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Longitudinal study of a School based HIV/AIDS early prevention program for Mexican Adolescents

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Abstract

A quasi-experimental study is reported with four measurement occasions to evaluate longer-term effects of a life-skills and HIV/AIDS school-based prevention program. Trained teachers administered the program promoting precursors of safer sex behavior to 2064 Mexican high-school students at an age before most were sexually active. The variables included in the study (knowledge about HIV/AIDS prevention, attitudes towards use of condoms, subjective norms, intentions to use condoms and life skills as decision-making skills, partner communication and individual responsibility) have been reported as precursors of protective sexual behavior. The results demonstrate the stability of training effects and a positive impact on these precursors over 1 year of follow-up.

Keywords: *Adolescents, HIV prevention, life skills, longitudinal study, school-based programs*

Introduction

The risk behavior of today's adolescents will shape the course of the AIDS pandemic in the future. In most countries, recent data indicate that up to 60% of all new HIV infections are among 15–24-year-olds, while this group also boasts the highest incidence of sexually transmitted infections (STIs) of all age groups (Universidad Nacional Autónoma de México, 2002). Clearly, adolescents are a key target group for behavior change programs aimed at adopting safe sexual behaviors. A national survey in Mexico found that 23.8% of the sexually active male and 40.9% of the sexually active female adolescents do not know any method for protecting against STIs (Gayet, Juárez, Pedroza & Magis, 2003). Moreover, adolescents who are knowledgeable about AIDS, its causes and means of prevention, may still not adopt protective behaviors (Tapia-Aguirre et al., 2004).

There is evidence that programs need to provide HIV/AIDS and sexual health education to youth before their sexual debut (Pick de Weiss, Andrade-Palos, Townsend, & Givaudan, 1994; Schenker & Nyirenda, 2002). The literature on HIV/STI prevention mentions several factors that affect high-risk behavior in sexually active adolescents

(Basen-Engquist et al., 1999). These protective factors include communication, self-esteem, self-efficacy in condom use, decision-making, knowledge about sexuality and HIV/AIDS, and social norms (Bandura 1997; Feeney, Kelly, Gallois, Peterson, & Terry, 1999; Fishbein, 2000; Whitman, 2001; Wight et al., 2002). Recent studies and reviews of school-based programs indicate that youth need accurate knowledge on topics related to sexuality. On top of this, they need to be taught life skills such as assertive communication, self-knowledge, mutual respect, and commitment (Grunseit, 1997). Beale, Dusseldorp, and Maes (2001) found that teaching assertiveness and communication skills is a positive strategy against AIDS and concluded that self-efficacy is a valid predictor of condom use in sexually experienced and inexperienced youth. However, most studies on the impact of life skills are directed to sexually experienced adults or adolescents. There is a lack of theoretical perspectives and studies involving sexually inexperienced youngsters (Kirby, 2002).

Based on the theory of reasoned action (Fishbein, 2000; Fishbein & Ajzen, 1975) and social learning theory (Bandura, 1987, 1998), Givaudan, Poortinga, and Van de Vijver (2005) developed an exploratory model to identify precursors of safer practices in Mexican adolescents. They identified two variables, partner communication and intentions to use condoms, as the main outcome variables for HIV/AIDS prevention in a sample of Mexican high-school adolescents with no sexual experience. In turn, these variables were also found to predict protective sexual behavior in a sample of adolescents who reported to have had sexual intercourse. These outcome variables formed part of a path model with self-knowledge, self-efficacy, and decision-making as (exogenous) individual resources. Self-efficacy about the use of condoms was the most relevant of these three variables with positive influence on most of the other variables included in the model: knowledge, attitudes toward condoms, subjective norms, intentions to use condoms and partner communication. Of the latter variables, knowledge had a significant effect on attitudes toward condoms, which in turn had strong effects on subjective norms and on intentions to use condoms. The present study is based on these findings.

School programs provide an obvious approach to prevention; in this way, one can reach large numbers of young people at a relatively low cost. Such programs can increase knowledge about HIV/AIDS and lead to more positive attitudes toward safe-sex behaviors (e.g., Cáceres, Rosasco, Mandel, & Hearst, 1994; Dolan, Ramírez, Strouse, Hedges, & Sogolow, 2002; Pick de Weiss, Atkin, Gribble, & Andrade-Palos, 1991). Nevertheless, to the best of our knowledge, there have been no studies in Latin American countries in which the impact of a school-based program on precursors of protective sexual behaviors in youngsters, prior to their sexual debut, has been documented and evaluated over a longer period.

The present investigation describes the effects of the school-based program *A Team Against AIDS* (Fernández & Givaudan, 1999) among adolescents in Mexico, up to a year after completion of the curriculum. Teachers trained in participatory methodology administered the program to an experimental group prior to most participants' sexual debut. The study design included a control group and there were four repeated measurements.

In summary, we report the evaluation of the longer-term effects of a school-based life skills and HIV/AIDS prevention program, administered by specifically trained school teachers. The program was implemented before most of the students were sexually active. Data were collected on four occasions to explore the effect of the intervention up to 1 year after its conclusion. The design of the study was geared to the questions of (a) whether, and to what extent, there are differences between the control and experimental groups in the factors included in the program by the end of the intervention, and (b) whether, and to what extent,

there is a decrease in effect between the post-test and follow-up measures administered 6 and 12 months.

Method

Participants

Schools. Four of the five public schools that exist in Toluca, Mexico, were invited and agreed to participate in the study. These four schools were divided in two pairs based on similarity in size. Within each pair, one school was assigned randomly to the control group and one to the experimental group. The schools are similar with respect to curricula and organization, dropout rates, rates of students continuing to university, and average number of students per class. Uncontrolled dissemination of the experimental treatment to the control group (i.e., members of the control group gaining knowledge about the intervention) was unlikely, because of the geographical distance (minimally 10 miles) between the schools, situated in different quarters of the city.

Students. All students beginning the tenth grade in the four schools were invited to participate in the study and the repeated administration of a questionnaire. Initially, the sample consisted of 2,064 adolescents (49.5% male, 50.4% female, mean age 15.97 years, SD = 11 months); due to school drop-out, absenteeism, and similar factors, the number of participants at the second, third, and fourth measurement occasion were 1877, 1696, and 1793, respectively. Most of the students who attend government schools belong to the low to medium socioeconomic level, where the average income per family is about 500 USD monthly. The general socioeconomic and demographic characteristics of the experimental and control groups were similar.

Intervention

The intervention consisted of two stages: (a) training of teachers and (b) training of the students by their teachers. The program *A Team Against AIDS* was developed specifically for the intervention, partly based on a previous program *Planeando tu Vida* (Pick et al., 2003).

Teacher training. Seventeen high-school teachers (13 women and 4 men) from the experimental schools were trained by an experienced instructor to become sexuality educators in their schools. For the training of teachers, two manuals were used: one from *Planeando tu Vida* (Pick et al., 2003) and the other from *A Team Against AIDS* (Fernández & Givaudan, 1999). In the training, the teachers learned how to conduct an interactive AIDS-focused sexuality education program that aimed at developing life skills. They also learned how to address sensitive issues in class discussions. At the end of the training teachers received a manual that describes how to implement the program with the students. The teacher training was positively evaluated (Givaudan, Van de Vijver, Poortinga, Leenen, & Pick, 2007).

Experimental group intervention. Students in this group received the program *A Team Against AIDS*, administered during one school semester and lasting 30 h, divided into 2 h per week. The program consists of a comprehensive AIDS and sexual health education curriculum,

including activities that allow students to practice the skills they learn. Each session is designed to reach a specific objective combining knowledge and skills practice in an informal environment. Activities for students promote self-knowledge through the analysis of their own qualities and limits and reflection on how they deal with difficulties and risky situations, such as peer or partner pressure. Role-playing helps them to practice assertive communication, decision-making, and negotiation about sexual relations and use of condoms. These activities as well as homework to practice the skills with friends or partner adolescents are meant to make participants feel more confident about their capabilities. Discussions about attitudes and beliefs toward condoms and subjective and social norms are promoted through team exercises in order to clarify attitudes and norms about protective sex. A summary of program content and didactic strategies is given in Table I.

Control group intervention. Students in the control schools received a traditional sexuality education course called *Sexuality and First Aid*, which is usually taught in 10th grade as a 2-h semester course. Topics include anatomy and physiology of the body, gender issues, sexuality, reproductive physiology, and first aid. This course consists of lectures, readings, and informational material and is not participatory. Instructors often are physicians and, less frequently, nurses, dentists, or social workers. Instructors are not necessarily trained, although several teachers update themselves on new education approaches.

Design of the evaluation

To measure the impact of the *A Team Against AIDS* program, a quasi-experimental pre-post design was followed with an experimental and a control group. The study was longitudinal with four measurement occasions that enabled the exploration of longer effects of a school-based intervention.

Measure. Drawing on previous experience (Pick de Weiss et al., 1991) and complemented with additional information provided by indicators included in the *Handbook for Evaluating HIV Education* (Centers for Disease Control, 2000), we developed a self-report questionnaire with 174 items based on the contents of the program. The instrument included the following topics: knowledge about HIV/AIDS, subjective norms regarding use of condoms, attitudes toward use of condoms, self-efficacy in condom use, self-knowledge, decision-making, partner communication, intentions to use condoms, and behavior (for those reporting sexual experience). Students answered the same questionnaire on four occasions. Eight scales were derived from the instrument. Cronbach's alpha was calculated across all applications and participants. An overview of the scales and their reliabilities is given in Table I. There were also four demographic information items, including an item asking for the age of first sexual intercourse. For this item, a compatibility check was made using items from the behavior scale.

Procedure. Before the start of the course, all students signed an informed consent letter and the questionnaire was applied to obtain a baseline measure, in both the intervention and control schools. The questionnaire was administered again in both groups by the end of the semester (post-test). The third measurement was taken 6 months after completing the intervention; and the fourth measurement 1 year after completion of the intervention.

Table I. Summary of didactic strategy, program contents, and assessment scale.

Program content	Examples of didactic strategy	Number of items	Item example	Response scale	Cronbach's α
Knowledge about HIV/AIDS	Information about HIV prevention. Training in use of a condom with fingers as model	19	"A person can contract HIV by having a blood transfusion from an infected person"	I am certain this is incorrect - correct (1 - 5)	.78
Subjective norms regarding use of condoms	Team discussions about subjective and social norms regarding the use of condoms and protective sex behavior	3	"My significant others think I should use condoms"	Disagree - agree completely (1 - 5)	.68
Attitudes toward use of condoms	Participatory exercises analyzing advantages and disadvantages of condom use	10	"It takes fun out of sex if you use condoms every single time"	Disagree - agree completely (1 - 5)	.82
Perceived self-efficacy in condom use	Role playing to practice assertive communication about sexual behavior; handling of condoms to feel confident about them	3	"I can interrupt a sexual relation to wear a condom"	Disagree - agree completely (1 - 5)	.78
Self-esteem	Exercises for analyzing qualities and limits, personal and emotional needs, fears and future expectations	9	"I like myself"	Almost never - all time (1 - 4)	.78
Decision-making	Individual and team exercises to analyze different alternatives about sexual behavior and its consequences as well as other relevant decisions	7	"I carefully evaluate my options before making a decision"	Almost Never - all time (1 - 4)	.81
Partner Communication	Role playing activities related to communication skills about sexuality	11	"I am ashamed to talk about AIDS with my partner (boy/girlfriend)"	Almost never - all time (1 - 4)	.69
Intentions to use condoms	Role playing activities related to the intention of using condoms and consolidation of communication skills	Single item	"What are your plans regarding condom use during your next sexual encounter?"	No condom use - condom use in spite of strong opposition by the partner (1 - 5)	
Behavior (for those reporting sexual experience)	Not applicable	10	"I have had sexual relations with penetration and without protection"	Risky - safe (0 - 1)	.87

Analysis

Questionnaire matching. Confidentiality and anonymity of the students had to be guaranteed in view of the sensitive questions asked in the questionnaire. The basis for matching protocols across the four measurement occasions while guaranteeing confidentiality was a code that each student created from his or her own name and surname by changing the letters to the digits “0” and “1” for vowels and consonants, respectively.

There was some loss of protocols over measurement occasion, due to illness and school drop-out. A further cause of apparent loss was due to inconsistencies in the coding of names, including interchanging given names and family names, and changing to nicknames (e.g., the strings 01010100100 and 01010100 could identify the same person; i.e., Ana Maria Cue and Anita Cue). For this reason, a probabilistic code matching procedure was adopted, that apart from similarities in strings of digits also took into account variables like gender, birthday, school, and class schedule to establish a correspondence between codes at different measurement times. Table II shows the numbers of matched questionnaires that were obtained in this way. We read, for example, that for 946 participants (i.e., 35% of all cases) all four protocols were matched (which means that 51% of all available protocols belongs to a set of four matched protocols); for 60% of the cases, at most one measurement occasion was lost (which means that 78% of the available protocols belongs to a set of three or four matched protocols).

A protocol of a measurement occasion could theoretically be uniquely matched to another protocol at zero, one, two, or three other occasions. By means of an analysis of variance, we checked for each of the eight scales whether protocols from the same measurement occasion differed depending on how well they were matched with protocols from other measurement occasions. In the few cases that a significant effect was found, it accounted for a very small proportion of variance (0–3%), from which we concluded that they could be left out of consideration in interpreting the results below.

Statistical analysis. Given the design of the study, we specified a multilevel model (Goldstein, 1995; Raudenbush & Bryk, 2002) for evaluating the effects of the program on each of the eight scales. Advantages of the multilevel approach over traditional methods, like linear regression models or (multivariate) analyses of variance, have been amply documented and include the correct estimation of the standard error of the fixed regression coefficients and the use of all available data, even in cases where one or more data points in the repeated measure design are missing.

The multilevel model fitted to the data is discussed in detail in the Appendix. Here, we provide a short summary of its most important aspects. The effects specified in the model can be conceptually divided in three groups: (a) effects of control variables, including the student’s starting value (the intercept, which is allowed to vary among students), sex, and

Table II. Number of participants (as distinguished by the matching procedure) contributing a single protocol, or two, three, or four matched protocols.

	Number of participants	% of all participants	% of all protocols
Single protocol	612	22	8
Two protocols matched	503	18	14
Three protocols matched	676	25	27
Four protocols matched	946	35	51

sexual experience at baseline; (b) maturation effects (which, loosely speaking, correspond with the increase over time in the control group); and (c) intervention-related effects, which include the change in students who received the program (as compared to those in the control group) immediately after the intervention (i.e., between the first and the second measurement occasion) and at follow-up (i.e., the change, assumed to be linear, from the second to the fourth measurement occasion). In the presentation of the results below, we will focus on the parameters of most substantive interest (omitting the results for the random effects with their variance–covariance parameters, and the intercept).

Results

The main findings are presented in Table III. The effects of the treatment measured after completion of the program (γ_{1T}) are of most interest and are given in bold. The entries for all outcome variables are positive, and with one exception, they are statistically significant, which points to a broad, positive impact of the intervention. The next column (γ_{2T}) represents the linear effect of the intervention after the second measurement moment (at follow-up). The entries in this column are mostly negative, but considerably smaller than those in the column γ_{1T} . This points to a small loss over time in the intervention effects. The overall patterning is clear: all variables show a substantial increase due to the intervention and there is some decrease of this effect, but much smaller, at follow-up.

Figures 1 and 2 illustrate this pattern taking as examples two of the variables. Figure 1 shows the large increase in knowledge of .356, followed by a slight decrease of .037 at follow-up. Figure 2 illustrates how self-efficacy about condom use showed a score increase after intervention (.319) and a small score decrease of .065 over time.

Table III. Estimates of the fixed effects associated with the control and intervention-related variables.

Variables	Control-variable effects			Maturation effects			Intervention effects	
	γ_G	γ_E	γ_{GE}	γ_1	γ_{1G}	γ_2	γ_{1T}	γ_{2T}
Knowledge	-.033	.008	.092	-.029	.071**	.036**	.356**	-.037**
Norms	-.121**	.035	.125	-.249**	.135**	.014	.268**	-.030
Attitude	.045	-.040	.167**	-.186**	.164**	.012	.273**	-.046**
Self-efficacy	.250**	-.173**	.278**	-.168**	.067	.025	.319**	-.065**
Self-esteem	-.077**	-.016	.058	-.013	.014	.007	.062**	.001
Decision making	.025	-.008	-.023	-.093**	.010	.035**	.137**	-.031*
Communication	.242**	-.007	.068	-.049**	.055**	.033**	.051**	-.001
Intentions	.080**	.049*	-.031	-.023	.005	-.022*	.068**	-.023
Behavior	-.031	.005	-.021	-.019	.033	-.010	.037	-.012

Note: The multilevel model on which these results are based is described in the Appendix. The (fixed) effects presented here are interpreted similarly as weights or coefficients in an ordinary linear regression model. γ_G , gender effect (positive values indicate an advantage for females); γ_E , effect of sexual experience (s.e.) (positive values indicate an advantage for sexually experienced); γ_{GE} , interaction effect between gender and sexual experience (positive values indicate an advantage for s.e. females); γ_1 , effect of time (maturing) between the first and second measurement occasion; γ_{1G} , differential gender effect of time (maturing) between the first and second measurement occasion; γ_2 , effect of time (maturing) after the second measurement occasion; γ_{1T} , treatment/intervention effect between the first and second measurement occasion (i.e., for students in experimental schools); γ_{2T} , additional effect of time after the second measurement occasion for students from the experimental group. * $p < .05$; ** $p < .01$.

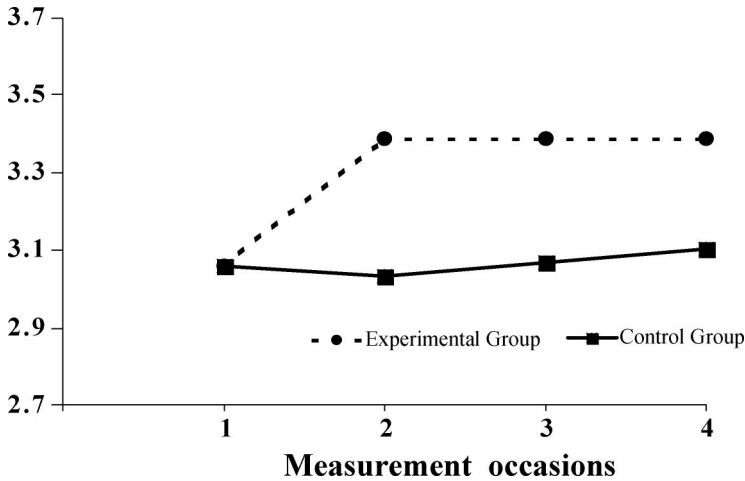


Figure 1. Knowledge about HIV by measurement occasion and study group for boys without sexual experience. (The figure is based on the values predicted by the multilevel model presented in Table III.)

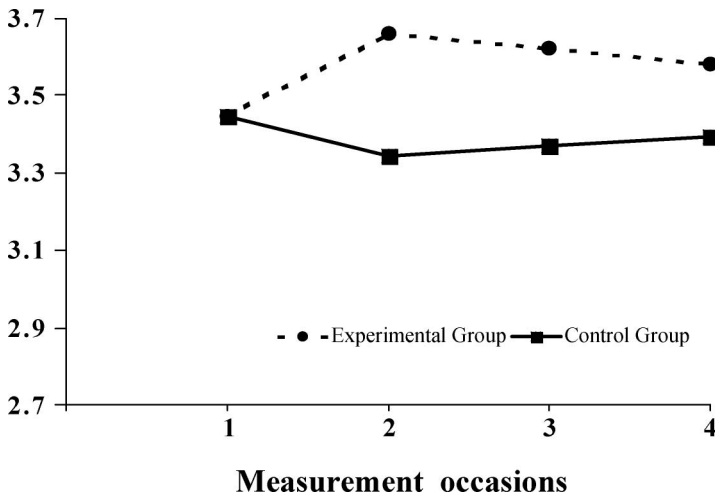


Figure 2. Self-efficacy about the use of condoms by measurement occasion and study group for girls with sexual experience. (The figure is based on the values predicted by the multilevel model presented in Table III.)

The study was designed to assess primarily changes in precursors of sexuality behavior. The proportion of youngsters with sexual experience was known to be low in the age group at which the program was targeted, in line with our strategy to have life skills in place beforehand. However, the questionnaire did include questions about safe versus risky practices during sexual intercourse (oral, vaginal, or anal) and, as shown in Table III, the analysis with the behavior scale as the dependent variable shows a positive immediate effect of the program in the expected direction (.037), although with a *p*-value of .12 the effect failed to reach statistical significance. This nonsignificant result may be due to the small numbers of students on which the analysis is based (17 [4%] girls and 80 [17%] boys in the experimental schools and 27 [8%] girls and 79 [24%] boys in the control schools reported to have had at least one sexual intercourse at the start of the program).

In an additional analysis, we evaluated the combined overall change across the full time span covered by this study. This alternative analysis directly checks whether the significant difference between control and experimental group at the post-test is maintained until the last measurement occasion. The results show that for all variables in Table III, except intentions and behaviors, the change from the first to the fourth measurement is significantly ($p < .01$) different for both treatment groups, indeed.

There were also findings not related to the intervention program. The first three columns in Table III show effects of gender and sexual experience. The column (γ_G) shows gender differences observed from the beginning of the study; entries indicate values for girls in comparison with boys. We found that girls scored significantly higher than boys on partner communication, self-efficacy in condom use, and intentions to use them. Boys scored significantly higher than girls on self-esteem and norms about the use of condoms. The second column, γ_E , presents pretest differences related to sexual experience. It was found that adolescents who reported sexual experience had significantly lower self-efficacy about condom use than those who had not had sex at the time of the first administration of the questionnaire. In addition, adolescents without sexual experience had a higher intention to use a condom. The interaction between gender and sexual experience (γ_{GE} , third column) showed that girls with sexual experience had higher scores on this variable and had more positive attitudes toward condom use.

The fourth column, γ_1 , indicates the effect of time between the first and the second measurement for all the students without taking into account the effect of the treatment (loosely speaking, it corresponds to the change in the control group between the first and the second application). A comparison between pretest and post-test measures in the control group shows decreases on all variables, several of them are significant: self-efficacy, decision-making, attitudes and norms about condom use, and partner communication. The fifth column shows important differences in this respect between boys and girls, though: the positive values for γ_{1G} imply that the decrease between the first and the second measurement was much smaller (or even nonexistent) in girls. Particularly, for norms, attitudes, knowledge, and communication, boys and girls changed differently between the first and second measurement occasion. The parameter γ_2 shows the linear effect of time after the second application that is unrelated to the treatment. Decision-making, knowledge, and communication showed small but significant increases, while the intention to use a condom showed a significant decrease.

Discussion and conclusions

The present research has demonstrated a positive effect over a medium time span (1-year follow-up period) of a curriculum aimed at promoting life skills, enhancing knowledge, and changing norms and attitudes vis-à-vis safe-sex behavior. The program *A Team Against AIDS* (Fernández & Givaudan, 1999) was delivered by trained teachers to Mexican high-school students. Theory, design, and analysis were integrated in order to maximize the validity of the study, which was rooted in the theory of reasoned action (Ajzen & Fishbein, 1980) and social learning theory (Bandura, 1987). Longer-term effects of the intervention were evaluated using a quasi-experimental design with four occasions and a multilevel model for the data analysis.

The most important finding of the study is the positive impact on all the precursor variables used to assess the effect of this intervention. The results of our analyses suggest that the training had the largest effects on knowledge and self-efficacy in condom use. Both can be viewed as important precursors of actual condom use. Knowledge is an important

condition for change in behavior patterns that are not part of traditional ways of doing things. Higher levels of self-efficacy (the belief that you can achieve something) are more likely to lead to actual behavior.

The second important finding is the relatively strong stability over time of the effects of this early prevention program. A recurrent problem in intervention studies is the long-term decrease or even disappearance of effects that can be observed immediately after the program implementation. The increase in scores on the precursor variables as a consequence of participating in the program remained considerably larger than the score decrease at follow-up even after a year. Although further reinforcement and support should be useful (cf. Kelly, 1995; Morrill, Ickovics, Golubchikov, Beren, & Rodin, 1996; Sobo, 1993), our results imply that an intervention program that strengthens social skills in addition to knowledge can have a positive effect that extends over time.

Some additional findings deserve a comment. First, the somewhat lower scores of the control group on the second measurement occasion have to be noted. One can imagine that, for example, with increasing age, adolescents engaging in social interactions with the other sex feel less sure of themselves and experience some loss in self-efficacy. However, the trend across variables is suggestive of some general factor, such as a lower motivation to complete the questionnaire among control group participants. The results, as illustrated in Figures 1 and 2, suggest that this effect dissipated over time. Hence, we like to argue that the substantial differences that remained between treatment group and control group have to be interpreted as due to the differences between the two curricula. The results argue for the greater effectiveness of a program that is interactive and promotes life skills, such as decision-making, self-efficacy, and reflection on norms and attitudes (Venguer, Pick, & Fishbein, in press).

Significant gender differences were found at baseline. Girls scored higher than boys on partner communication, self-efficacy about the use of condoms, and intentions to use them, whereas boys scored significantly higher than girls on self-esteem and norms about the use of condoms, which reflect views of important others concerning condom use (e.g., "My family thinks that if I am to have sexual relations, I should use a condom"). Simmons and Blyth (1987) suggested that girls are more likely than boys to be exposed to two major life transitions simultaneously during the early adolescent years: the physical changes and the transition to high school. Boys are likely to experience these changes with about 18 months difference. Several researchers have found that early maturation in girls is associated with lower self-esteem and less self-confidence (Buchanan, Eccles, & Becker, 1992; Stattin & Magnusson, 1990). Gender differences in self-esteem are even more likely in the Mexican context because boys are more socially valued (Amezcuca & Pichardo, 2000).

The ultimate demonstration of the effectiveness of an intervention program like *A Team Against AIDS* requires criteria such as observed use of condoms, fewer sexual partners and a lower incidence of STIs and HIV/AIDS. Such criteria were out of reach for this program that is aiming at prevention. Hence, program evaluation mainly focused on variables that can be seen as precursors to safe sex behaviors (Givaudan et al., 2005). A limitation of the current study is the time span over which the program participants could be followed. The desired effect of the program is meant to extend over a large number of years. Also in this respect we had to find a compromise between ideal standards and realistic targets. Obviously, a longer follow-up would have been desirable, but it would have been difficult and costly to keep track of participants, especially after them leaving high school.

A concrete point on which the study went less well than expected was the name coding by the students. We still believe that with sensitive issues like sex behavior, data collection

procedures are needed, which guarantee anonymity in a way that is evident to participants. However, we should have provided more detailed instructions with the first questionnaire and these should have been repeated each of the following times (e.g., requiring name as entered on the birth certificate).

For future research, it will be important to extend the age range in order to have a larger proportion of sexually active participants and evaluate the effectiveness of the program on close proxies of actual behavior in a bigger sample. Nevertheless, despite the small sexually active subsamples at the start of the intervention, it was possible to show some interaction of gender and sexual experience, namely in attitudes toward condoms and self-efficacy. Girls with sexual experience obtained somewhat higher scores on both variables. However, differences were small and there appears to be no need to develop different versions of the program for boys and girls.

There is an obvious need to follow up *A Team Against AIDS* with actualization programs, which focus on further practicing of the knowledge and skills developed in the initial stage. After all, the present study may have shown convincingly that the program had a positive effect, but this by no means implies that the participants are fully protected against risky behaviors.

In summary, the results of this project have demonstrated clearly the effect of a school-based intervention program promoting life skills even a year after its completion in a sample of adolescents most of whom were not yet sexually active. In our view, this finding strongly suggests the effectiveness of early intervention in a school context before the age at which adolescents become sexually active and at risk for HIV/AIDS infection. The comparison with a traditional lecture-based program suggested that interactive teaching and learning methods are essential to develop skills and abilities before adolescents are dealing with risky situations.

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Appendix

Statistical details: Specification of a multilevel model

The following specification of a two-level linear hierarchical model was used to evaluate the program's effect in each of the eight scales (dependent variables):

$$\begin{aligned}
 Y_{ij} = & \gamma_0 + \gamma_G G_i + \gamma_E E_i + \gamma_{GE} (G_i \times E_i) + \gamma_1 X_{1j} \\
 & + \gamma_{1G} (G_i \times X_{1j}) + \gamma_2 X_{2j} + \gamma_{1T} (T_i \times X_{1j}) \\
 & + \gamma_{2T} (T_i \times X_{2j}) + u_{0i} + u_{2i} X_{2j} + \varepsilon_{ij},
 \end{aligned} \tag{1}$$

with $(u_{0i}, u_{2i})' \sim N(0, \Sigma)$ and $\varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2)$ and N denoting a (possibly multivariate) normal distribution. The parameters in the model of Equation (1) are (a) the fixed effects (represented by a subscripted γ) and (b) the variance–covariance parameters (Σ and σ_ε^2) of the random effects u_{0i} , u_{2i} and ε_{ij} . The dependent variable Y_{ij} denotes the score, for the scale under consideration, of student i ($1 \leq i \leq 2591$) at measurement occasion j ($1 \leq j \leq 4$). The independent variables included in Equation (1) are: G_i (student's i gender, with $G_i = 1$ for females and $G_i = 0$ for males), E_i (student's i sexual experience, with $E_i = 1$ for students who, at baseline, indicated to have had sexual intercourse and $E_i = 0$ otherwise), T_i (student's i treatment, with $T_i = 1$ for students from the experimental group and $T_i = 0$ for students from the control group), and X_{1j} and X_{2j} , which together code the measurement occasion with $X_{1j} = 1$ if $j > 1$ and $X_{1j} = 0$ otherwise, and $X_{2j} = j - 2$ if $j > 2$ and $X_{2j} = 0$, otherwise. This specification of the multilevel model was motivated by both theoretical considerations and results obtained from fitting more complex multilevel models (showing that some of the effects in these models can be omitted without affecting the fit of the model). Estimates of the parameters in this model were obtained using the program MLwiN (Rasbash, Brown, Healy, Cameron, & Charlton, 2002).