An Abstinence Program's Impact on Cognitive Mediators and Sexual Initiation

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***Objectives*: To evaluate the impact of an abstinence education program on sexual intercourse initiation and on possible cognitive mediators of sexual initiation for virgin seventh graders in suburban Virginia. *Methods*: Measures of sexual behavior and 6 mediating variables were compared at 3 time periods for program participants and a matched comparison group (n=550), controlling for pretest differences. *Results*: At posttest, program students scored significantly better on 4 of the 6 mediators. After one year, program students had a substantially lower risk of sexual initiation than did comparison students (*RR*=.457, P=.008). *Conclusion*: The program achieved a significant reduction in teen sexual initiation, and the role of the cognitive mediators was supported.**

***Key words*: abstinence, teen pregnancy, STDs, sex education, program evaluation**

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In 2005, approximately 63% of US adolescents had experienced sexual intercourse by the end of high school,[1] and approximately one in 7 had sex for the first time at age 14 or younger.[2] Despite a recent decline, teen pregnancy rates are still high; approximately 1 in 13 adolescent girls in the United States becomes pregnant each year.[3] In addition, the percentage of teen births occurring outside of marriage has dramatically increased in recent decades, from 46% in 1980 to 80% in 2002.[4] The negative consequences of teen pregnancy to teen mothers, their children, and society are well documented.[5-7]

In addition to the problems of teen pregnancy, sexually transmitted diseases (STDs) are a serious and growing consequence of teen sexual activity.[8-10] Approximately 4 million new STD infections occur in US adolescents each year.[9] Adolescents represent about 10% of the US population but contract about 25% of the new STD cases each year, including one fourth of all new HIV infections.[11,12]

The high rate of STDs among teens may be due in part to the fact that adolescent girls have a heightened biological susceptibility to many STDs.[8,11,12] The problem may also be compounded by the fact that although condom use can reduce the risk of STDs, it does not provide full protection, and most estimates of this protection are based on consistent condom

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use, ie, use with every act of intercourse.[13] Unfortunately, US teens have fairly low rates of consistent condom use. Among the sexually active, only 47.8% of males and 27.5% of females report they are consistent condom users over a one-year time period.[14] Although several interventions appear to have increased teen condom use at first or last intercourse, or frequency of use,[15] efforts to increase adolescent rates of *consistent* condom use have produced little evidence of success. A recent review of 83 sex education evaluations reported that only one program had significantly increased consistent condom use over a 12-month time period—from 45.3% to 58.1% for a self-selected high-risk population.[15,16]

Whether or not a pregnancy or STD occurs, early sexual initiation has been associated with poorer emotional health for adolescents, including depression, increased risk of suicide, lower self-esteem, and regret for sexual activity, as well as a higher likelihood of experiencing sexual exploitation (such as statutory rape) and unwanted or forced intercourse.[17-22]

These factors have contributed to an increased interest in a primary prevention (risk avoidance) approach to adolescent sexual health. This interest, combined with new federal funding for abstinence initiatives, has led to a proliferation during the past decade of abstinence education programs aimed at US teens. However, few evaluations of these programs have been conducted, and there is disagreement about the quality of the research and the meaning of the results.[15,23-25] Yet there appears to be some positive, if mixed, evidence that it is possible to influence US teens to postpone the initiation of sexual intercourse.[15,24-26] This evidence comes from several types of sexuality education programs, both those that take a *risk reduction* approach and those that promote *risk avoidance*.

Prevention programs taking a risk reduction approach often emphasize condom use or other protective measures for sexually active adolescents while also teaching abstinence as the best option. A few programs of this type have reported statistically significant delays in sexual initiation. They include the CAS-Carrera youth development program, the Reach for Health community youth service program, and the Reducing the Risk, Draw the Line/Respect the Line, and Becoming a Responsible Teen sex education programs.[27-32] Their results suggest that it is possible to delay adolescent sexual initiation, even when it is not the primary focus of the intervention.

The risk avoidance approach is typified by prevention programs focused solely on teaching sexual abstinence. An early abstinence version of the Postponing Sexual Involvement program produced a reduction in sexual intercourse initiation in an eighth-grade minority student population of approximately 40% ($P<.01$) after one year,[33] but such positive results were not found in a later replication.[34] An abstinence version of the Be Proud Be Responsible HIV/AIDS prevention program reported a significant delay in sexual initiation for pretest virgins after 3 months ($P=.02$), but not at 6 and 12 months.[35] The Sex Respect and Teen Aid programs reduced the rate of initiation of sex by more than one-third ($P<.01$) for the high-risk students in a high school sample after 12 months, but the effect was not found for the low-risk students, possibly due to a ceiling effect.[36] Project Taking Charge reduced the number initiating intercourse by 50% (18 percentage points) after 6 months for a sample of 91 teens ($P=.051$).[24,25] Bearman and Bruckner[18] found that making a "virginity pledge" accounted for a 34% reduction in the relative risk of sexual initiation for pledge-takers ($P<.05$). A subsequent analysis found that upon becoming sexually active, pledgers were less likely to use a condom at first intercourse but not at last intercourse.[37] A 5-year countywide mass communications program, Not Me, Not Now, appeared to produce a significant reduction in the percent of teens under age 16 who had experienced sex (46.6% vs 31.6%, $P<.05$) but did not show the same impact for older teens.[38] And an evaluation by Borawski et al of an abstinence-only curriculum called For Keeps found a significant reduction in levels of sexual activity for sexually active program students after 5 months (odds ratio=.47/.50, $P<.05$). However, no impact on sexual initiation was detected at that point.[39]

Most of the above abstinence evaluation studies have methodological limitations—eg, lack of replication, results found for some subgroups but not others, small sample sizes, lack of adequate comparison groups or long-term follow-up, or fail-

ure to establish clear causal connections. A recent study of the Heritage Keepers abstinence program avoided some of these pitfalls. This evaluation had a large sample size, matched comparison group, 12-month follow-up, and measurement of mediating factors. It found a significant and sizeable reduction of sexual initiation for middle school students one year after program participation (odds ratio=.539, P<.001). However, the attrition of higher risk students in both the program and comparison group limited the ability to generalize the program effect to a broader population of teens.[40]

All of the above trends point to the need for more and better research to evaluate the effectiveness of abstinence programs. This is coupled with a need to better understand the causal mechanisms which influence teen sexual abstinence.[39] Evidence is accumulating that social-cognitive factors are important to understanding adolescent sexual behavior, including abstinence, especially because they are more amenable to manipulation than demographic or environmental influences.[39-41] Research by Weed and Olsen and others[36,40,42] explored a broad set of cognitive/affective constructs with several samples of US teens and identified a set of mediator variables that are common to established social-cognitive theories of behavior change, including health behavior change models.[43-46] These constructs are significant predictors of sexual abstinence in adolescents, and include behavioral intentions or proximal goals, self-efficacy, outcome expectancies, moral norms or values, and subjective norms or perceived social expectations/pressures.

The purpose of this evaluation was 2-fold: (1) to determine the impact of an abstinence education program on the initiation of sexual intercourse by virgin teens after a one-year period and (2) to understand *how* this impact occurred, ie, to determine the program's impact on intermediate outcomes that were hypothesized to be key mediators in a predictive model of teen sexual initiation. Consistent with previous research and established social-cognitive theories,[36,40,41,43] this model posited behavioral intentions for sex as a primary mediator or first order predictor of teen sexual initiation. Variables predicting behavioral intentions, ie, second order predictors, included the cognitive constructs of self-efficacy—called *abstinence efficacy* in the present study, outcome expectancies—called *future impact of sex*, moral norms—called *abstinence values*, and 2 measures of perceived social expectations—*peer environment* and *opportunity for sex*. It was expected that program students' scores on these mediators at posttest would be significantly better than comparison students' scores (controlling for pretest differences) and that this difference would correspond to a lower rate of sexual initiation one year later.

METHODS

Program Description

The present study was a one-year evaluation of an abstinence education curriculum operating in the Commonwealth of Virginia. The Virginia Department of Health developed the Virginia Abstinence Education Initiative (VAEI) as a primary prevention/risk avoidance strategy that could target the full spectrum of STDs as well as pregnancy and emotional health concerns for adolescents. This paper summarizes the first-year evaluation of a VAEI program called Reasons of the Heart (ROH) taught to public middle school students in a suburban northern Virginia county. The core of the program was a 9-unit abstinence curriculum taught consecutively over 20 class periods, called Reasonable Reasons to Wait: Keys to Character. This curriculum complies with Title V's "A through H" guidelines. It emphasizes the development of personal character and teaches the benefits for individuals, families, and society of abstaining from sex until marriage. It was presented as part of the required physical/health education class and was taught by the public schools' certified health teachers after they received 8 hours of ROH training.

Research Design and Procedures

This study used a quasi-experimental design; 3 middle schools were selected to receive the ROH program, and 2 middle schools from the same geographic region with similar demographics served as the comparison group. All seventh-grade students in those 5 schools participated in the evaluation. Comparison school students received the generic family life education prescribed by the state, delivered by regular classroom teachers. In

this curriculum, sexual health topics were covered using 2 videos on HIV/STD prevention and one 30-minute video on abstinence called "Choosing to Say No." Classroom hours for this program were about one third of the ROH program. Baseline data were collected during the 1999–2000 school year. All data were obtained using paper-and-pencil questionnaires. A pretest was administered in the week prior to program startup, a post-test was administered within a week of program completion, and a follow-up questionnaire was administered 12 months later. Comparison students were surveyed on the same schedule as the program students. Privacy was ensured and the linking of individual cases across each time period was accomplished through the use of a confidential identification code. The confidentiality and the aggregate use of the questionnaire data were emphasized by the instructors before students filled out the survey.

Sample

All students in the designated seventh-grade classes on the day of the pretest filled out a survey, and those absent that day took the pretest survey on a make-up day. The study sample of 550 virgin students (those who had not experienced sexual intercourse as of the pretest) was obtained from the initial sample of 820 seventh-grade students. There were 421 virgin students in the 3 program middle schools and 241 in the 2 comparison middle schools at the pretest. (The proportion of virgin students was not statistically different in the program versus the comparison schools.) The proportion of pretest surveys that successfully linked to the one-year follow-up surveys by means of the confidential ID codes was fairly high—84.8% for program virgins, 80.1% for comparison virgins—and not statistically different between groups (χ^2=2.40, P=.12 and Fisher's exact test of 2 proportions, P=.067). After linking the pretest and one-year follow-up surveys, there were 357 virgins in the program group and 193 in the comparison group, for a total sample size of 550.

Measures

Behavioral outcome. The primary outcome of the study was sexual initiation, referring to virgin students who went on to experience vaginal sexual intercourse during the following year. The questionnaire asked about sexual intercourse experience in 3 different ways. Respondents were asked if they had ever had sex, how many times, and how recently. For the latter 2 questions, the first response option allowed them to say they had never had sex. This triangulation increased the accuracy of the sexual intercourse measure, Ever Had Sex. *Sex* was defined in the questionnaire as "sexual intercourse, sometimes also called *going all the way* or *doing it*."

Intermediate outcomes. The cognitive mediators were measured by multiple questions in the survey instrument and then transformed into scale measures through factor analysis. (The exception was *opportunity for sex,* which was a single-item measure.) Most of the questionnaire items used a 5-point Likert scale response format. All cognitive scales were coded so that a higher score was the desired or positive result.

The *behavioral intentions* for sex variable consisted of 2 items (alpha=.76), "If someone you were attracted to tried to get you to have sex with them during the next year, what would you do?" with responses ranging from "I definitely would not do it" to "I definitely would do it," and "How likely do you think it is that you will remain abstinent until you are married?" with responses ranging from "I am sure I will abstain until I am married" to "I am sure I will not remain abstinent until I am married." In the survey, *abstain* was defined as "not having sex." The *abstinence values* scale (alpha=.87) was 6 items assessing students' beliefs and values about sex before marriage, eg, "Having sex before marriage is against my personal standard of what is right and wrong." The *future impact* variable (alpha=.51) consisted of 2 items, "Having sex as a teen could really mess up my future" and "Having sex now would not affect my future goals." These items all used the strongly agree/strongly disagree response format. *Abstinence efficacy* (alpha=.88) measured students' confidence in their ability to remain abstinent in sexually risk-prone settings. The 4 items began with "How sure are you that you could…" with endings like "…firmly say *no* to having sex?" and responses ranging from not sure at all to very sure. The 3-item *peer environment* measure (alpha=.68) asked whether the respondent's close friends supported

Table 1
Program and Comparison Group Distributions on Baseline Demographics and Sexual Attitudes Virginia Seventh Graders, 1999–2000

	Pretest Measures					
	All Virgins			Linked Virgins[a]		
	Program Group n=421	Comparison Group n=241	Test of Significant Difference[b]	Program Group n=357	Comparison Group n=193	Test of Significant Difference[b]
Males	47.3% 199/421	44.4% 107/241	NS	45.7% 163/357	42.0% 81/193	NS
Females	52.7% 222/421	55.6% 134/241	NS	54.3% 194/357	58.0% 112/193	NS
Married Parents	68.6% 289/421	63.2% 152/241	NS	70.9% 253/357	66.5% 128/193	NS
African American	9.0% 38/421	22.4% 54/241	****	9.0% 32/357	22.3% 43/193	****
White	73.9% 311/421	60.6% 146/241	NS	74.8% 267/357	62.2% 120/193	NS
Other	17.1% 72/421	17.0% 41/241	NS	16.2% 58/357	15.5% 30/193	NS
Behavioral Intentions for Sex[c]	3.96	3.98	NS	3.97	4.02	NS
Abstinence Values[c]	3.77	3.92	NS	3.79	3.95	NS
Abstinence Efficacy[c]	3.79	3.85	NS	3.81	3.93	NS
Future Impact of Sex[c]	3.88	4.02	NS	3.90	4.05	NS
Opportunity for Sex[c]	3.72	3.53	*	3.76	3.51	*
Peer Environment[c]	3.79	3.80	NS	3.80	3.84	NS

Note.
a Individuals' pretest and one-year follow-up surveys were identified and linked.
b Significant differences were tested using a Fisher's exact test for 2 proportions; NS = not significant (P>.05), * = P<.05, **** = P<.0001.
c Mediator variable score, given as a mean. A higher score is better; ie, a higher score indicates a lower risk for initiation of intercourse, for all mediator variables.

and approved of abstinence and whether they were having sex. The single item measuring *opportunity* for sex asked, "During the next year, how likely is it that someone might try to get you to have sex with them?" with options ranging from "I'm sure this won't happen" to "I'm sure this will happen." (See Appendix for notes on scale reliability.)

Demographics. Measures included grade level, gender, race (Native American, Asian/Pacific Islander, black/African American, Hispanic, white, biracial/multiracial, or other), and family composition (both natural parents, single mother/father, reconstituted family, living with grandparents/other adults).

Analyses

Analyses were run to test for similarity

between the program and comparison group virgins in the pretest sample and the one-year linked follow-up sample. This also tested the effects of attrition and of the loss of cases from the linking procedure. Following this, a series of statistical analyses was performed to test the program's impact. First, the difference in sexual initiation rates for program and comparison students over the one-year follow-up period was computed. Then, the difference in these rates was tested for statistical significance using a logistic regression analysis that controlled for pretest differences between groups on the demographic and mediator variables. Further subgroup analyses were performed to examine alternative explanations of program impact.

Next, to confirm the validity of the proposed predictive model, 2 regression analyses were conducted—logistic regression to confirm the predictive impact of *behavioral intentions* on sexual initiation in this sample and linear regression to verify the relationship of the other 5 mediator variables to *behavioral intentions.* In each case, the hypothesized mediator variables competed with 7 other related scale measures in the regression analysis.

Finally, a repeated measures analysis of covariance was conducted to test the program's impact on the mediator variables at the posttest, the point at which effects are most observable. For all statistical tests, the P-value of .05 was selected as the cutoff for statistical significance.

RESULTS

Sample

Table 1 contains a description of the sample at each time period. For both the original sample of virgins and the linked one-year follow-up sample, the program and comparison groups were not statistically different with respect to gender composition, the percent living with married parents, or their pretest scores on 5 of the 6 mediating variables. However, there were statistically significant differences in the racial composition of these groups for both the original and the linked samples, with fewer African Americans in the program group than the comparison group in both samples (9% vs 22%, P<.0001, Table 1). This difference was controlled for statistically in the outcome analysis, and African Americans were also examined as a separate subgroup.

Table 2
Virgin Seventh-grade Students Initiating Sexual Intercourse After One Year

	Program Group		Comparison Group	
	n	%	n	%
Ever Had Sex[a]:				
Yes	32	9.2	31	16.4
No	315	90.8	158	83.6
Total	347	100.0	189	100.0

Note.
a A triangulated measure derived from responses to 3 questions about sexual intercourse experience.

Behavioral Outcome

Impact on sexual initiation. Of the 189 comparison group pretest virgins for whom there was a valid sexual behavior measure, 31, or 16.4%, had initiated sexual intercourse by the one-year follow-up. In the program group, 32 out of 347 pretest virgins, or 9.2%, had initiated by the follow-up (Table 2).

When the difference was tested in a logistic regression analysis controlling for pretest differences between groups, including the imbalance on race, it produced an odds ratio of .413 for program participation (Table 3, *Exp(B)*, P=.008; χ^2*change*=7.0, P=.008). The odds ratio was converted to a relative risk ratio (per Zhang[48]), resulting in a relative risk (*RR)* of .457.

African American subgroup analysis. The race variable was not significant in the above logistic regression predicting the program effect. In order to further examine the possible impact that the disparate race distribution (Table 1) might have had on the outcome measures, the subsample of African Americans (n=73) was subjected to an exploratory analysis. Using pretest scores on *behavioral intentions* for sex as an hypothesized indicator

Table 3
Logistic Regression Predicting Initiation of Sexual Intercourse After One Year (seventh-grade virgins, n=492[a])

	B	S.E.	Wald	df	P	Exp(B)
Centered Pretest Variables						
Abstinence Efficacy	–0.374	0.187	3.999	1	.046	0.688
Future Impact of Sex	–0.470	0.170	7.627	1	.006	0.625
Abstinence Values	–0.181	0.238	0.580	1	.446	0.834
Opportunity for Sex	–0.338	0.151	5.017	1	.025	0.713
Peer Environment	0.162	0.227	0.507	1	.476	1.176
Behavioral Intentions for Sex	0.357	0.273	1.703	1	.192	1.428
Race			2.285	2	.319	
Black to White	0.609	0.455	1.791	1	.181	1.838
Other to Whites	0.429	0.429	1.002	1	.317	1.536
Gender						
Females to Males	–0.839	0.352	5.694	1	.017	0.432
Family Composition			4.900	3	.179	
Reconstituted to Intact[b]	0.577	0.451	1.636	1	.201	1.780
Single Parent to Intact[b]	–0.158	0.431	0.134	1	.715	0.854
Other to Intact[b]	1.822	1.089	2.802	1	.094	6.185
Program Participation	–0.884	0.335	6.963	1	.008	0.413
Intercept	–1.139	0.354	10.342	1	.001	0.320
R^2 (Nagelkerke) = .213						

Note.
a Individual pretest and one-year follow-up survey forms were linked in the data file; some loss of cases due to the large number of variables in the analysis (ie, due to missing values).
b Intact =Living with both natural parents.

of baseline risk level for sexual initiation, program and comparison students were compared to assess their similarity. No significant difference was found. Next, sexual initiation rates were computed for the virgin African American students in the program group versus the comparison group. Fourteen out of 42, or 33.3%, of the virgin African American comparison group students initiated sexual activity after 12 months, whereas only one of 31, or 3.2% in the program group did so. Given these small cell sizes, the computation of an odds ratio—as was done for the full sample—was not appropriate, so the difference was tested using McNemar's chi-square and found to be significant (χ^2=5.82, P=.02.). In addition, Time x Race x Program interaction terms were not significant for 5 of the 6 hypothesized mediator variables, suggesting there were similar intermediate program effects for blacks

Table 4
Logistic Regression Predicting Sexual Intercourse at One Year via Social Cognitive Constructs, Regardless of Program Participation (seventh-grade virgins, n=482[a])

Centered Posstest Scores	B	S.E.	Wald	df	P	Exp(B)
Behavioral Intentions for Sex	–0.783	0.286	7.511	1	0.006	0.457
Peer Environment	0.284	0.244	1.352	1	0.245	1.329
Beliefs About Marriage	0.032	0.319	0.010	1	0.920	1.033
Marriage in the Context of Sex	–0.018	0.264	0.005	1	0.944	0.982
Parental Values About Sex	–0.061	0.291	0.044	1	0.834	0.941
Religious Values	–0.047	0.133	0.126	1	0.722	0.954
Self-control	–0.144	0.133	1.170	1	0.279	0.866
Parental Supervision	0.071	0.188	0.140	1	0.708	1.073
Opportunity for Sex	–0.208	0.146	2.045	1	0.153	0.812
Abstinence Values	0.115	0.350	0.108	1	0.742	1.122
Abstinence Efficacy	–0.181	0.205	0.780	1	0.377	0.835
Future Impact of Sex	–0.155	0.184	0.705	1	0.401	0.857
Reasons for Waiting for Sex	0.003	0.318	0.000	1	0.993	1.003
Intercept	–2.502	1.283	3.803	1	0.051	0.082
R^2 (Nagelkerke) = .192						

Note.
a Individual pretest and follow-up survey forms were linked, program and comparison groups were combined; some loss of cases due to the large number of variables in the analysis (ie, due to missing values).

and whites. (These analyses were not reported in table form.)

Gender analysis. In a separate logistic regression to test the interaction effect of gender and program participation on sexual initiation, the interaction term was not significant, and program participation remained significant (odds ratio=.408, P=.03). With regard to program impact on the mediating variables, repeated measures analysis that included gender as a factor produced no significant 3-way (Time x Program x Gender) interaction for any of the measures. (The above results were not reported in table form.)

Intermediate Outcomes

Predictive model. A logistic regression analysis indicated that virgin students' posttest scores on *behavioral intentions* for sex were predictive of sexual initiation when the program participation variable was not in the equation (odds ratio=.457, P=.006, see *Exp[B]*, Table 4) and that none of the other

Table 5
Linear Regression Predicting Behavioral Intentions for Sex
(All seventh-grade virgins, n=589[a])

Pretest Scores	B	S.E.	Beta	t	P
(Constant)	–0.069	0.218		–0.317	0.751
Reasons for Waiting for Sex	0.020	0.044	0.014	0.455	0.649
Beliefs About Marriage	0.006	0.045	0.004	0.144	0.886
Marriage in the Context of Sex	–0.015	0.039	–0.014	–0.376	0.707
Parental Values About Sex	0.065	0.043	0.051	1.530	0.127
Religious Values	0.022	0.019	0.033	1.144	0.253
Self-control	0.039	0.020	0.049	1.917	0.056
Parental Supervision	0.025	0.026	0.026	0.945	0.345
Peer Environment	0.125	0.032	0.116	3.888	0.000
Opportunity for Sex	0.128	0.021	0.161	6.173	0.000
Abstinence Values	0.403	0.045	0.425	9.036	0.000
Abstinence Efficacy	0.164	0.030	0.183	5.423	0.000
Future Impact of Sex	0.083	0.026	0.093	3.127	0.002
R^2 (adjusted) = .653					

Note.
a Pretest surveys only (ie, not linked), program and comparison groups combined; some loss of cases due to the large number of variables in the analysis (ie, due to missing values).

social cognitive constructs in the analysis, including the other 5 hypothesized mediators, were significant. The $R^2_{Nagelkerke}$ indicated that the equation accounted for an estimated 19.2% of the variance in sexual initiation. We also tested whether any of these variables would be indirect predictors of initiation through their relationship to *behavioral intentions.* As Table 5 shows, a linear regression analysis demonstrated that pretest scores on these 5 potential mediators were all significantly related to pretest *behavioral intentions* for sex ($\leq$.002 in all cases, with standardized *beta* values ranging from .09 to .43) and that none of the other cognitive variables was significant. This analysis accounted for approximately 65% of the variance in *behavioral intentions* ($R^2_{Adjusted}$ =.653).

Impact on mediator variables. The pre-post repeated measures analysis produced significant Time x Program interaction effects for 4 scales (P<.05)—*behavioral intentions, abstinence values, future impact of sex*, and *opportunity for sex*—with effect sizes ranging from .17 to .44 (Table 6). The same pattern was seen in the scores for *abstinence efficacy*, but the P-value did not quite meet the .05 level of significance (.05<P<.10). The observed interaction effect for the mediator variables was due in part to significant deterioration by the

Table 6
Pre-Post Differences[a] on Mediator Variables
(Linked seventh-grade virgins, n=550)

Variable	Statistic	Program Group Pre-Test	Program Group Post-Test	Program Group Signif-icance[b]	Comparison Group Pre-Test	Comparison Group Post-test	Comparison Group Signif-icance[b]	Signif-icance[b]	d[c]
Behav. Intent.	Means[d] & Simple Effects	3.99	4.08	*	4.01	3.77	**		
	Time×Program Interaction							***	
	Effect Size								0.35
Abstin. Values	Means[d] & Simple Effects	3.80	4.05	***	3.92	3.74	**		
	Time×Program Interaction							***	
	Effect Size								0.44
Future Impact of Sex	Means[d] & Simple Effects	3.90	4.08	**	4.02	3.90	NS		
	Time×Program Interaction							**	
	Effect Size								0.30
Abstin. Efficacy	Means[d] & Simple Effects	3.82	3.84	NS	3.93	3.78	NS[e]		
	Time×Program Interaction							NS[e]	
	Effect Size								0.16
Opport. for Sex	Means[d] & Simple Effects	3.74	3.62	NS[e]	3.52	3.16	***		
	Time×Program Interaction							*	
	Effect Size								0.17
Peer Envirmt	Means[d] & Simple Effects	3.80	3.73	NS	3.88	3.71	**		
	Time×Program Interaction							NS	
	Effect Size								0.12

Note.
a Differences tested using repeated measures analysis of covariance
b NS = not significant (P >.05), * = P<.05, ** = P<.01, *** = P<.001
c *Cohen's d,* a measure of effect size
d A higher score is better; ie, a higher score indicates a lower risk for initiation of sexual intercourse on this and all mediator variable means.
e .05< P<.10

comparison group on 3 of the measures (*behavioral intentions* for sex, *abstinence values*, and *opportunity for sex*) and in part to significant improvement by the program group on 3 of the measures (*behavioral intentions* for sex, *abstinence values*, and

future impact of sex).

DISCUSSION

The main purpose of this study was to assess the impact of an abstinence education program on teenage initiation of sexual intercourse for a sample of suburban seventh graders using behavioral outcomes measured one year later. The program's goal of reducing the rate at which these adolescents initiated sexual intercourse appears to have been realized. After controlling for pretest differences on mediating and demographic variables (including gender and race), the relative risk value was .457 (odds ratio=.413, Table 3), indicating that virgin program students were about 46% as likely to initiate sexual intercourse as the virgins in the comparison group after one year. This result appears to compare favorably to the reductions in initiation achieved by some of the abstinence programs cited previously, while deriving from a study that improves in some ways on the rigor of these previous evaluations. The results appeared to hold up across demographic groups and suggest a fairly broad program effect.

For example, because African American teens typically have higher rates of sexual activity and are more likely to initiate sexual intercourse at an earlier age,[17] the higher percentage of African American students in the comparison group could have contributed to a higher initiation rate for that group without any program effect having occurred. However, in this evaluation, the program's positive impact held up in the regression analysis on sexual initiation, which controlled for race; and when examined as a subsample, the African American program group appeared to have a substantially lower sexual initiation rate after one year (3.2%) than the comparison group (33.3%), even though the groups appeared well-matched on preexisting risk indicators. Thus, having somewhat more African American students in the comparison group did not appear to account for the significant program effects that were found with the races combined. However, the small cell sizes in this African American analysis do not allow for strong conclusions about program impact on this subsample.

Evidence also suggested that the program effect did not differ by gender. Separate analyses testing the interaction of gender and program effects on behavioral and mediator outcomes (not reported in table form) produced no significant results. In addition, whereas gender was predictive of sexual initiation (odds ratio=.432, P=.017) it did not eliminate the program effect (odds ratio=.413, P=.008, Table 3). These findings, and the above examination of race, suggest that the program effect was not simply a function of the demographic characteristics of the groups.

It is important to note that the program and comparison groups did not differ in pretest scores on 5 of 6 mediating variables—hypothesized indicators of pretest risk to initiate sex—suggesting there was not a significant difference in initial risk propensity that influenced the program effect. In addition, neither the composition of the program or comparison groups nor their similarity to each other changed appreciably from pretest to follow-up on these key variables. This suggests that differential attrition did not occur and thus did not influence the estimation of program impact on initiation (Table 1).

A second purpose of the study was to learn more about the possible mechanisms that mediate adolescent propensity to initiate sexual intercourse. A predictive model was proposed consisting of a set of 6 social-cognitive constructs that previous research suggested would be important mediators of teen sexual initiation and also amenable to program intervention.[36,40,43] The study findings supported both of these premises and built on recent research regarding cognitive mediators and teen abstinent behavior.[18,39,40] Logistic regression on the predictive model suggested that *behavioral intentions* was an important direct predictor of teen sexual initiation because it was the only significant variable out of 13 social-cognitive measures in the equation, and it accounted for 19% of the variance in initiation (Table 4). The other 5 mediating variables appeared to be indirect predictors of initiation, by virtue of their significant correlation with *behavioral intentions*, which occurred in competition with 7 other variables in a linear regression (Table 5). Given these results on the predictive model, it was important to find that the pre-post change in program students' scores was significantly better than the comparison students' pre-post change on 4 of these mediating variables. One of

the other 2 variables showed a similar pattern, although not significant at the .05 level. (Table 6.) Considering how well matched the 2 groups were on these measures at the pretest, this post-program difference suggests that program influence had occurred.

These results point to the mediating variables as important candidates for consideration in testing and establishing a causal model for influencing teen abstinence. If the role of these variables can be further validated, they will provide important tools for program design and for early assessment of potential program impact.

Limitations

The researchers used several methods to minimize respondent error and maximize candor. However, the self-reported nature of the data should be kept in mind when considering the findings. The limitations of a quasi-experimental or comparison group design should also be remembered. The 2 groups were well matched on all key variables with one exception—the somewhat higher ratio of African Americans in the comparison group. Although this racial imbalance was taken into account in the statistical analysis, it would have been preferable to have had a better match on race at the outset. In addition, there may have been other sources of pretest dissimilarity that were not measured.

Recommendations

This evaluation was designed around several hypothesized predictors of sexual initiation. A valuable next step would be to test a program designed specifically around these theoretical predictors. Also, measuring condom use and the reduction of sex by the sexually active, as was done in the Borawski study,[42] adds an important dimension to the measurement of the impact of abstinence programs. Follow-up periods of more than one year would facilitate the tracking of both pregnancy and STD outcomes, as well as more durable postponement of sexual initiation. Future efforts should refine comparison group matching procedures to further minimize the limitations of quasi-experimental design where random assignment is not practical. Given the limited number of rigorous evaluations, replication will be important in order to assess patterns of evidence regarding abstinence education.

CONCLUSION

This paper contributes to the research on the effectiveness of abstinence education programs by reporting the results of a quasi-experimental evaluation study with an adequate sample size, linked one-year follow-up, low student attrition, and the examination of possible causal connections. The finding of significant program effects on social-cognitive factors at posttest and on sexual initiation after 12 months suggests that by focusing on key mediators, abstinence programs can achieve significant reductions in teen sexual initiation.

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Appendix

A recent article by Helms et al[47] reviewing the literature on the use and interpretation of Cronbach alpha coefficients, indicates that coefficients computed on the same scales across several samples can inform scale reliability if the samples are demographically similar. The same 6 mediator scales used in this study have been used in previous studies[39,43] with similar populations and have been found to have Cronbach alpha coefficients ranging from .76 to .85. The Helms article also cites .70 as an oft-used rule of thumb for an adequate alpha coefficient size, but notes that values ranging from .50 to .90 can be considered adequate depending on other psychometric factors. In this study, the alpha for the 2-item *future impact* measure (.51) is the only one below the .70 benchmark (*peer environment*, at .68 is roughly the same), suggesting it may not be a strong measure. However, similar measures of this construct in similar samples have been found to have alpha values above .70 and to predict *behavioral intentions*.[39,43] ■

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