

# Effects of the Seattle Social Development Project on Sexual Behavior, Pregnancy, Birth, and Sexually Transmitted Disease Outcomes by Age 21 Years

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**Objective:** To examine the long-term effects of the full Seattle Social Development Project intervention on sexual behavior and associated outcomes assessed at age 21 years.

**Design:** Nonrandomized controlled trial with long-term follow-up.

**Setting:** Public elementary schools serving children from high-crime areas in Seattle, Wash.

**Participants:** Ninety-three percent of the fifth-grade students enrolled in either the full-intervention or control group were successfully interviewed at age 21 years (n=144 [full intervention] and n=205 [control]).

**Interventions:** In-service teacher training, parenting classes, and social competence training for children.

**Main Outcome Measures:** Self-report measures of all outcomes.

**Results:** The full-intervention group reported significantly fewer sexual partners and experienced a margin-

ally reduced risk for initiating intercourse by age 21 years as compared with the control group. Among females, treatment group status was associated with a significantly reduced likelihood of both becoming pregnant and experiencing a birth by age 21 years. Among single individuals, a significantly increased probability of condom use during last intercourse was predicted by full-intervention group membership; a significant ethnic group  $\times$  intervention group interaction indicated that after controlling for socioeconomic status, single African Americans were especially responsive to the intervention in terms of this outcome. Finally, a significant treatment  $\times$  ethnic group interaction indicated that among African Americans, being in the full-intervention group predicted a reduced probability of contracting a sexually transmitted disease by age 21 years.

**Conclusion:** A theory-based social development program that promotes academic success, social competence, and bonding to school during the elementary grades can prevent risky sexual practices and adverse health consequences in early adulthood.

*Arch Pediatr Adolesc Med.* 2002;156:438-447

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**T**HE OFTEN devastating and life-changing implications of early sexual activity underscore the importance of prevention-focused research.

For several decades, early pregnancy has maintained its standing as one of the United States' most persistent and troublesome social problems. With more than 900 000 teenagers becoming pregnant each year,<sup>1</sup> adolescent pregnancy rates in the United States have continued to surpass those of almost all other developed countries.<sup>2</sup> Each year, 10% of American females aged 15 to 19 years will become pregnant, and roughly half of them will give birth.<sup>3</sup> Adolescent motherhood has been associated with academic deficits,<sup>4-6</sup> poor socioeconomic outcomes,<sup>7,8</sup> repeat pregnancy,<sup>9,10</sup> and single-parent status.<sup>11,12</sup>

Sexually transmitted disease (STD) is another threat to the health and well-being of American young people. Adolescents and adults younger than 25 years experience STD in far greater numbers than

*For editorial comment  
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older adults. For example, excluding human immunodeficiency virus (HIV), two thirds of the 12 million cases of STD reported annually occur among individuals younger than 25 years.<sup>13</sup> Among the negative consequences of STD are cancer, ectopic pregnancy, perinatal infection, chronic pain, sterility, and death.<sup>14</sup>

Pregnancy and STD outcomes occur as a function of early intercourse onset, multiple sexual partners, and lack of contra-

## PARTICIPANTS AND METHODS

### DESIGN AND DATA COLLECTION

The study of intervention effects is part of a longitudinal panel study of all consenting fifth-grade students ( $n=808$ ) in 18 public schools serving high-crime areas of Seattle, Wash. All schools contacted by SSDP staff chose to participate in the study. In 1981, an intervention was initiated among first-grade students in 8 public schools, and in 1985, when these children entered fifth grade, the study was expanded to include fifth-grade students in 10 additional schools. Schools were assigned nonrandomly to conditions in the fall of 1985, and thereafter, all fifth-grade students in each school participated in the same interventions. New schools added for the panel study were matched to the intervention schools with respect to grades served and inclusion of students drawn from high-crime neighborhoods. Schools added for the panel study were assigned to conditions to achieve balanced numbers across conditions. This resulted in a nonrandomized controlled trial with 4 conditions. The full-intervention group ( $n=156$ ) received the intervention described earlier from grades 1 through 6 if they remained in intervention schools, with an average dose of 3 years. The late intervention group ( $n=267$ ) received the intervention during grades 5 and 6 only and is not discussed in this article because no significant effects of the late intervention on sexual behavior outcomes were found at age 18 years. The "parent training only" group ( $n=141$ ) was offered only the "Preparing for the Drug (Free) Years" curriculum during grades 5 and 6 and is not discussed in this article. The control group ( $n=220$ ) received no intervention. (There was also a small group of individuals who could not be classified into any of these groups [ $n=24$ ]). In sum, parents of 76% of fifth-grade students ( $N=808$ ) in 18 Seattle public schools consented to participate in the longitudinal follow-up study; this group constitutes the SSDP sample. Of those 808, 376 were assigned to the full-intervention and control groups discussed in the present article. At age 21 years, 349 of those 376 were successfully interviewed and constitute the sample analyzed here.

Research staff interviewed participants in the spring of 1996 when respondents were age 21 years. Due to item

sensitivity, the sex questionnaire was completed as a separate paper-and-pencil instrument and placed in a sealed envelope by the respondent. All phases of the study were approved by the Human Subjects Review Committee at the University of Washington. Participants were informed about the nature of the interviews and provided consent prior to participation in the study at age 21 years.

### SAMPLE

Because an earlier study<sup>66</sup> found significant effects on sexual behavior outcomes at age 18 years only for the full-intervention group, this article compares only the full-intervention group with the control group to test the durability of these findings in early adulthood. Of the 376 youths in these 2 conditions, 27 were not interviewed at age 21 years. This resulted in a sample size of 349, with 144 participants from the full-intervention group and 205 from the control group.

### INTERNAL VALIDITY

The SSDP has had consistently high sample-retention rates, with 93% of individuals in the full-intervention group and control group successfully interviewed at age 21 years. Prior analyses of these groups<sup>66</sup> found no significant differences in gender distribution, race distribution (white vs nonwhite), poverty (free lunch eligibility during grades 5, 6, or 7), proportion from single-parent homes (during grade 5), mean years of parents' education (during grade 5), mean years living in Seattle (by grade 6), or mean number of residences lived in (from age 5 to 14 years) between the full-intervention group and the control group. Hawkins et al<sup>66</sup> found no significant attrition effects or differences in treatment group distribution at age 18 years by gender, race, or poverty. Analyses of possible effects of attrition on the internal validity of results at age 21 years were conducted on the following variables: gender, race or ethnicity (white vs nonwhite), poverty (free lunch eligibility), family size (a continuous measure of the number of people currently living in the home), mother's educational level (a continuous measure of mother's highest level of completed schooling), church attendance (an ordinal

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ceptive use.<sup>15-17</sup> Individuals who begin having intercourse at a young age are at an increased risk for pregnancy and STD because they tend to have more sexual partners and are less likely to use contraception.<sup>18-21</sup> Additionally, given their relatively increased susceptibility to some pathogens, females are particularly at risk for acquiring certain STDs.<sup>22</sup>

### PREVENTION

While program evaluations have shown improved results in the past several years (Kirby<sup>23</sup> provides a comprehensive review), there is still much work to be done in the prevention of risky sexual behavior. Among the program types that have demonstrated effectiveness in reducing youth sexual behavior-related adverse outcomes are competency-promoting, positive youth development programs.<sup>23</sup> These programs attempt to foster behavioral, so-

cial, emotional, and cognitive competency to promote healthy adjustment in multiple settings. Examples of effective positive youth development programs include the High/Scope Perry Preschool Program<sup>24</sup> (an enriched preschool program promoting early prosocial development among high-risk children), the Quantum Opportunities Program<sup>25</sup> (which used financial incentives, tutoring, mentoring, and other strategies to promote academic competence among high school students), and Teen Outreach<sup>26</sup> (which promoted prosocial norms, involvement, bonding and self-efficacy by involving tenth graders in community-based volunteer activities and weekly classroom discussions). Each of these programs resulted in significantly fewer adolescent pregnancies among intervention group members as compared with controls, despite the fact that none of them focused directly on sexual behavior. Additionally, the Children's Aid Society Carrera Program<sup>27</sup> took a broad approach to pregnancy prevention by including a

measure of yearly church attendance frequency), and age at the survey. These analyses (**Table 2**) found no significant differences in the distribution into treatment groups among those retained in the 21-year-old sample for any of the variables examined.

## MEASURES

Participants' sexual activity was assessed at the age-21 survey by the following question: "Have you ever had sex with another person?" As defined in the sex questionnaire instructions, the terms "sex" and "sexual intercourse" refer to oral, vaginal, and anal sex. The 2 dichotomous measures of condom use were assessed by the following questions: "The first time you had sexual intercourse did you use latex protection such as condoms or gloves?" and "The last time you had sexual intercourse did you use latex protection such as condoms or gloves?" Past-year condom use was measured by the following question: "In the past year, how much of the time was latex protection used when you had sexual intercourse?" Response choices were as follows: "none of the time=1," "less than half of the time=2," "about half of the time=3," "most of the time=4," and "always=5." Note that because condom use outcomes pertain only to individuals who had had sex by age 21 years, sample sizes are smaller for these variables. Further, aside from the "condom use during first intercourse" measure, condom-use outcomes include only individuals who were single (neither married nor living with a partner) at age 21 years. The relative lack of monogamy among single individuals places this group at greater risk for engaging in risky sexual behavior and, therefore, experiencing or causing an unplanned pregnancy or an STD. Further, because single and nonsingle individuals might have distinct motivations for condom-use or nonuse (eg, lack of condom use among nonsingle people might be due to the desire to get pregnant), combining these groups is inappropriate. Thus, samples for these condom-use measures are smaller because they are limited to single people. Age of sexual onset was assessed by the following open-ended question: "How old were you the first time you had sex?" Four individuals reported their ages at sexual intercourse as before the age of 9 years; they were excluded from analyses examining age of sexual debut for 2 reasons. First, persons younger

than 9 years would have received only a portion of the intervention prior to initiating sex; and second, such early ages at sexual intercourse may represent nonconsensual intercourse. Sexual partners were assessed by the following question: "How many sexual partners have you had in your lifetime?" Response choices were as follows: 0, 1, 2, 3, 4, 5, or 6 or more. Finally, the dichotomous measures of STD, pregnancy, and birth were as follows, respectively: "Have you ever been told by a nurse or doctor that you had a sexually transmitted disease (STD or VD [venereal disease], other than HIV/AIDS [human immunodeficiency virus/acquired immunodeficiency virus]), such as gonorrhea, genital warts, chlamydia, trich, herpes, or syphilis?"; "Have you ever been pregnant?" (females) or "Have you ever gotten a woman pregnant?" (males); and "Have you ever had a baby?" (females) or "Have you ever fathered a baby?" (males).

## ANALYSIS

To evaluate the intervention, logistic regression was used to examine dichotomous outcomes, linear regression was used to examine continuous outcomes, and survival analysis was used to evaluate effects on age of sexual onset. Each model was first run to examine whether, with poverty statistically controlled, there were interaction effects between treatment group, and African American ethnic group vs all remaining ethnic groups combined. Poverty was measured by school record data indicating whether or not study children participated in the federal free or reduced school lunch program in the fifth, sixth, or seventh grades. African Americans were compared with other ethnic groups because, without intervention, African American young people have been reported as having disproportionately high rates of sexual activity,<sup>67-69</sup> pregnancies and births,<sup>1,67</sup> and STD.<sup>11,70</sup> relative to other ethnic groups. For example, African American males have been reported as 9 times more likely than white males to have initiated sexual intercourse by age 13 years.<sup>71</sup> Interaction terms were also tested for treatment group  $\times$  gender. Because they represent distinct outcomes for males and females, pregnancy and birth outcomes were analyzed separately by gender. Finally, to provide a more powerful test of the effect of treatment on age of sexual debut, age of sexual onset was examined using Cox regression analysis.

work-related component (eg, stipends), an educational component (eg, tutoring), family life and sex education, and individual sports. Relative to a control group, adolescent females who participated in this program experienced significant reductions in pregnancies and births, were significantly less likely to have initiated sex, and were significantly more likely to use contraception.<sup>27</sup> This program demonstrates that a comprehensive prevention approach targeting multiple domains of behavior can result in significant reductions in adolescent sexual risk taking and its associated outcomes. Evaluations have also identified the following as important components of effective pregnancy prevention programs: a theoretical foundation,<sup>28-31</sup> a reasonable treatment duration or dose,<sup>28</sup> and the inclusion of youths who have not yet initiated sexual activity.<sup>32,33</sup>

Studies of the antecedents of sexual behavior outcomes can inform prevention efforts by identifying targets for preventive interventions. For example, analysis of

the National Longitudinal Study of Adolescent Health reported both parent/family bonding and school bonding to be associated with a delayed sexual debut, and shared activities with parents to be associated with a reduced risk of adolescent pregnancy.<sup>34</sup> Other familial factors associated with lower rates of risky sexual behavior include parental monitoring and supervision, rule-setting about dating, and parent-child relationships characterized by support and open communication.<sup>35-38</sup> Additionally, peer norms have been found to affect the timing and nature of adolescent sexual behavior.<sup>16,39-41</sup> Finally, academic failure has been found to be a strong predictor of risky sexual behavior and teen pregnancy.<sup>28,29,42</sup> Adolescents who do well in school and have relatively high educational aspirations engage in less risky sexual behavior<sup>36</sup> and are less likely to become teen parents.<sup>31,38,43-45</sup> Consequently, empowering families, addressing peer influences, and promoting academic competence are important goals for prevention programs aimed

at reducing risky sexual behavior and its consequences among young people.

## THE SEATTLE SOCIAL DEVELOPMENT PROJECT

The Seattle Social Development Project (SSDP) included an intervention nested within a longitudinal panel study. The SSDP intervention was guided by the social development model,<sup>46</sup> a theory of behavior that integrates elements of social control,<sup>47</sup> social learning,<sup>48</sup> and differential association theories.<sup>49,50</sup> The social development model hypothesizes that families and schools that provide youths with opportunities for active, contributing involvement; that ensure that youths develop competency or skills for participation; and that consistently reinforce effort and skillful participation in school and family, produce strong bonds between young people and these social units. Following control theory, the social development model hypothesizes that strong bonds to school and family protect youths against socially unacceptable behaviors, including early sexual intercourse and unprotected sexual behavior.

Based on the social development model,<sup>46,51</sup> the SSDP intervention sought to promote bonding to school and family by enhancing opportunities and reinforcement for children's active involvement in family and school, and by strengthening children's social competencies. The intervention included the following 3 components: teacher training, child social and emotional skill development, and parent training. These are described further in **Table 1**.

Each year during the elementary grades (grades 1 through 6), teachers in the intervention classrooms received 5 days of in-service training in a package of instructional methods<sup>52</sup> with 3 major components: proactive classroom management,<sup>53</sup> interactive teaching,<sup>54</sup> and cooperative learning.<sup>55</sup> Teachers of control students did not receive training in instructional or classroom management skills from the project. Both intervention and control teachers were observed for 50 minutes on 2 different days during fall and spring each year using the Interactive Teaching Map.<sup>56,57</sup> This structured observation system provides assessment of the degree to which teachers are using the proactive classroom management, interactive teaching, and cooperative learning methods outlined in Table 1. These controlled observations indicated greater use of the targeted instructional and management methods in the intervention classrooms than in the control classrooms. Effects of implementation of the projects' instructional methods on students' social development and achievement, and mediators of the sexual behavior-related outcomes investigated here, have been reported elsewhere.<sup>58</sup>

Second, prior to the school year, first-grade teachers in the full-intervention group received instruction in the use of a cognitive and social skills training curriculum, Interpersonal Cognitive Problem Solving,<sup>59,60</sup> which teaches children the skills to identify a problem, generate alternative solutions, and choose and implement the chosen solution. This curriculum sought to develop children's skills for involvement in cooperative learning groups and other social activities, without resorting to aggressive or other problem behaviors. Additionally, during grade 6, a study consultant provided students in the full-intervention group

**Table 1. Seattle Social Development Project Interventions**

Component 1: teacher training in classroom instruction and management	
Proactive classroom management	
Establish consistent classroom expectations and routines at the beginning of the year	
Give clear, explicit instructions for behavior	
Recognize and reward desirable student behavior and efforts to comply	
Use methods that keep minor classroom disruptions from interrupting instruction	
Interactive teaching	
Assess and activate foundation knowledge before teaching	
Teach to explicit learning objectives	
Model skills to be learned	
Frequently monitor student comprehension as material is presented	
Reteach material when necessary	
Cooperative learning	
Involve small teams of students of different ability levels and backgrounds as learning partners	
Provide recognition to teams for academic improvement of individual members over past performance	
Component 2: child social and emotional skill development	
Interpersonal problem-solving skills	
Communication	
Decision making	
Negotiation	
Conflict resolution	
Refusal skills	
Recognize social influences to engage in problem behaviors	
Identify consequences of problem behaviors	
Generate and suggest alternatives	
Invite peer(s) to join in alternatives	
Component 3: parent training	
Behavior management skills	
Observe and pinpoint desirable and undesirable child behaviors	
Teach expectations for behaviors	
Provide consistent positive reinforcement for desired behavior	
Provide consistent and moderate consequences for undesired behaviors	
Academic support skills	
Initiate conversation with teachers about children's learning	
Help children develop reading and math skills	
Create a home environment supporting of learning	
Skills to reduce risks for drug use	
Establish a family policy on drug use	
Practice refusal skills with children	
Use self-control skills to reduce family conflict	
Create new opportunities in the family for children to contribute and learn	

with 4 hours of training in skills to recognize and resist social influences to engage in problem behaviors and to develop positive alternatives to stay out of trouble while maintaining friendships.<sup>61</sup> Children in the intervention group, therefore, received child social and emotional skills training during grades 1 and 6, and teacher interventions during all grades from 1 through 6.

Third, parent training was offered on a voluntary basis to the parents or adult caretakers of children in intervention classrooms. Child behavior management skills training was offered when children were in the first and second grades through a 7-session curriculum, "Catch 'Em Being Good,"<sup>62</sup> grounded in the work of Patterson et al.<sup>63</sup> In the spring of second grade and again in the third grade, parents were offered a 4-session curriculum, "How to Help Your Child Succeed in School,"<sup>64</sup> to strengthen their skills for sup-

**Table 2. Analyses of Attrition and Intervention Group Distribution**

Factor*	Original Sample			Analysis Sample			Internal Validity†
	Control Group (n = 220)	Full-Intervention Group (n = 156)	Total No. (376)	Control Group (n = 205)	Full-Intervention Group (n = 144)	Total No. (349)	
Gender (male), %	54	51	376	52	51	349	$\chi^2_1 = 0.035 (P = .85)$
Race/ethnicity (white), %	45	47	376	46	47	349	$\chi^2_1 = 0.026 (P = .87)$
Poverty, %	43	41	360	42	42	349	$\chi^2_1 = 0.128 (P = .72)$
Mean family size	4.5	4.8	337	4.5	4.8	315	$t_{313} = 1.50 (P = .13)$
Mother's education, mean	4.1	4.3	328	4.2	4.4	307	$t_{305} = 1.52 (P = .13)$
Church attendance, mean	2.5	2.5	358	2.5	2.6	335	$t_{333} = 0.278 (P = .78)$
Mean age at age-21 survey, y	21.4	21.3	376	21.3	21.3	349	$t_{347} = -1.09 (P = .28)$

\*Poverty refers to participation in the federal free or reduced-price school lunch program between the fifth and seventh grades; mean family size is a continuous measure of the number of people currently living in the home; mother's education, the highest level of education mothers had completed by the time their participation child was in the eighth grade (1 = some or all of elementary school, 2 = some or all of middle school, 3 = some high school, 4 = 4 years of high school, 5 = some college, 6 = 4 or more years of college,); and church attendance, participants' typical church attendance (1 = once a year or never; 2 = 2 or 3 times a year; 3 = once or twice a month; 4 = once a week).

†This analysis compares distribution on each factor by treatment condition for those retained in the sample.

porting their children's academic development. During grades 5 and 6, parents were offered a 5-session curriculum "Preparing for the Drug (Free) Years,"<sup>65</sup> designed to strengthen their skills to reduce their children's risks for drug use. Parents of 43% of children in the full-intervention group attended parenting classes. Overall, children in the full-intervention group received the SSDP intervention for at least one semester in grade 1, 2, 3, or 4, and for at least one semester in grade 5 or 6; thus participating in the intervention in both early and late elementary grades.

In summary, the intervention was focused on enhancing the socialization processes specified by the social development model during grades 1 through 6. No content specific to sexual behavior was provided. The full intervention, delivered in grades 1 through 6, has demonstrated effects in significantly reducing sexual behavior at age 18 years.<sup>66</sup> This article examines the effects of the full SSDP intervention on sexual behavior (age of sexual onset, condom use, and sexual partners), pregnancy, birth, and STD outcomes at age 21 years.

## RESULTS

### DESCRIPTIVE STATISTICS

#### Demographics

Of the 349 full-intervention and control participants with data at age 21 years, 179 participants (51%) were males and 170 participants (49%) were females. The mean age of participants at the time of the fifth-grade survey (fall 1985) was 10.8 years. At the time of the age-21 survey, participants' ages averaged 21.3 years. The distribution by ethnic groups was as follows: white, 163 participants (47%); African American, 89 participants (26%); Asian American, 74 participants (21%); and other ethnic groups, 23 participants (7%). Fifty-five percent of the sample had experienced poverty, as indicated by eligibility for the federal free lunch program between the fifth and seventh grades. Marital status at the time of the age-21 interview was as follows: single, 260 participants (75%); married, 31 par-

ticipants (9%); living with partner, 52 participants (15%); and separated/divorced, 6 participants (2%).

#### Sexual Activity and Age at Onset

Ninety-three percent of the sample were sexually active by the age-21 assessment. Males reported a significantly earlier mean age at sexual onset than did females (15.7 years vs 16.3 years, respectively;  $P < .05$ ). Controlling for poverty, age at sexual initiation also varied significantly ( $P < .001$ ) by ethnic group, with African Americans reporting the earliest mean age at sexual debut (15.1 years) and Asian Americans reporting the latest (16.8 years). Mean age at sexual initiation for white participants was 16.0 years, and for those in other ethnic groups, it was 16.1 years.

#### Condom Use

Among the 317 individuals who were sexually active by age 21 years, 67% used condoms the first time they had sex. Females were significantly more likely to report condom use than were males (74% vs 59%, respectively;  $P < .01$ ). There were no significant differences in condom use frequencies during first intercourse across ethnic groups. Among the 240 single individuals who were sexually active by age 21 years, 49% used condoms during their last intercourse experience. There were no significant associations between condom use during last sexual intercourse and either gender or ethnicity.

Frequency of condom use varied among the 223 currently sexually active, single individuals in the sample. Thirty-one percent reported using latex protection "most of the time" during the past year. There were no significant differences in past-year condom use across gender or ethnicity.

#### Sexual Partners

Thirty-eight percent of the sample reported having 6 or more lifetime sexual partners. The average number of sexual partners reported was 3.9. Males reported significantly more

**Table 3. Continuous Outcomes by Intervention Group\***

Outcome	Full-Intervention Group	Control Group	Mean Difference (95% CI)
Mean age at first sexual experience, y	16.32 ± 2.34 (n = 131)	15.75 ± 2.35 (n = 188)	-0.57 (1.09 to -0.09)†
Frequency of condom use in past year among single individuals, No. of uses	3.28 ± 1.37 (n = 81)	3.12 ± 1.45 (n = 142)	-0.16 (-0.55 to 0.23)
No. of lifetime sexual partners†	3.58 ± 2.20 (n = 144)	4.13 ± 2.05 (n = 205)	0.55 (0.10 to 1.0)†

\*All data are presented as mean ± SD (participants); CI indicates confidence interval.

† $P < .05$ .

sexual partners than did females (mean number of partners, 4.14 and 3.68, respectively;  $P < .05$ ). Controlling for poverty, differences in the mean number of sexual partners varied significantly by ethnic group ( $P < .001$ ). African Americans reported the highest mean number of sexual partners (4.5 partners), followed by white participants (4.1 partners), those in the other ethnic groups (3.8 partners), and finally Asian Americans (2.8 partners).

### Pregnancy, Birth, and Sexually Transmitted Disease

Experiencing a pregnancy was common in this sample ( $n = 349$ ), with 41% reporting having experienced or caused a pregnancy by the age-21 survey. Females were significantly more likely than males to report having experienced or caused a pregnancy (48% vs 35%, respectively;  $P < .05$ ). Twenty-six percent of the total sample reported experiencing or causing a birth by age 21 years. Females were significantly more likely to report a birth than males (33% vs 20%, respectively;  $P < .01$ ). Both of these gender differences are likely to be influenced by the relatively greater certainty of females vs males regarding whether pregnancy or birth outcomes have occurred. Fifteen percent of the sample reported having been diagnosed with STD during their lifetimes. Females were significantly more likely than males to report a STD diagnosis (21% vs 10%, respectively;  $P < .01$ ).

### TESTS OF INTERVENTION EFFECTS

Multiple imputation<sup>72,73</sup> was used to estimate parameters. Multiple imputation represents an advancement over standard missing data strategies such as listwise and pairwise deletion, which have been shown to systematically underestimate means, variances, and covariances, and thus to produce biased results.<sup>74</sup> In contrast, multiple imputation techniques have been found to produce maximally unbiased parameter estimates.<sup>73</sup> The NORM multiple imputation program<sup>75</sup> was used for imputing data. This program has been shown to impute unbiased estimates for both continuous and dichotomous variables.<sup>73,75</sup>

There was a minimal amount of missing data overall, with only 7% of the 5584 data points missing. Three imputed data sets were created for the present analyses. As shown by Rubin,<sup>72</sup> 3 imputations will produce valid inferences in a data set in which data missing for any variable does not exceed 20%. Condition effect analyses were performed separately with each of the 3 data sets. Resulting unstandardized  $\beta$  coefficients and standard errors were entered back into the NORM program,<sup>75</sup> which

computed the average of the regression coefficients and the overall standard errors.

### REGRESSION RESULTS

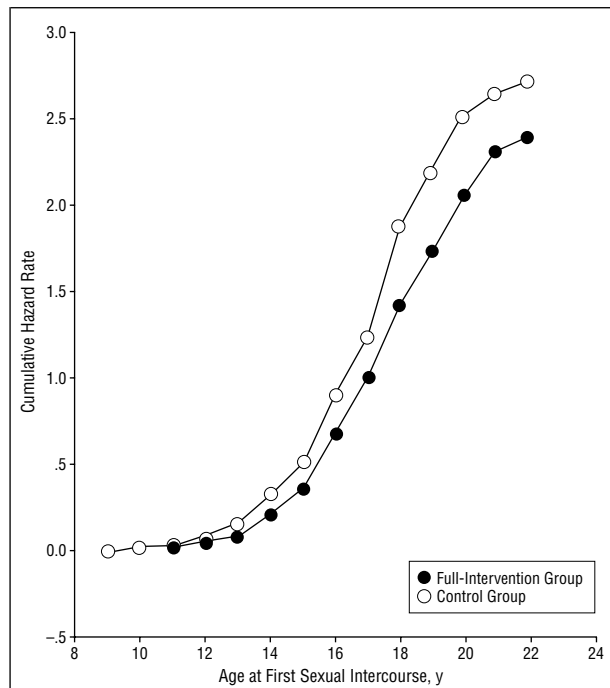
Means by treatment group for each continuous outcome are displayed in **Table 3**.

#### Age at First Sexual Experience

As shown in Table 3, on average, those in the full-intervention group had their first sexual experience significantly later (age 16.3 years) than those in the control group (age 15.8 years,  $P < .05$ ). Using survival analysis to examine this outcome, each person was coded as a “1” (if they initiated intercourse) or a “0” (if they did not initiate intercourse) at each age between 9 and 22 years. There were 26 right-censored participants who did not initiate intercourse by the age-21 survey. Because the Cox proportional hazards model assumes that the effect of predictors on hazards is proportional over time (Statistical Product and Service Solutions 7.0; SPSS Inc, Chicago, Ill), the question of nonproportional hazards was first examined by creating a time  $\times$  treatment group interaction variable and testing its significance. The interaction was not significant ( $P = .21$ ), indicating that the hazard function for the treatment groups was proportional over time. The Cox proportional hazard was marginally significant ( $P < .10$ ), suggesting that the full intervention produced a marginally significant effect in reducing the overall relative risk for engaging in sexual intercourse for the first time before age 21 years. As shown in **Figure 1**, the control group had a higher hazard or cumulative risk for initiating intercourse than the full-intervention group.

#### Condom Use

There was not a significant main effect of the full intervention on past-year condom-use frequency among single individuals at age 21 years. However, after controlling for poverty, the intervention by ethnic group interaction effect for this outcome was statistically significant ( $P < .05$ ). The difference in condom use frequency between the full-intervention group and the control group was significantly greater for single African Americans than for single non-African Americans. For example, 50% of single African Americans in the full-intervention group reported always using a condom, compared with 12% of single African Americans in the control group—a difference of 38%. Among single non-African Americans, the



**Figure 1.** Cumulative hazard rate for age at first sexual intercourse by intervention group (N=337). Differences are statistically significant at  $P < .10$ . The nonimputed data set was used for figure construction, resulting in a sample size of 337.

difference in prevalence across intervention groups was only 9%.

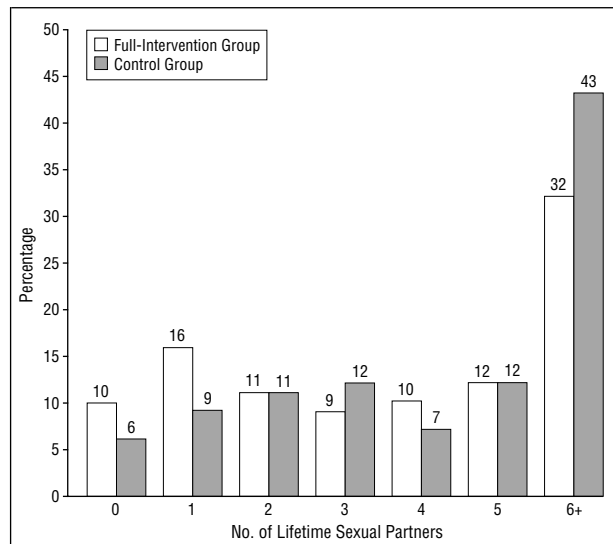
### Sexual Partners

On average, those in the full-intervention group reported significantly fewer sexual partners in their lifetimes than did those in the control group ( $P < .05$ ). As **Figure 2** illustrates, the difference between the full-intervention group and control group was especially pronounced for those reporting the greatest number of partners, with 43% of the control group reporting 6 or more partners compared with only 32% of the full-intervention group.

With regard to dichotomous outcomes, **Table 4** shows the prevalences of condom use at first and last intercourse in addition to lifetime STD for the full-intervention and control groups.

### Condom Use

There was not a significant main effect of intervention on condom use during first intercourse. However, those in the full-intervention group were significantly more likely to report condom use during last intercourse than those in the control group. Sixty percent of those in the full-intervention group used condoms during last intercourse, compared with 44% of those in the control group. After controlling for poverty, the treatment  $\times$  ethnic group interaction was significant for condom use during last intercourse ( $P < .05$ ; odds ratio, 5.84), indicating that the difference in last condom use between the full-intervention group and the control group was significantly greater for single African Americans than



**Figure 2.** Percentage of full-intervention and control groups reporting lifetime sexual partners.

for single non-African Americans. More specifically, 79% of African Americans in the full-treatment group reported using a condom during last intercourse, compared with 36% of African Americans in the control group. Among non-African Americans, 56% of those in the full-treatment group reported using a condom during last intercourse, compared with 47% of those in the control group.

### STD Diagnosis

There was not a significant main effect of treatment group on STD diagnosis. However, after controlling for poverty, the ethnic group  $\times$  treatment group interaction was significant for this outcome ( $P < .01$ ; odds ratio, 0.11). Among African Americans, only 7% of those in the full-intervention group, compared with 34% of those in the control group, reported being diagnosed with a STD over their lifetimes. Among non-African Americans, 14% of those in the full-intervention group reported a STD diagnosis, compared with 11% of those in the control group. Therefore, the difference between the full-intervention group and the control group was 27% for African Americans, but only 3% for non-African Americans.

### Pregnancy and Birth

**Table 5** displays the proportion of females in each group reporting pregnancies and births and the proportion of males in each group reporting having caused pregnancies or births by age 21 years. Females in the full-intervention group were significantly less likely both to become pregnant ( $P < .05$ ) and to have a baby ( $P < .05$ ) by age 21 years than were females in the control group. Fifty-six percent of the control females compared with 38% of the females in the full-intervention group had been pregnant by age 21 years, and 40% of the control females had given birth compared with only 23% of the females in the full-intervention group. In contrast, as pre-

**Table 4. Prevalence of Condom Use and STD Outcomes by Intervention Group\***

Outcome	Full-Intervention Group	Control Group	Odds Ratio (95% CI)
Condom use during first intercourse			
Used condoms	73 (131)	66 (192)	1.42 (0.87-2.30)
Condom use during last intercourse among single individuals			
Used condoms	60 (89)	44 (154)	1.88 (1.11-3.19)†
Lifetime STD			
Reported STD	13 (144)	18 (205)	0.67 (0.38-1.27)

\*All data are presented as percentage (number). STD indicates sexually transmitted disease; CI, confidence interval.

† $P < .05$ .

sented in Table 5, the proportion of males in each group who reported causing a pregnancy or birth did not differ significantly.

### COMMENT

These analyses provide evidence that a theory-based intervention that promoted improved classroom management and instruction, children's social competence, and parenting practices during the elementary grades, can reduce potentially dangerous sexual behaviors and their outcomes among young people. By age 21 years, those in the SSDP full-intervention group reported significantly fewer lifetime sexual partners. Significantly more single people in the full-intervention group reported condom use during last intercourse than did those in the control group. The delay in age of sexual onset by half a year for those in the full-treatment group is also a notable finding.

After controlling for socioeconomic status, important treatment  $\times$  ethnic group interaction effects were also found. Perhaps most striking is the decreased probability of contracting an STD by age 21 years among African Americans in the full-intervention group. A greater proportion of single African Americans in the full-intervention group also reported protecting themselves from STD through the use of condoms at last intercourse, suggesting that greater use of condoms may be the mechanism producing this reduction in STD among African Americans.

It is also noteworthy that significantly fewer females in the full-intervention group than in the control group had been pregnant and had given birth by age 21 years, though the proportions of males in each group who reported causing pregnancy or birth did not differ. The absence of effects on these outcomes for males may reflect a relative lack of knowledge pertaining to these outcomes. However, these gender differences in intervention effects may also reflect unique responses to the intervention itself. Females may have more to lose from becoming pregnant and having children early in life. (There is some evidence, for example, that teen fatherhood is less detrimental than teen motherhood in terms of future occupational success).<sup>76</sup> Therefore, while the intervention may have enhanced the commitment of both males and females in the full-intervention group to healthy and prosocial lifestyles, for females, avoiding pregnancies and births may be a more important step toward ensuring the realization of such aspirations.

**Table 5. Prevalence of Lifetime Pregnancy and Birth Outcomes for Females and Males by Intervention Group\***

Outcome	Full-Intervention Group	Control Group	Odds Ratio (95% CI)
Females	N = 71	N = 99	
Reported a lifetime pregnancy	38	56	0.50 (0.27-0.93)†
Reported a lifetime birth	23	40	0.42 (0.21-0.84)†
Males	N = 73	N = 106	
Reported causing pregnancy	34	36	0.95 (0.51-1.78)
Reported fathering a child	23	20	1.22 (0.59-2.53)

\*All data are presented as percentages unless otherwise stated. CI indicates confidence interval.

† $P < .05$ .

Despite the scope of the problem, a limited number of prevention programs have shown significant and meaningful effects on sexual behavior and STD outcomes.<sup>23,28</sup> The present SSDP intervention is quite different from many of the interventions that have previously been studied for effects on such outcomes. SSDP included no sex education. In fact, it involved no discussion of sex at all. These results support social developmental hypotheses regarding the importance of providing children with opportunities for active involvement in the classroom and family; recognition for participation in these social units; and the social, emotional, and cognitive skills to effectively participate in school and family during the elementary grades.

Previously reported findings support the hypotheses that teachers who use better classroom management and instructional practices when children are in the elementary grades strengthen children's bonds of attachment and commitment to school.<sup>58</sup> The present results are consistent with the hypothesis that strengthening children's bonds to prosocial participation will have wide-ranging effects in reducing health-compromising behaviors.<sup>66</sup> The present results indicate that enhancing social development in the elementary school period can reduce risky sexual behavior through age 21 years and can be of particular benefit for 2 groups who may be especially at risk for being harmed by those behaviors: females and African Americans.

Significant effects were observed for multiple behaviors many years after the completion of the interven-

### What This Study Adds

Despite public concern regarding adolescent pregnancy and STD, there is a paucity of well-evaluated prevention programs effective in preventing risky sexual behavior. Although existing evaluations have generated mixed findings, they have identified important components of effective programs, including a theoretical foundation, a reasonable treatment duration or dose, and the inclusion of youths who have not yet initiated sexual activity. In line with these criteria, SSDP included a 6-year intervention with youth in the elementary grades. Guided theoretically by the social development model, the SSDP intervention sought to promote bonding to school and family by enhancing opportunities and reinforcement for active involvement of children in family and school, and by strengthening children's social competencies. This evaluation shows that the SSDP intervention had long-term effects in preventing risky sexual practices and adverse health consequences in early adulthood. It is particularly noteworthy that these effects were achieved despite the fact that the SSDP intervention included no sex education and involved no discussion of sex at all.

tion. These results suggest the importance of social developmental mechanisms in affecting subsequent sexual behavior among youth and young adults. They support the promotion of academic success, social competence, and social bonding as important for the prevention of risky sexual behavior and its consequences.

Accepted for publication January 28, 2002.

This research was supported by research grants from the National Institute on Drug Abuse (1R01DA09679) and the Robert Wood Johnson Foundation. Points of view are those of the authors and are not the official positions of the funding agencies.

We thank David P. Farrington, PhD, for his comments on drafts of the manuscript.

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