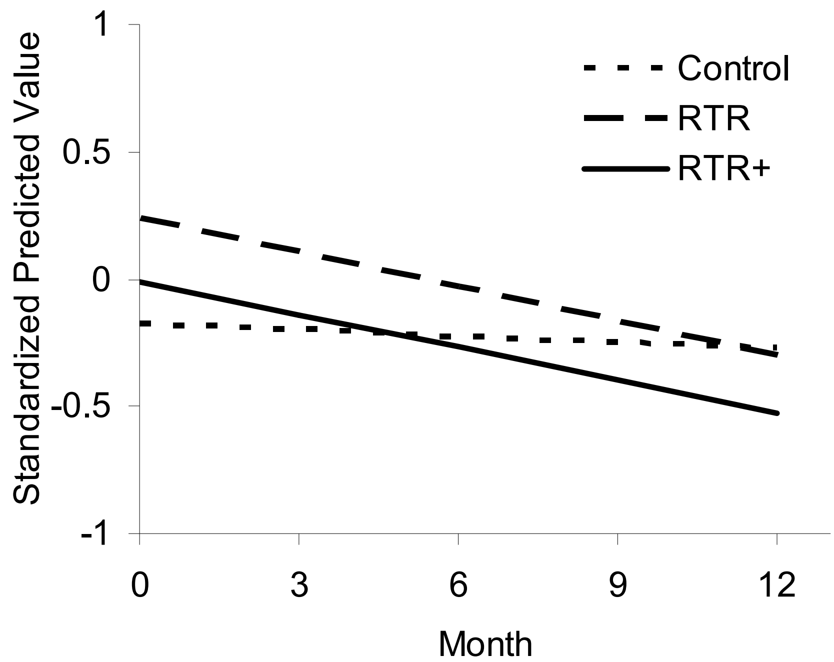

Figure 3.23. Fitted fixed-effect regression lines for gist principles, variable time trend model.

nonsignificant increase for RTR+) tend to converge with the control group over time (no groups differ at 12 months). Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the variable time trend model can be found in Table D.35 of Appendix D.

Specific Risk Perception

Linear random effects regression models were used to test effects of intervention assignment on participants' specific risk perception, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure significantly differed from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the model with no structure. Therefore, no structure was imposed on the covariance matrix of random effects in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.86.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction

Table 3.86. Random effect and covariance structure comparisons for specific risk perception.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3050.85	3145.67	17			
Random intercept	3096.72	3180.38	15	49.87	2	0.000
Covariance structure of random effects						
Unstructured	3050.85	3145.67	17			
Exchangeable	3190.86	3280.10	16	142.01	1	0.000
Independent	3055.07	3144.31	16	6.22	1	0.013
Identity	3211.19	3294.85	15	164.34	2	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Table 3.87. Comparison of baseline, covariate, and variable time trend models for specific risk perception.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.604***	0.582***	0.581***
RTR	-0.016	-0.015	0.002
RTR+	-0.047	-0.044	-0.028
Month	0.003	0.003	0.006
Arizona		0.120**	0.120**
New York		0.052	0.053
Age		-0.002	-0.002
Female		-0.199***	-0.199***
Hispanic		0.046	0.046
African-American		0.109**	0.109**
Month X RTR			-0.005
Month X RTR+			-0.005
Intercept	0.259***	0.353	0.343
Slope (sd)	0.037***	0.038***	0.038***
Intercept (sd)	0.365***	0.360***	0.360***
Residual (sd)	0.408	0.744**	0.742**
Difference df		6	2
Difference G^2		43.76	0.67
p		0.0000	0.7161

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

(allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of specific risk perception at presurvey: Participants who perceived higher specific risk initially tended to perceive more specific risk over all later time points. In addition, Arizona participants perceived more specific risk than Texas participants, females perceived more specific risk than males, and African-Americans perceived more specific risk than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.87.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=0.52$, p=.47), participants from Arizona did not differ overall from participants from New York ($\chi^2(1)=0.79$, p=.37), and African-Americans did not show significant overall differences compared to Hispanics ($\chi^2(1)=1.1$, p=0.29). Estimated means from the covariate model can be found in Table 3.88 and Figure 3.24. Tests of

Table 3.88. Estimated means for the covariate model for specific risk perception.

	Month			
Intervention	0	3	6	12
CONTROL	0.52 (.04)	0.53 (.04)	0.53 (.04)	0.55 (.05)
RTR	0.49 (.04)	0.50 (.04)	0.51 (.04)	0.52 (.05)
RTR+	0.53 (.04)	0.54 (.04)	0.55 (.04)	0.57 (.05)

Note 1. Means estimated at the following covariate values: Pretest=0.37, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

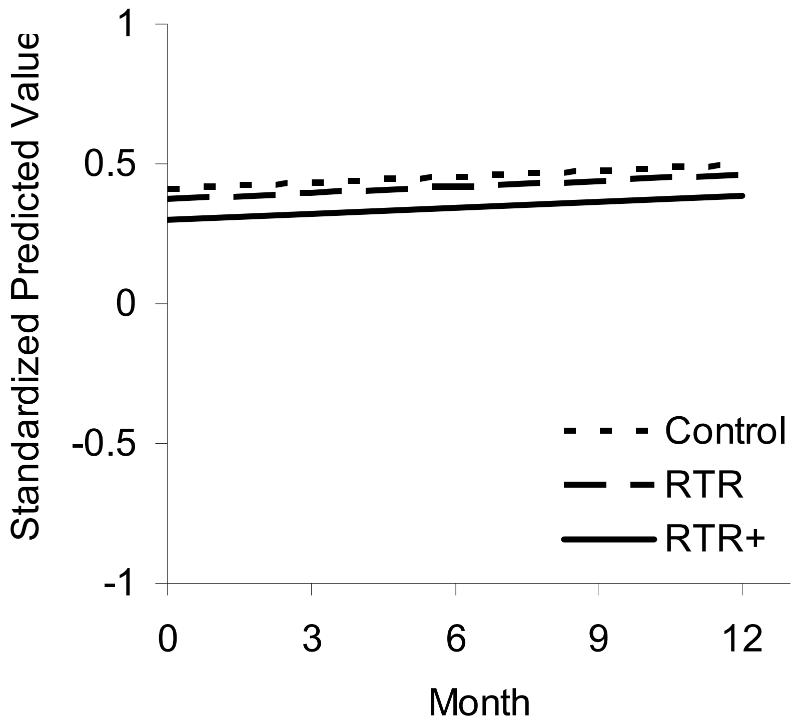

Figure 3.24. Fitted fixed-effect regression lines for specific risk perception, covariate model.

intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.36 of Appendix D.

Quantitative Risk Perception

Linear random effects regression models were used to test effects of intervention assignment on participants' quantitative risk perception, adjusting for covariates discussed in the methods section. A model including both a random slope for month and a subject-specific random intercept failed to converge, and a random intercept model was therefore used in all subsequent model testing. With only one random effect, there is no

Table 3.89. Comparison of baseline, covariate, and variable time trend models for quantitative risk perception.

	Model			
	Baseline	Covariate	VTT	Extended
Presurvey	0.303***	0.301***	0.301***	0.301***
RTR	1.643	1.846	2.248	-0.686
RTR+	0.549	0.648	1.305	1.747
Month	-0.068	-0.053	0.032	-0.053
Arizona		0.684	0.698	0.827
New York		-1.416	-1.390	-1.159
Age		0.031	0.025	-0.002
Female		-0.372	-0.367	-1.113
Hispanic		0.770	0.767	0.603
African-American		2.798*	2.801*	2.863*
Month X RTR			-0.090	
Month X RTR+			-0.151	
Female X RTR				4.615*
Female X RTR+				-1.707
Intercept	3.848***	2.613	2.332	3.541
Intercept (sd)	8.491***	8.44***	8.44***	8.38***
Residual (sd)	11.86***	11.81***	11.80***	11.79***
Difference df		6	2	2
Difference G^2		7.8	1.00	8.96
p		0.2532	0.6055	0.0114

Note 1. VTT = Variable time trend, Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Difference test comparisons: Baseline vs. Covariate, Covariate vs. VTT, Covariate vs. Extended.
* p<0.05, ** p<0.01, *** p<0.001

covariance structure of random effects and alternative covariance structures were not assessed.

Addition of site, age, gender, and ethnicity did not significantly improve fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of quantitative risk perception at presurvey: Higher risk perception initially was linked to higher perceived risk at all later time points. There was also a significant effect of ethnicity, with African-Americans perceiving themselves at higher quantitative risk than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.89.Linear contrasts assessing additional hypotheses showed that RTR+ and RTR did not significantly differ overall ($\chi^2(1)=1.23$, p=.27), New York participants did not differ overall from Arizona participants ($\chi^2(1)= 1.10$, p=.29), and African-Americans did not differ from Hispanics overall ($\chi^2(1)= 1.62$, p=.20).

Table 3.90. Estimated means for the covariate model for quantitative risk perception.

	Month			
Intervention	0	3	6	12
CONTROL	5.85 (1.1)	5.70 (1.0)	5.54 (1.0)	5.22 (1.2)
RTR	7.70 (1.1)	7.54 (1.0)	7.38 (1.1)	7.07 (1.2)
RTR+	6.50 (1.1)	6.34 (1.0)	6.18 (1.0)	5.87 (1.0)

Note 1. Means estimated at the following covariate values: Pretest=9.10, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

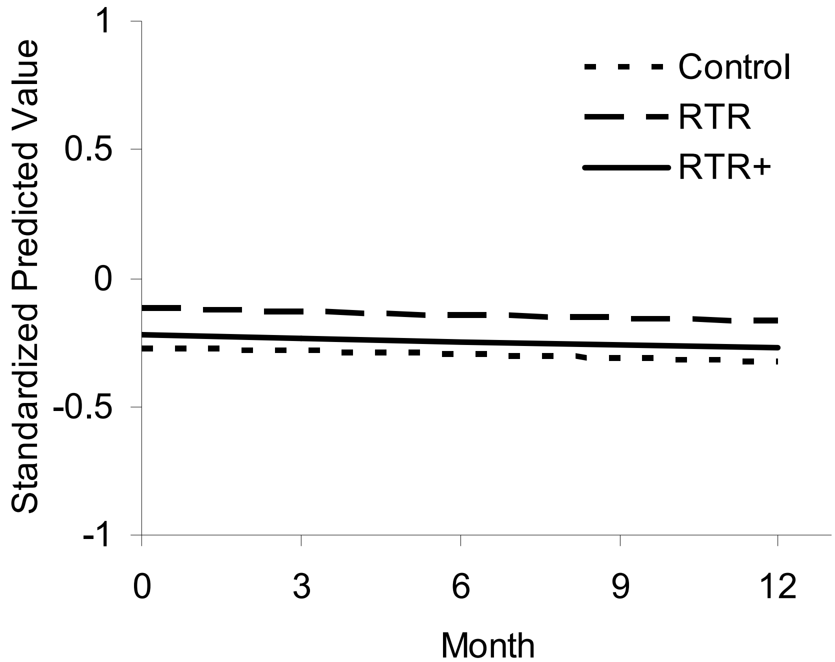

Figure 3.25. Fitted fixed-effect regression lines for quantitative risk perception, covariate model.

Estimated means from the covariate model can be found in Table 3.90 and Figure 3.25.

Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions revealed an effect of intervention by gender (Table 3.89). Inspection of parameter estimates from Table 3.89 and subsequent linear contrasts (Table 3.91) revealed qualified curriculum effects: females in RTR had higher quantitative risk perception than females in either RTR+ or the control group over all time points after the interventions. These trends can be seen in the estimated means from the extended model in Table 3.92. Detailed summary statistics for the covariate and extended models can be found in Tables D.37 and D.38 of Appendix D.

Table 3.91. Tests of additional hypotheses for the extended model of quantitative risk perception.

Comparison	$\chi^2(1)$	p
RTR vs. Control, Females	6.60	0.01
RTR+ vs. Control, Females	0.00	0.977
RTR+ vs. RTR, Females	7.62	0.006
RTR+ vs. RTR, Males	2.19	0.139

Table 3.92. Estimated means for the extended model for quantitative risk perception.

	Month			
	0	3	6	12
Male				
CONTROL	6.91 (1.3)	6.38 (1.3)	6.43 (1.3)	6.07 (1.4)
RTR	6.36 (1.2)	5.92 (1.2)	5.85 (1.2)	5.52 (1.3)
RTR+	8.67 (1.2)	8.36 (1.2)	8.23 (1.2)	7.68 (1.3)
Female				
CONTROL	7.19 (1.3)	6.85 (1.3)	6.57 (1.3)	6.33 (1.3)
RTR	11.13 (2.0)	10.83 (2.0)	10.54 (2.0)	10.34 (2.0)
RTR+	7.14 (1.9)	6.83 (1.9)	6.52 (1.9)	6.36 (1.9)

Note 1. Means estimated at the following covariate values: Pretest=9.10, Site=Texas, Age=16, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

Reasons For/Against Pregnancy

Linear random effects regression models were used to test effects of intervention assignment on participants' scores on a scale of reasons for/against pregnancy, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of

Table 3.93. Random effect and covariance structure comparisons for reasons for/against pregnancy.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	1460.08	1554.90	17			
Random intercept	1512.55	1596.21	15	56.46	2	0.000
Covariance structure of random effects						
Unstructured	1460.08	1554.90	17			
Exchangeable	1588.83	1678.07	16	130.75	1	0.000
Independent	1462.60	1551.84	16	4.52	1	0.034
Identity	1622.24	1705.90	15	166.15	2	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure significantly differed from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the model with no structure. Therefore, no structure was imposed on the covariance matrix of random effects in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.93.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of the presurvey score on the reasons for/against pregnancy

Table 3.94. Comparison of baseline, covariate, and variable time trend models for reasons for/against pregnancy.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.768***	0.762***	0.762***
RTR	-0.054	-0.045	-0.042
RTR+	-0.028	-0.032	-0.022
Month	0.001	0.001	0.003
Arizona		0.051	0.052
New York		-0.048	-0.048
Age		-0.010	-0.010
Female		-0.033	-0.033
Hispanic		0.056	0.056
African-American		0.054	0.054
Month X RTR			-0.001
Month X RTR+			-0.004
Intercept	0.373***	0.527**	0.524**
Slope (sd)	0.02***	0.02***	0.019***
Intercept (sd)	0.207***	0.20***	0.20***
Correlation	0.405	0.371	0.373
Residual (sd)	0.279***	0.279***	0.279***
Difference df		6	2
Difference G^2		14.91	1.04
p		0.0209	0.5951

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

scale: Participants who scored higher on that scale (who perceived the consequences of pregnancy more favorably) tended to score higher over all later time points. No other effects reached significance. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.94.

Table 3.95. Estimated means for the covariate model for reasons for/against pregnancy.

	Month			
Intervention	0	3	6	12
CONTROL	1.67 (.03)	1.67 (.03)	1.67 (.03)	1.68 (.03)
RTR	1.62 (.03)	1.63 (.03)	1.63 (.03)	1.64 (.03)
RTR+	1.63 (.03)	1.64 (.03)	1.64 (.03)	1.65 (.03)

Note 1. Means estimated at the following covariate values: Pretest=1.70, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

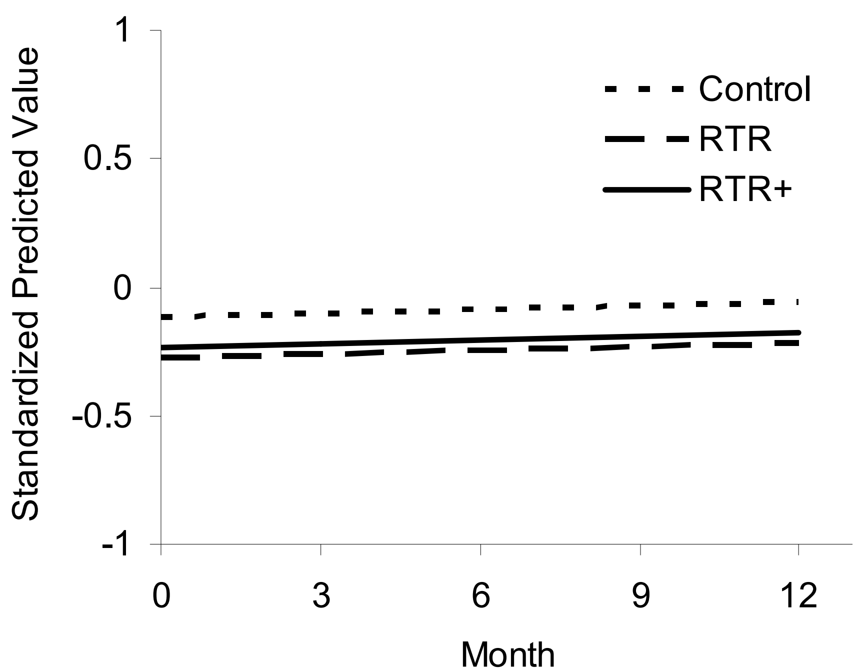

Figure 3.26. Fitted fixed-effect regression lines for reasons for/against pregnancy, covariate model.

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=0.23$, p=.63), participants from Arizona scored higher than participants from New York ($\chi^2(1)=3.75$, p=.05), and African-Americans did not show significant overall differences compared to Hispanics ($\chi^2(1) =0.00$, p=0.96). Estimated means from the covariate model can be found in Table 3.95 and Figure 3.26. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.39 of Appendix D.

Reasons to Have Sex

Linear random effects regression models were used to test effects of intervention assignment on participant ratings of reasons to have sex, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.96.

Table 3.96. Random effect and covariance structure comparisons for reasons to have sex.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	3056.40	3151.21	17			
Random intercept	3089.22	3172.88	15	36.83	2	0.000
Covariance structure of random effects						
Unstructured	3056.40	3151.21	17			
Exchangeable	3210.53	3299.77	16	156.14	1	0.000
Independent	3055.78	3145.01	16	1.38	1	0.240
Identity	3244.55	3328.20	15	190.77	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction (allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of reasons to have sex ratings at presurvey: More favorable ratings of the reasons to have sex were linked to more favorable ratings over all later time points. In addition, New York (relative to Texas) participants and older participants rated reasons to have sex more favorably, and females rated them less favorably than males. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.97.

Table 3.97. Comparison of baseline, covariate, and variable time trend models for reasons to have sex.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.671***	0.653***	0.653***
RTR	0.060	0.025	0.035
RTR+	-0.025	-0.031	-0.048
Month	0.001	0.001	0.000
Arizona		-0.043	-0.044
New York		0.167*	0.168*
Age		0.048**	0.048**
Female		-0.085*	-0.085*
Hispanic		-0.037	-0.037
African-American		-0.042	-0.041
Month X RTR			-0.004
Month X RTR+			0.005
Intercept	0.537***	-0.115	-0.116
Slope (sd)	0.031***	0.030***	0.030***
Intercept (sd)	0.345***	0.333***	0.333***
Residual (sd)	0.417***	0.417***	0.417***
Difference df		6	2
Difference G^2		24.57	2.23
p		0.0004	0.3280

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.

* p<0.05, ** p<0.01, *** p<0.001

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=1.84$, p=.18), participants

Table 3.98. Estimated means for the covariate model for reasons to have sex.

	Month			
Intervention	0	3	6	12
RTR	1.79 (.04)	1.79 (.04)	1.79 (.04)	1.80 (.05)
RTR+	1.73 (.04)	1.73 (.04)	1.74 (.04)	1.74 (.05)
CONTROL	1.76 (.04)	1.76 (.04)	1.77 (.04)	1.77 (.05)

Note 1. Means estimated at the following covariate values: Pretest=1.70, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other
Note 2. Cell values are: estimated mean (standard error).

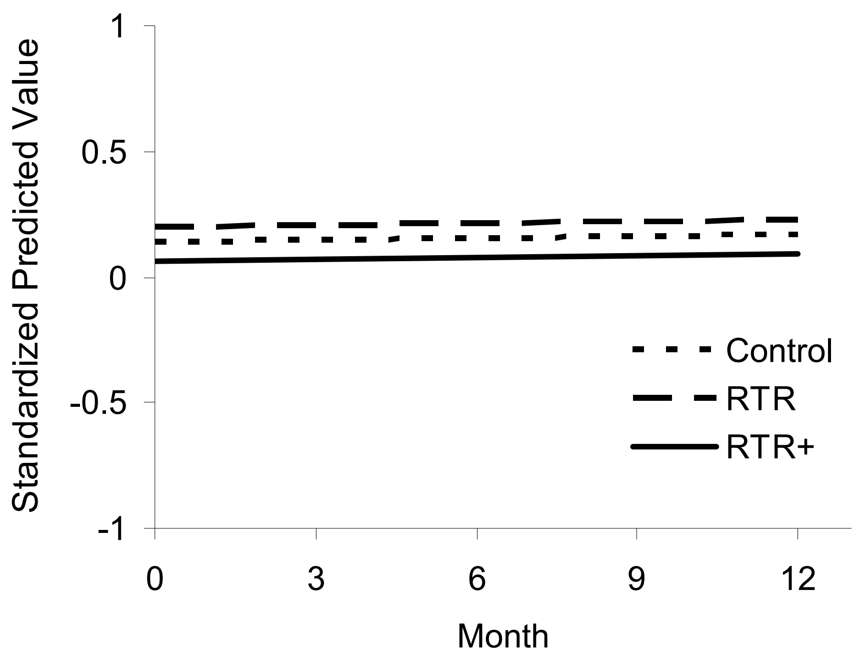

Figure 3.27. Fitted fixed-effect regression lines for reasons to have sex, covariate model.

from New York rated reasons to have sex more favorably than participants from Arizona (χ^2(1)=7.36, p=.01), and African-Americans did not differ significantly from Hispanics (χ^2(1)=0.01, p=.94). Estimated means from the covariate model can be found in Table 3.98 and Figure 3.27. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.40 of Appendix D.

Reasons to Not Have Sex

Linear random effects regression models were used to test effects of intervention assignment on participant ratings of reasons to not have sex, adjusting for covariates discussed in the methods section. The removal of a random slope for month significantly degraded fit relative to a model with a random slope for month and a subject-specific random intercept, and a random coefficient model was therefore used in all subsequent model testing. Comparison of possible covariance structures of the random effects revealed that 1) an exchangeable structure significantly degraded model fit relative to an unstructured covariance matrix; 2) an independent structure did not significantly differ from the unstructured matrix; and 3) an identity matrix significantly degraded model fit relative to the independent covariance structure. Therefore, an independent structure was used in all subsequent model testing. Summary statistics for comparisons of random effects models and alternative covariance structures appear in Table 3.99.

Addition of site, age, gender, and ethnicity significantly improved fit over the baseline model, and the addition of an intervention by month interaction

Table 3.99. Random effect and covariance structure comparisons for reasons to not have sex.

Model	AIC	BIC	Model df	Diff G^2	Diff G^2 df	p
Random effects						
Random slope	2609.20	2703.98	17			
Random intercept	2619.05	2702.68	15	13.85	2	0.001
Covariance structure of random effects						
Unstructured	2609.20	2703.98	17			
Exchangeable	2761.92	2851.13	16	154.73	1	0.000
Independent	2607.37	2696.58	16	0.17	1	0.677
Identity	2785.52	2869.15	15	180.15	1	0.000

Note 1. Tests of random slope and intercept models assumed no covariance structure.
Note 2. Diff = Difference, AIC = Aikake information criterion, BIC = Bayesian information criterion.

(allowing the time trends to vary across groups) did not significantly improve fit over the covariate model. In the covariate model, there was a significant positive effect of reasons to not have sex ratings at presurvey: More favorable ratings of the reasons to not have sex were linked to more favorable ratings over all later time points. In addition, there were positive effects of both RTR+ and RTR relative to the control group. Ratings of reasons to not have sex tended to decrease over time, Arizona participants rated those reasons significantly less favorably than did Texas participants, and older participants rated them more favorably than younger participants. In addition, females rated reasons to not have sex more favorably than males, and African-Americans rated them less favorably than Caucasians. Hierarchical comparisons of the baseline, covariate, and variable time trend models, and associated parameter estimates, appear in Table 3.100.

Table 3.100. Comparison of baseline, covariate, and variable time trend models for reasons to not have sex.

	Model		
	Baseline	Covariate	Variable time trend
Presurvey	0.674***	0.651***	0.651***
RTR	0.159***	0.143***	0.162***
RTR+	0.171***	0.167***	0.190***
Month	-0.0139***	-0.0133***	-0.00918*
Arizona		-0.132**	-0.131**
New York		-0.005	-0.004
Age		0.0347*	0.0344*
Female		0.119***	0.119***
Hispanic		0.044	0.043
African-American		-0.0802*	-0.0801*
Month X RTR			-0.005
Month X RTR+			-0.006
Intercept	0.836***	0.330	0.318
Slope (sd)	0.022***	0.021***	0.021***
Intercept (sd)	0.305***	0.293***	0.294***
Residual (sd)	0.382***	0.383***	0.383***
Difference df		6	2
Difference G^2		31.33	1.59
p		0.000	0.4509

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.
Note 3. Covariate model evaluated against the baseline model; variable time trend model evaluated against the covariate model.
* p<0.05, ** p<0.01, *** p<0.001

Linear contrasts assessing additional hypotheses showed that RTR+ did not significantly differ from RTR overall ($\chi^2(1)=0.44$, p=.51), participants from New York did not differ from participants in Arizona ($\chi^2(1)=3.43$, p=0.06), and African-Americans rated reasons to not have sex significantly less

Table 3.101. Estimated means for covariate model for reasons to not have sex.

	Month			
Intervention	0	3	6	12
CONTROL	2.81 (.04)	2.77 (.04)	2.73 (.04)	2.65 (.04)
RTR	2.95 (.04)	2.91 (.04)	2.87 (.04)	2.79 (.04)
RTR+	2.97 (.04)	2.93 (.04)	2.89 (.04)	2.81 (.04)

Note 1. Means estimated at the following covariate values: Pretest=2.95, Site=Texas, Age=16, Gender=Male, Ethnicity=Caucasian/Other

Note 2. Cell values are: estimated mean (standard error).

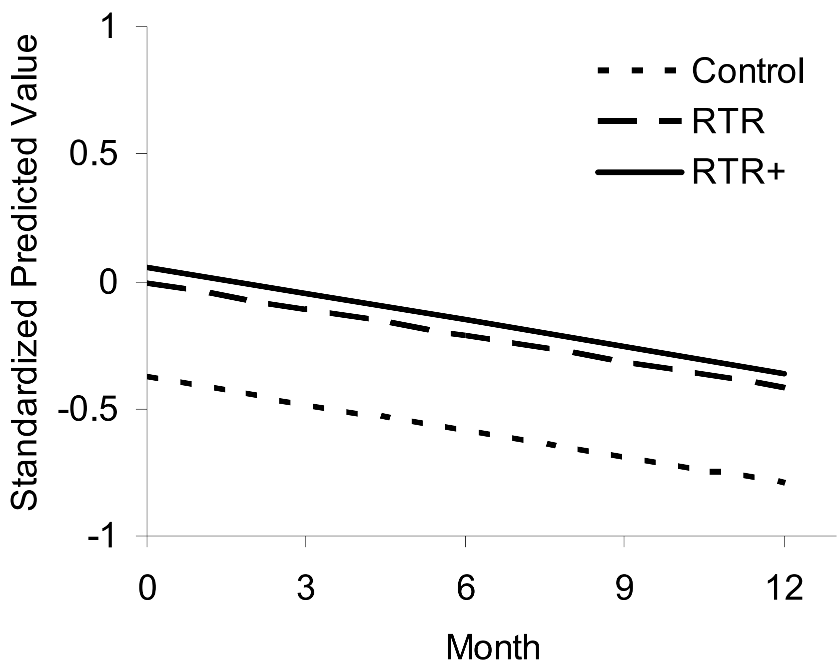

Figure 3.28. Fitted fixed-effect regression lines for reasons to not have sex, covariate model.

favorably than Hispanics (χ^2(1)=5.31, p=.02). Estimated means from the covariate model can be found in Table 3.101 and Figure 3.28. Tests of intervention by age, intervention by gender, and intervention by ethnicity interactions did not reach significance. Detailed summary statistics for the covariate model can be found in Table D.41 of Appendix D.

CHAPTER 4
DISCUSSION

Overall, the results of the study provide convincing evidence that the modified RTR+ curriculum not only is effective at reducing sexual risk in adolescence, but that it improves upon an established, theoretically motivated multi-component intervention endorsed by the Centers for Disease Control. Of 23 domains of variables assessed (including both behavioral variables and psychosocial mediators), theoretically sensible intervention effects were identified in 18 domains (the remaining five domains showed no differences between intervention groups and the control group). Of those 18 domains, assignment to RTR+ was more of a protective factor than assignment to the control group in 16 domains, and assignment to RTR was more of a protective factor than control-group assignment in 12 domains. Also among those 18 domains involving detected intervention effects, RTR+ assignment was more of a protective factor than RTR assignment for nine domains, whereas RTR assignment was more of a protective factor than RTR+ assignment in only two domains.

This chapter begins with a summary of findings presented in the results chapter with a focus on identifying important patterns of effects. Given the number of variables analyzed, to facilitate this objective material is organized by key predictor variables in the models – for example, when (for what dependent variables) did intervention assignment produce an effect, what was the nature of that effect, and how does it relate to other identified effects. The discussion begins with a review of significant covariates, followed by a discussion of intervention effects. Finally, the chapter ends with concluding remarks about the implications of the study and future directions for research.

Covariate Effects

The covariates of age, gender, ethnicity, and site related to behavioral and psychosocial variables in ways comparable to other studies. Consistent with theoretical expectations, age was a protective factor for two variables (Table 4.1) related to gist-based processing: categorical risk perception

Table 4.1. Domains involving significant overall age effects.

	Age Comparisons	
Domain	Older > Younger	Younger > Older
Sexual Behavior		✓
Prophylactic Behavior		✓
Recognition of warning signals	✓	
Perceived global benefits of sex		✓
Categorical risk perception	✓	
Reasons to have sex		✓
Reasons to not have sex	✓	

Note. Columns correspond to whether being older is more of a protective factor than being younger, or vice versa.

(older participants perceived more categorical risk) and warning signal recognition (older participants more readily recognized warning signals). Older age was also a protective factor for reasons to not have sex (older participants more readily endorsed such reasons). In contrast, younger age was a protective factor for sexual behavior (older participants were more sexually active), prophylactic behavior (older participants were more likely to report 2 or more unprotected encounters), global benefit perception (older participants rated the benefits of sex higher), and reasons to have sex (older participants more readily endorsed such reasons).

Table 4.2. Domains involving significant overall gender effects.

	Gender Comparisons	
Domain	M>F	F>M
Sexual Behavior*	✓	✓
Prophylactic Behavior**	✓	
Intentions to use Prophylaxis		✓
Knowledge		✓
Prophylactic attitudes		✓
Perceived parental sexual norms		✓
Perceived prophylactic norms		✓
Self-efficacy in "saying no" to sex		✓
Self-efficacy in using prophylaxis		✓
Perceived behavioral control - Prophylaxis		✓
Perceived global benefits of sex		✓
Categorical risk perception		✓
Gist principle endorsement		✓
Specific risk perception	✓	
Reasons to have sex		✓
Reasons to not have sex		✓

Note 1. M = Male, F = Female.
Note 2. Columns correspond to whether being male is more of a protective factor than being female, or vice versa.
*Being male was a protective factor when predicting 0, 1, or 2+ partners (categorized), but being female was a protective factor when predicting the reported number of partners (uncategorized).
**Being male was a protective factor when predicting 0, 1, or 2+ unprotected sexual encounters, but not when predicting other forms of prophylaxis.

Being female was a protective factor much more often than being male (Table 4.2). Out of 16 domains where a main effect of gender was identified, being female was an unambiguous protective factor in 13 cases. Two cases involving sexual and prophylactic behavioral effects were ambiguous because a protective effect of being female (or male) was restricted to when the dependent variable being analyzed was not treated as a three level categorical variable: When the categorized count was analyzed, being male was a protective factor. This finding could be attributable to more variation among males who have two or more sexual partners (or unprotected encounters), or to a tendency for males to over report those numbers. The third case in which being female was a risk factor was for specific risk perception. Although recognizing one is at risk – whether verbatim or gist-based – cannot be a bad thing (and hence is classified as protective in this tabulation of effects), as discussed in the introduction, verbatim-based risk perception is more heavily influenced by behavior than is gist-based risk perception (Mills et al., 2008), and consequently, these effects are likely to at least partially reflect differences in behavioral risk taking between the genders (and past studies have shown that females are at higher risk; Adam et al., 2005; Reyna & Adam, 2003).

Among 14 significant main effects of ethnicity across all analyses, the most frequent finding was that being African-American was more of a risk factor than being Caucasian (11 of those domains). Alternative orderings were observed and can be seen in Table 4.3. Being Hispanic was rarely a protective factor relative to being Caucasian (or vice versa), and being African-American was never a protective factor relative to being Hispanic. However, being African-American was more of a protective factor than being Caucasian for four domains of variables: prophylactic behavior, quantitative risk perception, perceived global benefits of sex, and specific risk perception.

Table 4.3. Domains involving significant overall ethnicity effects.

	Ethnicity Comparisons					
Domain	C>H	C>B	H>C	H>B	B>C	B>H
Sexual Behavior	✓	✓				
Prophylactic Behavior			✓		✓	
Knowledge		✓		✓		
Prophylactic attitudes		✓		✓		
Perceived prophylactic norms		✓				
Self-efficacy in "saying no" to sex		✓				
Self-efficacy in using prophylaxis		✓		✓		
Perceived behavioral control		✓				
Quantitative risk perception					✓	
Recognition of warning signals		✓				
Perceived global benefits of sex					✓	
Categorical risk perception		✓				
Specific risk perception					✓	
Reasons to not have sex		✓		✓		

Note 1. C = Caucasian/Other, H = Hispanic, B = African-American
Note 2. Columns correspond to whether being one ethnicity was more of an overall protective factor than being a different ethnicity.

Again, the finding that African-Americans perceive themselves to be at higher risk on verbatim-based questions of risk perception is likely to reflect differences in behavioral risk taking between African-Americans and Caucasians. However, the finding that despite taking more behavioral risks, they do not perceive the same degree of benefits that Caucasians perceive, suggests that perceived benefits may play less of a role in the choice to engage in risky sexual behavior among African-Americans.

Main effects of site across the 23 domains (Table 4.4) generally followed predictable patterns given sociopolitical differences across the

Table 4.4. Domains involving significant overall site effects.

	Site Comparisons					
Domain	TX>AZ	TX>NY	AZ>TX	AZ>NY	NY>TX	NY>AZ
Sexual Behavior			✓		✓	
Prophylactic Behavior					✓	
Intentions to use Prophylaxis						✓
Sexual attitudes		✓		✓		
Perceived parental sexual norms				✓		
Perceived prophylactic norms	✓					✓
Self-efficacy in "saying no" to sex	✓					✓
Self-efficacy in using prophylaxis	✓					✓
Perceived behavioral control - Prophylaxis					✓	✓
Recognition of warning signals	✓					
Categorical risk perception	✓					✓
Gist principle endorsement	✓					
Specific risk perception			✓			
Pregnancy attitudes						✓
Reasons to have sex		✓		✓		
Reasons to not have sex	✓					✓

Note 1. TX = Texas, AZ = Arizona, NY = New York.
Note 2. Columns correspond to whether being from one site was more of an overall protective factor than being from another site.

geographic locations of intervention administration, with participants from New York having more favorable attitudes towards most prophylactic measures than participants from Arizona, and, to a lesser extent, than participants from Texas. Interestingly, results were more mixed for some psychosocial mediators of sexual behavior. For example, participants from both Texas and New York had more favorable attitudes towards sex than participants from New York.

Intervention Effects

RTR+: Main effects and time-qualified effects

Of the 16 detected differences between RTR+ and the control group shown in Table 4.5, 12 of those differences involved overall effects across all time points (a significant RTR+ effect in covariate models). Those variables were: number of sexual partners; knowledge; sexual attitudes; prophylactic attitudes; perceived sexual norms; perceived prophylactic norms; self-efficacy in "saying no" to sex; self-efficacy in using prophylaxis; perceived behavioral control (prophylaxis); recognition of warning signals; categorical risk perception; and reasons to not have sex. Of those 12 effects, three involved situations where an intervention by time interaction (variable time trend models) significantly improved the fit of the model (knowledge, prophylactic attitudes, and recognition of warning signals), but the form of the interaction had little bearing on the implications of the RTR+ effect: For knowledge and warning signal recognition, the effect extended through 12 months, and for prophylactic attitudes, the effect extended through six months and remained marginally significant at 12 months. Three of those 16 differences were found

Table 4.5. Performance of RTR+ and RTR relative to Control and each other for domains that showed intervention effects.

	Comparison			
Domain	RTR+>C	RTR>C	RTR+>RTR	RTR>RTR+
Sexual Behavior	✓			
Intentions to have sex	✓		✓	
Intentions to use Prophylaxis	✓	✓		✓
Knowledge	✓	✓	✓	
Sexual attitudes	✓		✓	
Prophylactic attitudes	✓	✓		
Perceived sexual norms	✓		✓	
Perceived parental sexual norms*	✓		✓	
Perceived prophylactic norms	✓	✓		
Self-efficacy in "saying no" to sex	✓	✓		
Self-efficacy in using prophylaxis	✓	✓	✓	
Perceived behavioral control (Prophylaxis)	✓	✓		
Recognition of warning signals	✓	✓	✓	
Categorical risk perception	✓	✓	✓	
Perceived global benefits of sex*	✓		✓	
Gist principle endorsement		✓		✓
Quantitative risk perception*		✓		✓
Reasons to not have sex	✓	✓		

Note 1. C = Control
Note 2. Columns correspond to whether being assigned to one group was more of a protective factor than being assigned to the comparison group.
*Specific to certain ethnic, gender, or age subgroups.

in the absence of an overall difference between RTR+ and control group assignment: They are specific to particular time points. Those variables were initiation time, sexual intentions, and prophylactic intentions. For initiation time, effects of RTR+ were found to emerge over time, with RTR+ participants being less likely than control participants to initiate during the final six months of the one year follow-up period, a key finding considering that long-term changes on behavior are an often sought-after – but infrequently observed – goal of established HIV risk programs. RTR+ also produced a marginally significant overall increase in prophylactic intentions (and statistically significant immediate increases), and immediate decreases in sexual intentions.

The failure to find statistically significant effects of RTR+ for either intentions measure after the postsurvey should be interpreted with caution for multiple reasons. First, variables that exhibited this type of trend (and variables for which no effects were observed) were assessed with psychometrically weaker measurement scales than other variables (see Appendix A). This was an inevitable consequence of limited time and resources: With a large number of theoretically relevant constructs to measure, some constructs were measured with a smaller number of items. Although both intentions measures produced acceptable measures of reliability despite being measured with six or fewer items, reliability is a necessary, but not a sufficient component to consider in the measurement of latent constructs. The other, of course, is validity, and these competing goals of scale construction often act in opposition, where gains in internal consistency produced by homogenizing item content are accompanied by losses in discriminative validity and generalizability (Mills, Caetano, &

Bernstein, under review; Nunnally & Bernstein, 1994). Second, no strong evidence was found that these trends change over time – interaction effects in both cases were not significant. Third, as can be seen from Table 3.20, the estimated means for sexual intentions – as is typical in longitudinal studies – tend to have increasing variance over time, which will decrease the chances of detecting a constant difference between groups at later time points. Fourth, RTR+ produces effects on variables that theoretically are causal antecedents (attitudes) and consequents (behavior) of intentions, supporting the contention that the weaker effects identified for intentions are a consequence of the properties of the measure as opposed to a weakened effect of RTR+ on that variable.

RTR+: Ethnicity, Age, and gender-qualified effects

As noted in the methods chapter, examinations of age, gender, and ethnicity qualifications of treatment effects were conducted primarily to probe the boundaries of intervention efficacy and to suggest possible avenues for further modification of curriculum content in future deliveries of the RTR+ curriculum. Of the 16 detected differences between RTR+ and the control group shown in Table 4.1, seven of those differences – knowledge; prophylactic attitudes; perceived parental sexual norms; self-efficacy in using prophylaxis; perceived behavioral control (prophylaxis); global benefit perception; and categorical risk perception – involve models that found some type of ethnic or age qualification to the effect of the interventions. However, for two of those variables – knowledge and categorical risk perception – the basic conclusion from the covariate or variable time trend remained unchanged: For knowledge, the positive effect of RTR+ over control extended through 12 months for Caucasians and Hispanics and through six months for African-Americans, and for categorical risk perception, the overall effect of RTR+ was found for Caucasians, Hispanics, and African-Americans.

Of the remaining five effects, three involved a qualification to a previous model that would have a substantive impact on interpretation if the corresponding hypothesis tests were not underpowered: Those variables were prophylactic attitudes, self-efficacy in using prophylaxis, and perceived behavioral control for prophylaxis. For prophylactic attitudes, RTR+ was found to extend through six months in the variable time trend model (marginal at 12 months), and adding an ethnicity by curriculum interaction revealed that the effect extended through 12 months for Hispanics, through six months for Caucasians, and only at the postsurvey for African-Americans. For prophylactic self-efficacy, the significant overall RTR+ effect of the covariate model was found to apply to Caucasians and marginally to Hispanics in the ethnicity extension to this model. Similarly, for perceived behavioral control for prophylaxis, the significant overall RTR+ effect of the covariate model was found to apply to Caucasians and Hispanics in the ethnicity-extended model, but not to African-Americans.

The remaining two effects – perceived parental sexual norms and global benefit perception – were found to emerge in the absence of identified effects in previous models. For perceived parental sexual norms, Hispanics assigned to RTR+ had significantly larger overall decreases than did Hispanics assigned to the control group, and for perceived global benefits, 14 year olds assigned to RTR+ had significantly larger overall decreases than 14 year olds assigned to the control group.

RTR: Efficacy relative to RTR+ and Control

Of the 12 detected differences between RTR and the control group shown in Table 4.1, 11 of those differences involved an overall effect of RTR across all time points. Those variables were: Intentions to use prophylaxis; knowledge; prophylactic attitudes; perceived prophylactic norms; self-efficacy in "saying no" to sex; self-efficacy in using prophylaxis; perceived behavioral control (prophylaxis); recognition of warning signals; categorical risk perception; gist principle endorsement; and reasons to not have sex. Of those 11 effects, five were qualified by an interaction between time of assessment and intervention, but substantive interpretation was only affected for one variable. Specifically, intentions to use prophylaxis, knowledge, prophylactic attitudes, and warning signal recognition involved accepted variable time trend models where the effect of RTR was sustained through 12 months, but the effect of RTR on gist principles was only sustained through three months.

With respect to the relative efficacy of RTR+ and RTR in covariate and variable time trend models, RTR+ outperformed RTR. For example, RTR+ produced effects on two measures of sexual behavior and on sexual intentions, whereas no such effects were identified for RTR. In addition, direct comparisons between RTR+ and RTR revealed 5 cases in which RTR+ outperformed RTR in covariate or variable time trend models – knowledge (through 6 months), sexual attitudes, perceived sexual norms, warning signal recognition, and categorical risk perception – and two cases – sexual intentions and prophylactic self-efficacy – in which RTR+ marginally outperformed RTR in covariate models. However, there were three exceptions to this general trend, two of which are consistent with theoretical principles discussed in the introduction. For two measures related to prophylaxis – prophylactic intentions and prophylactic attitudes – although direct comparisons between RTR and RTR+ revealed no differences, RTR effects were trending in a higher direction. Specifically, RTR produced overall increases in prophylactic intentions relative to the control group, whereas RTR+ only produced initial increases relative to the control group. Second, the effect of RTR on prophylactic attitudes extended through 12 months for RTR participants versus six months (marginal at 12 months) for RTR+ participants. The third exception was one of the few anomalies of the study and concerned intervention effects on gist principles, where RTR was found to produce increases – relative to both RTR+ and control – that lasted through the three month assessment.

Of the 11 domains involving an overall RTR versus control effect, six were qualified by some form of interaction with ethnicity, and the relative improvements in efficacy afforded by RTR+ become even more apparent when comparing RTR and RTR+ effects in extended versions of covariate and variable time trend models. For knowledge, RTR produced increases sustained through 12 months for Caucasians and Hispanics but only through three months for African-Americans. RTR+ effects on knowledge were similar with the exception that effects extended through six months for African-Americans. For prophylactic attitudes, both RTR and RTR+ produced increases (relative to control) sustained through six months for Caucasians and through 12 months for Hispanics, but whereas initial increases were found for African-American RTR+ participants, no effects on prophylactic attitudes were found at any time point for African-Americans in RTR. Although for prophylactic norms, the overall RTR+ effect was restricted to African-Americans whereas the overall RTR effect was restricted to Caucasians and

Hispanics, for prophylactic self-efficacy, RTR produced an overall increase for Hispanics only, whereas RTR+ produced an overall increase for Caucasians and a marginal increase for Hispanics. And although for perceived behavioral control, both RTR and RTR+ produced increases restricted to Caucasians and Hispanics, for categorical risk perception, RTR+ produced unqualified increases for all ethnicities, whereas increases for RTR were restricted to Caucasian and Hispanic participants. Finally, one of the 12 RTR versus control effects marked in Table 4.1 involved a subgroup-specific effect in the absence of an overall effect: Females in RTR perceived significantly more overall quantitative risk than females in the control group. A comparable effect on quantitative risk perception was not found for RTR+.

Domains where no intervention effects were identified

Five domains of variables showed no effect and no qualified effect of either intervention. Those variables were prophylactic behavior, perceived global risks, specific risk perception, pregnancy attitudes, and reasons to have sex. Under commonly used methods of operationalizing prophylaxis in studies of sexual risk, the term is defined conditional on sexual activity. In other words, participants who are not sexually active are not assigned a score on the prophylaxis variable. For a participant population that is primarily sexually abstinent, this can result in a substantial loss of eligible participants for the analysis and consequently, a loss of power. Alternatives to subpopulation analysis are to measure the absolute number of non-prophylactic behaviors (such as the total number of unprotected sexual encounters) or to assign a score to sexually abstinent participants that groups the two types of maximally risk avoidant participants – those who are sexually abstinent and those who always use prophylaxis – together (as with PRI). Either approach, however, results in slightly modified analytical questions, as such measures of prophylaxis are partially confounded with sexual behavior. With respect to the targeted question of engagement in prophylactic behavior, the gains in statistical power by such aggregation methods are artificial, as the number of subjects to which questions such as “Did you use a condom” apply have not actually been increased. All three of these approaches were used in the present study, and the failure to find effects on prophylaxis – despite intervention effects on prophylactic intentions – suggests that future implementations of the RTR+ curriculum targeting higher risk adolescents may shed more light on the question of whether there are differential improvements for prophylactic behavior.

The second two variables for which no intervention effects were found, perceived global risks and specific risk perception, were measured with instruments in the initial stages of psychometric development. Although each scale has already proven to relate in theoretically predictable (and opposite) ways with sexual behavior (Mills et al., 2008), each currently has properties that could potentially hinder its ability to discriminate among levels of other theoretically relevant variables. Perceived global risks (a variable that already is known to relate less strongly to behavior than its counterpart, perceived global benefits; Reyna & Farley, 2006) is measured with a single item with four response options – none, low, medium, or high. Future modifications of the survey instrument should focus on identifying additional subsets of items tapping the same construct to take advantage of aggregation effects. Specific risk perception was measured with five items questioning the likelihood that various events will occur at some point in the future. The events in question –

such as getting pregnant, getting an STD, etc. – are certainly relevant but nevertheless are, relatively speaking, somewhat rare for adolescents. The scale therefore has a substantial positive skew, with most of the averaged scores clustering in the zero to one range. Roughly half of the participants have a mean of zero on these items at presurvey, indicating that those participants answered “strongly disagree” to all five items on the scale. To take an extreme analogy, this is akin to having a test of knowledge with many extremely difficult items that all students answer incorrectly: Low scores on the test do not necessarily reflect low knowledge, because the test does not discriminate at all among the students. The scores on the specific risks scale say little about baseline differences in specific risk perception for almost half of the participants, and it’s likely that the scale in its current form is too “difficult” to register existing intervention effects for those participants, even if they exist. As with global risk perception, future modifications of the survey instrument should focus attention on developing additional items for this scale and/or rewording the current items so that the scale as a whole corresponds to multiple representative points along the underlying latent continuum.

Finally, the last two variables for which intervention effects were not found were pregnancy attitudes and reasons to have sex. Each of these scales contain a large majority (pregnancy attitudes – 12 out of 17 items) or a totality (reasons to have sex) of items that are rationalizations for engaging in risky sexual behavior. Although both RTR+ and RTR contained material that directly confronted such rationalizations, the primary focus of both interventions was obviously on their counterparts: reasons to *not* favor pregnancy and reasons to *not* have sex. Although decreases in scores on either scale would not be an unwelcome finding, it appears that intervention efficacy in these cases was restricted to content that was a primary focus of the interventions (such as scores on the reasons to not have sex scale, which were increased by assignment to both RTR and RTR+).

Efficacy relative to previous studies

The initial implementation of RTR (Kirby et al., 1991) and the subsequent followup (Hubbard et al., 1998) reported decreased rates of sexual initiation 18 months after the intervention. The present study did not replicate that finding for RTR, but it did find long term effects on sexual initiation rates for RTR+. However, it is important to note that the initial RTR study reported two analyses on sexual initiation rates, and it was the unadjusted bivariate comparison that showed a difference in favor of RTR. Likewise, the follow-up study only reported one bivariate analysis. A more formal logistic regression analysis in the initial study, controlling for demographic characteristics, did not show a significant long term effect. The long term effects of RTR+ reported in this study represent effects that are adjusted for demographic covariates. Initial evaluations of RTR also reported no effects on the number of sexual partners, and that was found in the present study as well. However, RTR+ did show evidence of an effect on that variable when it was not categorized into a three level variable. Overall effects on prophylactic behavior in the initial RTR evaluations were not found, but some effects were identified for certain subgroups. For example, more frequent prophylaxis (measured by use or by number of unprotected acts) was found among females and low risk youth in the initial evaluation, but the effect depended on the way the measures were defined and whether a bivariate or logistic analysis was used. The followup evaluation found the effect among sexually active participants. The present study found no overall and no subpopulation effects for RTR or RTR+, suggesting that this should be an important focus of future refinements of both curricula.

For psychosocial mediators, the present study replicated past findings that RTR is effective in increasing knowledge about issues related to sexual risk taking, and it demonstrated that the changes incorporated into RTR+ were even more efficacious in that regard. Previous reports showed no effect on intentions to avoid unprotected intercourse, although the present findings showed that both RTR and RTR+ have positive effects on intentions to use prophylaxis. As discussed previously, the slight difference in the focus of the questions may be relevant, as the questions about unprotected intercourse are partially confounded with sexual behavior. In that regard, previous studies reported no effects of RTR on sexual intentions and no effects were documented in the present study, although evidence was obtained suggesting that RTR+ is effective in lowering sexual intentions. RTR was also effective in lowering perceived (descriptive) norms in the initial evaluation using a t-test, although no multivariate analyses were reported. An effect on a composite measure of descriptive and injunctive norms was found for RTR+, but not RTR, in the present study. Although the initial evaluation of RTR failed to find effects on intentions to use refusal skills learned during the class, the present study found effects of both RTR and RTR+ on a measure of participants' self-efficacy in using those refusal skills. Effects on other psychosocial mediators, such as attitudes and perceived behavioral control, have not been reported in evaluations of RTR to date, although as reported above, both RTR and RTR+ have positive effects on many of them and thus represent potential targets for future modifications of both interventions.

Conclusion

In sum, results of the study suggest that previous recommendations (e.g., Rivers, Reyna, & Mills, 2008) to incorporate gist-based manipulations into current intervention approaches were well-founded. Relative improvements in protection afforded by RTR+ over RTR were substantial: The only time assignment to RTR was more of a protective factor than RTR+ assignment was for three variables related to prophylaxis or verbatim risk perception – prophylactic intentions, prophylactic attitudes, and quantitative risk perception – and for gist principle endorsement. For the first two variables, the differences between RTR+ and RTR were merely trends that did not reach statistical significance. For quantitative risk perception, the effect was restricted to females. The finding of trends in favor of RTR only for variables related to prophylaxis makes some sense theoretically. Whereas decisions about having sex are an either-or proposition about whether to take a risk, decisions about using prophylaxis are about mitigating risk, which involves no categorical contrasts and instead involves a choice about differing degrees of risk. Since RTR is less gist-based in focus than RTR+, it makes sense that if RTR were to outperform RTR+, it would be most likely to occur for decision domains more heavily influenced by verbatim-level considerations. The three month long effect on gist principle endorsement for participants in RTR (relative to control and RTR+ participants) is an anomaly, and future implementations of the RTR+ curriculum should direct attention to how those principles are discussed in the RTR+ curriculum.

The finding of some qualifications to main effects by ethnicity – for both RTR and RTR+ – highlight the importance of continued development of culturally appropriate intervention methods (St Lawrence et al 1995). In addition, given the impressive results of recent studies that link standard multicomponent interventions to community-wide implementations effecting large-scale changes in the environment of the participants (Coyle et al 2001; Coyle et al., 1998), a potentially productive approach to future refinements to the RTR+ curriculum may lie in linking its novel theoretical manipulations to those environmental approaches.

Overall, these findings highlight how effective simple, theory-driven memory manipulations can be in improving upon evidence-based programs for reducing risk behaviors in adolescents. As noted in the methods chapter, RTR and RTR+ had a large degree of overlap in curriculum content. Minor changes – as simple as providing a gist-based review of covered material at the end of a class – were sufficient to produce detectable differences across a wide range of variables important to adolescent sexual risk behavior.

Appendix A

Multi-Item Scales and Reliabilities

Table A.1. Item and scale statistics for intentions to have sex.

Item	Mean	SE
Do you think you will have sex (again) before you turn 20?	2.66	0.05
Do you think you will have sex (again) before you are in love?	1.64	0.05
Do you think you will have sex (again) before you finish high school?	2.15	0.05
Do you think you will have sex (again) during the next year?	1.93	0.05
Do you think you will have sex (again) before you get married?	2.57	0.05
Cronbach's α	0.92	

Note. Each item was measured on a five point scale ranging from very unlikely to very likely, scored from 0 to 4.

Table A.2. Item and scale statistics for intentions to use prophylaxis.

Item	Mean	SE
Do you think you will actually use birth control when you have sex?	2.91	0.04
If you were going to have sex, would you prefer to use a condom?	3.27	0.04
Do you intend to use birth control when you have sex?	2.98	0.04
Do you intend to use a condom (rubber) when you have sex?	3.38	0.03
Do you think you will actually use a condom when you have sex?	3.34	0.03
If you were going to have sex, would you prefer to use birth control?	3.03	0.04
Cronbach's α	0.87	

Note. Each item was measured on a five point scale ranging from very unlikely to very likely, scored from 0 to 4.

Table A.3. Item and scale statistics for attitudes towards sex.

Item	Mean	SE
I believe it's OK for people my age to have sex with a steady boy/girlfriend.	1.99	0.05
It is OK for unmarried teens to have sex if they are in love.	1.80	0.04
I believe people my age should wait until they are older to have sex. [R]	2.64	0.04
Cronbach's α	0.81	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.4. Item and scale statistics for attitudes towards prophylaxis.

Item	Mean	SE
I believe condoms (rubbers) should always be used if a person my age has sex, even if the two people know each other very well.	3.47	0.03
I believe condoms (rubbers) should always be used if a person my age has sex if the girl DOES NOT use birth control.	3.33	0.03
I believe condoms (rubbers) should always be used if a person my age has sex, even if the girl USES birth control pills.	3.23	0.04
I believe birth control should always be used if a person my age has sex.	3.17	0.03
Condoms (rubbers) protect against sexually transmitted diseases.	2.51	0.04
A condom (rubber) is not necessary when my partner and I agree not to have sex with anyone else. [R]	0.88	0.04
Using a condom (rubber) shows my partner I care about him/her.	2.49	0.04
People having sex should use birth control if they are not ready to have a baby.	3.37	0.03
I would not put my partner at risk by having unprotected sex.	3.16	0.04
Condoms (rubbers) create a sense of safety.	2.82	0.03
If my partner suggested using a condom (rubber), I would think he/she was only being cautious.	2.72	0.04
Condoms (rubbers) protect against pregnancy.	2.76	0.04

Table A.4 (Continued).

Item	Mean	SE
Using birth control is morally wrong.	0.78	0.04
A condom (rubber) is not necessary if I am pretty sure the other person doesn’t have a sexually transmitted disease. [R]	0.80	0.03
If someone is planning to be abstinent, he or she doesn’t need to know about other kinds of birth control. [R]	1.22	0.04
More people should be aware of the importance of birth control.	3.27	0.03
A condom (rubber) is not necessary if I know my partner. [R]	0.65	0.04
People who use condoms (rubbers) sleep around a lot. [R]	1.21	0.04
I wouldn't use a condom (rubber) if my partner refused. [R]	0.94	0.04
People who carry condoms (rubbers) are just looking for sex. [R]	1.62	0.04
People who carry condoms (rubbers) would have sex with anyone. [R]	1.19	0.04
Condoms (rubbers) are so ineffective it is not worth using them. [R]	0.81	0.03
If I got an STD it would not be all that bad. [R]	0.38	0.03
If I used birth control my friends might think I was looking for sex. [R]	1.50	0.04
Cronbach's α	0.82	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.5. Item and scale statistics for attitudes towards getting pregnant.

Item	Mean	SE
I would feel like someone really needs me.	2.49	0.04
It would be the first time I had something that was truly mine.	1.76	0.05
My family would be supportive.	2.27	0.04
I'd be able to make enough money to support the baby and myself.	1.22	0.04
My boyfriend/girlfriend would be more committed to me.	1.84	0.04
I would feel more like an adult.	1.62	0.05
My family would let me continue to live at home.	2.36	0.05
I would feel like I had truly done something meaningful in life.	1.10	0.04
It wouldn't be all that bad at this time in my life.	0.74	0.04
I'd still be able to finish my high school education.	2.26	0.05
My family would help me to raise the baby.	2.49	0.04
I would never be lonely.	1.81	0.04
My family would not approve. [R]	3.02	0.04
I might marry the wrong person, just to get married. [R]	1.77	0.05
At this time in my life it would be one of the worst things that could happen to me. [R]	3.12	0.04
It would be embarrassing for me. [R]	2.54	0.05
I would have to decide whether or not to have the baby and that would be stressful. [R]	2.28	0.05
Cronbach's α	0.79	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.
Note 2. All items were preceded by: "Imagine what would happen if you had a baby [became a parent] while you were still a teenager in high school. Which of these things do you think would happen?"
Note 3. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.6. Item and scale statistics for perceived sexual norms.

Item	Mean	SE
Most adults who are important to me believe it's OK for people my age to have sex with a steady boyfriend or girlfriend.	0.94	0.04
Most of my friends believe it's OK for people my age to have sex with a steady boyfriend or girlfriend.	2.38	0.04
Most people my age have already had sex.	2.53	0.04
Most of my friends believe people my age should wait until they are older before they have sex. [R]	1.73	0.04
Most of my friends have not had sex yet. [R]	1.89	0.05
Most adults who are important to me believe people my age should wait until they are older before they have sex. [R]	3.26	0.03
Cronbach's α	0.72	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.7. Item and scale statistics for perceived parental sexual norms.

Item	Mean	SE
How would your mother feel about your having sex at this time in your life?	0.69	0.04
How would your mother feel about your having sexual intercourse with someone who was special to you and whom you knew well, like a steady boyfriend/girlfriend?	1.06	0.04
How would your father feel about your having sex at this time in your life?	0.67	0.04
How would your father feel about your having sexual intercourse with someone who was special to you and whom you knew well, like a steady boyfriend/girlfriend?	0.87	0.04
Cronbach's α	0.87	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.8. Item and scale statistics for perceived prophylactic norms.

Item	Mean	SE
Most of my friends believe condoms (rubbers) should always be used if a person my age has sex if the girl DOES NOT use birth control pills.	2.92	0.04
Most adults who are important to me believe condoms (rubbers) should always be used if a person my age has sex if the girl DOES NOT use birth control.	3.27	0.04
Most adults who are important to me believe condoms (rubbers) should always be used if a person my age has sex, even if the two people know each other very well.	3.36	0.03
Most of my friends believe some kind of birth control should always be used if a person my age has sex.	2.94	0.04
Most adults who are important to me believe some kind of birth control should always be used if a person my age has sex.	3.20	0.03
Most of my friends believe condoms (rubbers) should always be used if a person my age has sex, even if the girl USES birth control pills.	2.81	0.04
Most adults who are important to me believe condoms (rubbers) should always be used if a person my age has sex, even if the girl USES birth control pills.	3.29	0.03
Most of my friends believe condoms (rubbers) should always be used if a person my age has sex, even if the two people know each other very well.	2.97	0.04
Cronbach's α	0.81	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.9. Item and scale statistics for perceived behavioral control.

Item	Mean	SE
It is easy for me to get birth control.	2.26	0.04
In general, birth control is too expensive to buy. [R]	1.15	0.04
It takes too much planning to have birth control on hand when you are going to have sex. [R]	1.09	0.04
In general, birth control is too much of a hassle to use. [R]	0.89	0.04
It is too hard to get a partner to use birth control. [R]	1.02	0.03
Cronbach's α	0.72	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.10. Item and scale statistics for self efficacy in “saying no” to sex.

Item	Mean	SE
I can say no to sex in a way that won't hurt the other person's feelings.	2.90	0.03
I feel comfortable refusing to have sex.	2.64	0.04
I know how to avoid having sex if I don't want to do it.	3.09	0.03
I know ways to make my body language say NO to sex.	2.75	0.04
Cronbach's α	0.71	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.11. Item and scale statistics for prophylactic self efficacy.

Item	Mean	SE
I could succeed in using birth control when I have sex.	2.72	0.04
I could succeed in using a condom (rubber) when I have sex.	3.05	0.03
I would find it difficult to use a condom when I have sex. [R]	1.04	0.04
I am not sure I could use birth control when I have sex. [R]	1.11	0.04
I would find it difficult to use birth control when I have sex. [R]	1.14	0.04
I am not sure I could use a condom (rubber) when I have sex. [R]	0.93	0.03
Cronbach's α	0.82	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.12. Item and scale statistics for categorical risk perception.

Item	Mean	SE
If you keep having unprotected sex, risk adds up and you WILL get pregnant or get someone pregnant.	3.21	0.03
If you can't handle getting protection, you are not ready for sex.	3.05	0.04
When in doubt about having sex, delay or avoid it.	3.04	0.04
If you keep having unprotected sex, risk adds up and you WILL get a sexually transmitted disease.	3.02	0.04
Even low risks add up to 100% if you keep doing it.	2.75	0.04
It only takes once to get pregnant or get an STD.	3.38	0.03
Even low risks happen to someone.	3.15	0.03
Even if you use condoms, eventually you'll get an STD if you have sex enough.	1.80	0.04
Once you have HIV/AIDS, there is no second chance.	3.05	0.04
Cronbach's α	0.71	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.13. Item and scale statistics for gist principle endorsement.

Item	Mean	SE
Better to not have sex than risk getting HIV/AIDS.	0.79	0.02
Better fo focus on school than have sex.	0.77	0.02
I have a responsibility to my partner to not put him/her at risk.	0.54	0.02
Avoid risk.	0.73	0.02
Better to be safe than sorry.	0.88	0.01
Better to not have sex than risk getting pregnant or getting someone.	0.79	0.02
Better to wait than to have sex when you are not ready.	0.82	0.01
I have a responsibility to my parents/family to not have sex.	0.52	0.02
Better to not have sex than hurt my parents/family.	0.58	0.02
I have a responsibility to God to wait to have sex.	0.43	0.02
I have a responsibility to myself to wait to have sex.	0.59	0.02
Better to have fun (sex) while you can. [R]	0.15	0.01
Known partners are safe partners. [R]	0.26	0.02
Having sex is better than losing a relationship. [R]	0.08	0.01
Having sex is worth risking pregnancy. [R]	0.11	0.01
Cronbach's α	0.81	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.14. Item and scale statistics for specific risk perception.

Item	Mean	SE
I am likely to have HIV/AIDS by age 25.	0.40	0.03
I am likely to get (a girl) pregnant in next 6 months.	0.50	0.03
I am likely to have a STD by age 25.	0.46	0.03
I am likely to have HIV/AIDS in the next 6 months.	0.28	0.02
I am likely to have STD in the next 6 months.	0.29	0.02
Cronbach's α	0.82	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.15. Item and scale statistics for knowledge.

Item	Mean	SE
One way to REDUCE the risk of STDs (including HIV/AIDS), is for you and your partner to get tested.	3.26	0.04
HIV can be spread by sharing a needle with a drug user who has HIV or AIDS.	3.67	0.03
Using a condom (rubber) can lower your chance of getting HIV.	2.94	0.05
One way to REDUCE the risk of STDs (including HIV/AIDS), is to not have multiple partners.	3.03	0.05
The only way to have NO risk of STDs or pregnancy is to not have sex.	3.43	0.04
You can have the HIV virus without being sick from AIDS.	2.86	0.04
Viruses like herpes are not curable; you have them and can give them to others for the rest of your life.	3.05	0.04
To REDUCE the risk of STDs (including HIV/AIDS), other than not having sex, the second best thing to do is to use condoms.	3.07	0.04
A pregnant woman with HIV can give HIV to her unborn baby.	3.44	0.03
To use a condom (rubber) correctly, a person must hold it on the penis while pulling out of the vagina.	2.21	0.05
Latex condoms (rubbers) prevent HIV better than animal skin condoms (rubbers).	2.35	0.04
You are at risk of getting STDs from everyone your partner has had sex with and everyone your partner's partners have had sex with, and so on.	2.91	0.04
Using condoms lowers the risk of getting STDs (including HIV/AIDS) by a BIG amount for a single act.	2.50	0.04
One way to REDUCE the risk of STDs (including HIV/AIDS) or pregnancy, is to limit sex-have fewer partners and less sex.	2.79	0.04

Table A.15 (Continued).

Item	Mean	SE
ONLY condoms and not having sex protect against BOTH STDs and pregnancy.	2.50	0.05
Vaseline can be used with condoms (rubbers), and they will work just as well. [R]	1.79	0.04
It is a myth that you have sex with everyone your partner has had sex with because germs don't live that long. [R]	1.57	0.04
Teenagers who use withdrawal do not have to worry about pregnancy. [R]	1.37	0.04
A girl can't get pregnant the first time she has sex. [R]	0.94	0.06
You can always tell if someone has HIV by looking at them. [R]	0.52	0.03
A girl can prevent pregnancy by douching immediately after sex. [R]	1.30	0.04
Taking birth control pills is one way to protect yourself from becoming infected with the HIV virus. [R]	1.06	0.05
The pill is as effective as abstinence. [R]	1.14	0.04
There's a high chance of getting HIV if you get a blood transfusion. [R]	2.21	0.05
There is a cure for HIV/AIDS. [R]	0.63	0.04
If a girl forgets to take her pill for three days, she is still protected from pregnancy. [R]	1.30	0.04
Condoms eliminate the risk of BOTH STDs and pregnancy. [R]	1.56	0.05
Cronbach's α	0.79	

Note 1. R = Reverse coded prior to aggregation. Means and standard errors in this table are presented as originally scaled.

Note 2. Each item was measured on a five point scale ranging from "It is false" to "It is true," scored from 0 to 4.

Table A.16. Item and scale statistics for warning signal recognition.

Item	Mean	SE
Being alone is a warning signal for sex	1.44	0.04
Using drugs or alcohol is a warning signal for sex.	1.61	0.04
Being pressured or controlled in any way is a warning signal for unwanted sex.	2.68	0.03
Cronbach's α	0.50	

Note. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.17. Item and scale statistics for reasons to have sex.

Item	Mean	SE
I think it will feel good.	2.57	0.04
I want to have a child soon.	0.55	0.04
I am very curious about it.	2.20	0.05
Having sex makes you a man/woman.	0.85	0.04
I am in love.	1.98	0.05
I am ready to accept the responsibility of having sex.	2.04	0.05
I feel mature enough to make this decision.	2.43	0.05
I think having sex brings you closer together and strengthens relations.	1.74	0.05
Sex would help my partner and I learn more about each other.	1.50	0.04
It seems like everyone else is doing it.	1.43	0.05
Cronbach's α	0.79	

Note 1. All items were preceded by: "I might choose TO HAVE sex because:"

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Table A.18. Item and scale statistics for reasons to not have sex.

Item	Mean	SE
I could get a sexually transmitted disease (STD)...- PRE	3.22	0.03
I could get AIDS (Acquired Immune Deficiency Syndrome)	3.27	0.03
I do not want to be a teen parent	3.51	0.03
I want to save my virginity for the person I marry	2.27	0.05
I do not want to have any regrets	3.04	0.04
I'm not ready to have sex	2.25	0.05
My parents would freak out if they thought I was having sex	2.92	0.05
I want people to like me for who I am, not because they think I will have sex.	3.28	0.03
If I got an STD it would be embarrassing to me	3.34	0.03
If I got an STD, my friends would lose respect for me	2.16	0.05
Cronbach's α	0.79	

Note 1. All items were preceded by: "I might choose NOT to have sex because:"

Note 2. Each item was measured on a five point scale ranging from strongly disagree to strongly agree, scored from 0 to 4.

Appendix B

Calculation of Linear Combinations

The fixed-effects portion of the variable time trend model is

$$\hat{y} = \beta_0 + \beta_1 pre + \beta_2 RTR + \beta_3 RTR^{+} + \beta_4 Month + \beta_5 AZ + \beta_6 NY + \beta_7 Age$$
$$+ \beta_8 Female + \beta_9 Hispanic + \beta_{10} Black \qquad (1)$$
$$+ \beta_{11} MonthXRTR + \beta_{12} MonthXRTR^{+}$$

where β_i represents parameters estimated for variables in the model, and terms following the β's correspond to continuous variables or 0-1 coded dummy variables in the model. Holding variables that do not interact constant (for simplicity, at zero) and substituting ones and zeros for intervention dummy variables where appropriate, this model can be formulated as 3 separate equations:

Control | Month	$\beta_0 + \beta_4 Month$	(2)
RTR | Month	$\beta_0 + \beta_2 + \beta_4 Month + \beta_{11} Month$	(3)
RTR^{+} | Month	$\beta_0 + \beta_3 + \beta_4 Month + \beta_{12} Month$	(4)

Note that differences between some of these equations at certain values of month are explicitly represented by parameters in equation 1. For example, when Month = 0 (postsurvey), the difference between equations 3 and 2 corresponds to the coefficient for RTR – β_2 – in equation 1: the effect of RTR (relative to control) at postsurvey. Formulating the model as separate equations allows linear combinations representing other hypotheses of interest, for specific values of the interacting variable, to be derived that do not explicitly appear in this model parameterization. These additional hypotheses of interest concern differences between each treatment group and the control group at three, six, and 12 months, as well as differences between the treatment groups themselves at three, six, and 12 months. Substituting values for month and subtracting equations gives the following linear combinations of coefficients that can be explicitly tested against the null hypothesis that their value is zero:

RTR vs. Control at 3mo	$\beta_2 + 3(\beta_{11})$	(5)
RTR vs. Control at 6mo	$\beta_2 + 6(\beta_{11})$	(6)
RTR vs. Control at 12mo	$\beta_2 + 12(\beta_{11})$	(7)
RTR+ vs. Control at 3mo	$\beta_3 + 3(\beta_{12})$	(8)
RTR+ vs. Control at 6mo	$\beta_3 + 6(\beta_{12})$	(9)
RTR+ vs. Control at 12mo	$\beta_3 + 12(\beta_{12})$	(10)
RTR+ vs. RTR at postsurvey	$\beta_3 - \beta_2$	(11)

RTR+ vs. RTR at 3mo	$\beta_3 - \beta_2 + 3(\beta_{12} - \beta_{11})$	(12)
RTR+ vs. RTR at 6mo	$\beta_3 - \beta_2 + 6(\beta_{12} - \beta_{11})$	(13)
RTR+ vs. RTR at 12mo	$\beta_3 - \beta_2 + 12(\beta_{12} - \beta_{11})$	(14)

For example, the expression in equation 12 is arrived at by substituting a value of 3 for month and subtracting equation 3 from equation 4, giving a term representing the difference between RTR+ and RTR at three months.

Likewise, the fixed effects portion of the extended covariate model (using the ethnicity extension as an example) is:

$$\begin{aligned}\hat{y} = {} & \beta_0 + \beta_1 pre + \beta_2 RTR + \beta_3 RTR^{+} + \beta_4 Month + \beta_5 AZ + \beta_6 NY + \beta_7 Age \\ & + \beta_8 Female + \beta_9 Hispanic + \beta_{10} Black \\ & + \beta_{13} HispanicXRTR + \beta_{14} BlackXRTR \\ & + \beta_{15} HispanicXRTR^{+} + \beta_{16} BlackXRTR^{+}\end{aligned} \tag{15}$$

Again, holding variables that do not interact constant (for simplicity, at zero) and substituting ones and zeros for treatment and ethnicity dummy variables where appropriate, this can be formulated as 9 separate equations:

Control, White	$\hat{y} = \beta_0$	(16)
Control, Hispanic	$\hat{y} = \beta_0 + \beta_9$	(17)
Control, Black	$\hat{y} = \beta_0 + \beta_{10}$	(18)
RTR, White	$\hat{y} = \beta_0 + \beta_2$	(19)
RTR, Hispanic	$\hat{y} = \beta_0 + \beta_2 + \beta_9 + \beta_{13}$	(20)
RTR, Black	$\hat{y} = \beta_0 + \beta_2 + \beta_{10} + \beta_{14}$	(21)
RTR^+, White	$\hat{y} = \beta_0 + \beta_3$	(22)
RTR^+, Hispanic	$\hat{y} = \beta_0 + \beta_3 + \beta_9 + \beta_{15}$	(23)
RTR^+, Black	$\hat{y} = \beta_0 + \beta_3 + \beta_{10} + \beta_{16}$	(24)

Once again, differences between some of these are explicitly represented by parameters in equation 15. For example, the difference between equations 22 and 16 corresponds to the coefficient for RTR+ – β_3 – in equation 15: the effect of RTR+ – relative to control – for the ethnicity reference group, White (Caucasian/other). The specific additional hypotheses of interest for this model are whether RTR (or RTR+) significantly differs from the control group for Hispanics and African-Americans, and whether RTR differs from RTR+ for Hispanics and African-Americans. These effects are represented by the following linear combinations of coefficients:

RTR vs Control, Hispanics	$\beta_2 + \beta_{13}$	(25)
RTR vs Control, African-Americans	$\beta_2 + \beta_{14}$	(26)
RTR+ vs Control, Hispanics	$\beta_3 + \beta_{15}$	(27)
RTR+ vs Control, African-Americans	$\beta_3 + \beta_{16}$	(28)
RTR+ vs RTR, Whites	$\beta_3 – \beta_2$	(29)
RTR+ vs RTR, Hispanics	$\beta_3 – \beta_2 + \beta_{15} – \beta_{13}$	(30)
RTR+ vs RTR, African-Americans	$\beta_3 – \beta_2 + \beta_{16} – \beta_{14}$	(31)

For example, the expression in equation 30 is arrived at by subtracting equation 20 from equation 23, giving a term representing the overall difference between RTR+ and RTR for Hispanics. Similar logic would apply to age by curriculum or gender by curriculum interaction extensions to the covariate model, although note that since age is continuous, linear combinations representing treatment effects at several meaningful values of age would be formed (e.g., one standard deviation below the mean age, at the mean, and one standard deviation above the mean age).

Finally, the fixed effects portion of the extended variable time trend model (again using the ethnicity extension as an example) is:

$$\hat{y} = \beta_0 + \beta_1 pre + \beta_2 RTR + \beta_3 RTR^{+} + \beta_4 Month + \beta_5 AZ + \beta_6 NY + \beta_7 Age$$
$$+ \beta_8 Female + \beta_9 Hispanic + \beta_{10} Black$$
$$+ \beta_{11} MonthXRTR + \beta_{12} MonthXRTR^{+} \quad (32)$$
$$+ \beta_{13} HispanicXRTR + \beta_{14} BlackXRTR$$
$$+ \beta_{15} HispanicXRTR^{+} + \beta_{16} BlackXRTR^{+}$$

As before, this model can be formulated as 9 separate equations:

$\text{Control, White} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_4 Month$	(33)
$\text{Control, Hispanic} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_4 Month + \beta_9$	(34)
$\text{Control, Black} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_4 Month + \beta_{10}$	(35)
$\text{RTR, White} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_2 + \beta_4 Month + \beta_{11} Month$	(36)
$\text{RTR, Hispanic} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_2 + \beta_4 Month + \beta_{11} Month + \beta_9 + \beta_{13}$	(37)
$\text{RTR, Black} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_2 + \beta_4 Month + \beta_{11} Month + \beta_{10} + \beta_{14}$	(38)
$\text{RTR}^{+}\text{, White} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_3 + \beta_4 Month + \beta_{12} Month$	(39)
$\text{RTR}^{+}\text{, Hispanic} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_3 + \beta_4 Month + \beta_{12} Month + \beta_9 + \beta_{15}$	(40)
$\text{RTR}^{+}\text{, Black} \mid \text{Month}$	$\hat{y} = \beta_0 + \beta_3 + \beta_4 Month + \beta_{12} Month + \beta_{10} + \beta_{16}$	(41)

For example, substituting a value of zero for month, the difference between equations 39 and 33 corresponds to the coefficient for RTR+ – β_3 – in equation 32: the effect of RTR+ – relative to control – for the ethnicity reference group, White (Caucasian/other). The specific additional hypotheses of interest for this model are whether RTR (or RTR+) significantly differs from the control group for Hispanics and African-Americans, and whether RTR+ differs from RTR for Hispanics and African-Americans. However, since extensions to the variable time trend model also include interactions between intervention and time, parameters for RTR and RTR+ in the model correspond to the effect of those conditions for Caucasian/others at postsurvey. Therefore, contrasts involving those coefficients, ignoring time, would represent postsurvey effects only. Separate linear combinations are therefore formed for each additional time point:

RTR vs. Control, White @ 3mo	$\beta_2 + 3(\beta_{11})$	(42)
RTR vs. Control, White @ 6mo	$\beta_2 + 6(\beta_{11})$	(43)
RTR vs. Control, White @ 12mo	$\beta_2 + 12(\beta_{11})$	(44)
RTR vs. Control, Hispanic @ postsurvey	$\beta_2 + \beta_{13}$	(45)
RTR vs. Control, Hispanic @ 3mo	$\beta_2 + 3(\beta_{11}) + \beta_{13}$	(46)
RTR vs. Control, Hispanic @ 6mo	$\beta_2 + 6(\beta_{11}) + \beta_{13}$	(47)
RTR vs. Control, Hispanic @ 12mo	$\beta_2 + 12(\beta_{11}) + \beta_{13}$	(48)
RTR vs. Control, Black @ postsurvey	$\beta_2 + \beta_{14}$	(49)

RTR vs. Control, Black @ 3mo	$\beta_2 + 3(\beta_{11}) + \beta_{14}$	(50)
RTR vs. Control, Black @ 6mo	$\beta_2 + 6(\beta_{11}) + \beta_{14}$	(51)
RTR vs. Control, Black @ 12mo	$\beta_2 + 12(\beta_{11}) + \beta_{14}$	(52)
RTR+ vs. Control, White @ 3mo	$\beta_3 + 3(\beta_{12})$	(53)
RTR+ vs. Control, White @ 6mo	$\beta_3 + 6(\beta_{12})$	(54)
RTR+ vs. Control, White @ 12mo	$\beta_3 + 12(\beta_{12})$	(55)
RTR+ vs. Control, Hispanic @ postsurvey	$\beta_3 + \beta_{15}$	(56)
RTR+ vs. Control, Hispanic @ 3mo	$\beta_3 + 3(\beta_{12}) + \beta_{15}$	(57)
RTR+ vs. Control, Hispanic @ 6mo	$\beta_3 + 6(\beta_{12}) + \beta_{15}$	(58)
RTR+ vs. Control, Hispanic @ 12mo	$\beta_3 + 12(\beta_{12}) + \beta_{15}$	(59)
RTR+ vs. Control, Black @ postsurvey	$\beta_3 + \beta_{16}$	(60)
RTR+ vs. Control, Black @ 3mo	$\beta_3 + 3(\beta_{12}) + \beta_{16}$	(61)
RTR+ vs. Control, Black @ 6mo	$\beta_3 + 6(\beta_{12}) + \beta_{16}$	(62)
RTR+ vs. Control, Black @ 12mo	$\beta_3 + 12(\beta_{12}) + \beta_{16}$	(63)
RTR+ vs. RTR, White @ Postsurvey	$\beta_3 - \beta_2$	(64)
RTR+ vs. RTR, White @ 3mo	$\beta_3 - \beta_2 + 3(\beta_{12} - \beta_{11})$	(65)
RTR+ vs. RTR, White @ 6mo	$\beta_3 - \beta_2 + 6(\beta_{12} - \beta_{11})$	(66)
RTR+ vs. RTR, White @ 12mo	$\beta_3 - \beta_2 + 12(\beta_{12} - \beta_{11})$	(67)
RTR+ vs. RTR, Hispanic @ postsurvey	$\beta_3 - \beta_2 + \beta_{15} - \beta_{13}$	(68)
RTR+ vs. RTR, Hispanic @ 3mo	$\beta_3 - \beta_2 + 3(\beta_{12} - \beta_{11}) + \beta_{15} - \beta_{13}$	(69)
RTR+ vs. RTR, Hispanic @ 6mo	$\beta_3 - \beta_2 + 6(\beta_{12} - \beta_{11}) + \beta_{15} - \beta_{13}$	(70)
RTR+ vs. RTR, Hispanic @ 12mo	$\beta_3 - \beta_2 + 12(\beta_{12} - \beta_{11}) + \beta_{15} - \beta_{13}$	(71)

RTR+ vs. RTR, Black @ postsurvey	$\beta_3 - \beta_2 + \beta_{16} - \beta_{14}$	(72)
RTR+ vs. RTR, Black @ 3mo	$\beta_3 - \beta_2 + 3(\beta_{12} - \beta_{11}) + \beta_{16} - \beta_{14}$	(73)
RTR+ vs. RTR, Black @ 6mo	$\beta_3 - \beta_2 + 6(\beta_{12} - \beta_{11}) + \beta_{16} - \beta_{14}$	(74)
RTR+ vs. RTR, Black @ 12mo	$\beta_3 - \beta_2 + 12(\beta_{12} - \beta_{11}) + \beta_{16} - \beta_{14}$	(75)

For example, the expression in equation 74 is arrived at by substituting a value of six for month and subtracting equation 38 from equation 41, giving a term representing the overall difference between RTR+ and RTR for African-Americans at six months. Similar logic would apply to age by curriculum or gender by curriculum interaction extensions to the variable time trend model.

APPENDIX C

Interpreting Parameter Coefficients in Regression Models

This appendix outlines the basic principles of interpreting parameter coefficients in linear regression, with and without categorical interaction effects. A central point concerns why the meaning of the parameter for a "main effect," – such as b_1 or b_2 in the models below – changes when interactions involving that term are included in regression models.

Assume a simple linear model (for simplicity, the constant – the intercept – is assumed to be zero), where x_1 and x_2 are dichotomous variables coded 0 or 1, y is the predicted value of a continuous dependent variable, and assume the estimated values of the coefficients are b_1=.5, b_2=.2, and b_3=.1:

$$b_1x_1 + b_2x_2 = y$$

As x_1 is varied from 0 to 1 (a unit change), holding other variables (x_2) at a common value (0):

b_1	x_1	+	b_2	x_2	=	y
(0.5)	(0)	+	(0.2)	(0)	=	0
(0.5)	(1)	+	(0.2)	(0)	=	0.5

The change in the dependent is 0.5 – 0 = 0.5, which is equal to b_1. It should be clear from this example that if additional variables, weighted by additional coefficients, were added to this model and held at zero, the difference in the dependent variable when varying x_1 from 0 to 1 would be the same.

Likewise, as x_1 is varied from 0 to 1, holding other variables (x_2) at *another* common value (1):

b_1	x_1	+	b_2	x_2	=	y
(0.5)	(0)	+	(0.2)	(1)	=	0.2
(0.5)	(1)	+	(0.2)	(1)	=	0.7

The change in the dependent is 0.7 - 0.2 = 0.5, which is also equal to b_1. As before, the addition of extra parameter-weighted variables, held constant, would cancel out and the change in the dependent would be the same.

Therefore, the interpretation of b_1 is the change in the dependent for a unit change in x_1, holding all other variables constant (*any* constant). It does not matter what common value other variables are held at in a non-interaction model, all that matters is that they are held constant: b_1 is equal to 0.5 regardless. Note that the definition of an interaction is that the effect of a variable depends on the level of another variable - that's precisely what is *not* happening here: Because the model excludes interactions with x_2, x_2 can be held at any value and the effect of a unit change of x_1 on the dependent variable will always be the same.

In contrast, if the product of x_1 and x_2 (representing an interaction effect) is added, the model now becomes:

$$b_1x_1 + b_2x_2 + b_3x_1x_2 = y$$

Following the previous template, as x_1 is varied from 0 to 1, holding other variables (x_2) at a common value (0):

b_1	x_1	+	b_2	x_2	+	b_3	x_1	x_2	=	y
(0.5)	(0)	+	(0.2)	(0)		(.1)	(0)	(0)	=	0
(0.5)	(1)	+	(0.2)	(0)		(.1)	(1)	(0)	=	0.5

The change in the dependent is 0.5 - 0 = 0.5, which is equal to b_1.

However, as x_1 is varied from 0 to 1, holding other variables (x_2) at *another* common value (1):

b_1	x_1	+	b_2	x_2	+	b_3	x_1	x_2	=	y
(0.5)	(0)	+	(0.2)	(1)		(.1)	(0)	(1)	=	0.2
(0.5)	(1)	+	(0.2)	(1)		(.1)	(1)	(1)	=	0.8

The change in the dependent is 0.8 - 0.2 = 0.6, which is *not* equal to b_1.

In the interaction model, the only time the dependent changed an amount that was equal to the coefficient for x_1 was when x_2 was at zero. Therefore, the interpretation of b_1 in the interaction model is the change in the dependent for each unit change in x_1, holding all other variables *at zero*. (Or more technically, holding the variables it interacts with at zero and the variables it doesn't interact with at any constant). It is the effect of x_1 when x_2 is zero. An alternative way to conceptualize this point is that in the interaction model, it is no longer possible to vary x_1 while holding all other terms constant, *because x_1 also appears in one of those latter terms*.

The observed change in the dependent variable in the interaction model when x_1 is varied from 0 to 1 – 0.6 – represents the effect of a unit change in x_1 when x_2 is held constant (0.5) *plus* the interactive effect of x_1 and x_2 when both are equal to 1 (0.1). That is, the interaction means there is a synergistic effect: When both x_1 and x_2 are "present" (both equal 1), there is an effect that goes above and beyond the individual contributions of x_1 and x_2. Alternatively, whereas the main effect of a dichotomous variable in a non-interaction model represents a mean difference (the test of the coefficient is mathematically identical to an independent samples t-test of mean differences), interaction terms represent "differences of differences": e.g., the mean difference between levels 0 and 1 of x_1 is .5 when $x_2 = 0$, the same difference is .6 when $x_2 = 1$, and the difference of those differences is equal to x_3 (0.1).

Identical principles apply to more complicated situations involving multiple interactions, interactions with continuous variables, or interactions between (dummy-coded) polytomous variables. In all situations, the term representing a variable's "main effect" in an interaction model is always interpreted as the effect of that variable when the variables it interacts with are at zero. This underscores one of several reasons why it is always useful to ensure that the zero levels of variables allowed to interact reflect a meaningful reference level. For example, in all models of continuous multi-item scales in this dissertation, interactions between continuous time (month) and intervention (represented by dummy coded RTR and RTR+ variables) are explored. Therefore, effects of the month term in these interaction models (referred to as variable time trend models) correspond to effects of month for the control group (the reference level for RTR and RTR+), and effects of the RTR and RTR+ terms correspond to differences between RTR/RTR+ and the control group (e.g., a unit change in the RTR term represents a change from the control group to the RTR group) at the “reference level” for month, which is zero. In this case, zero has a meaningful value since it corresponds to the time at which the postsurvey was administered.

APPENDIX D

Detailed Model Statistics

Table D.1. Odds ratios, standard errors, and confidence intervals for the intervention model of sexual initiation times.

Variable	Odds Ratio	SE	t	p	95% CI
Interval 2	1.36	0.48	0.87	0.386	(0.68-2.73)
Interval 3	2.13	0.72	2.22	0.027	(1.09-4.15)
Interval 4	4.33	1.35	4.71	0.000	(2.35-7.98)
Arizona	0.84	0.27	-0.55	0.581	(0.45-1.57)
New York	1.50	0.57	1.06	0.289	(0.71-3.18)
Age	1.06	0.12	0.52	0.601	(0.85-1.32)
Hispanic	1.29	0.44	0.75	0.451	(0.66-2.54)
Af. American	1.78	0.47	2.17	0.031	(1.06-2.99)
Female	0.84	0.19	-0.78	0.438	(0.54-1.3)
RTR	1.16	0.33	0.52	0.601	(0.66-2.03)
RTR+	0.94	0.26	-0.24	0.810	(0.55-1.6)

Note. Af. = African; Reference for interval 2-4: interval 1; reference for Hispanic and Af. American: Caucasian/Other; reference for RTR and RTR+: Control.

Table D.2. Odds ratios, standard errors, and confidence intervals for the full interaction model of sexual initiation times.

Variable	Odds Ratio	SE	t	p	95% CI
Interval 2	2.50	2.26	1.02	0.309	(0.43-14.7)
Interval 3	4.28	3.63	1.71	0.087	(0.81-22.61)
Interval 4	15.31	11.79	3.54	0.000	(3.38-69.4)
Arizona	0.83	0.27	-0.58	0.561	(0.44-1.56)
New York	1.52	0.58	1.10	0.273	(0.72-3.21)
Age	1.06	0.12	0.50	0.620	(0.85-1.32)
Hispanic	1.30	0.45	0.76	0.446	(0.66-2.55)
Af. American	1.81	0.48	2.22	0.027	(1.07-3.05)
Female	0.84	0.19	-0.79	0.428	(0.54-1.3)
RTR	3.20	2.61	1.43	0.154	(0.65-15.87)
RTR+	2.75	2.20	1.26	0.208	(0.57-13.25)
Interval 2 X RTR	0.54	0.58	-0.58	0.565	(0.07-4.34)
Interval 2 X RTR+	0.43	0.46	-0.79	0.429	(0.05-3.45)
Interval 3 X RTR	0.36	0.37	-1.00	0.317	(0.05-2.67)
Interval 3 X RTR+	0.49	0.48	-0.73	0.468	(0.07-3.37)
Interval 4 X RTR	0.21	0.20	-1.66	0.097	(0.03-1.33)
Interval 4 X RTR+	0.16	0.15	-2.00	0.046	(0.03-0.97)

Note. Af. = African; Reference for interval 2-4: interval 1; reference for Hispanic and Af. American: Caucasian/Other; reference for RTR and RTR+: Control.

Table D.3. Odds ratios, standard errors, and confidence intervals for the reduced interaction model of sexual initiation times.

Variable	Odds Ratio	SE	t	p	95% CI
Interval 2	1.37	0.49	0.89	0.375	(0.68-2.76)
Interval 3	2.16	0.74	2.25	0.024	(1.1-4.22)
Interval 4	9.12	4.29	4.70	0.000	(3.63-22.94)
Arizona	0.83	0.27	-0.58	0.562	(0.44-1.56)
New York	1.51	0.57	1.08	0.282	(0.71-3.19)
Age	1.06	0.12	0.50	0.618	(0.85-1.32)
Hispanic	1.30	0.44	0.76	0.450	(0.66-2.54)
Af. American	1.80	0.48	2.20	0.028	(1.06-3.03)
Female	0.84	0.19	-0.78	0.433	(0.54-1.3)
RTR	1.69	0.65	1.37	0.172	(0.79-3.61)
RTR+	1.52	0.56	1.14	0.256	(0.74-3.11)
Interval 4 X RTR	0.40	0.24	-1.50	0.135	(0.12-1.33)
Interval 4 X RTR+	0.29	0.17	-2.12	0.034	(0.09-0.91)

Note. Af. = African; Reference for interval 2-4: interval 1; reference for Hispanic and Af. American: Caucasian/Other; reference for RTR and RTR+: Control.

Table D.4. Detailed statistics for the covariate model of number of sexual partners.

Variable	b	SE	z	p	95% CI for b	
Presurvey	1.131	0.023	48.23	0.000	1.085	1.177
RTR	-0.284	0.177	-1.6	0.109	-0.630	0.063
RTR+	-0.345	0.165	-2.09	0.036	-0.668	-0.022
Month	0.073	0.008	8.9	0.000	0.057	0.090
Arizona	0.157	0.192	0.82	0.413	-0.219	0.533
New York	0.091	0.271	0.33	0.739	-0.441	0.622
Age	-0.072	0.068	-1.06	0.290	-0.205	0.061
Female	-0.357	0.136	-2.62	0.009	-0.624	-0.090
Hispanic	0.203	0.205	0.99	0.323	-0.199	0.606
African-American	0.115	0.163	0.71	0.480	-0.204	0.434
Intercept	1.591	1.100	1.45	0.148	-0.566	3.747
Slope (sd)	0.171	0.007			0.158	0.184
Intercept (sd)	1.676	0.051			1.579	1.780
Correlation	0.174	0.057			0.060	0.284
Residual (sd)	0.635	0.015			0.606	0.665

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.5. Detailed statistics for the variable time trend model of number of sexual partners.

Variable	b	SE	z	p	95% CI for b	
Presurvey	1.131	0.023	48.24	0.000	1.085	1.177
RTR	-0.289	0.177	-1.63	0.103	-0.636	0.058
RTR+	-0.348	0.165	-2.11	0.035	-0.671	-0.025
Month	0.082	0.015	5.58	0.000	0.053	0.110
Arizona	0.157	0.192	0.82	0.413	-0.219	0.533
New York	0.090	0.271	0.33	0.741	-0.442	0.621
Age	-0.072	0.068	-1.06	0.290	-0.205	0.061
Female	-0.357	0.136	-2.62	0.009	-0.624	-0.090
Hispanic	0.203	0.205	0.99	0.323	-0.199	0.605
African-American	0.115	0.163	0.7	0.481	-0.204	0.433
Month X RTR	-0.016	0.0213	-0.75	0.451	-0.058	0.0257
Month X RTR+	-0.009	0.0197	-0.47	0.639	-0.048	0.0293
Intercept	1.595	1.100	1.45	0.147	-0.561	3.752
Slope (sd)	0.171	0.007			0.158	0.184
Intercept (sd)	1.676	0.051			1.579	1.780
Correlation	0.174	0.057			0.060	0.284
Residual (sd)	0.635	0.015			0.606	0.665

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.6. Detailed statistics for the covariate model of PRI.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.590	0.024	24.95	0.000	0.544	0.636
RTR	-0.035	0.021	-1.7	0.089	-0.076	0.005
RTR+	-0.007	0.019	-0.37	0.713	-0.044	0.030
Month	-0.005	0.002	-3.1	0.002	-0.008	-0.002
Arizona	-0.018	0.022	-0.82	0.410	-0.061	0.025
New York	0.028	0.031	0.9	0.367	-0.033	0.089
Age	-0.026	0.008	-3.24	0.001	-0.041	-0.010
Female	-0.017	0.016	-1.09	0.277	-0.049	0.014
Hispanic	0.015	0.024	0.65	0.518	-0.031	0.062
African-American	0.026	0.019	1.35	0.176	-0.012	0.065
Intercept	0.774	0.134	5.79	0.000	0.512	1.036
Slope (sd)	0.025	0.002			0.021	0.029
Intercept (sd)	0.161	0.011			0.142	0.183
Correlation	-0.298	0.084			-0.454	-0.125
Residual (sd)	0.202	0.005			0.192	0.212

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.7. Detailed statistics for the variable time trend model of PRI.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.590	0.024	24.95	0.000	0.544	0.636
RTR	-0.034	0.023	-1.43	0.153	-0.080	0.013
RTR+	-0.003	0.022	-0.13	0.895	-0.046	0.040
Month	-0.004	0.003	-1.47	0.141	-0.009	0.001
Arizona	-0.018	0.022	-0.82	0.411	-0.061	0.025
New York	0.028	0.031	0.9	0.366	-0.033	0.089
Age	-0.026	0.008	-3.25	0.001	-0.041	-0.010
Female	-0.017	0.016	-1.08	0.278	-0.049	0.014
Hispanic	0.015	0.024	0.65	0.517	-0.031	0.062
African-American	0.026	0.019	1.35	0.177	-0.012	0.065
Month X RTR	0.001	0.0039	-0.14	0.889	-0.008	0.0072
Month X RTR+	-0.001	0.0037	-0.39	0.698	-0.009	0.0057
Intercept	0.772	0.134	5.77	0.000	0.510	1.034
Slope (sd)	0.025	0.002			0.021	0.029
Intercept (sd)	0.161	0.011			0.142	0.183
Correlation	-0.299	0.084			-0.454	-0.126
Residual (sd)	0.202	0.005			0.192	0.212

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.8. Detailed statistics for the covariate model of number of unprotected sexual encounters.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	1.844	0.021	85.79	0.000	1.802	1.886
RTR	-0.287	0.584	-0.49	0.623	-1.433	0.858
RTR+	-0.458	0.542	-0.85	0.398	-1.520	0.604
Month	0.672	0.104	6.49	0.000	0.469	0.875
Arizona	-0.465	0.623	-0.75	0.456	-1.685	0.756
New York	-0.770	0.879	-0.88	0.381	-2.493	0.954
Age	0.368	0.223	1.66	0.098	-0.068	0.805
Female	0.011	0.452	0.02	0.980	-0.875	0.897
Hispanic	0.515	0.670	0.77	0.442	-0.798	1.828
African-American	0.362	0.548	0.66	0.509	-0.712	1.437
Intercept	-5.303	3.613	-1.47	0.142	-12.38	1.778
Slope (sd)	2.109	0.077			1.964	2.264
Intercept (sd)	3.922	0.288			3.396	4.530
Correlation	0.255	0.098			0.054	0.435
Residual (sd)	4.872	0.131			4.622	5.136

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.9. Detailed statistics for the variable time trend model of number of unprotected sexual encounters.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	1.844	0.021	85.77	0.000	1.802	1.886
RTR	-0.302	0.585	-0.52	0.606	-1.448	0.844
RTR+	-0.454	0.542	-0.84	0.403	-1.516	0.609
Month	0.666	0.183	3.64	0.000	0.307	1.026
Arizona	-0.470	0.623	-0.75	0.451	-1.690	0.751
New York	-0.766	0.879	-0.87	0.384	-2.489	0.958
Age	0.368	0.223	1.65	0.098	-0.068	0.805
Female	0.009	0.452	0.02	0.983	-0.877	0.895
Hispanic	0.518	0.670	0.77	0.439	-0.795	1.831
African-American	0.368	0.548	0.67	0.502	-0.707	1.442
Month X RTR	0.244	0.2709	0.9	0.368	-0.287	0.7752
Month X RTR+	-0.143	0.2433	-0.59	0.556	-0.62	0.3336
Intercept	-5.299	3.613	-1.47	0.142	-12.38	1.782
Slope (sd)	2.103	0.076			1.958	2.258
Intercept (sd)	3.922	0.288			3.396	4.530
Correlation	0.263	0.098			0.062	0.443
Residual (sd)	4.873	0.131			4.622	5.136

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.10. Detailed statistics for the covariate model for intentions to have sex.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.808	0.017	47.74	0.000	0.775	0.842
RTR	0.007	0.053	0.14	0.888	-0.096	0.110
RTR+	-0.072	0.048	-1.49	0.135	-0.167	0.022
Month	0.018	0.004	4.99	0.000	0.011	0.025
Arizona	0.048	0.055	0.88	0.379	-0.059	0.156
New York	0.121	0.079	1.54	0.125	-0.034	0.276
Age	0.009	0.020	0.45	0.655	-0.030	0.048
Female	-0.054	0.041	-1.33	0.184	-0.134	0.026
Hispanic	0.017	0.060	0.28	0.780	-0.100	0.134
African-American	-0.003	0.049	-0.06	0.953	-0.099	0.093
Intercept	0.318	0.322	0.99	0.322	-0.312	0.949
Slope (sd)	0.053	0.003			0.046	0.060
Intercept (sd)	0.349	0.023			0.308	0.396
Residual (sd)	0.529	0.012			0.506	0.553

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.11. Detailed statistics for the variable time trend model for intentions to have sex.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.808	0.017	47.75	0.000	0.775	0.841
RTR	-0.013	0.057	-0.23	0.821	-0.125	0.100
RTR+	-0.105	0.053	-1.97	0.049	-0.209	-0.001
Month	0.011	0.006	1.68	0.093	-0.002	0.024
Arizona	0.048	0.055	0.87	0.382	-0.060	0.156
New York	0.121	0.079	1.53	0.125	-0.034	0.276
Age	0.009	0.020	0.46	0.646	-0.030	0.048
Female	-0.054	0.041	-1.33	0.184	-0.134	0.026
Hispanic	0.017	0.060	0.28	0.781	-0.100	0.134
African-American	-0.003	0.049	-0.06	0.956	-0.099	0.094
Month X RTR	0.008	0.009	0.83	0.405	-0.010	0.026
Month X RTR+	0.013	0.009	1.47	0.141	-0.004	0.030
Intercept	0.334	0.322	1.04	0.299	-0.297	0.965
Slope (sd)	0.052	0.003			0.046	0.060
Intercept (sd)	0.349	0.023			0.308	0.396
Residual (sd)	0.529	0.012			0.506	0.554

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.12. Detailed statistics for the covariate model for intentions to use prophylaxis.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.606	0.027	22.61	0.000	0.553	0.658
RTR	0.160	0.053	3.03	0.002	0.056	0.263
RTR+	0.088	0.049	1.82	0.069	-0.007	0.183
Month	0.001	0.003	0.48	0.629	-0.004	0.007
Arizona	-0.095	0.055	-1.72	0.086	-0.203	0.013
New York	0.134	0.079	1.7	0.089	-0.021	0.289
Age	0.015	0.020	0.77	0.440	-0.024	0.055
Female	0.117	0.041	2.88	0.004	0.037	0.197
Hispanic	-0.039	0.060	-0.65	0.515	-0.157	0.079
African-American	-0.080	0.049	-1.62	0.104	-0.177	0.017
Intercept	0.916	0.328	2.79	0.005	0.273	1.559
Intercept (sd)	0.408	0.018			0.373	0.445
Residual (sd)	0.515	0.010			0.495	0.535

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.13. Detailed statistics for the variable time trend model for intentions to use prophylaxis.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.606	0.027	22.61	0.000	0.553	0.659
RTR	0.159	0.060	2.65	0.008	0.041	0.276
RTR+	0.124	0.056	2.22	0.027	0.014	0.233
Month	0.004	0.005	0.91	0.361	-0.005	0.014
Arizona	-0.094	0.055	-1.70	0.088	-0.202	0.014
New York	0.133	0.079	1.69	0.092	-0.022	0.288
Age	0.015	0.020	0.74	0.459	-0.024	0.054
Female	0.118	0.041	2.90	0.004	0.038	0.198
Hispanic	-0.039	0.060	-0.64	0.519	-0.157	0.079
African-American	-0.081	0.049	-1.64	0.101	-0.178	0.016
Month X RTR	0.001	0.007	0.11	0.912	-0.013	0.014
Month X RTR+	-0.008	0.006	-1.32	0.188	-0.021	0.004
Intercept	0.911	0.328	2.77	0.006	0.267	1.555
Intercept (sd)	0.408	0.018			0.374	0.446
Residual (sd)	0.514	0.010			0.494	0.534

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.14. Detailed statistics for the variable time trend model for knowledge.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.825	0.036	23.03	0.000	0.755	0.895
RTR	0.390	0.039	10.00	0.000	0.314	0.467
RTR+	0.498	0.036	13.70	0.000	0.427	0.569
Month	0.008	0.003	2.69	0.007	0.002	0.013
Arizona	-0.064	0.039	-1.63	0.102	-0.141	0.013
New York	0.026	0.056	0.47	0.639	-0.083	0.136
Age	-0.007	0.014	-0.52	0.604	-0.036	0.021
Female	0.057	0.028	2.03	0.043	0.002	0.113
Hispanic	-0.042	0.042	-0.98	0.325	-0.125	0.041
African-American	-0.179	0.034	-5.19	0.000	-0.247	-0.111
Month X RTR	-0.015	0.004	-3.66	0.000	-0.023	-0.007
Month X RTR+	-0.017	0.004	-4.37	0.000	-0.024	-0.009
Intercept	0.547	0.228	2.40	0.016	0.100	0.994
Slope (sd)	0.016	0.002			0.012	0.022
Intercept (sd)	0.313	0.012			0.291	0.337
Residual (sd)	0.271	0.006			0.259	0.283

Note 1. Presurvey = Presurvey score on the dependent measure.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.15. Detailed statistics for the extended model for knowledge.

Covariate	b	SE	z	P>|z|	95% CI for b	
Presurvey	0.831	0.036	23.39	0.000	0.762	0.901
RTR	0.412	0.049	8.33	0.000	0.315	0.509
RTR+	0.549	0.046	11.85	0.000	0.458	0.640
Month	0.008	0.003	2.79	0.005	0.002	0.014
Arizona	-0.049	0.039	-1.24	0.214	-0.125	0.028
New York	0.027	0.056	0.49	0.625	-0.082	0.137
Age	-0.007	0.014	-0.51	0.611	-0.035	0.021
Female	0.050	0.028	1.77	0.077	-0.005	0.105
Hispanic	-0.133	0.075	-1.78	0.075	-0.280	0.014
African-American	-0.024	0.061	-0.39	0.696	-0.143	0.096
Month X RTR	-0.015	0.004	-3.74	0.000	-0.023	-0.007
Month X RTR+	-0.017	0.004	-4.49	0.000	-0.025	-0.010
Hispanic X RTR	0.216	0.107	2.03	0.043	0.007	0.426
Af. Amer. X RTR	-0.188	0.083	-2.27	0.023	-0.351	-0.025
Hispanic X RTR+	0.067	0.092	0.72	0.469	-0.114	0.247
Af. Amer. X RTR+	-0.232	0.080	-2.91	0.004	-0.389	-0.076
Intercept	0.499	0.228	2.19	0.028	0.053	0.946
Slope (sd)	0.016	0.002			0.012	0.022
Intercept (sd)	0.308	0.012			0.286	0.332
Residual (sd)	0.270	0.006			0.258	0.283

Note 1. Presurvey = Presurvey score on the dependent measure; Af. Amer. = African American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for ethnicity = Hispanic and African-American: White/Other.

Table D.16. Detailed statistics for the covariate model for attitudes towards sex.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.725	0.019	38.44	0.000	0.688	0.762
RTR	0.025	0.049	0.5	0.614	-0.071	0.120
RTR+	-0.095	0.045	-2.12	0.034	-0.183	-0.007
Month	0.018	0.003	6.19	0.000	0.012	0.024
Arizona	0.069	0.051	1.35	0.178	-0.031	0.170
New York	0.272	0.074	3.67	0.000	0.127	0.417
Age	-0.001	0.019	-0.07	0.944	-0.038	0.035
Female	-0.057	0.038	-1.5	0.133	-0.131	0.017
Hispanic	-0.104	0.056	-1.86	0.063	-0.213	0.006
African-American	-0.023	0.045	-0.51	0.607	-0.112	0.066
Intercept	0.459	0.299	1.54	0.125	-0.127	1.044
Slope (sd)	0.038	0.003			0.032	0.045
Intercept (sd)	0.363	0.018			0.330	0.400
Residual (sd)	0.445	0.010			0.425	0.466

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.17. Detailed statistics for the variable time trend model for attitudes towards prophylaxis.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.756	0.031	24.28	0.000	0.695	0.818
RTR	0.151	0.035	4.32	0.000	0.082	0.219
RTR+	0.210	0.032	6.46	0.000	0.146	0.273
Month	0.005	0.003	1.95	0.051	0.000	0.011
Arizona	-0.067	0.035	-1.88	0.059	-0.136	0.003
New York	0.023	0.051	0.45	0.652	-0.076	0.122
Age	0.021	0.013	1.70	0.089	-0.003	0.046
Female	0.125	0.026	4.82	0.000	0.074	0.176
Hispanic	-0.021	0.038	-0.54	0.588	-0.096	0.054
African-American	-0.139	0.031	-4.51	0.000	-0.199	-0.078
Month X RTR	-0.004	0.004	-1.07	0.283	-0.012	0.003
Month X RTR+	-0.010	0.004	-2.81	0.005	-0.017	-0.003
Intercept	0.332	0.212	1.57	0.117	-0.084	0.747
Slope (sd)	0.020	0.002			0.017	0.024
Intercept (sd)	0.283	0.011			0.263	0.305
Residual (sd)	0.235	0.006			0.224	0.246

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.18. Detailed statistics for the extended model for attitudes towards prophylaxis.

Covariate	b	SE	z	p	95 % CI for b	
Presurvey	0.759	0.031	24.520	0.000	0.699	0.820
RTR	0.156	0.044	3.520	0.000	0.069	0.244
RTR+	0.221	0.042	5.310	0.000	0.139	0.303
Month	0.005	0.003	2.010	0.045	0.000	0.011
Arizona	-0.049	0.035	-1.390	0.163	-0.119	0.020
New York	0.027	0.051	0.530	0.598	-0.072	0.126
Age	0.021	0.013	1.710	0.088	-0.003	0.046
Female	0.118	0.026	4.570	0.000	0.067	0.168
Hispanic	-0.132	0.068	-1.930	0.053	-0.265	0.002
African-American	-0.051	0.055	-0.930	0.350	-0.159	0.056
Month X RTR	-0.004	0.004	-1.130	0.258	-0.012	0.003
Month X RTR+	-0.011	0.004	-2.870	0.004	-0.018	-0.003
Hispanic X RTR	0.250	0.097	2.580	0.010	0.060	0.439
Af. Amer. X RTR	-0.140	0.075	-1.870	0.061	-0.287	0.007
Hispanic X RTR+	0.092	0.084	1.100	0.273	-0.072	0.256
Af. Amer. X RTR+	-0.095	0.072	-1.320	0.188	-0.237	0.047
Intercept	0.318	0.212	1.500	0.134	-0.097	0.733
Slope (sd)	0.020	0.002			0.017	0.024
Intercept (sd)	0.280	0.010			0.260	0.301
Residual (sd)	0.235	0.006			0.224	0.246

Note 1. Presurvey = Presurvey score on the dependent measure, Af. Amer. = African American.
Note2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.19. Detailed statistics for the covariate model for perceived sexual norms.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.691	0.021	32.97	0.000	0.650	0.733
RTR	-0.011	0.039	-0.28	0.783	-0.087	0.066
RTR+	-0.088	0.036	-2.44	0.015	-0.158	-0.017
Month	0.020	0.002	9.46	0.000	0.016	0.024
Arizona	0.018	0.041	0.43	0.667	-0.063	0.098
New York	0.041	0.059	0.71	0.481	-0.074	0.156
Age	0.014	0.015	0.9	0.366	-0.016	0.043
Female	-0.032	0.030	-1.08	0.282	-0.091	0.027
Hispanic	-0.040	0.045	-0.9	0.367	-0.128	0.047
African-American	-0.027	0.037	-0.74	0.462	-0.100	0.045
Intercept	0.314	0.240	1.31	0.190	-0.156	0.784
Slope (sd)	0.023	0.003			0.018	0.029
Intercept (sd)	0.300	0.014			0.274	0.328
Residual (sd)	0.352	0.008			0.337	0.368

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.20. Detailed statistics for the covariate model for perceived parental sexual norms.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.672	0.023	28.67	0.000	0.627	0.718
RTR	0.000	0.051	0.00	0.999	-0.100	0.100
RTR+	-0.025	0.047	-0.54	0.590	-0.118	0.067
Month	0.011	0.003	4.19	0.000	0.006	0.016
Arizona	-0.099	0.054	-1.82	0.068	-0.206	0.007
New York	0.134	0.077	1.73	0.083	-0.017	0.286
Age	0.007	0.020	0.36	0.720	-0.031	0.045
Female	-0.140	0.040	-3.47	0.001	-0.219	-0.061
Hispanic	-0.023	0.059	-0.39	0.696	-0.138	0.092
African-American	-0.030	0.048	-0.61	0.539	-0.124	0.065
Intercept	0.277	0.314	0.88	0.379	-0.340	0.893
Slope (sd)	0.029	0.003			0.023	0.037
Intercept (sd)	0.403	0.017			0.370	0.438
Residual (sd)	0.433	0.010			0.414	0.453

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.21. Detailed statistics for the extended model for perceived parental sexual norms.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.678	0.023	29.17	0.000	0.633	0.724
RTR	0.026	0.066	0.40	0.691	-0.103	0.156
RTR+	0.050	0.062	0.81	0.417	-0.071	0.171
Month	0.011	0.003	4.21	0.000	0.006	0.016
Arizona	-0.101	0.054	-1.87	0.062	-0.208	0.005
New York	0.119	0.077	1.54	0.124	-0.033	0.271
Age	0.012	0.019	0.60	0.548	-0.026	0.050
Female	-0.132	0.040	-3.30	0.001	-0.211	-0.054
Hispanic	0.215	0.104	2.06	0.039	0.011	0.420
African-American	-0.036	0.084	-0.43	0.668	-0.201	0.129
Hispanic X RTR	-0.110	0.148	-0.74	0.457	-0.400	0.180
Af. Amer. X RTR	-0.014	0.115	-0.12	0.903	-0.240	0.212
Hispanic X RTR+	-0.445	0.127	-3.49	0.000	-0.695	-0.195
Af. Amer. X RTR+	0.024	0.111	0.22	0.828	-0.194	0.242
Intercept	0.158	0.314	0.50	0.615	-0.458	0.774
Slope (sd)	0.029	0.003			0.023	0.037
Intercept (sd)	0.396	0.017			0.363	0.431
Residual (sd)	0.432	0.010			0.413	0.452

Note 1. Presurvey = Presurvey score on the dependent measure; Af. Amer. = African-American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site: Arizona and New York: Texas; reference for ethnicity = Hispanic and African American: White/Other.

Table D.22. Detailed statistics for the covariate model for perceived prophylactic norms.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.544	0.029	18.55	0.000	0.487	0.602
RTR	0.092	0.047	1.98	0.047	0.001	0.184
RTR+	0.087	0.043	2.04	0.042	0.003	0.172
Month	0.002	0.002	0.91	0.361	-0.002	0.007
Arizona	-0.132	0.049	-2.68	0.007	-0.228	-0.035
New York	0.112	0.070	1.58	0.113	-0.026	0.250
Age	0.025	0.018	1.44	0.149	-0.009	0.060
Female	0.140	0.036	3.89	0.000	0.069	0.210
Hispanic	-0.077	0.053	-1.45	0.148	-0.182	0.027
African-American	-0.154	0.043	-3.57	0.000	-0.239	-0.069
Intercept	0.928	0.293	3.16	0.002	0.353	1.503
Slope (sd)	0.024	0.003			0.018	0.031
Intercept (sd)	0.377	0.016			0.348	0.409
Residual (sd)	0.385	0.009			0.368	0.403

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.23. Detailed statistics for the extended model for perceived prophylactic norms.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.551	0.029	18.85	0.000	0.494	0.609
RTR	0.119	0.060	1.97	0.049	0.001	0.236
RTR+	0.080	0.056	1.43	0.152	-0.030	0.190
Month	0.002	0.002	0.95	0.341	-0.002	0.007
Arizona	-0.109	0.049	-2.21	0.027	-0.205	-0.012
New York	0.108	0.071	1.53	0.127	-0.031	0.246
Age	0.025	0.017	1.43	0.152	-0.009	0.059
Female	0.131	0.036	3.65	0.000	0.060	0.201
Hispanic	-0.186	0.095	-1.96	0.050	-0.371	0.000
African-American	-0.074	0.077	-0.95	0.340	-0.225	0.078
Hispanic X RTR	0.258	0.135	1.91	0.057	-0.007	0.522
Af. Amer. X RTR	-0.212	0.106	-2.01	0.044	-0.419	-0.005
Hispanic X RTR+	0.084	0.116	0.72	0.470	-0.144	0.311
Af. Amer. X RTR+	-0.012	0.102	-0.12	0.903	-0.212	0.187
Intercept	0.907	0.294	3.08	0.002	0.330	1.484
Slope (sd)	0.023	0.003			0.018	0.031
Intercept (sd)	0.373	0.016			0.343	0.405
Residual (sd)	0.385	0.009			0.368	0.403

Note 1. Presurvey = Presurvey score on the dependent measure; Af. Amer. = African-American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site: Arizona and New York: Texas; reference for ethnicity = Hispanic and African American: White/Other.

Table D.24. Detailed statistics for the covariate model for self-efficacy in "saying no".

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.441	0.029	15.35	0.000	0.384	0.497
RTR	0.190	0.052	3.62	0.000	0.087	0.293
RTR+	0.244	0.048	5.05	0.000	0.149	0.338
Month	-0.006	0.003	-2.12	0.034	-0.011	0.000
Arizona	-0.128	0.055	-2.33	0.020	-0.236	-0.020
New York	0.081	0.078	1.03	0.304	-0.073	0.234
Age	0.049	0.020	2.47	0.014	0.010	0.088
Female	0.171	0.041	4.13	0.000	0.090	0.253
Hispanic	-0.028	0.060	-0.47	0.639	-0.146	0.089
African-American	-0.136	0.049	-2.79	0.005	-0.232	-0.041
Intercept	0.789	0.325	2.43	0.015	0.152	1.426
Slope (sd)	0.021	0.005			0.014	0.033
Intercept (sd)	0.409	0.018			0.375	0.446
Residual (sd)	0.476	0.011			0.456	0.498

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.25. Detailed statistics for the covariate model for prophylactic self-efficacy.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.551	0.027	20.33	0.000	0.498	0.604
RTR	0.101	0.049	2.06	0.039	0.005	0.196
RTR+	0.177	0.045	3.94	0.000	0.089	0.266
Month	0.004	0.002	1.76	0.079	0.000	0.009
Arizona	-0.119	0.052	-2.32	0.021	-0.220	-0.018
New York	0.134	0.073	1.83	0.068	-0.010	0.278
Age	0.014	0.019	0.76	0.447	-0.022	0.050
Female	0.187	0.038	4.96	0.000	0.113	0.261
Hispanic	-0.001	0.056	-0.01	0.988	-0.111	0.109
African-American	-0.129	0.045	-2.84	0.005	-0.218	-0.040
Intercept	1.008	0.303	3.33	0.001	0.416	1.601
Slope (sd)	0.022	0.004			0.016	0.031
Intercept (sd)	0.388	0.016			0.357	0.421
Residual (sd)	0.427	0.010			0.408	0.447

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.26. Detailed statistics for the extended model for prophylactic self-efficacy.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.553	0.027	20.51	0.000	0.500	0.606
RTR	0.111	0.063	1.76	0.079	-0.013	0.235
RTR+	0.238	0.059	4.05	0.000	0.123	0.354
Month	0.004	0.002	1.76	0.078	0.000	0.009
Arizona	-0.103	0.052	-1.99	0.047	-0.204	-0.001
New York	0.138	0.074	1.87	0.062	-0.007	0.282
Age	0.017	0.018	0.90	0.366	-0.019	0.053
Female	0.180	0.038	4.77	0.000	0.106	0.254
Hispanic	-0.047	0.099	-0.48	0.634	-0.241	0.147
African-American	0.006	0.081	0.08	0.938	-0.153	0.165
Hispanic X RTR	0.247	0.143	1.74	0.083	-0.032	0.527
Af. Amer. X RTR	-0.158	0.111	-1.42	0.155	-0.376	0.060
Hispanic X RTR+	-0.041	0.121	-0.34	0.732	-0.279	0.196
Af. Amer. X RTR+	-0.206	0.107	-1.92	0.054	-0.415	0.004
Intercept	0.935	0.304	3.08	0.002	0.340	1.531
Slope (sd)	0.023	0.004			0.016	0.031
Intercept (sd)	0.384	0.016			0.353	0.417
Residual (sd)	0.426	0.010			0.408	0.446

Note 1. Presurvey = Presurvey score on the dependent measure, Af. Amer. = African-American.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.27. Detailed statistics for the covariate model for perceived behavioral control.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.569	0.028	20.67	0.000	0.515	0.623
RTR	0.133	0.048	2.76	0.006	0.039	0.228
RTR+	0.129	0.045	2.89	0.004	0.042	0.217
Month	0.007	0.002	2.94	0.003	0.002	0.012
Arizona	-0.064	0.051	-1.25	0.211	-0.164	0.036
New York	0.153	0.073	2.1	0.036	0.010	0.296
Age	0.031	0.018	1.71	0.088	-0.005	0.067
Female	0.146	0.037	3.9	0.000	0.072	0.219
Hispanic	-0.038	0.056	-0.69	0.493	-0.147	0.071
African-American	-0.106	0.045	-2.36	0.018	-0.194	-0.018
Intercept	0.703	0.299	2.36	0.018	0.118	1.288
Slope (sd)	0.028	0.003			0.023	0.035
Intercept (sd)	0.386	0.017			0.355	0.420
Residual (sd)	0.408	0.010			0.389	0.427

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.28. Detailed statistics for the extended model for perceived behavioral control.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.574	0.027	20.91	0.000	0.520	0.628
RTR	0.158	0.063	2.52	0.012	0.035	0.280
RTR+	0.182	0.058	3.13	0.002	0.068	0.297
Month	0.007	0.003	2.94	0.003	0.002	0.012
Arizona	-0.050	0.051	-0.97	0.330	-0.150	0.051
New York	0.154	0.073	2.10	0.036	0.010	0.297
Age	0.032	0.018	1.74	0.081	-0.004	0.068
Female	0.138	0.037	3.70	0.000	0.065	0.210
Hispanic	-0.127	0.098	-1.29	0.196	-0.320	0.066
African-American	0.060	0.080	0.75	0.452	-0.097	0.218
Hispanic X RTR	0.215	0.141	1.53	0.127	-0.061	0.490
Af. Amer. X RTR	-0.203	0.110	-1.84	0.065	-0.419	0.013
Hispanic X RTR+	0.064	0.121	0.53	0.599	-0.173	0.300
Af. Amer. X RTR+	-0.253	0.106	-2.39	0.017	-0.460	-0.046
Intercept	0.654	0.300	2.18	0.029	0.066	1.242
Slope (sd)	0.029	0.003			0.023	0.036
Intercept (sd)	0.381	0.017			0.350	0.415
Residual (sd)	0.407	0.010			0.389	0.426

Note 1. Presurvey = Presurvey score on the dependent measure; Af. Amer. = African-American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site: Arizona and New York: Texas; reference for ethnicity = Hispanic and African American: White/Other.

Table D.29. Detailed statistics for the variable time trend model for warning signals.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.825	0.036	23.03	0.000	0.755	0.895
RTR	0.390	0.039	10.00	0.000	0.314	0.467
RTR+	0.498	0.036	13.70	0.000	0.427	0.569
Month	0.008	0.003	2.69	0.007	0.002	0.013
Arizona	-0.064	0.039	-1.63	0.102	-0.141	0.013
New York	0.026	0.056	0.47	0.639	-0.083	0.136
Age	-0.007	0.014	-0.52	0.604	-0.036	0.021
Female	0.057	0.028	2.03	0.043	0.002	0.113
Hispanic	-0.042	0.042	-0.98	0.325	-0.125	0.041
African-American	-0.179	0.034	-5.19	0.000	-0.247	-0.111
Month X RTR	-0.015	0.004	-3.66	0.000	-0.023	-0.007
Month X RTR+	-0.017	0.004	-4.37	0.000	-0.024	-0.009
Intercept	0.547	0.228	2.40	0.016	0.100	0.994
Slope (sd)	0.016	0.002			0.012	0.022
Intercept (sd)	0.313	0.012			0.291	0.337
Residual (sd)	0.271	0.006			0.259	0.283

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.30. Detailed statistics for the covariate model for categorical risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.525	0.028	18.77	0.000	0.470	0.579
RTR	0.104	0.040	2.58	0.010	0.025	0.183
RTR+	0.282	0.037	7.57	0.000	0.209	0.355
Month	-0.005	0.002	-2.23	0.026	-0.008	-0.001
Arizona	-0.107	0.043	-2.5	0.012	-0.191	-0.023
New York	0.038	0.061	0.62	0.537	-0.082	0.157
Age	0.048	0.015	3.14	0.002	0.018	0.078
Female	0.130	0.031	4.2	0.000	0.070	0.191
Hispanic	-0.015	0.046	-0.32	0.749	-0.106	0.076
African-American	-0.101	0.037	-2.69	0.007	-0.174	-0.027
Intercept	0.572	0.254	2.25	0.024	0.074	1.071
Slope (sd)	0.021	0.003			0.016	0.027
Intercept (sd)	0.324	0.014			0.298	0.352
Residual (sd)	0.339	0.008			0.325	0.355

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.31. Detailed statistics for the extended model for categorical risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.525	0.028	18.84	0.000	0.470	0.579
RTR	0.129	0.052	2.48	0.013	0.027	0.232
RTR+	0.297	0.049	6.11	0.000	0.202	0.393
Month	-0.004	0.002	-2.22	0.027	-0.008	-0.001
Arizona	-0.089	0.043	-2.09	0.037	-0.173	-0.005
New York	0.037	0.061	0.61	0.542	-0.082	0.157
Age	0.048	0.015	3.15	0.002	0.018	0.077
Female	0.123	0.031	3.97	0.000	0.062	0.183
Hispanic	-0.123	0.082	-1.50	0.134	-0.284	0.038
African-American	0.018	0.067	0.27	0.790	-0.113	0.149
Hispanic X RTR	0.218	0.117	1.86	0.063	-0.012	0.448
Af. Amer. X RTR	-0.202	0.092	-2.21	0.027	-0.382	-0.023
Hispanic X RTR+	0.105	0.101	1.04	0.298	-0.093	0.302
Af. Amer. X RTR+	-0.126	0.088	-1.43	0.154	-0.299	0.047
Intercept	0.558	0.255	2.19	0.028	0.059	1.058
Slope (sd)	0.021	0.003			0.017	0.027
Intercept (sd)	0.320	0.014			0.295	0.348
Residual (sd)	0.339	0.008			0.324	0.354

Note 1. Presurvey = Presurvey score on the dependent measure, Af. Amer. = African-American.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.32. Detailed statistics for the covariate model for global risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.433	0.028	15.23	0.000	0.377	0.488
RTR	-0.099	0.077	-1.28	0.201	-0.251	0.053
RTR+	-0.008	0.071	-0.11	0.915	-0.147	0.132
Month	-0.012	0.004	-2.77	0.006	-0.020	-0.003
Arizona	-0.152	0.081	-1.89	0.059	-0.311	0.006
New York	-0.065	0.116	-0.56	0.574	-0.294	0.163
Age	0.031	0.029	1.04	0.298	-0.027	0.088
Female	-0.103	0.060	-1.72	0.085	-0.219	0.014
Hispanic	-0.110	0.089	-1.24	0.216	-0.284	0.064
African-American	-0.129	0.073	-1.75	0.080	-0.272	0.015
Intercept	0.682	0.479	1.42	0.155	-0.257	1.622
Slope (sd)	0.030	0.008			0.018	0.050
Intercept (sd)	0.578	0.028			0.525	0.636
Residual (sd)	0.759	0.017			0.726	0.793

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.33. Detailed statistics for the covariate model for global benefit perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.433	0.028	15.23	0.000	0.377	0.488
RTR	-0.099	0.077	-1.28	0.201	-0.251	0.053
RTR+	-0.008	0.071	-0.11	0.915	-0.147	0.132
Month	-0.012	0.004	-2.77	0.006	-0.020	-0.003
Arizona	-0.152	0.081	-1.89	0.059	-0.311	0.006
New York	-0.065	0.116	-0.56	0.574	-0.294	0.163
Age	0.031	0.029	1.04	0.298	-0.027	0.088
Female	-0.103	0.060	-1.72	0.085	-0.219	0.014
Hispanic	-0.110	0.089	-1.24	0.216	-0.284	0.064
African-American	-0.129	0.073	-1.75	0.080	-0.272	0.015
Intercept	0.682	0.479	1.42	0.155	-0.257	1.622
Slope (sd)	0.030	0.008			0.018	0.050
Intercept (sd)	0.578	0.028			0.525	0.636
Residual (sd)	0.759	0.017			0.726	0.793

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.34. Detailed statistics for the extended model for global benefit perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.523	0.026	19.80	0.000	0.471	0.575
RTR	0.081	0.065	1.24	0.216	-0.047	0.208
RTR+	0.014	0.060	0.24	0.812	-0.103	0.131
Month	0.004	0.003	1.24	0.215	-0.003	0.011
Arizona	-0.061	0.068	-0.89	0.372	-0.194	0.073
New York	0.140	0.099	1.41	0.159	-0.055	0.335
Centered Age	0.007	0.043	0.16	0.874	-0.077	0.091
Female	-0.153	0.051	-3.03	0.002	-0.252	-0.054
Hispanic	-0.107	0.075	-1.44	0.150	-0.253	0.039
African-American	-0.220	0.061	-3.63	0.000	-0.339	-0.101
C. Age X RTR	0.032	0.063	0.51	0.607	-0.091	0.156
C. Age X RTR+	0.139	0.058	2.41	0.016	0.026	0.253
Intercept	0.807	0.073	11.09	0.000	0.665	0.950
Slope (sd)	0.032	0.005			0.023	0.044
Intercept (sd)	0.494	0.023			0.451	0.541
Residual (sd)	0.601	0.014			0.574	0.629

Note 1. Presurvey = Presurvey score on the dependent measure; C. Age = Centered age.
Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site: Arizona and New York: Texas; reference for ethnicity = Hispanic and African American: White/Other.

Table D.35. Detailed statistics for the variable time trend model for gist principles.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.700	0.025	28.54	0.000	0.652	0.748
RTR	0.712	0.223	3.19	0.001	0.274	1.150
RTR+	0.288	0.208	1.39	0.166	-0.119	0.695
Month	-0.014	0.019	-0.71	0.480	-0.052	0.024
Arizona	-0.563	0.221	-2.54	0.011	-0.997	-0.129
New York	-0.418	0.318	-1.31	0.189	-1.041	0.205
Age	-0.064	0.079	-0.81	0.418	-0.218	0.090
Female	0.572	0.163	3.51	0.000	0.252	0.891
Hispanic	-0.148	0.240	-0.62	0.536	-0.619	0.322
African-American	0.064	0.194	0.33	0.739	-0.315	0.444
Month X RTR	-0.064	0.028	-2.28	0.023	-0.118	-0.009
Month X RTR+	-0.060	0.026	-2.29	0.022	-0.111	-0.009
Intercept	3.985	1.311	3.04	0.002	1.414	6.555
Slope (sd)	0.136	0.013			0.113	0.163
Intercept (sd)	1.675	0.069			1.544	1.817
Residual (sd)	1.708	0.039			1.633	1.787

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.36. Detailed statistics for the covariate model for specific risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.582	0.033	17.61	0.000	0.517	0.646
RTR	-0.015	0.044	-0.34	0.735	-0.101	0.072
RTR+	-0.044	0.041	-1.09	0.275	-0.124	0.035
Month	0.003	0.003	1.06	0.290	-0.002	0.008
Arizona	0.120	0.046	2.6	0.009	0.029	0.211
New York	0.052	0.066	0.79	0.431	-0.078	0.182
Age	-0.002	0.017	-0.13	0.900	-0.035	0.031
Female	-0.199	0.034	-5.87	0.000	-0.266	-0.133
Hispanic	0.046	0.050	0.91	0.360	-0.053	0.145
African-American	0.109	0.041	2.64	0.008	0.028	0.190
Intercept	0.353	0.273	1.29	0.197	-0.183	0.888
Slope (sd)	0.038	0.004			0.032	0.046
Intercept (sd)	0.360	0.021			0.321	0.403
Correlation	-0.287	0.094			-0.554	-0.095
Residual (sd)	0.405	0.010			0.385	0.426

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.37. Detailed statistics for the covariate model for quantitative risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.301	0.024	12.78	0.000	0.255	0.348
RTR	1.846	1.164	1.59	0.113	-0.435	4.128
RTR+	0.648	1.067	0.61	0.544	-1.443	2.739
Month	-0.053	0.064	-0.83	0.405	-0.177	0.072
Arizona	0.684	1.200	0.57	0.568	-1.667	3.036
New York	-1.416	1.753	-0.81	0.419	-4.851	2.019
Age	0.031	0.438	0.07	0.943	-0.827	0.889
Female	-0.372	0.893	-0.42	0.677	-2.122	1.378
Hispanic	0.770	1.311	0.59	0.557	-1.800	3.340
African-American	2.798	1.116	2.51	0.012	0.610	4.986
Intercept	2.613	7.139	0.37	0.714	-11.379	16.606
Intercept (sd)	8.437	0.447			7.605	9.359
Residual (sd)	11.808	0.248			11.330	12.304

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.38. Detailed statistics for the extended model for quantitative risk perception.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.301	0.024	12.82	0.000	0.255	0.347
RTR	-0.686	1.720	-0.40	0.690	-4.057	2.685
RTR+	1.747	1.657	1.05	0.292	-1.500	4.995
Month	-0.053	0.063	-0.83	0.405	-0.177	0.072
Arizona	0.827	1.195	0.69	0.489	-1.516	3.169
New York	-1.159	1.747	-0.66	0.507	-4.583	2.264
Age	-0.002	0.437	0.00	0.996	-0.858	0.853
Female	-1.113	1.603	-0.69	0.488	-4.254	2.029
Hispanic	0.603	1.308	0.46	0.645	-1.960	3.166
African-American	2.863	1.112	2.57	0.010	0.683	5.042
Female X RTR	4.615	2.270	2.03	0.042	0.166	9.064
Female X RTR+	-1.707	2.142	-0.80	0.426	-5.905	2.491
Intercept	3.541	7.128	0.50	0.619	-10.430	17.513
Intercept (sd)	8.379	0.444			7.553	9.296
Residual (sd)	11.792	0.247			11.318	12.287

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.39. Detailed statistics for the covariate model for reasons for/against pregnancy.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.762	0.021	36.88	0.000	0.721	0.802
RTR	-0.045	0.030	-1.53	0.127	-0.103	0.013
RTR+	-0.032	0.027	-1.17	0.241	-0.085	0.022
Month	0.001	0.002	0.81	0.421	-0.002	0.005
Arizona	0.051	0.031	1.65	0.099	-0.010	0.112
New York	-0.048	0.044	-1.08	0.282	-0.135	0.039
Age	-0.010	0.011	-0.87	0.383	-0.031	0.012
Female	-0.033	0.023	-1.46	0.145	-0.078	0.011
Hispanic	0.056	0.034	1.65	0.098	-0.010	0.123
African-American	0.054	0.028	1.93	0.053	-0.001	0.109
Intercept	0.527	0.183	2.89	0.004	0.169	0.885
Slope (sd)	0.020	0.003			0.015	0.026
Intercept (sd)	0.200	0.015			0.173	0.232
Correlation	0.355	0.211			-0.102	0.688
Residual (sd)	0.279	0.007			0.265	0.294

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.40. Detailed statistics for the covariate model for reasons to have sex.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.653	0.024	26.75	0.000	0.606	0.701
RTR	0.025	0.045	0.550	0.579	-0.063	0.112
RTR+	-0.031	0.041	-0.76	0.449	-0.112	0.050
Month	0.001	0.003	0.38	0.707	-0.004	0.006
Arizona	-0.043	0.047	-0.91	0.360	-0.135	0.049
New York	0.167	0.067	2.49	0.013	0.036	0.299
Age	0.048	0.017	2.82	0.005	0.014	0.081
Female	-0.085	0.035	-2.44	0.015	-0.153	-0.017
Hispanic	-0.037	0.051	-0.72	0.471	-0.137	0.063
African-American	-0.042	0.042	-1.00	0.319	-0.123	0.040
Intercept	-0.115	0.275	-0.42	0.677	-0.654	0.425
Slope (sd)	0.030	0.003			0.025	0.037
Intercept (sd)	0.333	0.016			0.303	0.365
Residual (sd)	0.417	0.009			0.400	0.436

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

Table D.41. Detailed statistics for the covariate model for reasons to not have sex.

Covariate	b	SE	z	p	95% CI for b	
Presurvey	0.651	0.026	25.19	0.000	0.600	0.702
RTR	0.143	0.040	3.6	0.000	0.065	0.220
RTR+	0.167	0.036	4.58	0.000	0.096	0.239
Month	-0.013	0.002	-6	0.000	-0.018	-0.009
Arizona	-0.132	0.041	-3.18	0.001	-0.213	-0.050
New York	-0.005	0.059	-0.08	0.934	-0.121	0.112
Age	0.035	0.015	2.32	0.021	0.005	0.064
Female	0.119	0.032	3.74	0.000	0.057	0.181
Hispanic	0.043	0.045	0.96	0.336	-0.045	0.132
African-American	-0.080	0.037	-2.16	0.031	-0.153	-0.007
Intercept	0.330	0.259	1.27	0.204	-0.179	0.838
Slope (sd)	0.021	0.003			0.016	0.028
Intercept (sd)	0.293	0.014			0.266	0.323
Residual (sd)	0.383	0.009			0.367	0.401

Note 1. Presurvey = Presurvey score on the dependent measure.

Note 2. Reference for intervention = RTR and RTR+: Control; reference for Site = Arizona and New York: Texas; reference for Ethnicity = Hispanic and African-American: White/other.

REFERENCES

(2007). *Consolidated Standards of Reporting Trials*. Retrieved January 31, 2009, from www.consort-statement.org.

Abma, J., Chandra, A., Mosher, W., Peterson, L., & Piccinino, L. (1997). Fertility, family planning, and women's health: New data from the 1995 National Survey of Family Growth. *Vital and Health Statistics*, 23(19).

Adam M.B., Reyna V.F. (2005). Coherence and correspondence criteria for rationality: experts' estimation of risks of sexually transmitted infections. *Journal of Behavioral Decision Making*, 18, 169-186.

Allison, P. D. (2002). *Missing data*. Thousand Oaks, CA: Sage Publications.

Altman D.G. (1998). Adjustment for covariate imbalance. In: P. Armitage & T. Colton (Eds.), *Encyclopedia of Biostatistics* (pp. 1000-1005). Chichester, UK: John Wiley & Sons.

Assmann S.F., Pocock S.J., Enos L.E., & Kasten L.E. (2000). Subgroup analysis and other (mis)uses of baseline data in clinical trials. *Lancet*, 355, 1064-1069.

Brainerd, C.J., Reyna, V.F., & Mojardin, A.H. (1999). Conjoint recognition. *Psychological Review*, 106, 160-179.

Brainerd, C.J., Stein, L.M., & Reyna, V.F. (1998). On the development of conscious and unconscious memory. *Developmental Psychology*, 34, 342-357.

Carlin, J.B., Galati, J.C., & Royston, P. 2008. A new framework for managing and analyzing multiply imputed data in Stata. *Stata Journal*, 8, 49-67.

Centers for Disease Control and Prevention. (2006). *Youth risk behavior surveillance—United States 2005*. Surveillance Summaries, MMWR, 55.

Christopher, F.S. & Roosa, M.W. (1990). An evaluation of an adolescent pregnancy prevention program: Is 'Just Say No' enough? *Family Relations*, 39, 68-72.

Coyle, K.K., Basen-Enquist, K.M., Kirby, D.B., Parcel, G.S., Banspach, S.W., & Collins, J. L (2001). Safer choices: Reducing teen pregnancy, HIV and STDs. *Public Health Reports*, 1, 82–93.

Coyle, K., & Fetro, J. V. (1998). *Safer choices: Preventing HIV, other STD and pregnancy: Level 2*. Scotts Valley, CA: ETR Associates.

Coyle, K. K., Kirby, D., Marin, B., Gomez, C., & Gregorich, S. (2004). Draw the line/respect the line: A randomized trial of a middle school intervention to reduce sexual risk behaviors. *American Journal of Public Health*, 94, 843–851.

Finer, L.B.H., & Henshaw, S.K. (2006). Disparities in rates of unintended pregnancy in the United States, 1994 and 2001. *Perspectives on Sexual and Reproductive Health*, 38, 90–96.

Graham, J.W., Cumsille, P.E., & Elek-Fisk, E. (2003). Methods for handling missing data. In I. B. Weiner (Series Ed.) & J. A. Schinka & W. F. Velicer (Vol. Eds.), *Handbook of psychology: Vol. 2. Research methods in psychology* (pp. 87–114). New York: Wiley.

Gøtzsche P.C. (1989). Methodology and overt and hidden bias in reports of 196 double-blind trials of nonsteroidal anti-inflammatory drugs in rheumatoid arthritis. *Controlled Clinical Trials*, 10, 31-56.

Guttmacher Institute. (2006). U.S. teenage pregnancy statistics national and state trends and trends by race and ethnicity. New York, NY: Guttmacher Institute.

Hogarth, R. M. (1980). *Judgment and choice: The psychology of decision*. Chicester, England: Wiley.

Holtgrave, D.R., Tinsley, B.J., & Kay, L.S. (1994). Heuristics, biases and environmental health risk analysis. In L. Health, R.S. Tindale, J. Edwards, E.J. Posavac, F. B. Bryant, E. Henderson-King, Suarez-Balcazar Y, & Myers J. (Eds), *Applications of Heuristics and Biases to Social Issues* (Volume III of the Social Psychological Applications to Social Issues series) (pp. 259-285). New York: Plenum Press.

Hubbard, B.M., Giese, M.L., & Rainey, J. (1998). A replication study of Reducing the Risk, a theory-based sexuality curriculum for adolescents. *Journal of School Health*, 68(6), 243-247.

Huber, P. J. (1967). "The Behavior of Maximum Likelihood Estimates under Nonstandard Conditions," Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability, vol. I, pp. 221–33.

Jeličić, E.P, & Lerner, R.M. (2009). Use of missing data methods in longitudinal studies: The persistence of bad practices in developmental psychology. *Developmental Psychology*, 45, 1195–1199.

Jemmott JB, Jemmott LS, & Fong GT. (1998). Abstinence and safer sex: A randomized trial of HIV sexual risk-reduction interventions for young African-American adolescents. *Journal of the American Medical Association*, 279, 1529–36.

Jemmott, J., III, Jemmott, L., Braverman, P., & Fong, G. T. (2005). HIV/STD risk reduction interventions for African American and Latino adolescent girls at an adolescent medicine clinic. *Archives of Pediatric Adolescent Medicine*, 159, 440–449.

Kaiser Family Foundation, American Social Health Association. (1998). *Sexually transmitted diseases in America: How many and at what cost?* Menlo Park, CA: Author.

Kirby, D. (2007). *Emerging Answers 2007: Research Findings on Programs to Reduce Teen Pregnancy and Sexually Transmitted Diseases*. Washington, DC: National Campaign to Prevent Teen and Unplanned Pregnancy.

Kirby D., Barth R.P., Leland N., & Fetro J.V. (1991). Reducing the risk: impact of a new curriculum on sexual risk-taking. *Family Planning Perspectives*, 23, 253-263.

Kirby, D., Lepore, G., & Ryan, J. (2005). *Sexual risk and protective factors: Factors affecting teen sexual behavior, pregnancy, childbearing and sexually transmitted disease: Which are important? Which can you change?* Washington, DC: National Campaign to Prevent Teen Pregnancy.

Long, J. S. & Ervin, L. H. (2000), "Using heteroscedastic consistent standard errors in the linear regression model," *American Statistician*, 54, 795-806.

Main D.S., Iverson D.C., McGloin J., Banspach S.W., Collin J.L., Rugg D.L., & Kolbe L.J. (1994). Preventing HIV infection among adolescents: Evaluation of a school-based education program. *Preventive Medicine*, 23, 409-417.

Marin, G. (1996). A new measurement of acculturation for Hispanics: The Bidimensional Acculturation Scale for Hispanics (BAS). *Hispanic Journal of Behavioral Sciences*, 18, 297-316.

Mills, B.A., Caetano, R.C., & Bernstein, I.H. The Hispanic Americans Baseline Alcohol Survey (HABLAS): Measurement invariance of attitudes towards alcohol across Hispanic national groups. Under review.

Mills, B.A., Reyna, V.F., & Estrada, S.M. (2008). Explaining contradictory relations between risk perception and risk taking. *Psychological Science*, 19, 429-33.

Misovich, S.J., Fisher, J.D. & Fisher, W.A. (1996). The perceived AIDS-preventive utility of knowing one's partner well: A public health dictum and individuals' risky sexual behavior. *Canadian Journal of Human Sexuality*, 5(2), 83-90.

Misovich, S.J., Fisher, J.D, & Fisher, W.A. (1997). Close relationships and elevated HIV risk behavior: Evidence and possible underlying psychological processes. *Review of General Psychology*, 1, 72-107.

Molenberghs, G., Beunkens, C., Jansen, I., Thijs, H., van Steen, K., Verbeke, G. & Kenward, M. G. (2006). Analysis of incomplete data. In A. Dmitrienko, C. Chuang-Stein & R. D'Agostino (Eds.), *Pharmaceutical Statistics with SAS*. Cary, NC: SAS publishing.

National Campaign to Prevent Teen Pregnancy. (2006). *How is the 3 in 10 statistic calculated?* Washington, DC: National Campaign to Prevent Teen Pregnancy.

Nunnally, J.C. & Bernstein, I.H (1994). *Psychometric Theory*. New York: McGraw Hill.

Nurius, P.S., Hudson, W.W., Daley, J.G., & Newsome, R.D. (1988). A short-form scale to measure peer relations dysfunction. *Journal of Social Service Research*, 13, 57-69.

Payne, J., Bettman, J.R, & Johnson, E.J. (1992). Behavioral decision research: A constructive processing perspective. *Annual Review of Psychology*, 43, 87-131.

Peugh, J.L., & Enders, C.K. (2004). Missing data in educational research: A review of reporting practices and suggestions for improvement. *Review of Educational Research*, 74, 525–556.

Piantadosi S. (1997). *Clinical Trials: A Methodologic Perspective*. New York, NY: John Wiley & Sons.

Pocock SJ. *Clinical Trials*. (1993). New York, NY: John Wiley & Sons.

Reyna, V.F. (1996). Conceptions of memory development with implications for reasoning and decision making. *Annals of Child Development*, 12, 87-118.

Reyna, V.F. (1999). *Interventions for Risk Reduction and Avoidance in Youth*. [Grant R01 MH061211 proposal to the United States Department of Health and Human Services, National Institute of Mental Health].

Reyna, V. F. (2004). How people make decisions that involve risk: A dual process approach. *Current Directions in Psychological Science*, 13, 60-66.

Reyna, V.F. (2008). A Theory of Medical Decision Making and Health: Fuzzy-trace theory. *Medical Decision Making*, 28, 850-865.

Reyna, V.F., & Adam, M.B. (2003). Fuzzy-trace theory, risk communication, and product labeling in sexually transmitted diseases. *Risk Analysis*, 23, 325–342.

Reyna, V.F., & Brainerd, C.J. (1991a). Fuzzy-trace theory and children's acquisition of mathematical and scientific concepts. *Learning & Individual Differences*, 3, 27-59.

Reyna, V.F., & Brainerd, C.J. (1991b). Fuzzy-trace theory and framing effects in choice. Gist extraction, truncation, and conversion. *Journal of Behavioral Decision Making*, 4, 249-262.

Reyna, V.F., & Brainerd, C.J. (1992). A fuzzy-trace theory of reasoning and remembering: paradoxes, patterns, and parallelism. In N. Hearst, S. Kosslyn, & R. Shiffrin (Eds.), *From learning processes to cognitive processes: Essays in honor of William K. Estes* (pp. 235-259). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Reyna, V.F., & Brainerd, C.J. (1993). Fuzzy memory and mathematics in the classroom. In Anonymous,. In G. M. Davies & R. H. Logie (Eds.), *Memory in everyday life*. (pp. 91-119). Amsterdam: North Holland Press.

Reyna, V.F., & Brainerd, C.J. (1994). The origins of probability judgement: A review of data and theories. In G. Wright & P. Ayton (Eds.), *Subjective probability*. (pp. 239-272). New York: Wiley.

Reyna, V.F., & Brainerd, C.J. (1995). Fuzzy-trace theory: An interim synthesis. *Learning & Individual Differences*, 7, 1-75.

Reyna, V.F., & Ellis, S.C. (1994). Fuzzy-trace theory and framing effects in children's risky decision making. *Psychological Science*, 5, 275-279.

Reyna, V.F. & Farley (2006). Risk and rationality in adolescent decision making: Implications for theory, practice, and public policy. *Psychological Science in the Public Interest*, 7, 1-44.

Reyna, V. F., & Mills, B. A. (2007). Interference processes in fuzzy-trace theory: Aging, Alzheimer's disease, and development. In C. MacLeod & D. Gorfein (Eds.), *Inhibition in cognition* (pp. 185-210). Washington: APA Press.

Reyna V.F., & Titcomb, A.L. (1997). Constraints on the suggestibility of eyewitness testimony: A fuzzy-trace theory analysis. In D.G. Payne & F. G. Conrad (Eds.), *A synthesis of basic and applied approaches to human memory* (pp. 157-174). Hillsdale, NJ: Lawrence Erlbaum Associates.

Reyna, V.F., Lloyd, F.J., & Brainerd, C.J. (2003). Memory, development, and rationality: An integrative theory of judgment and decision-making. In S. Schneider & J. Shanteau (Eds.), *Emerging perspectives on judgment and decision research* (pp. 201-245). New York: Cambridge University Press.

Reynolds, W.M. (1982). Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, 38, 119-125.

Reyna, V. & Rivers, S. (2008). Current theories of risk and decision-making. *Developmental Review*, 28, 1-11.

Rivers, S.E., Reyna, V.F., Mills, B.A. (2008). Risk Taking under the Influence: A Fuzzy-Trace Theory of Emotion in Adolescence. *Developmental Review*, 28, 107-144.

Roosa, M.W. & Christopher, F.S. (1990). Evaluation of an abstinence-only adolescent pregnancy prevention program: A replication. *Family Relations*, 30, 363-367.

Royston, P. 2007. Multiple imputation of missing values: further update of ice, with an emphasis on interval censoring. *Stata Journal* 7, 445-464.

Rubin,D.B. (1976). Inference and missing data. *Biometrika*, 63, 581-592.

Rubin,D.B. (1987). *Multiple Imputation for Non-Response in Surveys*. J. Wiley & Sons, New York.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, 7, 147–177.

Schafer, J.L. & Olsen, M.K. (1998). Multiple imputation for multivariate missing-data problems: A data analyst's perspective. *Multivariate Behavioral Research*, 33, 545-571.

Singer, J.D. & Willett, J.B. (2003). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*, New York: Oxford University Press.

Stanton, B.F., Li, X., Ricardo, I., Galbraith, J., Feigelman, S., & Kaljee, L. (1996). A randomized, controlled effectiveness trial of an AIDS prevention program for low-income African-American youths. *Archives of Pediatrics & Adolescent Medicine*, 150, 363-372.

St. Lawrence, J. S., Jefferson, K. W., Alleyne, E., Brasfield, T. L., O'Bannon, R. E., III, & Shirley, A. (1995). Cognitive-behavioral intervention to reduce African American adolescents' risk for HIV infection. *Journal of Consulting and Clinical Psychology*, 63, 221–237.

Suellentrop, K. (2006). *Teen contraceptive use*. Washington, DC: The National Campaign to Prevent Teen Pregnancy.

Tversky, A. (1969). Intransitivity of preferences. *Psychological Review*, 76, 31-48.

Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *Journal of Business*, 59, 252-278.

Unger, J.B., Molina, G.B., & Teran, L. (2000). Perceived consequences of teenage childbearing among adolescent girls in an urban sample. *Journal of Adolescent Health*, 26, 205-212.

Weinstock, H., Berman, S., & Cates, W. (2004). Sexually transmitted diseases among American youth: Incidence and prevalence estimates. *Perspectives on Sexual and Reproductive Health*, 36, 6–10.

Willett, J.B. & Singer, J.D. (1993). Investigating onset, cessation, relapse, and recovery: Why you should, and how you can, use discrete-time survival analysis to examine event occurrence. *Journal of Consulting and Clinical Psychology*, 61, 952-965.

White, H. (1980). A heteroscedastic-consistent covariance matrix estimator and a direct test of heteroskedasticity. *Econometrica*, 48, 817 - 838.

Wothke, W. (2000). Longitudinal and multi-group modeling with missing data. In T. D. Little, K. U. Schnabel, & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: Practical issues, applied approaches, and specific examples* (pp. 219–240). Mahwah, NJ: Erlbaum.