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# Increases in Student Knowledge and Protective Behaviors Following Enhanced Supports for Sexual Health Education in a Large, Urban School District

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A B S T R A C T

**Purpose:** School-based sexual health education (SHE) can teach students critical knowledge and skills. For effective SHE, school districts can offer support, including strong curricula and professional development. This study assessed changes in students' sexual health knowledge and sexual behaviors following implementation of enhanced support for SHE delivery in one school district.
**Methods:** Sexual health knowledge was assessed at the beginning and end of middle and high school health education classes in a large, urban district (n = 7,555 students). Sexual behaviors were assessed using Youth Risk Behavior Survey data from the district (2015 and 2017) and state (2017). Analyses explored differences in behavior from 2015 (n = 2,596) to 2017 (n = 3,371) among intervention district students and compared intervention district students (n = 3,371) to other students in the same state (n = 1,978).
**Results:** Hierarchical linear model regression analyses revealed significant knowledge gains among students. Logistic regression results revealed that among students in the intervention district, 6 of 16 examined behaviors moved in the intended direction from 2015 to 2017; 1 moved in the unintended direction. Logistic regression results of 2017 data revealed that in comparison of intervention district students to other students in the state, intervention district students had significantly higher odds of reporting condom use at last sex (adjusted odds ratio [AOR] = 1.36, 95% confidence interval [CI] = 1.07 −1.72) and significantly lower odds of reporting having had sex with 4+ persons (AOR = .72, 95% CI = .55−.94) or alcohol or drug use before last sex (AOR = .63, 95% CI = .42−.94).
**Conclusions:** Findings suggest potential effects of the district's SHE in increasing knowledge and improving behaviors and experiences among youth.

**IMPLICATIONS AND CONTRIBUTION**

Following implementation of a school district's enhanced supports for sexual health education, including systematic curricula selection, in-person professional development trainings, and tailored classroom observations and instructional coaching for teachers, this study found indicators of student health-related knowledge gains and favorable changes in sexual behaviors.

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Adolescents and young adults face disproportionately high risk for sexually transmitted infections (STIs) [1]. For example, in 2018, young people aged 15—24 accounted for almost one fifth of prevalent STIs and almost one half of all incident STIs in the U.S. [2]. Among females, those aged 15—24 accounted for 75.8% of chlamydial infections and 58.1% of gonococcal infections in 2018 [2]. Furthermore, although 21% of new HIV diagnoses in the U.S. in 2018 were among youth aged 13—24, youth are less likely than other age groups to remain in care and maintain a suppressed viral load. Birth rates in 2017 among women aged 15—19 years were 18.8 per 1,000, and although there have been recent declines in teen birth rates [3], many disparities between geographic regions and population subgroups remain [4]. For many individuals, behaviors and experiences contributing to risk for unintended pregnancy and STIs, including HIV, can emerge in adolescence. Data from the 2017 National Youth Risk Behavior Survey (YRBS) reveal that 39.5% of high school students report having ever had sexual intercourse, 9.7% report having had sex with four or more partners, and 28.7% report being currently sexually active (i.e., having had sex during the 3 months before the survey). Among currently sexually active youth, at last sexual intercourse 46.2% did not use a condom, 13.8% did not use any pregnancy prevention method, and 18.8% reported alcohol or drug use. Youth also report victimization experiences that can increase risk for unintended pregnancy and STIs/HIV; 7.4% of high school students reported being physically forced to have sexual intercourse and 9.7% reported experiencing sexual violence [5].

To reduce these risk-related behaviors and experiences, one commonly used intervention is school-based sexual health education (SHE). More than 56 million youth attend the nation's schools [6], and in that setting, can receive a range of education opportunities and health services [7]. Specifically, school-based SHE can teach students knowledge and skills to lower STIs/HIV and unintended pregnancy risk. Researchers have linked school-based SHE, including risk-reduction approaches, with multiple positive behavioral outcomes, including decreased sexual activity, fewer partners, and increased condom or contraceptive use among youth [8—11].

To increase the likelihood of such behavioral outcomes, school districts can strengthen SHE by selecting strong instructional materials (i.e., curricula) and providing tailored professional development. Strong SHE curricula feature characteristics of effective health education programs that have been identified through research and practice [12] and align with national/state/local health and education standards (e.g., National Health Education Standards) [13]. Strong curricula include a clear focus on health goals and outcomes, use medically accurate, developmentally tailored, and nonbiased, culturally inclusive content and skills, and are delivered using a variety of instructional strategies to increase student knowledge and skills [14,15]. In addition, teachers delivering SHE must demonstrate instructional competencies that support quality teaching practices linked to improvements in students' performance [10,14]. Professional development can help ensure teachers have the essential knowledge, skills, and confidence needed to effectively teach SHE [16—19].

The Centers for Disease Control and Prevention's (CDC) Division of Adolescent and School Health (DASH) offers competitive funding to local education agencies (school districts) to implement SHE for students in grades 6—12 as a key strategy for preventing STIs/HIV and unintended pregnancy [20,21]. One funded district participated was selected by CDC/DASH to participate in an evaluation with CDC/DASH and ICF, a research and evaluation firm, to assess their activities to support SHE. The district was selected based on the timing of their intervention initiation, as well as their expressed interest in learning more about the impact of their activities. Activities included the following: systematic selection and analysis of comprehensive health education curricula (comprehensive health education curricula that include a set of instructional strategies and learning experiences, for students in pre-kindergarten through grade 12, that provide opportunities to acquire the knowledge, attitudes, and skills required to make health-promoting decisions, achieve health literacy, adopt health-enhancing behaviors, and promote the health of others [22]) including SHE lessons; implementation of adapted health education curriculum for middle and high school students; tailored professional development for teachers; and individualized observation and coaching to support teachers' instructional practices.

A mixed-methods evaluation incorporated primary data collection and secondary analysis of existing data from the participating district's staff, teachers, and students. The study was reviewed and approved by ICF's Institutional Review Board and the district's Research Review Office. Other findings including those related to district-provided SHE supports [23], teachers' and students' perceptions and experiences with SHE [24], and associations between teacher characteristics and students' health-related (not specifically sexual health) knowledge gains [25] have been previously reported. The purpose of this study is to present findings related to sexual health knowledge and sexual behaviors among students following implementation of enhanced district support for SHE.

## Methods

### Sexual health education program description

The intervention district, a large, urban district in the southern U.S., used multiple strategies to enhance SHE within comprehensive health education. First, district staff used CDC's Health Education Curriculum Analysis Tool [22] to systematically assess multiple health education curricula and select one aligned with students' needs, priority health behavior outcomes, and required standards. Through this process, the district selected *HealthSmart* [26], a commercially available comprehensive health education curriculum. Although the curriculum has not been formally evaluated, it was designed to align with existing research and best practices, including the characteristics of effective health education curricula [12] and National Health Education Standards [13]. The curriculum's scope and sequence outlines topics, skills, and behavioral outcomes across sexual health, emotional and mental health, nutrition and physical activity, violence and injury prevention, and tobacco, alcohol, and other drugs. Lessons focus on shaping healthy behavior outcomes rather than simply increasing knowledge, and as a result, use strategies to help students build necessary skills to practice and adopt health-enhancing behaviors. The curriculum includes teacher instructional guides, student workbooks, and assignments that incorporate student engagement with their parents and families [27]. For alignment with state-specific standards [28] and allotted instructional time, district staff selected a

subset of sexual health lessons (10 for middle school, 13 for high school). Delivery of the adapted curriculum began in all middle and high schools in the district in August 2014 for high school students and August 2015 for middle school students. Additional curriculum information is available elsewhere [23,26,27].

The district also provided professional development support for health education teachers—in-person trainings and classroom observations paired with tailored instructional coaching. In the 2015–2016 academic year, the district provided three trainings for all health education teachers and a fourth training for middle school health education teachers. Trainings sought to improve teachers' knowledge, skills, and confidence to teach the adapted curriculum. In addition, district staff observed teachers during select classes and provided tailored coaching to address strength and areas for improvement in their lesson delivery. District staff maintained regular communication with teachers, designed professional development and coaching to meet teachers' needs, and provided relevant instructional materials and resources. This support is further described elsewhere [23–25].

*Procedure and instrumentation*

*Student knowledge assessment.* Students enrolled in middle or high school health education courses in the 2015–2016 school year completed a Scantron-based, 50-item knowledge assessment at the beginning and end of the course as part of course completion. The district provided this deidentified data along with linked data on student demographic characteristics. Demographic information included age, sex, race/ethnicity, grade level, and status regarding limited English proficiency (LEP), as gifted and talented, as economically disadvantaged (i.e., qualified for free or reduced price lunch or other public assistance), or as "at risk" [29] for dropping out of school (students "at risk" of dropout were those aged 26 or younger who report one or more of the following: poor/unsatisfactory academic performance in early education; poor grades; poor standardized test scores; have been expelled; have a criminal justice record; or have an unstable home/family structure [e.g., being homeless, living in foster care or another residential placement, or being pregnant or a parent]). Sex included female and male. Grade included 6th, 9th, 10th, 11th, and 12th grades. Race/ethnicity included the following: Hispanic or Latino, Asian or Native Hawaiian/Pacific Islander, black or African American, white, and other or multiracial. LEP status included the following: LEP, non-LEP/first year monitoring, non-LEP/second year monitoring, and other non-LEP. Status as gifted and talented, economically disadvantaged, and at risk were dichotomous variables.

The assessment captured knowledge of health education course topics. The study team reviewed the assessments to identify core items directly related to sexual health. Core items addressed abstinence, puberty, and personal health among middle school students (six items), and abstinence, personal health, sexual health, STI/HIV, and pregnancy prevention among high school students (nine items). For the wording of each multiple choice question and associated response options (Supplemental Table A1).

*Student behavior assessment.* The YRBS is a school-based survey administered biennially among high school students in the U.S. to monitor health-related behaviors. Surveys are conducted at national, state, and local levels [30]. Students complete a self-administered paper-and-pencil questionnaire, using computer-scannable response booklets. Participation is voluntary, anonymous, and follows local parental permission procedures [31].

Student behavior was assessed using cross-sectional datasets from the 2015 and 2017 YRBS cycles. To compare changes in student behavior prevalence over time, we used 2015 and 2017 YRBS data from the intervention district. Implementation of the enhanced SHE in the intervention district began in August 2014, with SHE most commonly delivered to 9th grade students; 2015 YRBS data were collected in spring of that same school year. Enhanced SHE was implemented each year after initiation, so 2017 YRBS data were collected in the third year of program implementation. In addition, 2017 YRBS data from both the intervention district and state in which the district is located were used in a comparison analysis. The state sample was originally drawn to be representative of high school students in the state, but it was modified to exclude students from school districts that received CDC/DASH funding for SHE, allowing the study team to compare intervention district students to other students in the state who received health education as usual, without the assistance of CDC/DASH funding. This modified sample is labeled the non-DASH-funded state sample.

YRBS assessed the following student sociodemographic characteristics: sex, grade, race/ethnicity, and sexual identity. Sex included female and male. Grade included 9th, 10th, 11th, and 12th grades, as well as ungraded or other grade (ungraded or other grade category, n = 13, was recoded to missing and not used in the regression analysis). Race/ethnicity was assessed using two questions combined to develop eight categories: American Indian/Alaska Native, Asian, black or African American, Native Hawaiian/Other Pacific Islander, white, Hispanic/Latino, multiple Hispanic, and multiple non-Hispanic. Sexual identity was categorized as heterosexual (straight), gay or lesbian, bisexual, and not sure (race/ethnicity was collapsed into black or African American, white, Hispanic/Latino and multiple Hispanic, and other category [American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, and multiple non-Hispanic] in the regression analysis. Sexual identity was collapsed into sexual minority indicator with gay or lesbian, bisexual, and not sure defined as sexual minority.).

Sixteen sexual behavior and experience measures were included as outcomes. A detailed description of each behavior and experience is provided in Table 1. Question wording and response options are available in YRBS documentation [32]. For analyses, outcomes were recoded dichotomously. For the question "Have you ever been tested for HIV, the virus that causes AIDS?" (response options: yes, no, and not sure), students who responded "not sure" (approximately 13% of students in both samples) were excluded from analyses. Analyses for the outcomes of alcohol or drug at last sexual intercourse, prevention method used at last sexual intercourse was limited to currently sexually active students. Analyses for physical and sexual dating violence were limited to students who dated or went out with someone during the 12 months before the survey.

*Analysis*

*Student knowledge assessment.* Analyses of student pre- and post-test data were conducted using IBM SPSS Statistics (version 22) and Stata 16. Descriptive statistics were calculated for sociodemographic characteristics. Change in student knowledge was explored by analyzing percent of core assessment items

**Table 1**
YRBS analysis outcome description

| Analysis outcome | Outcome description |
| --- | --- |
| Ever tested for HIV | Have you ever been tested for HIV, the virus that causes AIDS? |
| Ever physically forced to have sex | Percentage of students who were ever physically forced to have sexual intercourse (when they did not want to) |
| Experienced physical dating violence | Percentage of students who experienced physical dating violence (one or more times during the 12 months before the survey, including being hit, slammed into something, or injured with an object or weapon on purpose by someone they were dating or going out with among students who dated or went out with someone during the 12 months before the survey) |
| Experienced sexual dating violence | Percentage of students who experienced sexual dating violence (one or more times during the 12 months before the survey, including kissing, touching, or being physically forced to have sexual intercourse when they did not want to by someone they were dating or going out with among students who dated or went out with someone during the 12 months before the survey) |
| Ever had sex | Percentage of students who ever had sexual intercourse |
| Had sex before age 13 | Percentage of students who had sexual intercourse before age 13 years (for the first time) |
| Had sex with 4+ persons | Percentage of students who had sexual intercourse with four or more persons (during their life) |
| Currently sexually active | Percentage of students who were currently sexually active (had sexual intercourse with at least one person, during the 3 months before the survey) |
| Drank alcohol or used drugs before last sex | Percentage of students who drank alcohol or used drugs before last sexual intercourse (among students who were currently sexually active) |
| Used a condom during last sex | Percentage of students who used a condom (during last sexual intercourse among students who were currently sexually active) |
| Used birth control pills before last sex | Percentage of students who used birth control pills (before last sexual intercourse to prevent pregnancy among students who were currently sexually active) |
| Used an IUD or implant before last sex | Percentage of students who used an IUD (e.g., Mirena or ParaGard) or implant (e.g., Implanon or Nexplanon) (before last sexual intercourse to prevent pregnancy among students who were currently sexually active) |
| Used a shot, patch, or birth control ring before last sex | Percentage of students who used a shot (e.g., Depo-Provera), patch (e.g., OrthoEvra), or birth control ring (e.g., NuvaRing) (during last sexual intercourse among students who were currently sexually active) |
| Used birth control pills; an IUD or implant; or a shot, patch, or birth control ring before last sex | Percentage of students who used birth control pills; an IUD or implant; or a shot, patch, or birth control ring (before last sexual intercourse to prevent pregnancy among students who were currently sexually active) |
| Used both a condom and birth control pills; an IUD or implant; or a shot, patch, or birth control ring during/before last sex | Percentage of students who used both a condom and birth control pills; an IUD or implant; or a shot, patch, or birth control ring before last sexual intercourse (to prevent STD and pregnancy among students who were currently sexually active) |
| Used no prevention method during last sex | Percentage of students who did not use any method to prevent pregnancy (during last sexual intercourse among students who were currently sexually active) |

IUD = intrauterine device; STD = sexually tranmitted diseases; YRBS = Youth Risk Behavior Survey.

answered correct, using a hierarchical linear model to account for teacher- and school-level effects.

*Student behavior assessment.* Stata was used to conduct all YRBS analyses. Chi-square tests examined differences in both outcomes and controls by each predictor of interest (i.e., by year for the 2015–2017 intervention district sample and by receipt of CDC/DASH funding for 2017 intervention district and non-DASH-funded state samples). The study team estimated separate multivariable logistic regression models of associations between each outcome and predictor of interest, controlling for student sex, grade, race/ethnicity, and sexual identity. Results were determined significant if $p < .05$.

## Results

### Student knowledge

Approximately one half (53.4%) of participants in the total sample were middle school students (6th grade) in the 2015–2016 school year. Among the high school sample, most students (46.4%) were in the 9th grade. Most students in the analytic sample were Hispanic or Latino (66.6%), economically disadvantaged (79.9%), and "at risk" for dropout (75.5%) (Table 2).

Descriptive statistics for the full sample (n = 7,555) revealed a mean of 50.8% (median = 50.0%, standard deviation [SD] = 22.0) of items correct at pretest and 71.8% (median = 77.8%, SD = 22.9) correct at post-test. This pattern was similar for middle school students (n = 4,037), who had a mean of 42.9% (median = 33.3%, SD = 22.1) correct at pretest and 64.6% (median = 66.7%, SD = 24.5) correct at post-test, and for high school students (n = 3,518), who had a mean of 60.6% (median = 55.5%, SD = 17.2) correct at pretest and 80.1% (median = 88.9%, SD = 17.5) correct at post-test. Multilevel models revealed that for all students, middle school students, and high school students, the average post-test knowledge score was significantly higher than the pretest score after controlling for individual-level characteristics of students and accounting for variance at individual, teacher, and school levels (Table 3).

**Table 2**
Student knowledge assessment sample description

| Characteristic | All students (N = 7,555) | Middle school (N = 4,037) | High school (N = 3,518) |
|---|---|---|---|
| Date and type of assessment, n | | | |
| August 2015 (pretest) | 5,697 | 4,037 | 1,660 |
| December 2015 (post-test) | 1,660 | N/A | 1,660 |
| January 2016 (pretest) | 1,858 | N/A | 1,858 |
| May 2016 (post-test) | 5,895 | 4,037 | 1,858 |
| Grade, n (%) | | | |
| Grade 6 | 4,037 (53.4) | 4,037 (100) | N/A |
| Grade 9 | 1,631 (21.6) | N/A | 1,631 (46.4) |
| Grade 10 | 954 (12.6) | N/A | 954 (27.1) |
| Grade 11 | 721 (9.5) | N/A | 721 (20.5) |
| Grade 12 | 212 (2.8) | N/A | 212 (6.0) |
| Sex, n (%) | | | |
| Female | 3,689 (48.8) | 2,016 (49.9) | 1,673 (47.6) |
| Male | 3,866 (51.2) | 2,021 (50.1) | 1,845 (52.4) |
| Race/ethnicity, n (%) | | | |
| Hispanic or Latino | 5,039 (66.6) | 2,682 (66.4) | 2,350 (66.8) |
| Asian or Native Hawaiian/Pacific Islander | 141 (1.9) | 73 (1.8) | 68 (1.9) |
| Black or African American | 1,516 (20.1) | 815 (20.2) | 701 (19.9) |
| Other or multiracial | 111 (1.5) | 61 (1.5) | 50 (1.4) |
| White | 755 (10.0) | 406 (10.1) | 349 (9.9) |
| Limited English proficiency, n (%) | | | |
| LEP | 1,658 (22.0) | 1,315 (32.6) | 343 (9.7) |
| Non-LEP/first year monitoring | 586 (7.8) | 496 (12.3) | 90 (2.6) |
| Non-LEP/second year monitoring | 231 (3.1) | 179 (4.4) | 52 (1.5) |
| Other non-LEP | 5,080 (67.2) | 2,047 (50.7) | 3,033 (86.2) |
| Economically disadvantaged | 6,033 (79.9) | 3,402 (84.3) | 2,631 (74.8) |
| At risk of dropout/failure[a] | 5,705 (75.5) | 3,190 (79.0) | 2,515 (71.5) |
| Gifted and talented | 1,074 (14.2) | 642 (15.9) | 432 (12.3) |

LEP = limited English proficiency; N/A = not applicable.

[a] Students "at risk" of dropout were those aged 26 or younger who report one or more of the following indicators: poor/unsatisfactory academic performance in early education; poor grades; poor standardized test scores; have been expelled, have a criminal justice record; or have an unstable home/family structure (such as being homeless, living in foster care or another residential placement, or being pregnant or a parent).

We also examined effects of student-level characteristics on knowledge scores for all students combined. Knowledge scores were lower on average for black or African American youth ($B = -3.52$, standard error [SE] = .51) and higher for white youth ($B = 2.80$, SE = .67), when compared to scores for Hispanic youth. Scores were also lower for black or African American youth

**Table 3**
Results of hierarchical linear modeling predicting change in knowledge among all students, middle school students, and high school students

| Fixed effects | All students (N = 15,110; Nst = 7,555; Nt = 87; Ns = 41) | Middle school (N = 8,074; Nst = 4,037; Nt = 55; Ns = 27) | High school (N = 7,036; Nst = 3,518; Nt = 32; Ns = 17) |
|---|---|---|---|
| | Estimate (standard error) | Estimate (standard error) | Estimate (standard error) |
| Change in knowledge observed at post-test | 21.03*** (.28) | 22.43*** (.43) | 19.43*** (.34) |
| Race/ethnicity (Hispanic is reference) | | | |
| Asian or Native Hawaiian/Pacific Islander | −1.74 (1.26) | .53 (1.92) | −3.68* (1.56) |
| Black or African American | −3.52*** (.51) | −2.98*** (.84) | −3.22*** (.60) |
| Other or multiracial | 3.49* (1.42) | 5.74** (2.12) | 1.96 (1.79) |
| White | 2.80*** (.67) | 3.87*** (1.06) | 2.27** (.80) |
| Male sex (female is reference) | −2.68*** (.35) | −4.71*** (.54) | −.69 (.42) |
| Economically disadvantaged (no is reference) | −1.47** (.47) | −2.72** (.81) | −.39 (.53) |
| Grade | 2.56*** (.23) | N/A | 2.08*** (.24) |
| Gifted and talented (no is reference) | 7.82*** (.52) | 8.83*** (.77) | 5.83*** (.68) |
| At risk (no is reference) | −7.90*** (.47) | −10.10*** (.81) | −6.88*** (.52) |
| Limited English proficiency (LEP is reference) | | | |
| Non-LEP first year monitoring | 7.54*** (.72) | 7.19*** (.87) | 7.20*** (1.47) |
| Non-LEP second year monitoring | 8.82*** (1.03) | 8.80*** (1.29) | 9.21*** (1.85) |
| Other non-LEP | 6.28*** (.52) | 3.72*** (.77) | 8.77*** (.75) |

This table shows the change in knowledge (percent of core items correct) observed at post-test among middle and high school students combined, middle school students separately, and high school students separately. This table also shows adjustments for the effects of student-level characteristics or covariates, controlling for teacher- and school-level effects.

LEP = limited English proficiency; N/A = not applicable; Ns = number of schools; Nst = number of students, Nt = number of teachers.

***$p < .001$; **$p < .01$; *$p < .05$.

**Table 4**
Descriptive statistics for student behavior and experience analytic samples

| Variable | 2015 intervention district | | 2017 intervention district | | 2017 non-DASH-funded state sample | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| **Age** | | | | | | |
| 12 years or younger | 4 | .16 | 16 | .39 | 7 | .35 |
| 13 years | 3 | .09 | 9 | .22 | 1 | .04 |
| 14 years | 310 | 11.21 | 366 | 9.71 | 227 | 9.5 |
| 15 years | 714 | 26.92 | 872 | 24.6 | 588 | 26.54 |
| 16 years | 664 | 25.96 | 842 | 26 | 471 | 23.45 |
| 17 years | 548 | 22.28 | 772 | 23.94 | 430 | 24.37 |
| 18 years or older | 353 | 13.38 | 494 | 15.14 | 254 | 15.75 |
| Total | 2,596 | 100 | 3,371 | 100 | 1,978 | 100 |
| **Sex** | | | | | | |
| Female | 1,330 | 49.62 | 1,703 | 49.89 | 1,052 | 48.89 |
| Male | 1,257 | 50.38 | 1,646 | 50.11 | 917 | 51.11 |
| Total | 2,587 | 100 | 3,349 | 100 | 1,969 | 100 |
| **Grade** | | | | | | |
| 9th grade | 833 | 31.53 | 1,071 | 29.47 | 703 | 29.21 |
| 10th grade | 708 | 26.55 | 867 | 26.31 | 495 | 26.36 |
| 11th grade | 538 | 22.2 | 701 | 23.2 | 422 | 22.68 |
| 12th grade | 509 | 19.61 | 696 | 20.75 | 339 | 21.6 |
| Ungraded or other grade | 3 | .11 | 10 | .27 | 3 | .15 |
| Total | 2,591 | 100 | 3,345 | 100 | 1,962 | 100 |
| **Race/ethnicity** | | | | | | |
| American Indian/Alaska Native | 8 | .21 | 28 | .47 | 10 | .45 |
| Asian | 72 | 1.83 | **90** | **1.78** | **63** | **3.09** |
| Black or African American | 472 | 21.89 | **626** | **21.46** | **137** | **12.77** |
| Native Hawaiian/Other Pacific Islander | 3 | .08 | 9 | .19 | 5 | .24 |
| White | 364 | 12.31 | **371** | **11.76** | **452** | **31.58** |
| Hispanic/Latino | 697 | 27.83 | **955** | **29.56** | **252** | **10.03** |
| Multiple, Hispanic | 868 | 34.18 | 1,135 | 33.58 | 944 | 39.16 |
| Multiple, non-Hispanic | 83 | 1.67 | **80** | **1.21** | **57** | **2.69** |
| Total | 2,567 | 100 | 3,294 | 100 | 1,920 | 100 |
| **Sexual identity** | | | | | | |
| Heterosexual (straight) | 2,221 | 88.2 | 2,787 | 86.48 | 1,658 | 85.92 |
| Gay or lesbian | 57 | 2.1 | 81 | 2.6 | 50 | 2.76 |
| Bisexual | **132** | **5.59** | **255** | **7.35** | 158 | 7.79 |
| Not sure | 108 | 4.11 | 128 | 3.57 | 74 | 3.53 |
| Total | 2,518 | 100 | 3,251 | 100 | 1,940 | 100 |
| **Ever tested for HIV** | | | | | | |
| Yes | **193** | **8.65** | **392** | **14.36** | 240 | 16.83 |
| Total | 2,230 | 100 | 2,730 | 100 | 1,426 | 100 |
| **Ever physically forced to have sex** | | | | | | |
| Yes | **137** | **5.48** | **296** | **8.93** | 193 | 10.29 |
| Total | 2,583 | 100 | 3,329 | 100 | 1,951 | 100 |
| **Experienced physical dating violence** | | | | | | |
| Yes | 145 | 8.33 | 147 | 7.74 | 89 | 7.2 |
| Total | 1,718 | 100 | 2,100 | 100 | 1,245 | 100 |
| **Experienced sexual dating violence** | | | | | | |
| Yes | **142** | **8.58** | **117** | **5.84** | 74 | 6.15 |
| Total | 1,715 | 100 | 2,064 | 100 | 1,192 | 100 |
| **Ever had sex** | | | | | | |
| Yes | 925 | 39.46 | 1,023 | 37.7 | 622 | 38.81 |
| Total | 2,457 | 100 | 2,807 | 100 | 1,722 | 100 |
| **Had sex before age 13** | | | | | | |
| Yes | 106 | 4.87 | 118 | 4.66 | 55 | 3.25 |
| Total | 2,448 | 100 | 2,800 | 100 | 1,728 | 100 |
| **Had sex with 4+ persons** | | | | | | |
| Yes | **258** | **10.66** | **230** | **8.44** | **160** | **11.17** |
| Total | 2,438 | 100 | 2,786 | 100 | 1,727 | 100 |
| **Currently sexually active** | | | | | | |
| Yes | 636 | 27.09 | 677 | 24.97 | 425 | 27.27 |
| Total | 2,444 | 100 | 2,801 | 100 | 1,723 | 100 |
| **Drank alcohol or used drugs before last sex** | | | | | | |
| Yes | 116 | 18.24 | **99** | **13.96** | **78** | **19.08** |
| Total | 633 | 100 | 667 | 100 | 423 | 100 |
| **Used a condom during last sex** | | | | | | |
| Yes | 348 | 55.42 | **346** | **55.59** | **198** | **47.62** |

**Table 4**
Continued

| Variable | 2015 intervention district | | 2017 intervention district | | 2017 non-DASH-funded state sample | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Total | 621 | 100 | 642 | 100 | 415 | 100 |
| Used birth control pills before last sex | | | | | | |
| Yes | 69 | 11.1 | 80 | 12.83 | 51 | 14.42 |
| Total | 605 | 100 | 646 | 100 | 411 | 100 |
| Used an IUD or implant before last sex | | | | | | |
| Yes | **9** | **1.17** | **18** | **2.94** | 12 | 2.81 |
| Total | 605 | 100 | 646 | 100 | 411 | 100 |
| Used a shot, patch, or birth control ring before last sex | | | | | | |
| Yes | 13 | 2.5 | 20 | 2.83 | 15 | 3.93 |
| Total | 605 | 100 | 646 | 100 | 411 | 100 |
| Used birth control pills; an IUD or implant; or a shot, patch or birth control ring before last sex | | | | | | |
| Yes | 91 | 14.77 | 118 | 18.6 | 78 | 21.17 |
| Total | 605 | 100 | 646 | 100 | 411 | 100 |
| Used both a condom and birth control pills; an IUD or implant; or a shot, patch, or birth control ring during/before last sex | | | | | | |
| Yes | 33 | 5.68 | 31 | 5.08 | 22 | 5.88 |
| Total | 605 | 100 | 633 | 100 | 408 | 100 |
| Used no prevention method during last sex | | | | | | |
| Yes | 123 | 22 | 148 | 21.44 | 98 | 23.07 |
| Total | 605 | 100 | 646 | 100 | 411 | 100 |

Significant differences ($p < .05$) in variable categories are bolded.
DASH = Division of Adolescent and School Health; IUD = intrauterine device.

($B = -6.32$, SE = .75) and for Hispanic youth ($B = -2.80$, SE = .75), when compared to scores for white youth. Additionally, males ($B = -2.68$, SD = .35), economically disadvantaged youth ($B = -1.47$, SE = .47), and at-risk youth ($B = -7.91$, SE = .47) scored lower on average than their counterparts. Knowledge scores were higher for youth in higher grades ($B = 2.56$, SE = .23) and for gifted students ($B = 7.82$, SE = .52) compared to nongifted students. Additionally, non-LEP first year monitoring ($B = 7.54$, SE = .72), non-LEP second year monitoring ($B = 8.82$, SE = 1.03), and other non-LEP students ($B = 6.28$, SE = .52) scored higher than students classified as LEP students. Patterns of effects of student-level characteristics were similar for the middle and high school samples, except grade was not evaluated in the middle school sample (all students were in 6th grade), and in the high school sample, there was no significant difference in scores between males and females or economically disadvantaged and non-disadvantaged youth (Table 3).

### Student behavior

For the 2015–2017 intervention district sample, the majority of students were 15–17 years old in both years (Table 4). The sample was relatively evenly divided by sex; 9th and 12th grade students accounted for about 30% and 20% of students, respectively. Most students (62.0%–63.1%) in 2015–2017 were Hispanic or multiracial Hispanic, with 21.5%–21.9% black and 11.8%–12.3% white. In 2015–2017, 86.5%–88.2% of students reported being heterosexual (straight).

For the 2017 intervention district and non-DASH-funded state sample comparison, most students were 15–17 years old (Table 4). The intervention district sample included 50.1% male students, and the non-DASH-funded state sample included 51.1%. Although the non-DASH-funded state sample distribution by grade and sexual identity was similar to the intervention district sample, the racial composition of students varied significantly between the two samples. Chi-square tests revealed that the non-DASH-funded state sample contained significantly fewer

black (12.8%) and Hispanic (10%) students and more white (31.6%), multiracial non-Hispanic (2.7%), and Asian students (4.1%) than the intervention district sample (21.5%, 29.6%, 11.8%, and 1.78%, respectively).

Table 5 summarizes multivariable regression analysis findings of changes in sexual behavior among intervention district students from 2015 to 2017. Students had significantly higher odds of reporting having ever been tested for HIV (adjusted odds ratio [AOR] = 1.76, 95% confidence interval [CI] = 1.40–2.21) and using an intrauterine device or implant before last sexual intercourse (AOR = 2.48, 95% CI = 1.03–5.99) in 2017 than in 2015. In 2017, students had significantly lower odds of reporting experiencing sexual dating violence (AOR = .63, 95% CI = .46–.86), having sexual intercourse with four or more persons (AOR = .72, 95% CI = .58–.89), being currently sexually active (AOR = .86, 95% CI = .74–1.00), and drinking alcohol or using drugs before last sex (AOR = .69, 95% CI = .49–.96), when compared to 2015. However, students had significantly higher odds of reporting ever being physically forced to have nonconsensual sexual intercourse in 2017, compared to 2015 (AOR = 1.64, 95% CI = 1.40–2.21).

Table 5 also summarizes multivariable regression analysis findings of differences in outcomes among intervention district students and students in the non-DASH-funded state sample in 2017. Intervention district students had significantly higher odds of reporting using a condom at last sexual intercourse (AOR = 1.36, 95% CI = 1.07–1.72) and lower odds of reporting having sexual intercourse with four or more persons (AOR = .72, 95% CI = .55–.94) and drinking alcohol and using drugs before last sex (AOR = .63, 95% CI = .42–.94) than students in the non-DASH-funded state sample.

### Discussion

Findings suggest that implementation of a school district's enhanced efforts to support SHE was associated with gains in students' sexual health knowledge, increases in protective sexual

**Table 5**
Logistic regression model results examining difference in sexual risk behavior outcomes by year and receipt of DASH funding analyses

| Outcome | Intervention district change over time (2017 = 1) | | | Receipt of DASH funding (intervention district = 1) | | |
|---|---|---|---|---|---|---|
| | AOR | 95% CI | | AOR | 95% CI | |
| Ever tested for HIV ($N_1$ = 4,731; $N_2$ = 4,191) | 1.76*** | 1.40 | 2.21 | .89 | .67 | 1.17 |
| Ever physically forced to have sex ($N_1$ = 5,549; $N_2$ = 4,948) | 1.64*** | 1.28 | 2.11 | .86 | .68 | 1.10 |
| Experienced physical dating violence[a] ($N_1$ = 3,592; $N_2$ = 3,141) | .86 | .65 | 1.14 | 1.13 | .78 | 1.65 |
| Experienced sexual dating violence[a] ($N_1$ = 3,562; $N_2$ = 3,063) | .63** | .46 | .86 | 1.14 | .75 | 1.73 |
| Ever had sex ($N_1$ = 5,030; $N_2$ = 4,327) | .90 | .77 | 1.04 | .95 | .76 | 1.18 |
| Had sex before age 13 ($N_1$ = 5,018; $N_2$ = 4,327) | .96 | .69 | 1.34 | 1.43 | .83 | 2.45 |
| Had sex with 4+ persons ($N_1$ = 4,999; $N_2$ = 4,314) | .72** | .58 | .89 | .72* | .55 | .94 |
| Currently sexually active ($N_1$ = 5,020; $N_2$ = 4,328) | .86* | .74 | 1.00 | .88 | .70 | 1.11 |
| Drank alcohol or used drugs before last sex[b] ($N_1$ = 1,257; $N_2$ = 1,054) | .69* | .49 | .96 | .63* | .42 | .94 |
| Used a condom during last sex[b] ($N_1$ = 1,213; $N_2$ = 1,024) | 1.17 | .76 | 1.80 | 1.36* | 1.07 | 1.72 |
| Used birth control pills before last sex[b] ($N_1$ = 1,224; $N_2$ = 1,022) | 1.02 | .79 | 1.32 | 1.27 | .72 | 2.23 |
| Used an IUD or implant before last sex[b] ($N_1$ = 1,213; $N_2$ = 1,022) | 2.48* | 1.03 | 5.99 | .83 | .36 | 1.92 |
| Used a shot, patch, or birth control ring before last sex[b] ($N_1$ = 1,213; $N_2$ = 1,022) | 1.26 | .58 | 2.73 | 1.00 | .41 | 2.43 |
| Used birth control pills; an IUD or implant; or a shot, patch, or birth control ring before last sex[b] ($N_1$ = 1,213; $N_2$ = 1,022) | 1.34 | .91 | 1.98 | 1.13 | .73 | 1.73 |
| Used both a condom and birth control pills; an IUD or implant; or a shot, patch, or birth control ring during/before last sex[b] ($N_1$ = 1,203; $N_2$ = 1,011) | .85 | .47 | 1.53 | 1.18 | .58 | 2.42 |
| Used no prevention method during last sex[b] ($N_1$ = 1,213; $N_2$ = 1,022) | .93 | .66 | 1.31 | .82 | .59 | 1.15 |

Models control for sex, grade, race/ethnicity, and sexual identity. For the intervention district trend analysis, the time indicator, 2017 = 1; for the intervention district/non-DASH-funded state sample comparison analysis, intervention district = 1. In the change over time in the intervention district analysis of the "Used both a condom and birth control pills; an IUD or implant; or a shot, patch, or birth control ring during/before last sex" outcome, race/ethnicity was combined into racial minority indicator with black, Hispanic, and other defined as racial minority to improve model's fit. In DASH/non-DASH district comparison analysis of the "Used a shot, patch, or birth control ring before last sex" outcome, grade was combined into 9th–10th grade, 11th grade, and 12th grade to overcome model nonconvergence issue. In "Used an IUD or implant before last sex" outcome estimation, race/ethnicity was combined into a racial minority indicator with black, Hispanic, and other defined as minority to improve model's fit. $N_1$ are totals for trend analysis models and $N_2$ are totals for DASH funding receipt analysis models.
AOR = adjusted odds ratio; CI = confidence interval; DASH = Division of Adolescent and School Health.
*p < .05; **p < .01; ***p < .001.
[a] Sample is limited to students who dated or went out with someone during the 12 months before the survey.
[b] Sample is limited to currently sexually active students.

behaviors, and decreases in several risk behaviors and experiences. Data reveal that students exhibited a significant increase in sexual health knowledge following instruction, across both middle and high school students. Furthermore, as greater number of students were exposed to SHE in the intervention district (given more students received enhanced SHE with each additional year of implementation), the overall percentage of students in the district exhibiting the behaviors or experiences reflected an increase in having tested for HIV and having used an intrauterine device or implant before last sexual intercourse, and a decrease in experiencing sexual dating violence, being currently sexually active, having had sex with four or more persons, and having used alcohol or drugs before last sex. Of 16 behaviors examined, 6 moved in a favorable direction and 9 showed no difference from 2015 to 2017.

Only 1 of 16 behaviors examined among intervention district students moved in an unexpected direction—in 2017, compared to 2015, students in the district had significantly higher odds of reporting forced sex. This finding is inconsistent with national YRBS data, which have revealed no significant change in the percentage of high school students reporting forced sex from 2007 to 2017 [33]. Compared to students in the district in 2015, it is possible that a greater percentage of intervention district students in 2017 had experienced forced sex, but it is also possible that the result represents an increased ability of students in 2017 to recognize and report such experiences. This increased knowledge of, and ability to recognize violent experiences is consistent with a recent review showing effects of school-based interventions on increased knowledge of dating and sexual violence among adolescents [34].

Overall, findings from this study do not provide evidence of causality but taken together and in the context of the program implementation, they document encouraging indicators among students at the district level following enhanced district support to implement SHE. Comparison of student behavior and experiences in the intervention district to non-DASH-funded districts in the state further suggest a possible program impact. Of the 16 behaviors examined in the intervention district sample versus non-DASH-funded state sample, three reflected lower odds of risk behaviors among the intervention district's students. Specifically, students in the intervention district, compared to other students in the state, reported lower odds of reporting having had sex with four or more persons and alcohol or drug use before last sex and higher odds of condom use during last sex; however, magnitude of these differences was modest. Although intervention district students did not exhibit a change in condom use at last sex from 2015 to 2017, the lack of an unfavorable change may suggest a possible program effect, particularly given higher levels of condom use compared to other students in the state and trends in national YRBS data reflecting decreasing condom use among high school students over recent years [33].

A number of sexual behaviors and experiences did not show significant change among intervention district students from 2015 to 2017. Within this group of behaviors are several that the SHE program that sought to address, including having ever had sex, not using any method of pregnancy prevention at last sex, and having used a condom at last sex. In addition, 13 of 16 behaviors examined between intervention district students and other students in the state showed no significant difference between groups. Although recent data describing the type and reach of sexuality education in the state suggest that many

students do not receive comprehensive sexuality education [35], we cannot be sure that students in the rest of the non-DASH-funded state sample did not receive education on topics similar to those taught by the intervention district. Regardless, the number of null findings between intervention district students and other students in the state, in combination with the lack of change for several key behaviors among intervention district students, warrants attention as the district seeks to further improve SHE.

Although the positive findings related to knowledge gains and behavior change are encouraging, data showing disparities in knowledge gains also highlight a need for increased attention to needs of specific subpopulations. Gains were lower among groups of students who identified as black or African American or Asian or Native Hawaiian/Pacific Islander (compared to Hispanic students), Hispanic (compared to white, non-Hispanic), male, economically disadvantaged, younger, nongifted and talented classified, "at risk," and who had LEP. Curriculum content, including lessons and parent/family engagement activities, was provided only in English, which may have impacted the experience of students with LEP. However, the district had previously identified a need for improvement in this area of its SHE work, and it was conducting training for teachers on how to best support students with LEP. Findings suggest that future efforts to assess students' perceptions and experience with the curriculum, review of curriculum relevancy and fit, and teachers' cultural competence for addressing the needs of all youth during instruction remain important [10,11].

Furthermore, future research could be helpful in identifying potential roles of teacher and classroom characteristics in differential knowledge gains among student subgroups. A previous analysis from this district of knowledge gains for health education broadly (not just SHE topics) found that certain teacher characteristics (e.g., certification to teach health, having a dedicated classroom, having attended more professional development) were associated with greater knowledge gains among students [25]. When looking at SHE specifically, previous qualitative studies from this district found that certain class (e.g., having a dedicated classroom, having sufficient time) and teacher characteristics (e.g., gender, receiving professional development) impacted teacher confidence in implementing SHE [23,24]. However, additional classroom or teacher characteristics not captured in this study (e.g., race/ethnicity, languages spoken) could also be relevant for these specific student subgroups, and future analyses could help identify which teacher characteristics, if any, may be associated with greater knowledge gains among subgroups of students that exhibited lower gains in this study.

*Limitations*

This study's findings should be considered in the context of several limitations. First, reliability and validity of knowledge measures are unknown; the assessment was designed for educational use and had not been tested for research purposes. In addition, the knowledge assessment included only a minimal pre- and post-course assessment, and as such, did not provide a way to assess or account for other potential confounders that might have impacted knowledge gain. Second, the earliest YRBS data available for the intervention district was from 2015, which was collected in the first year of curriculum implementation; as such, it does not represent a true baseline, but represents an earlier time period in which a smaller percentage of the student population was exposed to the intervention; based on the timing of the enhanced SHE intervention and data collections, and the assumption that most students received SHE in their 9th grade year, it is estimated that approximately 31.5% of the intervention district's 2015 YRBS sample and 79% of the 2017 YRBS sample had received the intervention. Changes between the intervention district's 2015 and 2017 YRBS data do not capture individual-level changes, but instead reflect shifts in overall prevalence of reported behaviors and experiences among the district's student population. Of note, most students in 9th and 10th grade in the 2015 sample were likely in 11th and 12th grade in 2017, reflect overlap and nonindependence of the samples. Third, because the state sample was modified to remove CDC/DASH-funded districts, it was not representative of high school students in the state as a whole, nor was it designed to be representative of the districts in the state that did not receive CDC/DASH funding. Furthermore, the state did not have a 2015 YRBS dataset; therefore, 2015 comparisons were not possible. Finally, this study does not directly link knowledge and behavior outcomes for each student, nor does it assess skill development—another key desired outcome of SHE believed to influence student behavior [10].

## Conclusions and Implications

SHE provides a critical foundation for students to gain knowledge and skills needed to adopt protective health behaviors. Following implementation of district efforts to enhance SHE through a strong curriculum and multiple, layered professional development support for health education teachers, we documented measurable increases in student sexual health knowledge and encouraging, though modest, differences in risk-related behaviors, both over time within the district's students and in comparison to other students in the state. Although not definitive, taken together, the findings suggest beneficial effects of the district's SHE in increasing student knowledge and protective behaviors, and decreasing risk behaviors and experiences among adolescents.

## Supplementary Data

Supplementary data related to this article can be found at http://doi.org/10.1016/j.jadohealth.2021.05.015.

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