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Information-Motivation-Behavioral Skills Model-Based HIV Risk Behavior Change Intervention for Inner-City High School Youth

Jeffrey D. Fisher
University of Connecticut, JEFFREY.FISHER@uconn.edu

William A. Fisher
University of Western Ontario

Angela D. Bryan
University of Colorado

Stephen J. Misovich
University of Hartford

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This study assessed the effects of 3 theoretically grounded, school-based HIV prevention interventions on inner-city minority high school students' levels of HIV prevention information, motivation, behavioral skills, and behavior. It involved a quasi-experimental controlled trial comparing classroom-based, peer-based, and combined classroom- and peer-based HIV prevention interventions with a standard-of-care control condition in 4 urban high schools (N = 1,532, primarily 9th-grade students). At 12 months postintervention, the classroom-based intervention resulted in sustained changes in HIV prevention behavior. This article discusses why both of the interventions involving peers were less effective than the classroom-based intervention at the 12-month follow-up and, more generally, suggests a set of possible limiting conditions for the efficacy of peer-based interventions.

Key words: IMB model, HIV prevention intervention, high school HIV prevention

Inner-city minority adolescents are at elevated risk of sexually transmitted HIV infection (American Academy of Pediatrics, 2001; American Association for World Health, 1998; U.S. Department of Health and Human Services, 1999; Thurman, 2000), and there is direct evidence that HIV seroprevalence is increasing among such youth (DiLorenzo & Hein, 1995; Rodrigue, Tercyak, & Lescano, 1997; Thurman, 2000). In fact, half of all new HIV infections in the United States are among young people between the ages of 13 and 24, and among newly infected teens, 49% are African American and 20% are Hispanic. Overall, young Americans between the ages of 13 and 24 are contracting HIV at a rate of two per hour (Thurman, 2000). Researchers (e.g., Jemmott, Jemmott, & Fong, 1998; Rodrigue et al., 1997) and concerned organizations (e.g., National Institutes of Health, 1997; Thurman, 2000) concur that the development of effective HIV prevention interventions for urban minority adolescents is a top research priority. In this connection, it has been emphasized that school-based HIV prevention interventions may represent the most efficient and universal delivery channel available for targeting adolescents at risk of HIV infection (Basen-Engquist et al., 1997; Thurman, 2000).

Reviews of school-based HIV prevention interventions (Coyle et al., 1999; Kirby, 1999; Kirby & DiClemente, 1994), however, indicate that with very few exceptions (Coyle et al., 1999; Kirby & DiClemente, 1994; Walter & Vaughn, 1993), school-based interventions have not been based on well-articulated and well-tested behavior change theory (J. D. Fisher & Fisher, 2000) and have not demonstrated a significant impact on students' HIV risk behavior. Some school-based interventions that have been reported to be effective have had significant methodological shortcomings (e.g., selective loss to follow-up of students who may be at greatest HIV risk; Coyle et al., 1999; Walter & Vaughn, 1993), have had effects that were limited to a subset of adolescents at relatively low risk of infection (Kirby & DiClemente, 1994), or have demonstrated treatment effects only within a relatively brief time frame postintervention (e.g., less than 6 months; Coyle et al., 1999; Kirby & DiClemente, 1994; Walter & Vaughn, 1993). Other interventions have drawn paid volunteer participants from middle or high schools for out-of-school interventions but have not actually taken place within school settings, used existing teaching staff, or included the full range of inner-city high school students at risk of infection (Jemmott, Jemmott, & Fong, 1992; Jemmott et al., 1998; Kipke, Boyer, & Hein, 1993). Such interventions can have an impact (Coyle et al., 1999; Jemmott et al., 1992, 1998) but may have critical limitations associated with self-selection of participants, use of select and not necessarily representative teachers, limited generalizability of effects, and limited potential for widespread application in such real-world settings as entire, intact inner-city high schools. To date, a substantial literature does not

Jeffrey D. Fisher, Center for HIV Intervention and Prevention, Department of Psychology, University of Connecticut; William A. Fisher, Departments of Psychology and Obstetrics and Gynecology, University of Western Ontario, London, Ontario, Canada; Angela D. Bryan, Department of Psychology/Institute of Behavioral Science, University of Colorado; Stephen J. Misovich, Department of Psychology, Hillyer College, University of Hartford.

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Correspondence concerning this article should be addressed to Jeffrey D. Fisher, Center for HIV Intervention and Prevention, Department of Psychology, Unit 1020, University of Connecticut, Storrs, Connecticut 06269-1020. E-mail: jfisher@uconnvm.uconn.edu

exist on school-based HIV prevention interventions that have been conducted within existing school settings and that have clearly demonstrated increased safer sexual practices over time.

The present research applied the information-motivation-behavioral skills (IMB) model (J. D. Fisher & Fisher, 1992, 2000; W. A. Fisher & Fisher, 1993; W. A. Fisher, Williams, Fisher, & Malloy, 1999), a well-established conceptualization for changing HIV risk behavior with demonstrated intervention efficacy (e.g., Carey et al., 1997; J. D. Fisher & Fisher, 2000; J. D. Fisher, Fisher, Misovich, Kimble, & Malloy, 1996), to design, implement, and evaluate three HIV prevention interventions in inner-city minority high school settings. According to the IMB model, HIV prevention information, motivation, and behavioral skills are the fundamental determinants of HIV preventive behavior. Information that is directly relevant to HIV transmission and prevention and easy to apply in an individual's social setting is an initial prerequisite of HIV preventive behavior. Motivation to engage in HIV preventive behavior, including personal motivation (favorable attitudes toward performance of HIV preventive acts) and social motivation (perceived social support for performing these acts), is a second prerequisite of HIV preventive behavior and determines whether well-informed individuals will be inclined to act on what they know concerning HIV prevention. Behavioral skills for performing specific HIV preventive acts, including objective skills for performing such acts and a sense of self-efficacy for doing so, are a third critical prerequisite of HIV preventive behavior and determine whether even well-informed and well-motivated individuals will be capable of enacting HIV preventive behaviors effectively. According to the IMB model, to the extent that individuals are well informed, highly motivated, and skilled, they are expected to initiate and maintain patterns of HIV preventive behavior.

The IMB model (J. D. Fisher & Fisher, 1992, 2000; W. A. Fisher & Fisher, 1993) specifies a three-step approach to promoting HIV preventive behavior. First, *elicitation research* is conducted with a subsample of a target population to empirically identify that population's deficits and assets in HIV prevention information, motivation, behavioral skills, and behavior. Second, *empirically targeted interventions* are designed on the basis of elicitation research findings and then delivered to address a population's HIV prevention information, motivation, and behavioral skills deficits and to capitalize on the population's strengths in these areas. Finally, *evaluation research* is conducted in a context ostensibly independent of the intervention to determine whether the intervention has had significant sustained effects on the information, motivation, and behavioral skills precursors of HIV preventive behavior and on HIV preventive behavior per se.

The present research applied the IMB model in high school–based interventions designed to increase HIV preventive behavior among inner-city minority adolescents. To date, the literature has been very sparse on theoretically based, methodologically strong HIV prevention interventions that have been conducted within existing high school settings using school personnel and that have been rigorously evaluated and found to be effective. In addition, little is known about the most effective intervention delivery system for high school–based interventions—classroom-based programs (Kirby & DiClemente, 1994), peer-based programs (Jemmott et al., 1998), or a combination of classroom- and peer-based programs (Coyle et al., 1999; J. D. Fisher et al., 1996; Walter & Vaughn, 1993). Although teachers may excel at conveying some types of HIV prevention information, motivation, and behavioral skills content, peers may be superior at communicating other such content, and it is possible that a combination of classroom- and peer-based strategies would prove maximally effective in promoting HIV preventive behavior in school settings. Recent evidence has indicated, however, that peer-based behavior change interventions may sometimes be problematic (Dishion & Andrews, 1995; Dishion, McCord, & Poulin, 1999; Dishion, Poulin, & Burraston, 2001; Luna & Rotheram-Borus, 1999) and that interventions involving peers or friends may not always have favorable outcomes on targeted behaviors. In particular, interventions involving peers may sometimes have unintended long-term negative effects, which may run counter to intervention objectives and in some cases may even constitute "risk training" or "deviancy training."

In the current study, we designed, implemented, and evaluated three IMB-model–based, empirically targeted HIV prevention interventions in inner-city minority high schools. An IMB-model–based *classroom intervention* consisted of HIV prevention information, motivation, and behavioral skills content, targeted to address students' empirically identified deficits in these areas. It was delivered to all students present by their regular high school teachers in their everyday classroom settings. An IMB-model–based *peer intervention* used popular students who interacted with friends and acquaintances outside classroom settings to address HIV prevention information, motivation, and behavioral skills deficits identified in the target population. An IMB-model–based *combined intervention* consisted of the classroom and peer interventions delivered simultaneously to determine if this combined approach could produce greater change in HIV risk behavior than either the classroom or peer interventions alone. Finally, a standard-of-care control condition was included to provide a basis for comparison of short-term and longer term effects of the three experimental interventions on HIV prevention information, motivation, behavioral skills, and behavior, over and above standard school-based HIV prevention educational activities.

Method

Participants

Participants were 1,577 students in four inner-city high schools in Connecticut. The sample was 37% male and 63% female, reflecting the gender breakdown in the schools at focus. Participants ranged in age from 13 to 19, the mean age was 14.8 years, and most (92%) were in the ninth grade. More than half of participants (61%) were African American, 28% were Hispanic American, and 11% classified their race as Caucasian, "mixed," or "other." Fifty-four percent of participants reported living with their mothers only, 32% with both parents, and the remaining participants lived with some combination of natural and step-parents. Though we asked about total family income, the vast majority of students responded, "I don't know."

Of the total sample, 49% (63% of the boys and 41% of the girls) had sexual intercourse at least once during the course of the study. Of the 464 sexually experienced participants present for the initial measurement, 42% reported that they always used condoms, 35% reported that they sometimes used condoms, and 23% reported that they never used condoms. Of those same 464 sexually experienced participants who reported ever having engaged in vaginal intercourse, 17% of girls reported having been pregnant, 8% of boys reported impregnating a girl, and 4% reported that they had been diagnosed with a sexually transmitted infection.

Intervention Methods

The current study used a quasi-experimental nonequivalent control group design with four high schools. The high schools we selected were highly similar in terms of being located in a major inner-city area in the northeast, being predominantly minority, and having approximately equal numbers of students. Equating nonequivalent groups at pretest as much as possible is strongly recommended in this type of design (West, Biesanz, & Pitts, 2000). One high school participated in the classroom intervention, one participated in the peer intervention, and one participated in the combined classroom and peer intervention. A fourth school served as a standard-of-care comparison group. It was not possible or methodologically desirable to randomly assign students to conditions within a school because of the high likelihood of treatment diffusion within a school and its potential to compromise internal validity (see Cook & Campbell, 1979, p. 54; West et al., 2000). We therefore assigned an entire school to each treatment condition, using a nonequivalent control group quasi-experimental design (Cook & Campbell, 1979; West et al., 2000). Schools were assigned to condition on the basis of convenience factors (e.g., ease of scheduling research personnel to interact with critical school personnel at a particular point in time), though each school initially agreed to participate in any condition to which it was assigned. Assignment of schools to conditions did not involve any systematic factors that could plausibly differentiate the schools in terms of the processes and outcomes under study. To adjust for any bias in outcome measures because of preexisting differences between schools, we conducted tests for pretest equivalence and statistically adjusted for all measured variables on which the schools differed.

Classroom intervention. The classroom intervention was created by appropriately modifying procedures developed in earlier IMB-model–based intervention research (J. D. Fisher & Fisher, 2000; J. D. Fisher et al., 1996; W. A. Fisher & Fisher, 1993) that successfully increased HIV prevention information, motivation, behavioral skills, and behavior in a university student population. To maximize ecological validity and the potential to deploy this intervention widely in existing high school settings, the classroom intervention was delivered by regular high school classroom teachers to their regular classes during five successive class sessions (e.g., the intervention was delivered between Monday and Friday of a given week for a class that met daily). In each school, mainstreamed special education students were included in the intervention sessions.

During the first class, activities focused on providing factual information about HIV transmission and prevention and on correcting widespread misperceptions about HIV, including erroneous beliefs about monogamy (e.g., "If I currently have only one partner I am safe and I do not need to use a condom") and about "safe" partners (e.g., "Known and loved partners are safe and I do not have to use a condom with them"; Hammer, Fisher, & Fisher, 1996; Misovich, Fisher, & Fisher, 1997). Classroom activities to address information also included the teacher showing *Knowing the Facts: Preventing Infection* (Center for HIV Intervention and Prevention, University of Connecticut [CHIP], 1997), a video created specifically to address HIV prevention information deficits identified in this population. Students also reviewed flashcards designed to reinforce the information in this video.

The second class was designed to increase HIV prevention motivation by changing students' attitudes and social norms concerning HIV risk and prevention. Attitudinal and normative change were addressed by showing *Just Like Me: Talking About AIDS* (CHIP, 1997), a video created specifically for this research, which consisted of interviews with an ethnically diverse group of attractive, HIV-infected young people, selected on the basis of their social comparability (i.e., similarity) to intervention participants. The video was designed to demonstrate to students that adolescents who look and act like they do are at considerable risk of HIV infection. This video had a visible impact on adolescent viewers. The young people in the video directly implored students to alter their attitudes and norms about HIV risk and prevention, lest students in the audience experience the catastrophe that had befallen them. After viewing *Just Like Me: Talking About AIDS* teachers prompted students to consider and discuss how unfavorable attitudes and norms about HIV prevention led to the infection of the young people in the video (and the death of two of them), and how the same attitudes and norms are common—and in need of change—among high school students such as themselves.

The third class continued to focus on enhancing HIV prevention motivation. An additional video, *Stakes are High: Asserting Yourself* (CHIP, 1997, Part 1) conveyed strong attitudinal and normative support for HIV prevention, and supportive attitudes and norms were reinforced in associated teacher-led group activities following the video. Part 1 of *Stakes are High: Asserting Yourself* featured attractive, ethnically diverse, social comparison urban high school students encountering and overcoming typical HIV prevention obstacles (e.g., discussing abstinence or condom use with a resistant partner, assertively negotiating abstinence or safer sex, and physically exiting risky situations). The benefits of abstaining from sex or using condoms were discussed, ways of reducing the social costs of these practices were illustrated, and the youths in the video supported and encouraged one another's HIV prevention efforts. Associated classroom activities demonstrated to students that some classmates support HIV prevention and some reject HIV risk behaviors, and students had an opportunity to consider the benefits of HIV prevention and to problem solve with their classmates to overcome perceived obstacles to prevention.

The fourth class focused on developing HIV prevention behavioral skills for abstinence and condom acquisition and use. Students viewed a fourth specially produced video, *Stakes Are High: Asserting Yourself* (CHIP, 1997, Part 2), which featured ethnically diverse, social comparison inner city high school students skillfully enacting behaviors to protect themselves from HIV (e.g., assertively maintaining abstinence from intercourse; purchasing, carrying, discussing, and using condoms), including a demonstration of condom use. After the video, the teacher repeated the condom demonstration for the class, and students practiced unrolling a condom over their fingers. Next, students discussed how to apply the abstinence and safer sex skills depicted in the video in their own social environment. To learn the safer sex "script," each student was given a large card depicting a step in the safer sex process (e.g., deciding whether or not to have intercourse and communicating this decision to a partner, discussing safer sex, putting on a condom, removing a condom). Students arranged the cards in sequence by placing themselves into a line with the initial behavior (decide whether or not to have intercourse) first and succeeding behaviors (e.g., acquiring condoms, taking condom out of package) farther back.

During the final classroom session, students reviewed and discussed rules for effective safer sex communication. Next, they formed small groups and generated effective verbal responses to a series of common HIV risk scenarios (e.g., a partner refuses to use condoms during sexual intercourse, one partner insists on engaging in sexual intercourse when the other wants to abstain). Responses were critiqued and modified according to rules for effective communication that had been discussed, and students were then given the opportunity to role play and rehearse modified and improved safer sex statements. Finally, the teacher answered any remaining student questions related to the intervention.

Peer intervention. The peer intervention was also based on the IMB model and was delivered using modifications of procedures developed by Kelly and associates (Kelly, 1994; Kelly, St. Lawrence, Brasfield, & Stevenson 1991; Kelly, St. Lawrence, Stevenson, & Hauth, 1992). In this intervention, peer natural opinion leaders (NOLs) engaged in HIV prevention intervention contacts with approximately five same-sex friends and acquaintances of their choosing over a 3-week period. These contacts, in the context of brief (approximately 5-min) conversations between the NOL and his or her friends or acquaintances, were designed to convey key HIV prevention information, address negative attitudes about and stress normative support for abstinence and condom use, and teach critical HIV prevention behavioral skills. To provide a stimulus for HIV prevention contacts, NOLs wore distinctive T-shirts with stoplight logos (green to connote

safe behaviors, yellow to connote behaviors with some risk, and red to connote behaviors with high risk of HIV infection), and schools were decorated with matching stoplight logo posters, as part of the Students Working Against AIDS Together (SWAAT) program. Both the logo and the *SWAAT* acronym were pilot tested in this population for acceptability and attractiveness prior to program implementation.

NOLs conveyed key HIV prevention information by explaining high, medium, and low risk behaviors through reference to the red, yellow, and green lights on their stoplight logo T-shirts, and by debunking myths about HIV prevention (e.g., that monogamy means that condom use is unnecessary) that had been identified as widespread in the population in elicitation research. To enhance motivation, NOLs expressed their strong personal support for HIV prevention by means of abstinence or safer sex. To increase behavioral skills, NOLs gave tips for skillfully enacting critical behaviors necessary for practicing abstinence or safer sexual behaviors (e.g., telling participants where to purchase or obtain condoms, suggesting ways to tell a partner one wishes to be abstinent). NOLs also solicited and answered HIV prevention questions their student contacts had, and gave each student contact either a dog-tag necklace or a key chain bearing the SWAAT/stoplight logo. Two to three days after the initial contact, the NOLs approached their friends or acquaintances for booster sessions in which the NOLs restated their strong normative support for prevention and answered any additional questions or concerns their contacts may have generated since the initial discussion.

Combined intervention. We included a combined classroom- and peer-based intervention in our study design to examine the impact of the combination of these two intervention approaches. In the combined intervention, the classroom-based intervention took place in five successive classes as described above, and the peer intervention took place simultaneously.

Standard-of-Care Control Condition

The standard-of-care control condition did not receive any of the experimental interventions. They were, however, exposed to their school's standard HIV/AIDS curriculum, known as "AIDS Week." During this week, health classes focused on HIV/AIDS, and the curriculum consisted largely of HIV prevention information.

Elicitation Research, Intervenor Training, and Intervention Fidelity

In accord with the IMB approach (J. D. Fisher & Fisher, 1992, 2000; W. A. Fisher & Fisher, 1993), elicitation research was conducted with representative subsamples of the target population to empirically identify critical HIV prevention information, motivation, behavioral skills, and behavior deficits and assets in this population. The specific content of the classroom-based and peer NOL–based interventions was targeted empirically to address these deficits and to capitalize on strengths in these areas identified in the context of elicitation research. For maximum ecological validity and generalizability of procedures and findings, students' regular classroom teachers were used as intervenors in this research and NOLs were selected on the basis of peer nominations to represent the range of social groups reflected in their schools. NOL nominees whom knowledgeable school personnel (i.e., teachers, guidance counselors) believed could not credibly take on the NOL role at that time were dropped from further consideration. Individuals from all of the social groups represented in the school (e.g., the "jocks," the "druggies," the "popular crowd," the "smart kids") ultimately participated as NOLs. Following the NOL training, 81 NOLs (50 girls, 31 boys) were chosen to be retained and participated in the research.

In separate weekend workshops, classroom teachers and NOLs were thoroughly trained to deliver their respective intervention content before proceeding with the intervention. In addition to training on the delivery of the NOL intervention, which included lectures, small group interaction, and extensive role plays and other exercises, the NOL training also included intensive exposure of NOLs to techniques previously demonstrated to increase individuals' own practice of HIV preventive behavior (Coyle et al., 1999; J. D. Fisher et al., 1996; Jemmott et al., 1998). (For additional specifics of the teacher training and NOL training, see http://www.films.com; select Browse by Subject: Health: Complete List of 60 Subcategories: HIV/AIDS: HIV/AIDS: Real People, True Stories.) Before the intervention began, both teachers and NOLs were required to demonstrate mastery of intervention delivery to a preset criterion. Based on these evaluation procedures, 81 of the 100 NOLs who were initially trained were retained for the intervention, as were all of the teachers who were trained. During the intervention, teachers were observed during each class period by research staff, who completed checklists of intervention component delivery to ensure consistency of intervention content. NOLs met with a teacher–advisor and project staff on a regular basis to reinforce consistency of intervention delivery and to deal with any implementation problems. Intervention fidelity and consistency were high across all interventions. The interventions were designed to be relatively easy to apply in existing high school settings. All intervention procedures were approved by the University of Connecticut Human Participants Committee and by appropriate officials in each school district.

Outcome Measures

To assess intervention impact on HIV prevention information, motivation, behavioral skills, and behavior, self-administered measures of these constructs based on extensive earlier research were used (Misovich, Fisher, & Fisher, 1998). Measures were administered at a single point in time within a school to minimize contamination from discussion of measures among students. They were also administered in a context and by personnel ostensibly unconnected with the intervention itself. Premeasures were distributed 1 month prior to the intervention; posttest measures to assess changes in levels of HIV prevention information, motivation, and behavioral skills were distributed 1 month after intervention completion, and follow-up measures of safer and risky behavior were collected 3 months and 1 year after intervention completion. Standard-of-care control participants completed measures at the same points in time.

To measure participants' levels of HIV prevention information, a 23-item Likert-type instrument with $\alpha = .72$ assessed aspects of HIV prevention knowledge directly relevant to HIV preventive behavior (e.g., information about HIV transmission and prevention, correct condom storage, whether condoms are necessary with a steady partner; Misovich et al., 1998).

To assess HIV prevention motivation, we used three scale scores, based on aggregates of multiple items, to provide separate indicators of HIV prevention attitudes, norms, and intentions (J. D. Fisher et al., 1996; W. A. Fisher, Fisher, & Rye, 1995). The measure of HIV prevention attitudes ($\alpha = .60$) contained four 5-point Likert-type items assessing favorable to unfavorable evaluations of personally performing four HIV preventive behaviors (obtaining condoms, carrying condoms, telling a partner to use condoms, and using condoms). HIV prevention norms were measured with eight 5-point Likert-type items ($\alpha = .79$) assessing perceived social support from friends, parents, and sexual partners for practicing these same HIV preventive behaviors. Intentions to perform HIV preventive behaviors were measured with four 5-point Likert-type items ($\alpha = .58$) assessing behavioral intentions to engage in these HIV preventive behaviors.

HIV prevention behavioral skills were measured with five 5-point Likert-type items ($\alpha = .71$) designed to assess perceptions of the difficulty or ease with which one could perform the same four critical HIV preventive behaviors as well as using condoms while under the influence of drugs or alcohol. Responses to these measures have been found to correlate with the quality of role-played performance of such HIV preventive behaviors (Williams et al., 1998).

Finally, to assess HIV preventive behavior, a categorical self-report measure of abstinence from intercourse (*yes–no*) was used. Further, a continuous Likert-type item was used to assess the frequency with which students who had been sexually active used condoms during intercourse over the previous 2 months (pretest), previous 3 months (3-month follow-up), or previous 1 year (1-year follow-up). At each interval, response options were 1 = *never*, 2 = *almost never*, 3 = *sometimes*, 4 = *almost always*, and 5 = *always*.

Analytic Strategy

Descriptive data analyses were conducted with SAS, Version 9.0. The urban schools in which this research was conducted were highly socially disorganized and official school attendance lists were not accurate reflections of the actual number of students enrolled. For any given class, some of the students on the class list were no longer in school or had moved, and some number of students had moved into the area and were present in class but did not appear on the official class list. Thus, it was virtually impossible to ascertain the percentage of eligible students who participated because we have no accurate master list from which to obtain a denominator for such calculations. Further, in these heavily socially challenged inner-city schools, there are extreme fluctuations in attendance even among those students who are officially enrolled. Because adolescents who do not consistently attend class may be more likely to engage in a range of high-risk behaviors (O'Malley & Johnston, 1999; Pritchard, Cotton, & Cox, 1992), analyses conducted with a listwise missing data strategy (i.e., eliminating any participant who has a missing data point at any wave) would likely have biased our sample by excluding young people arguably at the highest risk.

Because of the complexity of the data, high rates of entering or leaving class (and hence the study), and other concerns, we adopted an intent-to-treat analytic strategy (W. A. Fisher & Fisher, 1999), a method recommended to correct for possible biased attrition (Mazumdar, Liu, Houck, & Reynolds, 1999), wherein all participants were retained for each analysis whether they actually provided data at that measurement wave or not. Missing values for variables of interest were iteratively estimated based on available data points with the use of full information maximum likelihood (FIML) estimation using the AMOS statistical program (Arbuckle, 1997). AMOS essentially provides the FIML estimates of the parameters that would have been obtained had there been no missing data (Turbin, Jessor, & Costa, 2000). The use of this technique in real-world samples (Turbin et al., 2000) as well as the results of simulation studies (Arbuckle, 1996; Wothke & Arbuckle, 1996) have suggested that the estimates obtained with FIML are more accurate and less biased than results obtained with standard pairwise or listwise missing data procedures. In the following analyses, for each outcome variable under investigation, approximately 30% of the data (virtually an entirely different subset of 30% for each wave) were missing and had to be estimated.

It is commonly the case in quasi-experimental designs that groups are not equivalent at pretest, as occurred here (see Table 1). Under these circumstances, use of the variables that differed between groups at baseline as covariates in further analyses is recommended (Keppel, 1991; Stevens, 1992), and we did so. Statistically adjusting for the effects of variables that systematically differ between groups reduces (though does not eliminate) the bias in tests for differences at subsequent measurement between the groups (Neter, Wasserman, & Kutner, 1990). Thus, any difference in our outcome variables that was due to pretest differences on those variables is substantially reduced (Stevens, 1992).

In addition to adjusting for effects of variables on which the groups differed at pretest (i.e., age, race, and gender), we controlled for pretest values of all measured IMB variables. The use of the pretest value on a variable as a covariate is primarily to reduce within-group error variance on the posttest measure, because pretest scores are highly correlated with posttest values (Keppel, 1991; Stevens, 1992). To evaluate the impact of the interventions on each IMB model variable, a simple path analysis equivalent to the structure of an ordinary least-squares regression was conducted with AMOS. The posttest value of the variable was regressed on dummy-coded experimental condition (with the standard-of-care control group serving as the referent), age, gender, dummy-coded race (African American or Hispanic American, with "other" serving as the reference category), and the pretest value of the variable. The racial and ethnic category of *other* included the small number of Caucasian, Asian, and Native American participants obtained. There were not a large enough number of any of these groups to analyze them separately. The significance values presented for each of the variables in the three intervention conditions apply to the test of the path coefficient from condition to the outcome variable and represent the effect of one of the three interventions on the variable of interest in comparison with the control condition at a given measurement interval.

For the behavioral outcome variable of condom use, two further regression analyses were conducted. First, condom use in the past 3 months, as assessed at the 3-month follow-up measurement, was regressed on experimental condition, age, gender, race, and pretest condom use. Second, condom use in the past year, as assessed at the 1-year follow-up, was regressed on the same variables, and the analysis was adjusted for 3-month follow-up condom use.

Finally, there is reason to assume that effects of an HIV prevention intervention will be different for participants who are already sexually active and those who are not (Jemmott et al., 1998). Our sample was approximately evenly split between ever sexually active (n = 755) and never sexually active (n = 777), and thus we conducted analyses on these two groups separately. The behavioral outcome of interest, however, was condom use, and although intervention effects on HIV prevention information, motivation, and behavioral skills are reported for both sexually active and sexually inexperienced participants, behavioral outcomes involving condom use during sexual intercourse were calculated only for sexually active participants. There were no differences by interventions or control condition in rates of sexual activity, and therefore rates of abstinence, in any of the analyses we conducted. Thus, we do not report further on rates of abstinence as an outcome measure.

Results

Pretest Differences

Demographic characteristics of participants in the four schools that made up the intervention and standard-of-care control conditions are presented in Table 1, along with appropriate statistical tests for differences at pretest on these variables. All four schools had predominantly minority students, but there were significant differences in age, racial and ethnic makeup, and gender. As

Table 1
Demographic Characteristics at Pretest by Condition

Characteristic	Condition			
	Classroom (n = 310)	Peer (n = 381)	Combined (n = 296)	Control (n = 589)
Age (years)[a]	14.5	15.0	14.6	14.8
Race (%)[b]				
African American	47	77	88	45
Hispanic American	34	8	7	47
Other	19	15	5	8
Gender (% male)[c]	42	37	42	33

[a] Test for difference: $F(3, 1572) = 28.85$, $p < .001$. [b] Test for difference: $\chi^2(6) = 310.25$, $p < .001$. [c] Test for difference: $\chi^2(3) = 10.56$, $p < .05$.

described earlier, statistical adjustments for age, race, and gender were calculated in all analyses. Further, for all variables under study, posttest outcomes were adjusted for pretest values of the variable.

Differences Between Sexually Active and Never Sexually Active Individuals

We found some expected differences between sexually active and never sexually active individuals, such that sexually active individuals were older and more likely to be male. The mean age for sexually active individuals was 14.92 (SD = 0.74), whereas never sexually active individuals had a mean age of 14.63 (SD = 0.81), $F(1, 1,529) = 56.11$, $p < .001$. The majority (63%) of boys were sexually active, whereas only 41% of girls were sexually active, $\chi^2(1, N = 1,504) = 64.98$, $p < .001$. Finally, we found significant racial differences, such that among African Americans 56% were sexually active, among Hispanic Americans 39% were sexually active, and among those reporting their race as Caucasian or other, 42% were sexually active, $\chi^2(2, N = 1,512) = 37.71$, $p < .001$. These results indicate that our sample of African American young people may be more likely to be sexually active than young people of other races. *Sexually inexperienced* refers to all individuals who indicated at all time points that they had never had sexual intercourse. About one third (32%) of the initially nonsexually active participants became sexually active at some point during the year-long follow-up period of our study, though there was no difference in the onset of sexual activity in the intervention or standard-of-care control conditions, $\chi^2(3, N = 877) = 3.69$, *ns*.

Intervention Effects on Information, Motivation, and Behavioral Skills at Posttest

The estimated pretest and 1-month posttest means from the AMOS analysis (Wothke & Arbuckle, 1996) for effects of the interventions on HIV prevention information, motivation, and behavioral skills, adjusted for race, age, and gender of participants, appear in Table 2. Significance levels in Table 2 refer to tests of the path coefficients that represent the comparisons of changes from pre- to posttest in the intervention conditions, to changes in the standard-of-care control condition.

Information. As can be seen in Table 2, for sexually inexperienced individuals, participation in the classroom intervention and the combined intervention resulted in significantly greater increases in HIV prevention information than did participation in the standard-of-care control condition. For sexually experienced individuals, participation in either the classroom, combined, or peer intervention resulted in significantly greater increases in HIV prevention information than the standard-of-care control condition.

Motivation. For sexually inexperienced individuals, participation in the classroom intervention improved HIV prevention attitudes and marginally improved HIV prevention intentions relative to standard-of-care controls. Participation in the peer intervention had a marginally significant positive effect on attitudes toward prevention relative to controls. When sexually inexperienced participants were exposed to the combined intervention, however, there were significant positive effects on attitudes, norms, and HIV prevention intentions relative to standard-of-care controls.

Table 2
Intervention Effects on Posttest Levels of HIV Prevention Information, Motivation, and Behavioral Skills

Measure	Classroom	Peer	Combined	Standard-of-care control
Sexually inexperienced participants (n = 777)				
Information				
Pre	13.07	13.72	13.57	12.51
Post	15.61***	14.35	16.58***	13.01
Attitudes				
Pre	3.97	4.08	4.09	3.93
Post	4.17**	4.16†	4.30**	3.95
Norms				
Pre	3.77	3.77	3.73	3.66
Post	3.88	3.66	3.88*	3.67
Intentions				
Pre	3.78	3.79	3.75	3.70
Post	3.95†	3.73	4.01*	3.72
Behavioral skills				
Pre	3.68	3.84	3.82	3.68
Post	3.85†	3.82	4.04**	3.69
Sexually experienced participants (n = 755)				
Information				
Pre	12.91	13.50	13.95	13.00
Post	15.03***	14.94**	16.19***	13.38
Attitudes				
Pre	4.30	4.27	4.42	4.23
Post	4.20	4.37**	4.46**	4.10
Norms				
Pre	3.73	3.91	3.98	3.91
Post	3.98*	3.83	3.95	3.83
Intentions				
Pre	4.03	4.02	4.17	4.03
Post	4.01	3.97	4.16	4.01
Behavioral skills				
Pre	3.96	4.11	4.11	4.09
Post	3.98	4.10	4.19*	3.98

Note. Means are adjusted for age, race, and gender. Statistical tests are the test of the significance of the regression coefficient of the effect of each particular intervention on the posttest score of the variable as compared with the control condition, controlling for pretest value on that variable. Information is measured as the number of correct responses out of 23 items. Attitudes, norms, intentions, and behavioral skills are measured on 1–5 scales, with higher numbers representing higher levels of constructs. Pre = pretest; Post = posttest.
† $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

For sexually experienced participants, effects on motivation were somewhat less pronounced. For those in the classroom intervention, there were significant positive effects on norms for condom use, and in the peer and combined interventions, there were significant intervention effects on attitudes towards preventive behavior.

Behavioral skills. For sexually inexperienced participants, exposure to the classroom intervention resulted in marginal improvement in behavioral skills, whereas exposure to the combined intervention resulted in significant improvement in behavioral skills, relative to standard-of-care controls. The combined intervention had similar significant positive effects on the behavioral skills of sexually experienced participants.

Intervention Effects on Condom Use Behavior at 3-Month Follow-Up

Means for condom use by condition at pretest, 3-month follow-up, and 1-year follow-up appear in Figure 1. Three months after the completion of the intervention, participants who indicated that they were sexually active were asked how often they had used condoms in the preceding 3 months. Examination of the path coefficients indicated that there were significant increases in condom use in the combined intervention ($B = .17$, $p < .05$) and in the peer intervention ($B = .16$, $p < .05$) compared with standard-of-care controls.[1]

Intervention Effects on Condom Use Behavior at 1-Year Follow-Up

One year after completion of the intervention, participants who indicated that they were sexually active were asked how often they had used condoms during sexual intercourse in the preceding year. Examination of the path coefficients indicated that the classroom-based intervention resulted in increased condom use for the year following completion of the intervention, in comparison with controls ($B = .19$, $p < .01$) (see Figure 1). For the year following completion of the intervention, effects of the combined intervention ($B = .05$, *ns*) and the peer intervention ($B = .05$, *ns*) were no longer in evidence.

Discussion

The current research demonstrates that a conceptually based, empirically targeted HIV prevention intervention delivered in inner-city high school classrooms to minority students by their own teachers had significant effects on precursors of HIV preventive behavior at intervention posttest and significant effects on HIV preventive behavior—condom use during sexual intercourse—over a 1-year follow-up interval. These findings represent one of the only reports of a rigorously evaluated controlled trial, conducted within existing high school settings, that has demonstrated success at increasing long-term HIV preventive behavior among inner-city youth at high risk of infection. In contrast with the very few previous effective interventions directed at high school students (including both school-based and out-of-school interventions), the probability is low that the present intervention efficacy results could be due, in part, to selective loss to follow-up of those students at greatest HIV risk or to differential attrition between the intervention and/or standard-of-care control conditions. This is due to our use of an intent-to-treat approach and to the particular statistical procedures used.

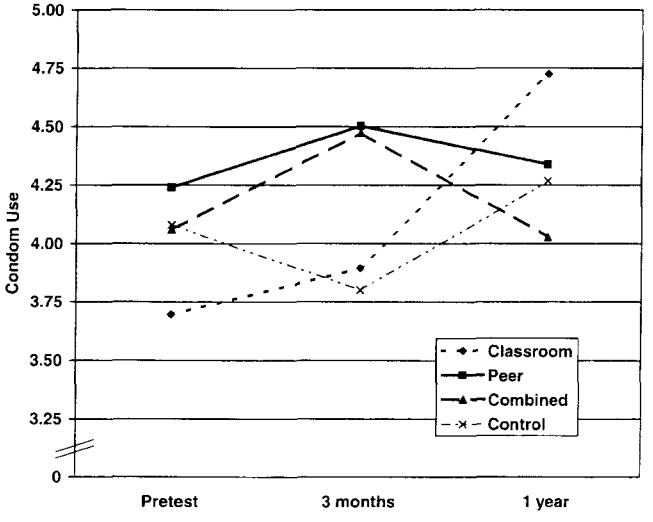

Figure 1. AMOS estimates of means for condom use in the three experimental intervention conditions and the standard-of-care control. Measures reflect condom use in the previous 2 months (pretest), previous 3 months (3-month follow-up), or previous 1 year (1-year follow-up). Response options were 1 = *never*, 2 = *almost never*, 3 = *sometimes*, 4 = *almost always*, and 5 = *always*. These means are adjusted for gender, race, and age.

This is also the only published study, to our knowledge, that has examined the comparative effectiveness of classroom- and peer-based approaches to the delivery of HIV prevention interventions in high school settings (Coyle et al., 1999; Jemmott et al., 1998). The current results show that at 3 months postintervention, the combined classroom- and peer-based intervention and the peer-based intervention had significant positive effects on inner-city minority high school students' HIV preventive behavior—their reported use of condoms during sexual intercourse. At 1 year postintervention, the effects of the combined classroom- and peer-based intervention as well as those of the peer-based intervention had dissipated, whereas the classroom-based intervention showed a significant and sustained effect on students' HIV preventive behavior. At 1 year, the classroom-intervention–induced changes resulted in shifts of 1 full unit on a 5-unit scale measuring condom use, a statistically significant shift that has clinically significant public and personal health implications.

The lack of significant HIV prevention intervention effects at the 1-year follow-up in all conditions that involved a peer influence component at first seems perplexing. Nevertheless, it is in accord with recently reported observations of positive short-term intervention effects and long-term deterioration of such effects, or even boomerang effects, of adolescent prevention interventions involving peer influence in the domains of tobacco use, substance use, delinquency, and other problem behaviors (Dishion & Andrews, 1995; Dishion et al., 1999). The potential for a lack of long-term intervention effect, or even a negative effect of interventions involving peer interactions (Luna & Rotheram-Borus, 1999), may have very important implications for the use of peer-based HIV prevention interventions.

When well-trained and supervised peers are directly involved in attempts at changing others' behaviors—as in the present research context—it seems likely that peer influence may initially be strong and positive (Dishion et al., 2001). Nevertheless, the intensity of these effects may wane over time. In the inner-city high school settings in which we intervened, this may have occurred, in part, because influential peers physically departed from the scene because of moves to other school districts, dropping out of school, inconsistent attendance, and similar events. Peers may also lose

[1] All of the analyses reported herein were performed with and without the inclusion of the peer NOLs, and the data are equivalent in both sets of analyses.

social influence as students' social referent groups change naturally over time. More importantly, and consistent with the research of Dishion and associates and others (Dishion & Andrews, 1995; Dishion et al., 1999, 2001; Luna & Rotheram-Borus, 1999), peer influence over students' behavior may become negative rather than positive if peers are eventually seen or believed to be enacting risky behavior themselves or to tolerate it in their friends and acquaintances. These behaviors may involve the practice of risky sex, but also alcohol, drug use, or antisocial behavior—all of which are common in the urban context where the high schools studied here are located.

In effect, we are arguing that in the combined classroom and peer intervention at the 3-month postintervention outcome interval, both the classroom- and peer-based components of the intervention were working together to produce a synergistic, consistent HIV prevention effect. At the 1-year outcome interval, the effects of the combined classroom and the peer-only interventions may have deteriorated because of markedly decreased social influence on the part of peer NOLs for the reasons discussed above. Further, at 1 year, in the combined classroom and peer intervention, the problematic peer component could have seriously undercut the positive effects of the classroom intervention, in part because long-term behavior of some peer HIV prevention advocates directly contradicted it. Although this explanation is supported by anecdotal data collected in the present research, our inability to do a definitive analysis of NOLs' behavior over time limits our ability to support this explanation directly. Nevertheless, our findings suggest that future intervention designs incorporating long-term supervision of NOLs and other elements that could limit NOLs' long-term intervention-inconsistent behavior, or at least limit peers' observation of it, could perhaps moderate these effects (Dishion et al., 2001).

Turning to the question of why the effects of the classroom intervention were enhanced over time, we suggest that for high school students, the introduction of HIV prevention (i.e., condom use) into the large numbers of existing relationships that were in force at the time of the intervention was not likely because of relationship maintenance concerns (i.e., concerns that introducing condom use would damage the relationship by showing mistrust or suggesting one member has been unfaithful; Misovich, et al., 1997). On the other hand, following our intervention, introducing the use of condoms was more likely to occur in succeeding new relationships (Misovich et al., 1997). Adolescent relationships are typically brief and of a serially monogamous nature (Everett et al., 2000). In addition to new relationships unfolding over time and affording greater potential for introducing condom use at lower psychological cost (Misovich et al., 1997), postintervention opportunities occur over time for practicing and developing one's HIV prevention skills, which further enhance individuals' self-efficacy at the skills learned in the intervention. Other things being equal (e.g., if the peer effects had not deteriorated for the reasons detailed above), the same pattern of long-term effects might have occurred in the classroom and in the combined interventions.

The IMB model classroom-based HIV prevention intervention examined in this research was empirically targeted to address deficits in inner-city high school students' HIV prevention information, motivation, and behavioral skills identified in population-specific elicitation research. It was designed to be cheaply, easily, and widely applied within real-world inner-city high school settings and included the existing teaching staff and entire intact classrooms rather than specially selected teachers, charismatic intervenors, select student volunteers, or expensive intervention materials. These intervention procedures require only the availability of currently employed teaching staff and a modest investment in intervention training and deployment. All intervention materials (including manuals, videos, and flashcards) are ready to implement and are available from Jeffrey D. Fisher or on the World Wide Web (see http://www.films.com; select Browse by Subject; Health; Complete List of 60 Subcategories; HIV/AIDS; HIV/AIDS: Real People, True Stories). Calculations indicated that the cost of the classroom-based intervention, using existing teaching personnel, amounted to $2.22 per student.

Comment should be made with respect to potential limitations of the current research. First, although these interventions contained empirically targeted elements that supported abstinence from sexual intercourse as well as content supportive of safer sexual behaviors such as condom use, intervention effects on rates of involvement in sexual activity were not observed during the course of this study. In common with many other intervention efforts (e.g., Jemmott et al., 1998; Walter & Vaughn, 1993), we were not able to alter teens' progression toward sexual activity. In the same vein, it is worth emphasizing that exposure to the safer sex components of the current interventions did not accelerate involvement in sexual activity, a fear that has often been raised (but not empirically supported) since the early days of sex education (Barrett, Fisher, McKay, 1994; W. A. Fisher et al., 1999). In addition, and again as in essentially all intervention research, inferences concerning intervention impact are being made on the basis of self-reports of behavior change. Although this is a potential limitation for this entire research area, efforts were made to dissociate the intervention from its evaluation in order to reduce perceptions on the part of participants that they needed to satisfy intervenors with reports of intervention success. It is also noted that there is a strong history of successful validation research for self-reports of sexual and safer sexual behavior, beginning with Kinsey and associates' validation studies (Kinsey, Pomeroy, & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953) and continuing to the present (e.g., Catania, Gibson, Chitwood, & Coates, 1990; Seal, 1997).

Note should also be made concerning the internal consistency coefficients of our measures. Although all of the alphas ranged between .59 and .79 (falling mostly at the higher end), Cohen and Cohen (1983) stated that "reliabilities of .60 are by no means uncommon in the behavioral sciences; in fact, in some circumstances . . . they may even be considered reasonably good" (p. 70). Further, to the degree that reliability deviates from 1.00, the estimates of relationships to other variables (i.e., the effect of an intervention) can only be attenuated, never increased (Cohen & Cohen, 1983). It must also be kept in mind that the reading and reading comprehension abilities of many of our minority inner-city intervention and control group participants were poor. To address this, we had reading-level consultants revise our questionnaire, but at a general level, poor reading and reading comprehension skills are a real-world condition that may be reflected in our reliabilities. The same factors that negatively influence reading skills (e.g., disadvantages of various sorts) make this population an especially critical target for HIV prevention interventions. The only realistic way for us to bolster our reliabilities would be to increase the

number of items for each of our scales, which would likely pose an extraordinary response burden on our participants and preclude their paying adequate attention. We also note that our measures were based on published scales that have been used effectively in our previous work (e.g., J. D. Fisher & Fisher, 1992, 2000; Misovich et al., 1998), that the measures have consistently correlated with HIV preventive behavior (Misovich et al., 1998), and that intervention-induced changes in HIV prevention behavior have been linked to changes in levels of these measures (e.g., J. D. Fisher et al., 1996).

Finally, the current research shares the limitations of all quasi-experimental designs in terms of being able to make strong causal assertions about intervention effects (West et al., 2000). Although it would have been methodologically ideal to have many more schools, to randomly assign schools to condition, and to use school as the unit of analysis, the cost of such an undertaking is prohibitive and has prevented conducting such work. Thus, our findings should be interpreted with the caution that some other unmeasured factor specific to the individual schools under study may partially account for our results.

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