HHS Public Access

Author manuscript

J Adolesc Health. Author manuscript; available in PMC 2022 February 01.

Published in final edited form as:

J Adolesc Health. 2022 February ; 70(2): 313–321. doi:10.1016/j.jadohealth.2021.08.004.

Local Education Agency Impact on School Environments to Reduce Health Risk Behaviors and Experiences Among High School Students

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Abstract

Purpose: The purpose of the study is to assess associations between exposure to a multilevel, socio-ecological health program administered by local education agencies and changes in health behaviors among high school students.

Methods: This analysis used a multilevel difference-in-differences approach to compare student health experiences and outcomes between schools selected by local education agencies nationwide to implement the program (exposed schools) and schools that were not (unexposed schools). We measured repeated cross-sectional outcomes using the 2015 and 2017 Youth Risk Behaviors Surveys. The final analytic sample comprised 638 schools in total (N = 64,838 students), with 237 exposed schools (n = 30,336 students) and 401 unexposed schools (n = 34,502 students).

Results: Students in exposed schools demonstrated significant reduction in odds compared with those in unexposed schools in ever having sex (adjusted odds ratio [aOR] = .88, 95% confidence interval [CI]: .81–.96), having four or more lifetime sexual partners (aOR = .84, 95% CI: .72–.97), being currently sexually active (aOR = .78, 95% CI: .78–.96), and using effective hormonal birth control (aOR = .7, 95% CI: .56–.88). Exposure to the program was associated with significant reduction in odds of not going to school because of safety concerns (aOR = .87, 95% CI: .78–.97), having experienced forced sex (aOR = .76, 95% CI: .68–.86), ever used marijuana (aOR = .89, 95% CI: .81–.98), and currently using marijuana (aOR = .77, 95% CI: .64–.93).

Conclusions: Exposure to the program was associated with significant decreases in sexual risk behaviors, experience of violence, and substance use.

Keywords

School health; Adolescent health; Adolescent behavior change

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Conflicts of interest: The authors have no conflicts of interest to disclose.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jadohealth.2021.08.004.

Frameworks for public health impact have long held that interventions to change social contexts, through policy, practice, or systems change, provide significant opportunity to lead to lasting change in health [1,2]. Multiple levels of the social ecology, including peer and family relationships, community structures like health care systems, neighborhoods, and schools, and macro-level factors such as laws and policies, all have an impact on individual behaviors and experiences, thus affecting health and well-being [3]. Across the levels of the social-ecological model, adolescents foster resources to promote healthy development and build resilience to risk. Using the social-ecological model allows researchers and practitioners to consider a broad set of factors that contribute to youths' environments [3,4]. School environments in particular can improve adolescent risk and provide a way to deliver individual-level programs to build knowledge and skills and shape health behavior [4]. Although schools have academic learning as their primary mission, there are strong relationships between adolescent health and academic performance [5], and school environments represent an important means to reach large numbers of youth [6]. Prior research has demonstrated that school-based systems-level approaches regarding health services increase utilization of those services at a population level in the school [7]. In addition, safe and supportive school environments promote protective factors such as parent engagement and school connectedness that reduce multiple health risk behaviors and experiences [8].

Although adolescents are generally healthy, these years are a time when behaviors and experiences occur that can influence their health and well-being. For example, in 2017, young people aged 13–24 accounted for an estimated 21% of all new HIV diagnoses in the United States, with most occurring among 20- to 24-year-olds [9]. Half of the nearly 20 million new sexually transmitted infections (STIs) reported each year are among young people aged 15–24 years [10]. There were 179,871 pregnancies in 2018 among young women aged 15–19 years [11]. By the 12th grade, the majority of U.S. high school students have had sexual intercourse (56.7%), and decreasing condom use continues to put young people at risk for HIV and other STIs [9,12]. In the most recent national survey of high school students, more than 11% of high school females experienced forced sex, 1.6% of all students injected any drugs using a needle, and more than 35% felt so sad and hopeless that they could not participate in their usual activities [9].

Engaging in risky sexual behaviors is associated with other adolescent risk behaviors, and experiences including violence victimization, substance use, and poor mental health tend to cluster so that adolescents engage in multiple health risk behaviors and experiences [13–16]. These adverse health consequences have shared risk factors including neighborhoods with low social cohesion, limited access to services for health and mental health, low levels of connectedness to schools and families, and affiliation with peers engaging in risk behaviors [13,17]. Similarly, several shared protective factors reduce adverse health consequences including connection to families and other adults and schools, access to health and mental health services, parent engagement, and strong problem-solving and negotiation skills [17,18].

From 2013–2018, the Centers for Disease Control and Prevention (CDC) funded local education agencies (LEAs) to implement a multilevel program designed to change systems,

practices, and environments in middle and high schools to address factors associated with increased risk for HIV, STI, and unintended pregnancy. In the 2014–2015 school year, there were 13,451 regular school districts (also called LEAs) in the United States. In 2015, 98.2% of 14- to 18-year-old students were enrolled in secondary schools. In the same year, schools had an average ratio of 7.9 students to one school staff member and 51.8% of students qualified for free or reduced-price lunch [6]. Among the funded districts, the program centered on three strategies: (1) increased provision of exemplary classroom health education, including sexual health education, (2) implementation of systems to increase student access to sexual and reproductive health care, and (3) promotion of activities to decrease bullying and increase parent engagement and school connectedness [19]. Although particular activities were required of LEAs, wide discretion was provided in terms of which, how, and when those activities were implemented based on local needs and resources. LEAs were required to provide supports for schools to teach sexual health education on an annual basis; however, choices regarding curriculum and lessons included were made to meet local needs and constraints [4,20,21] (See Table 1 for specific strategies and activities). Similarly, although LEAs developed systems for referring high school students to sexual health services and expanded sexual health services on-site in schools, schools designated staff to make sexual health service referrals [7]. Finally, LEAs provided schools with resources for anti-bullying initiatives [22,23], a variety of activities to foster school connectedness among students [24–26] and parent engagement in schools [27,28].

LEAs were also required to focus their efforts on a group of high-need “priority” schools, selected for high STI or pregnancy rates among school-aged populations or high percentages of students engaging in sexual risk behaviors (referred to in this study as exposed schools). LEAs received guidance, technical assistance, and professional development to select and implement program strategies. In turn, the LEAs provided exposed schools with additional follow-up from trainings and tailored technical assistance to ensure fidelity to program guidance and implementation of strategies. “Unexposed” schools, defined here as those schools in the same districts which were not the focus of the CDC programmatic efforts, may have also delivered sexual health education, sexual health services, and promotion of protective factors, but were not provided the same supports as exposed schools.

The primary purpose of this study is to assess the associations between exposure to this program and sexual behaviors and experiences relative to students in unexposed high schools. Given the inter-related nature of a variety of behaviors and experiences and risk for these outcomes, we also assess the associations between exposure to the program and violence victimization, mental health, and substance use behaviors and experiences.

Methods

This current analysis compares student health experiences and outcomes between exposed and unexposed schools aggregated across funded local school districts using a multilevel difference-within-differences analysis [29,30]. We used repeated cross-sectional data from administrations of the Youth Risk Behavior Survey (YRBS) in 2015 and 2017 to measure student-level health experiences and outcomes.

YRBS selection and sampling of exposed and unexposed schools

As part of the Youth Risk Behavior Surveillance System, conducted by the CDC, all 17 funded LEAs were required to implement the YRBS biennially using a 2-stage cluster sample design to produce a representative sample of public high school students in grades 9–12 within each jurisdiction. During a regular class period, students completed a self-administered questionnaire assessing their behaviors and experiences across multiple health domains. Answers were recorded on computer-scannable answer sheets, with participation of students being anonymous and voluntary, and all state procedures for parental permission were followed. All exposed schools were included in 2015 and 2017 administrations of the YRBS with unexposed schools sampled for the purposes of prevalence rate estimation. The 17 LEAs came from nine states and the District of Columbia, including California, Florida, Illinois, Massachusetts, New York, Ohio, Pennsylvania, Tennessee, and Texas. In 11 LEAs, all high schools were surveyed during both years, and in the remaining six, unexposed schools were sampled. In participating schools, one or two classrooms in each of grades 9–12 from either a required subject (e.g., English or social studies) or a required period (e.g., homeroom or second period) were randomly sampled. All students in sampled classrooms were eligible to participate. Random sampling of classrooms allowed for independent samples to be included in analyses. Participation of students was anonymous and voluntary, and all local procedures for parental consent were followed. The data used in this present study were approved by CDC as research not involving identifiable human participants because students responded anonymously.

LEAs were required to have an overall average response rate (as an average of school and student response rates) of at least 60% to be included in the analytic sample, a threshold based on YRBS response rate standards for generating weighted data. One LEA was excluded from the analytic sample because of a response rate of 20% among exposed schools in 2015. Among the 16 LEAs meeting the 60% threshold response, rates ranged from 72% to 86%, with an overall average of 75% for 2015 and an overall average of 76% in 2017, with a range of 63%–89%. Among the 16 LEAs, a total of 638 schools participated in the YRBS, including 237 exposed and 401 unexposed schools.

Participants

Our initial sample consisted of 101,728 students, with 46,966 students attending exposed schools and 54,762 attending unexposed schools in 2015 and 2017 combined. We further restricted the sample into cohorts based on potential exposure to the funded program in the 2015 and 2017 YRBS administrations. The initial implementation of the program was during the fall of the 2014–2015 school year, and students who participated in the 2015 YRBS (primarily administered in the spring) had less than one year of exposure to the program; this constitutes a baseline measure. We included only ninth and 10th grade students from the 2015 YRBS as that cohort of students would also be included in the 2017 YRBS administration. In 2017, we included 10th, 11th, and 12th grade students who (unlike ninth grade students) had at least one year of exposure to the funded program. The final analytic sample comprised 638 schools in total (N = 64,838 students), with 237 exposed schools (n = 30,336 students) and 401 unexposed schools (n = 34,502 students).

Measures

Outcomes.—The primary outcomes were seven sexual risk variables (e.g., had ≥4 lifetime sexual partners) and protective behaviors (e.g., use of effective hormonal birth control). We examined 15 associated health risks and experiences including violence victimization (e.g., did not go to school because of safety concerns), mental health and suicide-related outcomes (e.g., considered attempting suicide), and marijuana use and injecting drug use (IDU). All items were dichotomized. The items, YRBS questions, and analytic coding are listed in Table 2. In addition, we selected two control variables that were measured by the YRBS but were unlikely to be influenced by the school-based program, eating breakfast and wearing seatbelts, to conduct sensitivity analyses.

Covariates.—The individual-level covariates included the following: (1) student group, dichotomized into students attending exposed and unexposed schools (the reference group); (2) school year, dichotomized into school year 2015 (the reference group) and school year 2017; (3) the interaction term of group and school year indicating associations with exposure to the program; (4) the demographic covariates included sex dichotomized into female and male (the reference group), grade stratified by cohort including ninth and 10th grades in 2015; 10th, 11th, and 12th grades in 2017 with ninth grade students as the reference group, and race/ethnicity categorized into non-Hispanic white, non-Hispanic Black, Hispanic/Latino any race, and other with white as the reference group.

Analysis

We conducted descriptive and bivariate analyses to examine differences among students in exposed and unexposed schools. Chi-square tests of proportions were used to test for differences in distributions of demographic, primary, and secondary outcome variables across groups within years. To test for associations between group and the outcomes, we constructed three-level multilevel logistic regression models to account for nesting of respondents (level 1) in schools (level 2) within school districts (level 3) in the framework of a difference-in-differences design (the interaction term of exposure and school year is indicative of the program effect). As part of our difference-in-differences approach, we assume that intervention and comparison schools have parallel trends in all outcome variables and reflect greater levels of risk as adolescents grow older [31]. Analyses were conducted using STATA 16.0. Statistical significance was considered using a threshold of $\alpha < .05$. Adjusted odds ratios (aORs) and corresponding 95% confidence intervals (CIs) are reported, controlling for sex, race/ethnicity, grade, and year.

Results

Bivariate tests

Students in the exposed and unexposed school cohorts varied significantly across most demographic variables (Table 3). In 2015, exposed and unexposed schools differed significantly by sex, with unexposed schools having a higher proportion of female students than exposed schools. Race/ethnicity distribution differed significantly between exposed and unexposed schools, with unexposed schools having a smaller proportion of African-American students and higher proportions of white students. In 2015, there were significant

differences in the distribution of ninth and 10th grade students between exposed and unexposed schools, with more ninth grade students (51.4%) and fewer 10th grade students (48.6%) in exposed schools.

In addition, bivariate analyses indicate that districts were successful in targeting program efforts toward the schools at highest risk of HIV, STI, and unintended pregnancy. In 2015, exposed school students reported significantly higher proportions of sexual risk behaviors (i.e., ever had sex, four or more lifetime sexual partners, and were currently sexually active) than students in the unexposed schools and for ever being tested for HIV. No significant differences were found in sexual protective behaviors (i.e., used a condom during last sexual intercourse, used effective hormonal birth control, and used a condom and effective hormonal birth control) between exposed and unexposed school students. Students in exposed schools reported significantly higher proportions across all violence victimization, substance use, suicide-related outcomes, and marijuana use and IDU, except for sexual dating violence, being bullied at school, experiencing electronic bullying, and having persistent feelings of sadness or hopelessness, than their peers in unexposed schools.

Multivariable modeling

To observe the main associations of programmatic activities with outcomes, multilevel logistic models were fit for each of the seven sexual behavior outcomes (Table 4). These models were adjusted for demographic characteristics of sex, race, and grade and for exposure group and year. aORs for the interaction term of group and year demonstrated reduced odds of exposed school students for ever having sex (aOR = .88, 95% CI: .81–.96), having four or more lifetime sexual partners (aOR = .84, 95% CI: .72–.97), being currently sexually active (aOR = .87 95% CI: .78–.96), and using effective hormonal birth control (aOR = .7, 95% CI: .56–.88). Of these, decreased odds of ever having sexual intercourse, having four or more lifetime sexual partners, and being currently sexually active indicate intended program effects, whereas reduced odds of effective hormonal birth control use represent an adverse effect of the program. The program demonstrated no statistically significant association, however, with condom use, dual contraceptive use, or HIV testing.

The main effects of 15 outcomes related to violence victimization, mental health and suicide-related outcomes, and marijuana use and IDU are presented in Table 5. After controlling for sex, race, and grade, the interaction term of group and year was associated with significant reduction in odds of not going to school because of safety concerns (aOR = .87, 95% CI: .78–.97), having experienced forced sex (aOR = .76, 95% CI: .68–.86), ever used marijuana (aOR = .89, 95% CI: .81–.98), and currently using marijuana (aOR = .77, 95% CI: .64–.93). Results were nonsignificant for the remaining outcomes, including being threatened at school, physical dating violence, suicide-related outcomes, and IDU. Because exposed school students demonstrated significantly more health risk behaviors than unexposed school students, we would expect these disparities in risk behavior to persist, and therefore, these null findings suggest improvement for exposed students in positive directions.

Discussion

This analysis supports the association of exposure to a federal program for LEAs with select improved health behaviors and experiences among students. These associations were wide ranging despite the specific focus on sexual risk behaviors. As such, this study provides a number of key lessons for the field, including support for a multilevel, socio-ecological, and systemic approach.

First, we took a multilevel approach that addressed several aspects of adolescents' social environments. The three strategies include a focus on the provision of individual knowledge through annual implementation of quality sexual health curricula, the development of referral systems for sexual health services, and changes to the school environment to improve school connectedness and increase parent engagement. Second, we took a systems-level approach that required a set of strategies to be implemented, leaving wide discretion on actual school-based activities. Third, these approaches had population-level associations with health risk behaviors and experiences of students in exposed schools, as we have no way of knowing whether any or which of the students included in this study participated in any specific program activities.

Students' exposure to this approach was associated with reduced odds of ever having had sex, having four or more lifetime sexual partners, and being currently sexually active. We tested an interaction between gender and exposure to the program across school years, which suggested that the program demonstrated significantly stronger associations among male than female students in reducing the odds of ever having sex and being currently sexually active (analyses not shown). Exposure to the program was also associated with a decrease in missing school because of safety concerns, having experienced forced sex, and lifetime and current marijuana use. An interaction between gender and exposure to the program across school years indicated that program effects were significantly stronger for male than female students in reducing lifetime and current marijuana use (data not shown). Differences in these outcomes suggest a need to tailor the program to address experiences of female students in sexual behaviors and substance use.

Of particular note are reduced odds among students exposed to the program of lifetime experience of forced sex and not attending school because of safety concerns. Nationally, in 2017, more than 10% of female high school students were ever forced to have sex, and this percent has been unchanged in recent years [9]. Understanding the mechanisms underlying this association for such an entrenched and traumatizing outcome is an important next step. Reducing absenteeism due to safety concerns is not only important for students' well-being but also may increase academic performance, as we know that these outcomes are linked [5].

Although exposure to the program was associated with decreases in some sexual risk behaviors, it was not associated with protective sexual behaviors among students, including using a condom during last sexual intercourse, using a condom and effective hormonal birth control together, and ever being tested for HIV. Similarly, we found no association between exposure to the program and a number of variables related to violence, IDU, and suicide-related outcomes. Given their greater risk at baseline, however, we would have

expected exposed school students' risk to have significantly increased relative to unexposed school students in the absence of this program; thus, these null findings pose promise.

An unintended negative association with exposure to the program was a significant decrease in the odds of using effective hormonal birth control compared with students attending comparison schools. Examination of this general trend by demographic characteristics revealed that female students and non-Hispanic black students in intervention schools were most likely to decrease their use of effective hormonal birth control between 2015 and 2017. This decrease runs counter to the national trend of increasing use of effective hormonal birth control from 2013 to 2017, including among adolescent females and non-Hispanic black students [32]. This unintended effect needs further exploration and highlights an area of increased emphasis for this program, particularly tailored to female and non-Hispanic black students. Furthermore, this may indicate the need to take into account school and district policies regarding sexual health services and community resources for the provision of those services.

Although this study demonstrates associations of exposure to the program with decreases in health risk behaviors, it also has limitations. As revealed by our bivariate analyses, the intervention and comparison schools were nonequivalent groups. However, we stratified these groups by cohort and controlled for clustering effects at the LEA and school level and covariates at the individual level, controlling for the nonequivalence of the groups. It is possible that the decline in the outcome variables represents regression toward the mean of the intervention school students. To test this, we conducted sensitivity analyses using two control variables: eating breakfast and wearing seatbelts (analyses not shown). Following the same analysis as our outcome variables, we found no significant associations between exposure to the program and these outcomes. This supports the notion that regression to the mean was not the likely reason for our findings. Finally, our results cannot be generalized to LEAs and schools outside of our sample.

This study found associations between an approach for districts to change school environments and decreases in a wide range of youth health risk behaviors and experiences. Examining the association between exposure to the program and behavior change among student subgroups by race/ethnicity and sexual identity is critical to better tailor effective programmatic activities. Furthermore, analysis of the influence of covariates at the school and district levels, including resource allocation and the cost-effectiveness of activities, may help to determine which activities should be emphasized within district educational systems. Despite a specific focus on decreasing sexual risk behaviors, exposure to the program had broader impact and was associated with reduced violence victimization and marijuana use among students in high-need exposed schools relative to their peers in unexposed schools. This program's unique approach was associated with population-level decreases in health risk behaviors and experiences and supports the establishment and continued study of school-based health programs in improving the health of adolescents.

Acknowledgments

The findings and conclusions in the manuscript are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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IMPLICATIONS AND CONTRIBUTION

This study found associations between a multilevel, socio-ecological approach to change school environments and decreases in a wide range of youth risk behaviors and experiences. These findings support the establishment and continued study of school-based health programs in improving the health of adolescents.

Table 1

DASH program strategies, suggested activities, and implementation level

Strategy	Suggested activities	Implementation level	
		District	School
Designate a district school health coordinator and establish, strengthen, and maintain school health councils at the district level and school health teams at the school level.[a]			
Exemplary sexual health education			
Strengthen policies and guidance[b]	Assess, develop, monitor, and enforce policies and provide guidance on • health education requirements • classroom management strategies • selection of health education curricula • provision of health education materials • health education scope and sequence K-12 • qualifications for health educators • instructional competencies for health education	✓	
Strengthen staff capacity[c]	Provide professional development at least every 2 years for health education on • subject matter topics • delivering curricula • instructional competencies • policies and guidance on health education	✓	✓
Increase student access to programs and services[c]	• Select school health education curricula resulting in student behavioral change that are evidence-based and aligned with national, state, and district standards • Deliver effective classroom sexual health education curricula to students	✓	✓
Engage agency, parent, and community partners[c]	Engage and strengthen collaborations with parents, students, parent organizations, youth-serving community organizations, and local health agencies	✓	✓
Sexual health services			
Strengthen policies and guidance[c]	Assess, develop, monitor, and enforce policies and provide guidance on • what health services may be provided to students • contradictions among federal, state, and district policies • school and district policies on student absences related to seeking medical care • confidentiality policies at the federal, state, and district levels • guidance on student referrals to sexual health services	✓	
Strengthen staff capacity[c]	Provide professional development at least every 2 years to increase student access to appropriate health services including • policies and guidance on health service provision to students including confidentiality • raising awareness of student need for and availability of services • guidance on providing referrals to students for on-site services or community health care providers	✓	✓
Increase student access to programs and services[c]	Increase student access to appropriate health services through • social marketing campaigns • coordinating with condom availability programs • coordinating with school-based STI testing programs • providing referrals to on-site or community health care provider services • increasing billing and reimbursement for eligible services	✓	✓

Strategy	Suggested activities	Implementation level	
		District	School
Engage agency, parent, and community partners[c]	Engage and strengthen collaborations with state and local health departments; third-party contractors for school-based clinics; local health care providers; child health insurance programs; federal and state health care exchanges; and local health care providers.	✓	✓
Safe and supportive environments			
Strengthen policies and guidance[c]	Assess, develop, monitor, and enforce policies and provide guidance on • anti-bullying and sexual harassment policies • school-wide bullying prevention programs • revise or eliminate zero-tolerance policies • classroom management policies and guidance; anti-discrimination policies • soliciting and receiving parent input on policies and programs.	✓	
Strengthen staff capacity[c]	Provide professional development at least every 2 years for health education on • school anti-bullying policies and programs • classroom management strategies; school-wide positive behavior programs; strategies to increase student connection to schools and adults • strategies to increase parent communication with adolescents • strategies to involve parents in school policies, practices, and decision-making.	✓	✓
Increase student access to programs and services[c]	• Set positive behavior expectations school-wide • Provide targeted and intensive behavioral interventions for students with behavioral problems • Use language, behaviors, and environmental cues to make adults more approachable by students • Link students to mentorship and service-learning opportunities • Support student participation in clubs and extracurricular activities • Promote gender and sexual-supportive programs and practices (e.g., gay-straight alliances) • Promote parent practices to enhance the health of students • Involve parents in school programs and decision-making	✓	✓
Engage agency, parent, and community partners[c]	Engage and strengthen collaborations with parents, students, parent organizations, community youth-serving organizations, and local health departments	✓	✓

[a] Districts are required to engage in all the listed activities.

[b] Districts are required to assist all district secondary schools in all the listed activities.

[c] Districts are required to assist priority schools in one or more of the listed activities.

Table 2

Study variable, YRBS question, and analytic coding for primary and secondary study outcomes—2015, 2017 Youth Risk Behavior Survey

Study variable	YRBS question	Analytic coding
Primary outcomes		
Ever had sex	Have you ever had sexual intercourse?	0 = no; 1 = yes
Had ≥4 lifetime sexual partners	During your life, with how many people have you had sexual intercourse?	0 ≤3 people 1 ≥4 people
Currently sexually active	During the past 3 months, with how many people did you have sexual intercourse?	0 = none 1 ≥1 people
Effective hormonal birth control use[a]	The last time you had sexual intercourse, what one method did you or your partner use to prevent pregnancy? (Select only one response.) (Responses include birth control pills, an IUD, implant, shot, patch, or birth control ring)	0 = none of those responses 1 = one of those responses
Used a condom during last sexual intercourse[a]	The last time you had sexual intercourse, did you or your partner use a condom?	0 = no; 1 = yes
Condom and effective hormonal birth control use[a]	"Yes" responses to one or more "used effective hormonal birth control" responses and "used a condom during last sex"	0 = yes to one or none 1 = yes to both
Ever tested for HIV	Have you ever been tested for HIV, the virus that causes AIDS? (Do not count tests done if you donated blood.)	0 = no; 1 = yes
Secondary outcomes		
Did not go to school because of safety concerns	During the past 30 days, on how many days did you not go to school because you felt you would be unsafe at school or on your way to or from school?	0 = 0 days 1 ≥1 day
Threatened or injured with a weapon at school	During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club on school property?	0 = 0 times 1 ≥1 time
Forced sex	Have you ever been physically forced to have sexual intercourse when you did not want to?	0 = no; 1 = yes
Sexual dating violence (DV)[b]	During the past 12 months, how many times did someone you were dating or going out with force you to do sexual things that you did not want to do? (Count such things as kissing, touching, or being physically forced to have sexual intercourse.)	0 = 0 times 1 ≥1 time
Physical dating violence (DV)[b]	During the past 12 months, how many times did someone you were dating or going out with physically hurt you on purpose? (Count such things as being hit, slammed into something, or injured with an object or weapon.)	0 = 0 times 1 ≥1 time
Bullied at school	During the past 12 months, have you ever been bullied on school property?	0 = no; 1 = yes
Electronically bullied	During the past 12 months, have you ever been electronically bullied? (Count being bullied through texting, Instagram, Facebook, or other social media.)	0 = no; 1 = yes
Persistent feelings of sadness or hopelessness	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?	0 = no; 1 = yes
Seriously considered attempting suicide	During the past 12 months, did you ever seriously consider attempting suicide?	0 = no; 1 = yes
Made a suicide plan	During the past 12 months, did you make a plan about how you would attempt suicide?	0 = no; 1 = yes
Attempted suicide	During the past 12 months, how many times did you actually attempt suicide?	0 = 0 times 1 ≥1 time
Injured in a suicide attempt	If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?	0 = no; 1 = yes

Study variable	YRBS question	Analytic coding
Injection drug use	During your life, how many times have you used a needle to inject any illegal drug into your body?	0 = 0 times 1 ≥1 time
Ever use marijuana	During your life, how many times have you used marijuana?	0 = 0 times 1 ≥1 time
Currently use marijuana	During the past 30 days, how many times did you use marijuana?	0 = 0 times 1 ≥1 time

YRBS = Youth Risk Behaviors Survey.

[a]This question was only asked if the participants self-reported being sexually active.

[b]The denominator of this variable is students who ever dated or went out with someone during the 12 months before the survey.

Table 3

Demographic characteristics by exposed and unexposed schools—YRBS, 2015 and 2017 cohorts

Variables[a]	2015 YRBS				2017 YRBS		
	Total N (column %)	Exp schools n (column %)	Unexp schools	*p* *	Exp schools n (column %)	Unexp schools	*p* *
Sex							
Male	31,498 (49.3)	6,589 (50.3)	6,449 (48.1)	**<.00**	8385 (50.0)	10,075 (48.7)	**.01**
Female	32,436 (50.7)	6,505 (49.7)	6960 (51.9)		8,375 (50.0)	10,596 (51.3)	
Race							
White	7,920 (12.8)	1,312 (10.4)	2060 (15.8)	**<.00**	1,653 (10.1)	2,895 (14.4)	**<.00**
Non-Hispanic black	19,044 (30.7)	4,432 (35.0)	3,562 (27.4)		5,676 (34.8)	5,374 (26.7)	
Hispanic/Latino	25,543 (41.1)	4,957 (39.2)	5,449 (41.9)		6,228 (38.2)	8,909 (44.2)	
Other	9,613 (15.5)	1,950 (15.4)	1,943 (14.9)		2762 (16.9)	2958 (14.7)	
Grade[b]							
9th	13,283 (20.9)	6,663 (51.4)	6,620 (49.9)	**.01**	N/A	N/A	**<.00**
10th	26,774 (42.2)	6,301 (48.6)	6,658 (50.1)		5,802 (34.8)	8,013 (39.0)	
11th	12,003 (18.9)	N/A	N/A		5,468 (32.8)	6,535 (31.8)	
12th	11,400 (18.0)	N/A	N/A		5,398 (32.4)	6,002 (29.2)	

The bold values indicate *P* values less than .05.

[a]Because of missing values in each variable, the sum of the columns may not add up to the total N.

[b]Based on the data inclusion/exclusion criteria for this analysis, we only included 9th–10th grade students for 2015 YRBS and 10th–12th graders for 2017 YRBS.

*The chi-square (χ^2) difference test of proportions indicates significant differences in rates detected only between exposed and unexposed schools within years, using the significance threshold $\alpha = .05$.

Table 4

Multilevel model, exposed and unexposed school sexual risk behaviors by group and year: 2015 and 2017

Variables	Primary outcomes						
	Ever had sex[a] aOR, (95% CI)	Had ≥4 lifetime sexual partners[a]	Currently sexually active[a]	Effective hormonal birth control use[b]	Used a condom during last sex[b]	Condom and effective hormonal birth control use[b]	Ever tested for HIV[a]
Sex							
Female (vs. male)	.63 (.57, .69)	.31 (.27, .36)	.84 (.78, .91)	1.88 (1.61, 2.20)	.51 (.45, .58)	1.42 (1.14, 1.77)	.95 (.89, 1.01)
Race							
White (ref)							
Non-Hispanic black	1.45 (1.27, 1.65)	2.14 (1.86, 2.47)	1.22 (1.09, 1.37)	.56 (.41, .75)	1.03 (.89, 1.18)	.61 (.44, .83)	1.65 (1.46, 1.86)
Hispanic/Latino	1.39 (1.21, 1.59)	1.43 (1.12, 1.82)	1.22 (1.08, 1.37)	.66 (.49, .89)	.83 (.68, 1.01)	.61 (.43, .87)	1.46 (1.18, 1.79)
Other	.75 (.57, .98)	1.14 (.87, 1.50)	.69 (.54, .89)	.62 (.50, .77)	.95 (.83, 1.08)	.61 (.49, .76)	1.18 (.93, 1.51)
Grade							
9th (ref)							
10th	1.78 (1.66, 1.89)	1.46 (1.33, 1.60)	1.70 (1.59, 1.81)	1.57 (1.28, 1.94)	.90 (.75, 1.08)	1.06 (.71, 1.59)	1.39 (1.16, 1.68)
11th	2.82 (2.54, 3.13)	2.36 (2.11, 2.64)	2.73 (2.42, 3.08)	2.22 (1.77, 2.79)	.76 (.60, .96)	1.34 (.83, 2.17)	1.87 (1.48, 2.36)
12th	4.47 (3.97, 5.03)	3.73 (3.32, 4.18)	4.51 (3.97, 5.12)	3.03 (2.38, 3.84)	.60 (.49, .74)	1.33 (.84, 2.10)	2.42 (1.85, 3.16)
Exposed (vs. unexp)	1.61 (1.31, 1.98)	1.80 (1.45, 2.23)	1.52 (1.24, 1.85)	1.40 (1.09, 1.79)	.85 (.71, 1.02)	1.07 (.78, 1.47)	1.50 (1.23, 1.84)
Year (vs. 2015)	1.05 (.90, 1.22)	.90 (.80, 1.01)	1.06 (.92, 1.22)	1.13 (.90, 1.41)	.93 (.76, 1.13)	1.14 (.79, 1.64)	.94 (.78, 1.13)
Group × year	.88 (.81, .96)	.84 (.72, .97)	.87 (.78, .96)	.70 (.56, .88)	1.12 (.88, 1.44)	.89 (.63, 1.25)	.98 (.86, 1.12)
Observations	47,991	44,791	46,402	11,417	10,418	9,886	51,624

aOR = adjusted odds ratio; CI = confidence interval.

[a]Of all youth.

[b]Of sexually active youth.

Table 5

Multilevel model, intervention and comparison school secondary outcomes by group and year: 2015 and 2017

Variables	Secondary outcomes: violence victimization						
	Did not go to school because of safety concerns[a]	Threatened or injured with a weapon at school[a]	Forced sex[a]	Sexual dating violence[b]	Physical dating violence[b]	Bullied at school[a]	Electronically bullied[a]
	aOR, (95% CI)						
Sex							
Female (vs. male)	1.08 (.97, 1.19)	.57 (.51, .63)	1.67 (1.52, 1.84)	1.91 (1.65, 2.22)	1.28 (1.14, 1.42)	1.34 (1.25, 1.43)	1.62 (1.48, 1.78)
Race							
White (ref)							
Non-Hispanic black	1.08 (.88, 1.34)	1.35 (1.16, 1.58)	1.24 (1.09, 1.42)	.76 (.67, .87)	1.35 (1.12, 1.63)	.71 (.62, .80)	.63 (.58, .69)
Hispanic/Latino	1.40 (1.14, 1.71)	1.27 (1.04, 1.55)	1.32 (1.13, 1.53)	.90 (.81, 1.00)	1.36 (1.08, 1.71)	.75 (.65, .86)	.71 (.63, .80)
Other	1.29 (1.09, 1.54)	1.20 (.92, 1.56)	1.23 (1.03, 1.48)	1.00 (.83, 1.20)	1.48 (1.14, 1.93)	.83 (.74, .93)	.80 (.72, .89)
Grade							
9th (ref)							
10th	.93 (.85, 1.02)	.89 (.81, .97)	1.05 (.95, 1.17)	.99 (.89, 1.09)	1.05 (.95, 1.16)	.80 (.74, .86)	.81 (.76, .86)
11th	.94 (.83, 1.05)	.84 (.75, .95)	1.16 (.98, 1.37)	.98 (.85, 1.12)	1.12 (.95, 1.33)	.70 (.61, .81)	.74 (.66, .82)
12th	.86 (.73, 1.01)	.85 (.70, 1.03)	1.19 (1.02, 1.39)	.85 (.69, 1.05)	1.02 (.83, 1.24)	.61 (.53, .70)	.70 (.65, .77)
Exposed (vs. unexp)	1.63 (1.39, 1.91)	1.25 (1.06, 1.48)	1.53 (1.32, 1.77)	1.05 (.90, 1.23)	1.19 (.96, 1.47)	.97 (.89, 1.05)	.88 (.80, .98)
Year (vs. 2015)	1.34 (1.18, 1.52)	.99 (.86, 1.15)	1.34 (1.12, 1.61)	.84 (.53, 1.33)	.92 (.77, 1.11)	.94 (.88, 1.02)	1.09 (.96, 1.23)
Group × year	.87 (.78, .97)	1.03 (.92, 1.16)	.76 (.68, .86)	.93 (.67, 1.29)	1.13 (.98, 1.31)	1.06 (.96, 1.16)	1.04 (.93, 1.16)
Observations	55,405	57,863	46,801	31,543	34,451	58,261	58,439

Variables	Secondary outcomes continued: mental health and substance use by group and year							
	Persistent sadness and hopelessness[a]	Considered attempting suicide[a]	Made a suicide plan[a]	Attempted suicide[a]	Injured in a suicide attempt[a]	Lifetime injection drug use[a]	Ever use marijuana[a]	Currently use marijuana[a]

	aOR, (95% CI)							
Sex								
Female (vs. male)	2.30 (2.14, 2.49)	1.99 (1.82, 2.18)	1.74 (1.64, 1.86)	1.35 (1.24, 1.47)	1.07 (.94, 1.20)	.47 (.39, .55)	1.07 (.99, 1.15)	1.03 (.97, 1.10)
Race								
White (ref)								
Non-Hispanic black	.86 (.78, .94)	.90 (.81, 1.00)	1.00 (.90, 1.10)	1.44 (1.26, 1.65)	1.60 (1.29, 1.98)	1.63 (1.31, 2.02)	1.01 (.84, 1.20)	.85 (.73, .99)
Hispanic/Latino	1.19 (1.09, 1.30)	1.02 (.92, 1.12)	1.07 (.95, 1.21)	1.53 (1.34, 1.76)	1.69 (1.29, 2.21)	1.28 (1.07, 1.52)	1.03 (.94, 1.13)	.90 (.78, 1.02)
Other	1.01 (.90, 1.14)	1.10 (.96, 1.25)	1.25 (1.02, 1.54)	1.47 (1.22, 1.77)	1.57 (1.10, 2.24)	1.15 (.96, 1.38)	.55 (.40, .76)	.59 (.45, .77)
Grade								
9th (ref)								
10th	1.04 (.98, 1.10)	.93 (.87, 1.01)	.89 (.80, 1.00)	.83 (.75, .92)	.81 (.70, .94)	.75 (.62, .91)	1.40 (1.29, 1.52)	1.40 (1.26, 1.55)
11th	1.10 (1.01, 1.20)	.96 (.86, 1.07)	.92 (.80, 1.06)	.79 (.72, .87)	.85 (.66, 1.10)	.81 (.63, 1.04)	1.81 (1.57, 2.08)	1.63 (1.42, 1.87)
12th	1.02 (.94, 1.11)	.90 (.79, 1.01)	.82 (.71, .95)	.80 (.72, .88)	.89 (.69, 1.15)	.85 (.63, 1.14)	2.29 (1.99, 2.63)	2.03 (1.83, 2.25)
Exposed (vs. unexp)	1.03 (.94, 1.12)	1.05 (.97, 1.14)	1.03 (.91, 1.17)	1.39 (1.20, 1.63)	1.47 (1.16, 1.86)	1.63 (1.17, 2.26)	1.47 (1.29, 1.68)	1.66 (1.35, 2.04)
Year (vs. 2015)	1.06 (.98, 1.16)	1.07 (.95, 1.20)	1.00 (.86, 1.16)	1.04 (.92, 1.17)	1.10 (.84, 1.44)	1.10 (.82, 1.46)	.99 (.84, 1.16)	1.21 (1.03, 1.43)
Group × year	1.00 (.91, 1.11)	.91 (.82, 1.01)	.92 (.81, 1.03)	.97 (.82, 1.14)	.91 (.72, 1.16)	.85 (.58, 1.23)	.89 (.81, .98)	.77 (.64, .93)
Observations	57,713	57,979	42,636	49,547	42,745	36,992	32,159	55,930

aOR = adjusted odds ratio; CI = confidence interval.

[a]Of all youth.

[b]Of youth who dated or went out with someone during the 12 months before the survey.