ELSEVIER

Journal of Adolescent Health 42 (2008) 344–351

JOURNAL OF ADOLESCENT HEALTH

Original article

Abstinence-Only and Comprehensive Sex Education and the Initiation of Sexual Activity and Teen Pregnancy

Pamela K. Kohler, R.N., M.P.H.[a,c], Lisa E. Manhart, Ph.D.[b,c], and William E. Lafferty, M.D.[a,*]

[a]*Departments of Health Services and*
[b]*Epidemiology, and the*
[c]*Center for AIDS and STD, University of Washington, Seattle Washington*

Manuscript received April 17, 2007; manuscript accepted August 29, 2007

See Editorial p. 324

Abstract

Purpose: The role that sex education plays in the initiation of sexual activity and risk of teen pregnancy and sexually transmitted disease (STD) is controversial in the United States. Despite several systematic reviews, few epidemiologic evaluations of the effectiveness of these programs on a population level have been conducted.

Methods: Among never-married heterosexual adolescents, aged 15–19 years, who participated in Cycle 6 (2002) of the National Survey of Family Growth and reported on formal sex education received before their first sexual intercourse (n = 1719), we compared the sexual health risks of adolescents who received abstinence-only and comprehensive sex education to those of adolescents who received no formal sex education. Weighted multivariate logistic regression generated population-based estimates.

Results: Adolescents who received comprehensive sex education were significantly less likely to report teen pregnancy (OR_{adj} = .4, 95% CI = .22– .69, p = .001) than those who received no formal sex education, whereas there was no significant effect of abstinence-only education (OR_{adj} = .7, 95% CI = .38–1.45, p = .38). Abstinence-only education did not reduce the likelihood of engaging in vaginal intercourse (OR_{adj} = .8, 95% CI = .51–1.31, p = .40), but comprehensive sex education was marginally associated with a lower likelihood of reporting having engaged in vaginal intercourse (OR_{adj} = .7, 95% CI = .49–1.02, p = .06). Neither abstinence-only nor comprehensive sex education significantly reduced the likelihood of reported STD diagnoses (OR_{adj} = 1.7, 95% CI = .57–34.76, p = .36 and OR_{adj} = 1.8, 95% CI = .67–5.00, p = .24 respectively).

Conclusions: Teaching about contraception was not associated with increased risk of adolescent sexual activity or STD. Adolescents who received comprehensive sex education had a lower risk of pregnancy than adolescents who received abstinence-only or no sex education.

Keywords: Sexually transmitted disease; Teen pregnancy; Sex education; Abstinence

Rates of sexually transmitted disease (STD), teen pregnancy, and teen births are higher in the United States than in most other industrialized countries [1,2]. In a 2000 study of STD incidence among 16 developed countries, the rates of syphilis, gonorrhea and chlamydia in the United States (U.S.) were exceeded only by those in Romania and the Russian Federation [2]. Although there are minimal differences in levels of sexual activity across developed countries (Sweden, France, Canada, Great Britain, and the U.S.) [3], teen pregnancy, birth rates and abortion rates are higher in the U.S. than in other developed countries [1]. In 1995 adolescent pregnancy rates were 83.6 per 1000 in the U.S. compared with 47.0 in England and Wales, 45.4 in Canada, 20.2 in France, and 24.9 in Sweden.

In the U.S., although 15–24-year-olds represent only

*Address correspondence to: William E. Lafferty, M.D., Associate Professor/Director, Department of Health Services, Health & Policy Research Track, Health Sciences Center, Box 357660, Seattle, WA 98195-7660.

E-mail address: billlaf@u.washington.edu

1054-139X/08/$ – see front matter
doi:10.1016/j.jadohealth.2007.08.026

25% of the sexually active population, they account for nearly one-half of all new sexually transmitted infections [4], and rates are highest among young women and minorities [5]. Compared with male adolescents of the same age, rates of gonorrhea among 15–19-year-old women are more than twice as high (624.7 vs. 261.2 per 100,000), and rates of chlamydia are more than five times higher (2796.6 vs. 505.2 per 100,000). Among African-American adolescents aged 15–19 years, the 2005 rate of gonorrhea was 14 times greater than the rate among white female adolescents of similar age (2814 vs. 204.7 per 100,000).

Formal school-based or church-based sex education programs aimed at reducing risks of teenage pregnancy and STD acquisition generally promote one of two types of messages regarding sexual activity: (1) abstinence-only messages, or (2) comprehensive sex education messages. Abstinence-only messages teach that sex should be delayed until marriage, and discussion of birth control methods is typically limited to statements about ineffectiveness [6]. Comprehensive programs include abstinence messages, but also provide information on birth control methods to prevent pregnancy and condoms to prevent STDs.

Although several avenues of federal funding for formal sex education programs are available, all require adherence to abstinence-only messages. In 1996 Congress introduced Section 510(b) of Title V of the Social Security Act, allocating federal dollars for state initiatives promoting abstinence-only programming and establishing criteria for defining abstinence education. To receive federal Title V funding, a sex education program must have as its exclusive purpose "teaching the social, psychological, and health gains to be realized by abstaining from sexual activity" [7]. These programs must teach that abstinence from sexual activity outside marriage is the expected standard for all school-age children and the only certain way to avoid out-of-wedlock pregnancy and STDs.

Over the past 5 years, U.S. fiscal policy has allocated increasing amounts of funding to abstinence-only prevention programs. In 2001 abstinence-only education programs received $80 million in federal funding [6], and by 2005 federal funding had more than doubled to $167 million [8]. The 2008 fiscal year budget proposes $204 million for abstinence education [9]. Consistent with this increase in funding, analyses of Cycle 5 (1995) and Cycle 6 (2002) of the National Survey of Family Growth (NSFG) revealed that whereas only 9.3% of adolescents aged 15–19 received abstinence-only education in 1995, nearly a quarter (23.8%) did so in 2002 [10].

Systematic reviews suggest that the effects of abstinence-only programs on sexual risk behavior have been minimal, and that initiation of sexual activity is not hastened by receiving instruction about measures for safer sex [11–15]. However the majority of reviewed trials have been conducted in specific subgroups of the population, and there have been no population-level evaluations of the effectiveness of these programs. In addition the question of whether comprehensive or abstinence-only sex education is most effective at reducing risk for teen pregnancy and STD has stimulated a heated and politicized debate. To address this gap in the evidence, we used data from Cycle 6 of the NSFG to determine whether STD and pregnancy risk is significantly different based on the type of formal sex education adolescents receive and whether teaching about contraception increases risk for sexual activity before marriage.

Methods

The NSFG is a nationwide survey conducted by the National Center for Health Statistics. Data were collected in collaboration with the University of Michigan's Institute for Social Research by trained personnel, from January 2002 to March 2003, through an in-home interview process that included Audio Computer-Assisted Self-Interviewing (ACASI). Overall information collected included basic demographics; knowledge, attitudes, and beliefs regarding family planning issues; and self-reported sexual behavior and previous diagnoses of STDs.

Sample

The NSFG is based on an area probability sample designed to represent the national noninstitutionalized population 15–44 years of age. It includes responses from 12,571 male and female individuals from across the United States. The adolescent subset of this cohort (aged 15–19 years) was asked additional questions related to sex education, sexual behavior, pregnancy and STDs. A total of 1150 adolescent girls and 1121 adolescent boys responded to the NSFG general questionnaire and special adolescent interview.

To assess the effect of formal sex education programs on pregnancy and STD risk, the sample was restricted to never-married heterosexual teens aged 15–19 years who reported no formal sex education, formal sex education on "how to say no to sex" only (abstinence-only), or formal sex education covering both "saying no to sex" and teaching about birth control (comprehensive).

We excluded respondents who were married (n = 36), in whom formal sex education programs would not be expected to delay sexual debut or reduce risk for pregnancy. Individuals reporting sexual orientation other than heterosexual were also excluded (n = 318), as programs do not address same-sex behaviors. We further excluded respondents who reported exposure to sex education that taught only birth control without mentioning abstinence, as such programs were not consistent with our definitions of either abstinence-only or comprehensive programs (n = 111), as well as respondents who did not answer sex education questions (n = 1) or who reported an age of first intercourse <10 years (n = 8). To ensure temporal sequence in our assessment of whether formal sex education delayed sexual initiation or reduced teen pregnancy, we excluded those who reported first vaginal intercourse before formal sex education. We computed this by adding 5 years to

Table 1
Characteristics of heterosexual adolescents aged 15–19 years reporting on sex education (none, abstinence only or comprehensive) in the 2002 Cycle 6 of the National Survey of Family Growth (NSFG) (population and sample, n = 1719)

Characteristic	Total	No sex education: Weighted % (95%CI) n = 168	Abstinence-only education: Weighted % (95% CI) n = 390	Comprehensive sex education: Weighted % (95% CI) n = 1161
Overall		9.4	23.8	66.8
Age[a]	Mean = 17.0 (±.04)	Mean = 17.2 (±.12)	Mean = 16.8 (±.10)	Mean = 17.1 (±.05)
Gender				
Female	47.4	42.0 (34.5–50.0)	45.4 (39.1–51.9)	48.8 (44.7–52.9)
Male	52.6	58.0 (50.0–65.5)	54.6 (48.1–60.9)	51.2 (47.1–55.3)
Race/ethnicity				
White	76.7	69.4 (60.2–77.2)	75.1 (69.3–80.2)	78.2 (74.4–81.6)
Black	14.0	19.2 (12.8–27.8)	16.4 (12.0–21.9)	12.5 (10.2–15.2)
Other	9.3	11.4 (6.8–18.6)	8.5 (5.5–13.0)	9.3 (7.1–12.0)
Household income quartile (per year)[a]				
<$20,000	23.7	36.9 (28.4–46.3)	24.9 (20.5–29.9)	21.4 (18.6–24.6)
$20,000–39,999	27.0	23.0 (17.1–32.5)	32.6 (27.0–38.8)	25.6 (22.4–29.1)
$40,000–74,999	27.3	18.2 (12.4–25.9)	24.3 (20.0–29.2)	29.7 (26.7–32.8)
>$75,000	21.9	21.9 (13.7–33.1)	18.2 (13.8–23.6)	23.3 (19.8–27.1)
Residence[a]				
Metropolitan, central city	53.3	39.0 (27.4–52.1)	53.4 (44.9–61.6)	55.3 (48.7–61.7)
Metropolitan, not central city	27.0	26.8 (17.6–38.5)	24.7 (19.2–31.2)	27.9 (22.9–33.5)
Not metropolitan	19.7	34.2 (21.2–50.1)	22.0 (14.6–31.7)	16.8 (11.2–24.5)
Nonintact family unit[ab]	41.3	53.8 (43.5–63.8)	36.9 (31.1–43.1)	41.2 (37.7–44.8)

[a] Design-based Pearson χ^2 test for difference between categories significant at $p < .05$.
[b] Intact family unit defined as adolescent residing with the same two biological or adoptive parents from birth until age 18 years or living on own.

the grade at sex education and subtracting age at first sex education from age at first sex (n = 60). Another 18 adolescents who reported teen pregnancy or using birth control at last sex but reported no vaginal sex were also excluded (n = 18).

Type of formal sex education

Exposure to specific types of sex education was measured based on two separate questions. The first asked whether respondents, before the age of 18 years, ever received "any formal instruction at school, church, a community center, or some other place about how to say no to sex." A follow-up question asked the same about receiving instruction about methods of birth control. Individuals who reported birth control education in addition to education emphasizing saying no to sex were classified as having participated in comprehensive sex education. Respondents who reported only receiving sex education about how to say no to sex were classified as participants in abstinence-only programs.

Measures of adolescent sexual risk

We examined three dichotomous measures of adolescent sexual risk: ever having engaged in vaginal intercourse; pregnancy; and STD. Self-report of ever having had vaginal sex was coded as ever/never, and teen pregnancy was assessed by computing the total number of pregnancies reported by males and females by ACASI. Prior STD diagnosis was assessed by self-report of chlamydia, gonorrhea in the last year, or ever having been diagnosed with herpes, genital warts, or syphilis.

Characteristics previously associated with adolescent sexual risk behaviors were assessed as potential confounding factors and included: respondent age (integer years 15–19), household income quartiles (<$20,000; $20,000–39,999; $40,000–74,999; >$75,000), race/ethnicity (black, white, other), residence (rural, suburban, central city) and intactness of the family unit (residing with the same two biological/adoptive parents since birth).

Analysis

We conducted a stratified weighted analysis to account for the complex survey design of the NSFG using STATA 9 (Stata Corp., College Station, TX). A design based Pearson's χ^2 test was used to compare proportions, and weighted multivariate logistic regression was used to determine the association of type of formal sex education with measures of sexual risk (engaging in vaginal sex, pregnancy and STD). Covariates were retained in the model if they were significantly associated with the outcome and/or if their inclusion substantially changed the estimates for type of sex education by ≥10%. Although we performed analyses stratified by gender, there were no substantive differences in results; thus we present combined analyses.

Results

Population, sample, and sex education

Of the 1719 never-married heterosexual adolescents included in these analyses, 47.4% were female (Table 1). The

Table 2
Characteristics associated with report of ever engaging in vaginal intercourse among heterosexual adolescents aged 15–19 years reporting on sex education (none, abstinence-only, or comprehensive) in the 2002 Cycle 6 of the National Survey of Family Growth (NSFG)

Characteristic	Ever had vaginal intercourse: Weighted % (95%CI)	Never had vaginal intercourse: Weighted % (95%CI)	p**	Univariate OR (95% CI)	Multivariate†† OR (95% CI)
Sex education					
No sex education	11.5 (8.9–14.7)	7.6 (5.5–10.4)	.06	(Ref)	(Ref)
Abstinence-only sex education	22.6 (19.1–26.5)	25.0 (21.6–28.7)		.60 (.39–.92)*	.82 (.51–1.31)
Comprehensive sex education	66.0 (61.6–70.2)	67.4 (62.9–71.5)		.65 (.45–.95)*	.70 (.49–1.02)
Age (mean ± SE)	17.6 (±.06)	16.6 (±.06)	<.001§§	1.79 (1.58–2.02)‡§	1.91 (1.67–2.18)‡
Gender			.83		
Female	47.1 (42.4–51.8)	47.7 (43.9–51.6)		(Ref)	(Ref)
Male	52.9 (48.2–57.6)	52.3 (48.4–56.1)		1.02 (.81–1.29)	1.07 (.81–1.40)
Race/ethnicity			<.001		
White	73.2 (68.6–77.4)	79.6 (75.5–83.2)		(Ref)	(Ref)
Black	18.5 (14.6–23.0)	10.3 (8.2–12.8)		1.95 (1.46–2.61)‡	1.86 (1.35–2.58)‡
Other	8.3 (6.1–11.4)	10.1 (7.5–13.5)		.90 (.59–1.37)	.85 (.53–1.37)
Household income quartile (per year)			.02		
<$20,000	27.6 (24.2–31.2)	20.5 (17.6–23.7)		(Ref)	
$20,000–39,999	25.2 (21.6–29.1)	28.4 (24.8–32.3)		.89 (.81–.98)*¶	
$40,000–74,999	26.7 (23.2–30.6)	27.9 (24.7–31.4)			
>$75,000	20.6 (17.1–24.5)	23.2 (19.7–27.1)			
Residence			.002		
Metropolitan: Central City	48.1 (41.7–54.6)	57.6 (50.4–64.5)		(Ref)	
Metropolitan: Not Central City	31.8 (26.5–37.7)	23.0 (18.2–28.5)		1.66 (1.28–2.16)‡	
Not metropolitan	20.0 (13.5–28.7)	19.4 (13.1–27.8)		1.24 (.89–1.72)	
Nonintact family unit‡‡	49.3 (44.9–53.6)	34.5 (30.4–38.8)	<.001	1.85 (1.42–2.40)‡	2.29 (1.67–3.13)‡

CI = confidence interval; OR = odds ratio.
OR is significant at
* $p < .05$, † $p < .01$, ‡ $p < .001$.
§ OR represents increase in risk for each additional year.
¶ OR represents increase in risk for each additional income quartile.
** Design-based Pearson's χ^2 test for difference between categories unless otherwise specified.
†† ORs adjusted for all variables in the column. Further adjustment for income and residence did not appreciably change the estimates for type of sexual education and thus were not included.
‡‡ Intact family unit was defined as residing with the same two biological or adoptive parents from birth until age 18 years or living on own.
§§ p Value obtained by design-based t test

median age was 17 years; 76.7% were of white ethnicity and 14.0% black. Household incomes less than $40,000 per year were reported by half (50.7%) of the participants. The majority of respondents resided in a central city (53.3%), and 41.3% of respondents reported a nonintact family unit.

Overall 9.4% of participants reported that they had not received any sex education, whereas 23.8% reported abstinence-only education and 66.8% comprehensive sex education. Univariate analysis of sociodemographic characteristics revealed significant differences between type of education received with respect to age, income, residence, and family unit intactness. Generally individuals receiving no sex education tended to be from low-income nonintact families, black, and from rural areas. Participants reporting abstinence-only education were typically younger and from low-to-moderate–income intact families, whereas adolescents reporting comprehensive sex education were somewhat older, white, and from higher-income families and more urban areas.

Initiation of sexual activity

Almost half of respondents (46.3% of males and 45.7% of females) reported having engaged in vaginal intercourse by the time of the survey. In univariate analyses (Table 2), respondents who were older, black, from a lower-income household, resided in a noncentral city metropolitan area, and came from a nonintact family unit were significantly more likely to report ever having engaged in vaginal intercourse, whereas those who had received any type of formal sex education were less likely to report this ($p < .05$ for all). After adjustment for other significant predictors of engaging in vaginal intercourse (age, race, gender, and family intactness), abstinence-only education was not significantly associated with an adolescent ever engaging vaginal intercourse ($OR_{adj} = .8$, 95% CI = .51–1.31, $p = .40$), whereas comprehensive sex education was marginally associated with reduced reports of engaging in vaginal intercourse ($OR_{adj} = .7$, 95% CI = .49–1.02, $p = .06$).

Table 3
Characteristics associated with report of teen pregnancy among heterosexual adolescents ages 15–19 years reporting on sex education (none, abstinence-only, or comprehensive) in the 2002 Cycle 6 of the National Survey of Family Growth (NSFG)

Characteristic	Ever had teen pregnancy: Weighted % (95% CI)	No teen pregnancy: Weighted % (95% CI)	p**	Univariate OR (95% CI)	Multivariate†† OR (95% CI)
Sex education			.003		
No sex education	19.4 (13.2–27.4)	8.6 (6.6–11.0)		(Ref)	(Ref)
Abstinence-only sex education	27.1 (17.7–39.1)	23.6 (21.1–26.4)		.51 (.27–.98)*	.74 (.38–1.45)
Comprehensive sex education	53.5 (42.3–64.5)	67.8 (64.3–71.1)		.35 (.21–.60)‡	.39 (.22–.69)‡
Age (mean ± SE)	17.9 (±.11)	17.0 (±.04)	<.001§§	1.72 (1.46–2.02)‡§	1.87 (1.57–2.24)‡§
Gender			<.001		
Female	66.5 (54.6–76.5)	45.9 (42.7–49.1)		(Ref)	(Ref)
Male	33.5 (23.5–45.4)	54.1 (50.9–57.3)		.43 (.26–.70)‡	.44 (.26–.74)†
Race/ethnicity			.002		
White	66.7 (56.7–75.4)	77.4 (73.9–80.6)		(Ref)	(Ref)
Black	26.4 (18.6–36.0)	13.1 (10.7–16.0)		2.34 (1.49–3.67)‡	1.28 (.81–2.03)
Other	6.9 (3.0–15.3)	9.5 (7.4–12.0)		.85 (.35–2.07)	.72 (.28–1.85)
Household income quartile (per year)			<.001		
<$20,000	46.6 (37.6–55.9)	21.9 (19.4–24.7)		(Ref)	(Ref)
$20,000–39,999	25.7 (19.1–33.7)	27.2 (24.2–30.3)		.59 (.46–.74)‡¶	.69 (.53–.89)†¶
$40,000–74,999	15.4 (9.4–24.1)	28.3 (25.9–30.8)			
>$75,000	12.3 (6.9–20.9)	22.6 (19.7–25.9)			
Residence			<.001		
Metropolitan, central city	38.5 (28.7–49.4)	54.4 (48.0–60.7)		(Ref)	(Ref)
Metropolitan, not central city	43.6 (33.8–53.9)	25.7 (21.3–30.8)		2.39 (1.51–3.79)‡	1.83 (1.15–2.91)*
Not metropolitan	17.9 (10.3–29.4)	19.8 (13.7–27.9)		1.27 (.71–2.28)	.88 (.47–1.67)
Nonintact family unit‡‡	64.5 (53.9–73.8)	39.5 (36.4–42.8)	<.001	2.78 (1.75–4.41)‡	2.51 (1.54–4.08)‡
Birth control method at last intercourse	71.3 (61.2–79.6)	92.5 (88.8–95.0)	<.001	.20 (.11–.36)‡	.25 (.14–.48)‡¶¶

OR is significant at
* $p < .05$, † $p < .01$, ‡ $p < .001$.
§ OR represents increase in risk for each additional year.
¶ OR represents increase in risk for each additional income quartile.
** Design-based Pearson's χ^2 test for difference between categories unless otherwise specified.
†† ORs adjusted for all variables in the column except birth control at last intercourse.
‡‡ Intact family unit was defined as residing with the same two biological or adoptive parents from birth until age 18 years or living on own.
§§ p Value obtained by design-based t test.
¶¶ Adjusted for age, gender, race, income, residence, and family intactness.

Pregnancy

Among all respondents, 7.3% reported a pregnancy, although this was more common among females (10.2%) than males (4.7%) ($p < .001$). In univariate analyses, increased odds for teen pregnancy were significantly associated with older age, black race, lower household income, noncentral city metropolitan residence, and nonintact family unit status ($p < .05$) (Table 3).

In multivariate analyses adjusting for age, gender, race, income, residence, and family intactness, abstinence-only sex education was not significantly associated with reported teen pregnancy when compared with no sex education ($OR_{adj} = .7$, 95% CI = .38–1.45, $p = .38$). However adolescents who reported having received comprehensive sex education were significantly less likely to report a teen pregnancy compared with those who received no sex education at all ($OR_{ad\ j} = .4$, 95% CI = .22–.69, $p = .001$). The causal pathway intermediary of birth control use at last sexual intercourse was also associated with a decreased likelihood for reported pregnancy ($OR_{adj} = .3$, 95% CI = .13–.48, $p < .001$), adjusted for the same characteristics as teen pregnancy. Finally, when comparing adolescents who reported receiving a comprehensive sex education with those who received an abstinence-only education, comprehensive sex education was associated with a 50% lower risk of teen pregnancy ($OR_{adj} = .5$, 95% CI = .28– .96, $p = .04$).

Previous STD diagnosis

Few adolescents (3.4%) reported any prior STD diagnoses, and previous STD diagnoses were twice as common among females (4.8%) as among males (2.1%). In univariate analyses, increased likelihood of STD diagnosis was also significantly associated with older age, black race, and coming from a nonintact family unit (Table 4). However in multivariate analyses adjusted for age, gender, race, and family intactness, neither abstinence-only nor comprehensive sex education were significantly associated with risk for STD when compared with no sex education ($OR_{adj} = 1.7$, 95% CI = .57–4.76, $p = .36$; and $OR_{adj} = 1.8$, 95% CI =

Table 4
Characteristics associated with report of previous STD diagnoses among heterosexual adolescents aged 15–19 years reporting on sex education (none, abstinence only or comprehensive) in the 2002 Cycle 6 of the National Survey of Family Growth (NSFG)

Characteristic	Reported STD diagnosis: Weighted % (95% CI)	No reported STD diagnosis: Weighted % (95% CI)	p**	Univariate OR (95% CI)	Multivariate[††] OR (95% CI)
Sex education			.55		
No sex education	6.9 (3.0–15.4)	9.5 (7.4–11.9)		(Ref)	(Ref)
Abstinence-only sex education	19.7 (11.1–32.6)	24.0 (21.4–26.8)		1.12 (.39–3.22)	1.65 (.57–4.76)
Comprehensive sex education	73.4 (59.5–83.8)	66.6 (63.0–69.9)		1.50 (.56–4.00)	1.82 (.67–5.00)
Age (mean ± SE)	17.6 (±.15)	17.0 (±.04)	<.001§§	1.37 (1.14–1.65)‡§	1.45 (1.21–1.75)‡§
Gender			.03		
Female	66.9 (48.7–81.1)	46.7 (43.4–49.9)		(Ref)	(Ref)
Male	33.1 (18.9–51.3)	53.3 (50.1–56.6)		.43 (.20–.93)*	.47 (.21–1.06)
Race/ethnicity			.05		
White	64.1 (49.5–76.5)	77.1 (73.6–80.3)		(Ref)	(Ref)
Black	25.0 (15.4–38.1)	13.7 (11.1–16.7)		2.20 (1.14–4.25)*	1.67 (.85–3.27)
Other	10.9 (4.9–22.5)	9.2 (7.2–11.8)		1.42 (.56–3.55)	1.49 (.58–3.85)
Household income quartile (per year)			.33		
<$20,000	31.6 (20.0–46.0)	23.4 (20.9–26.2)		(Ref)	
$20,000–39,999	25.4 (15.8–38.1)	27.1 (24.2–30.2)		.80 (.61–1.06)¶	
$40,000–74,999	31.3 (17.1–50.1)	27.2 (24.8–29.7)			
>$75,000	11.8 (5.0–25.1)	22.3 (19.4–25.5)			
Residence			.50		
Metropolitan, central city	46.7 (31.3–62.7)	53.5 (47.3–59.7)		(Ref)	
Metropolitan, not central city	34.1 (21.6–49.2)	26.8 (22.3–31.8)		1.46 (.74–2.90)	
Not metropolitan	19.2 (10.0–33.6)	19.7 (13.6–27.8)		1.12 (.52–2.42)	
Nonintact family unit‡‡	72.2 (58.0–83.0)	40.2 (37.1–43.4)	<.001	3.85 (2.00–7.42)‡	3.93 (2.00–7.74)‡
Condom use at last vaginal intercourse	47.3 (31.8–63.3)	65.1 (61.0–68.9)	.03	.48 (.25–.94)*	.55 (.25–1.21)¶¶

CI = confidence interval; OR = odds ratio.
OR significant at
* $p < .05$, [†] $p < .01$, [‡] $p < .001$.
[§] OR represents increase in risk for each additional year.
[¶] OR represents increase in risk for each additional income quartile.
** Design-based Pearson's χ^2 test for difference between categories unless otherwise specified. Further adjustment for income and residence did not appreciably change the estimates for type of sexual education and were not included. Condom use at last intercourse was not considered in the model.
[‡‡] Intact family unit was defined as residing with the same two biological or adoptive parents from birth until age 18 years or living on own.
[§§] p Value obtained by design-based t-test.
[¶¶] Adjusted for age, gender, race, and family intactness.

.67–5.00, $p = .24$, respectively). The strongest predictor for STD was nonintact family unit status; such adolescents were four times more likely to report a previous diagnosis of STD ($OR_{adj} = 3.9$, 95% CI = 2.00–7.74, $p < .001$). Although condom use at last vaginal sex was significantly associated with a 50% decrease in odds of reported STD diagnoses in univariate analyses ($p = .03$), after adjusting for age, gender, race, and family intactness, this was no longer statistically significant, despite a similar odds ratio ($OR_{adj} = .55$, 95% CI = .24–1.20, $p = .13$).

Discussion

This assessment of the impact of formal sex education programs on teen sexual health using nationally representative data found that abstinence-only programs had no significant effect in delaying the initiation of sexual activity or in reducing the risk for teen pregnancy and STD. In contrast comprehensive sex education programs were significantly associated with reduced risk of teen pregnancy, whether compared with no sex education or with abstinence-only sex education, and were marginally associated with decreased likelihood of a teen becoming sexually active compared with no sex education.

As has been previously reported [10], receipt of formal sex education was associated with important sociodemographic characteristics including age, income, and residence. In addition, we also found a strong relationship between family intactness and receiving sex education. Teens from intact families were more likely to receive formal sex education than teens from nonintact families. Furthermore approximately 10% of teens ages 15–19 years participating in the NSFG had received no formal sex education at the time of the survey; these adolescents were most often nonwhite and from low-income families. Like many other health indicators, the opportunity for formal sex education appears to vary by social strata, with disadvantaged youth being the least likely to benefit from formal programs.

However a recent review suggests that abstinence-only programs, whether conducted in low- or middle-income settings, had similarly modest effects on risk behavior [14].

Our study is not the only recent work to suggest that abstinence-only education may not reduce sexual risk behaviors among teens. A randomized controlled trial of four federally funded abstinence programs found no significant decrease in number of partners or risk for STD and pregnancy, and no delay in sexual debut [13]. Similarly a systematic review of 13 trials found that abstinence-only programs were not associated with reductions in sexual risk behavior or in diagnosis of STDs [14]. Another review showed that all but one of 11 programs that taught about contraception resulted in no increase in sexual activity [12]. Other studies have shown that sexual activity is not increased with teaching about condoms [15] and HIV/AIDS [16].

Although one study found later sexual debut was associated with abstinence-only virginity pledging, the majority of adolescents who made virginity pledges ultimately broke their "promise" and engaged in sexual intercourse before marriage [17]. In addition the risk for STD was not significantly different between pledgers and nonpledgers, and sexually active pledgers were significantly less likely to use condoms at first sex than were nonpledgers. Similarly our data comparing abstinence-only and comprehensive education revealed no significant difference in initiation of sexual intercourse, while detecting a decreased likelihood of teen pregnancy among those who received comprehensive education. This suggests that preteens and teens who receive abstinence-only education may engage in higher risk behaviors once they initiate sexual activity.

The decreased risk of teen pregnancy we observed among adolescents receiving comprehensive sex education was likely mediated by use of birth control and condoms. Considerable evidence suggests that barrier contraceptives are effective in preventing teen pregnancy and infection with sexually transmitted pathogens. Vital statistics reports from the Department of Health and Human Services show a consistent decrease in teen pregnancies as use of condoms and contraceptive methods increases [18].

Although we observed a nonsignificant reduction in STD risk associated with condom use at last vaginal intercourse, the NSFG was not designed to evaluate the effectiveness of condoms in preventing STDs, making it difficult to draw firm conclusions about condom efficacy. Furthermore adolescents who have previously received an STD diagnosis may be more likely to use condoms, but we were unable to determine whether STD diagnosis or teen pregnancy preceded use of condoms or (other) contraception. Stronger epidemiologic evidence summarized in a review of prospective studies indicates that condom use is significantly protective against several bacterial STDs including chlamydia, gonorrhea, and syphilis [19]. More recent data indicate that condoms are more efficacious than previously thought against viral STDs such as herpes simplex virus [20] and human papillomavirus [21].

Despite the protective effects of birth control and condom use, results of numerous studies assessing the association of sexual debut, frequency of intercourse, numbers of partners, or contraceptive use associated with any type of sex education have been inconsistent [11,12]. Furthermore a population-based analysis using Wave I data from the National Longitudinal Study of Adolescent Health (Add Health) concluded that offering sex education to teens had no measurable health benefits; but there were no data on whether the teens subsequently received the education [22]. In contrast we demonstrated a significantly reduced risk for teen pregnancy and a marginally reduced risk of initiating sexual activity, but also showed no impact on likelihood for STD associated with either abstinence-only or comprehensive sex education.

This modest effect on STD outcomes may have several explanations. First, as suggested by the strong effect of family intactness on all three outcomes examined, sexual risk behavior is likely driven strongly by parental influence [23] in addition to, or possibly more than, curriculum content. Other potential unevaluated factors include risk perception, community resources, peer influence, and media messages. A second possibility is the limitation inherent in using reported STD diagnosis as a measured outcome. Reported STD diagnoses reflect access to care and symptomatic infection, and most STDs among U.S. teens are asymptomatic [24]. The absence of a measure of laboratory diagnosed STD in the NSFG suggests our estimates of the effect of formal sex education on STD are conservative and may even be biased, although it is impossible to determine in which direction. Third, even in a large, nationally representative sample, small numbers of reported STD cases can result in low statistical power to detect associations.

Other limitations make the overall interpretation of these data challenging. Although use of a nationally representative survey such as the NSFG allowed us to evaluate the effects of formal sex education in the U.S. population, and although we restricted our study population to adolescents who received formal sex education before engaging in sexual activity, the cross-sectional nature of this survey precludes any firm conclusions regarding cause and effect. Also the small number of individuals who received no sex education may have limited our power to detect smaller reductions in odds associated with abstinence-only education. Furthermore the NSFG was not initially designed to evaluate abstinence-only programs. The survey merely asked whether an individual ever participated in a formal program—a question that provides no information as to the quality, content, context, or duration of the program. The measures we created to indicate the type of sex education received can only be considered proxy measures. In addition recall or selection bias among adolescents who become

pregnant may have resulted in inaccurate reporting of type of sex education received.

Evaluations of abstinence-only programs may also be limited by social desirability bias, as participants in these programs may be less likely to report sexual activity before marriage. A recent study found that virginity pledgers were four times more likely than nonpledgers to initially admit to sexual activity and then later to deny it [25]. Given this social desirability bias, the true difference between these programs may be greater than what we observed. Similarly recipients of abstinence-only education may be less likely to seek testing for STDs, and thus be less likely to report diagnoses than recipients of a comprehensive education.

The lack of geographical measures in these data is also a limitation. A national survey of teachers providing sex education in grades 7–12 found significant differences in the content or approach of the education by geographic region [26]. Landry et al reported that teachers in the South, Midwest, and West were more likely than those in the Northeast to emphasize the ineffectiveness of birth control measures or not to cover them at all. Teachers in the South and Midwest were more likely than those in the Northeast to teach abstinence-only education. Regrettably the public-use version of the NSFG does not provide data on region of the U.S..

Although future prospective studies expressly designed to evaluate the effects of formal sex education programs are required, these data suggest that formal comprehensive sex education programs reduce the risk for teen pregnancy without increasing the likelihood that adolescents will engage in sexual activity, and confirm results from randomized controlled trials that abstinence-only programs have a minimal effect on sexual risk behavior. To ensure better data to evaluate the effect of sex education programs in the future, national surveys should more specifically assess types of formal sex education in an effort to more clearly understand its role and effectiveness, and, to the extent possible, seek biologic specimens to ascertain current infection with sexually transmitted pathogens.

References

[1] Singh S, Darroch JE. Adolescent pregnancy and childbearing: Levels and trends in developed countries. Fam Plann Perspect 2000;32:14–23.

[2] Panchaud C, Singh S, Feivelson D, Darroch J. Sexually transmitted diseases among adolescents in developed countries. Fam Plann Perspect 2000;32:24–32, 45.

[3] Alan Guttmacher Institute. Teenagers' Sexual and Reproductive Health: Developed Countries [Online]. Available at: http://www.guttmacher.org/pubs/fb_teens.pdf. Accessed April 5, 2007.

[4] Weinstock H, Berman S, Cates W Jr. Sexually transmitted diseases among American youth: Incidence and prevalence estimates, 2000. Perspect Sex Reprod Health 2004;36:6–10.

[5] Centers for Disease Control and Prevention. STD Surveillance 2005: Adolescents and Youth [Online]. Available at: http://www.cdc.gov/std/stats05/adol.htm. Accessed May 18, 2006.

[6] US House of Representatives Committee on Government Reform—Minority Staff Special Investigations Division. The Content of Federally Funded Abstinence-Only Education Programs [Online]. Available at: http://www.democrats.reform.house.gov/Documents/20041201102153-50247.pdf. Accessed July 15, 2005.

[7] Social Security Act. Section 510 [42 U.S.C. 710] [Online]. Available at: http://www.ssa.gov/OP_Home/ssact/title05/0510.htm#fn019. Accessed April 9, 2007.

[8] Office of Management and Budget, Budget of the United States Government, Fiscal Year 2005; Department of Health and Human Service [Online]. Available at: www.whitehouse.gov/omb/budget/fy2005/pdf/budget/hhs.pdf. Accessed November 23, 2005.

[9] Office of Management and Budget, Budget of the United States Government, Fiscal Year 2008; Department of Health and Human Services [Online]. Available at: http://www.gpoaccess.gov/usbudget/fy08/pdf/budget/hhs.pdf. Accessed April 4, 2007.

[10] Lindberg LD, Santelli JS, Singh S. Changes in formal sex education: 1995–2002. Perspect Sex Reprod Health 2006;38:182–9.

[11] Kirby D. Emerging Answers: Research Findings on Programs to Reduce Teen Pregnancy (Summary). Washington, DC: National Campaign to Prevent Teen Pregnancy, 2001 [Online]. Available at: http://www.teenpregnancy.org/resources/data/pdr/emerganswsum.pdf. Accessed April 4, 2007.

[12] Bennett SE, Assefi NP. School-based teen pregnancy prevention programs: A systematic review of randomized controlled trials. J Adolesc Health 2005;36:72–81.

[13] Trenholm C, Devaney B, Fortson K, et al. Impacts of Four Title V Section 510 Abstinence Education Programs [Online]. Available at: http://www.mathematica-mpr.com/publications/pdfs/impactabstinence.pdf. Accessed August 4, 2007.

[14] Underhill K, Montgomery P, Operario D. Sexual abstinence only programmes to prevent HIV infection in high income countries: Systematic review. Br Med J 2007;335:248 [epub].

[15] Smoak ND, Scott-Sheldon L, Johnson BT, Carey MP. Sexual risk reduction interventions do not inadvertently increase the overall frequency of sexual behavior: A meta-analysis of 174 studies with 116,735 participants. J Acquir Immune Defic Syndr 2006;41:374–84.

[16] Tremblay CH, Ling DC. AIDS education, condom demand, and the sexual activity of American youth. Health Econ 2005;14:851–67.

[17] Bruckner H, Bearman PS. After the Promise: The STD consequences of adolescent virginity pledges. J Adolesc Health 2005;36:271–8.

[18] U.S. Department of Health and Human Services, National Center for Health Statistics. Teenagers in the United States: Sexual Activity, Contraceptive Use and Childbearing, 2002. Available at: http://www.cdc.gov/nchs/nsfg.htm. Accessed May 30, 2006

[19] Holmes KK, Levine R, Weaver M. Effectiveness of condoms in preventing sexually transmitted infections. Bull WHO 2004;82:454–61.

[20] Wald A, Langenberg AG, Krantz E, et al. The relationship between condom use and herpes simplex virus acquisition. Ann Intern Med 2005;143:707–13.

[21] Winer RL, Hughes JP, Feng Q, et al. Condom use and the risk of genital human papillomavirus infection in young women. N Engl J Med 2006;354:2645–54.

[22] Sabia J. Does sex education affect adolescent sexual behaviors and health? J Policy Anal Manag 2006;25:783–802.

[23] DiLorio C, Dudley WN, Soet JE, McCarty F. Sexual possibility situations and sexual behaviors among young adolescents: The moderating role of protective factors. J Adolesc Health 2004;35:528.e11–20.

[24] Miller WC, Ford CA, Morris M, et al. Prevalence of chlamydial and gonococcal infections among young adults in the United States. JAMA 2004;291:2229–36.

[25] Rosenbaum JE. Reborn a virgin: Adolescents' retracting of virginity pledges and sexual histories. Am J Public Health 2006;96:1098–1103.

[26] Landry DL, Darroch JE, Singh S, Higgins J. Factors associated with the content of sex education in US public secondary schools. Perspect Sex Reprod Health 2003;35:261–9.