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Abstract: Purpose: While school health centers (SHC) may improve access to reproductive health care services and contraception, published data on SHC service use and reproductive health impact are limited. Methods: Reproductive health indicators among students at four urban high schools in a single building with a SHC in 2009 were compared to students in a school without a SHC, using a quasi-experimental research design (n=2,076 students, 1,365 from SHC school and 711 from comparison school). The SHC provided comprehensive reproductive health education and services, including on-site provision of hormonal contraception. Results: Students in the SHC school were more likely to report receipt of healthcare provider counseling and classroom education about reproductive health and a willingness to use a SHC for reproductive health services. Use of hormonal contraception measured at various time points (first sex, last sex, ever used) was greater among students in the SHC school. Most 10th-12th graders using contraception in the SHC school reported receiving contraception through the SHC. Comparing students in the non-intervention school to SHC non-users to SHC users, we found step-wise increases in receipt of education and provider counseling, willingness to use the SHC, and contraceptive use. Conclusions: Students with access to comprehensive reproductive health services via a SHC reported greater exposure to reproductive health education and counseling and greater use of hormonal contraception. SHCs can be an important access point to reproductive health care and a key strategy for preventing teen pregnancy.

D. Table

Table 1. Demographic Factors and Sexual Activity Among High School Students in Intervention and Comparison Schools and Among School Health Center (SHC) Users and Non-Users

Variable	Comparison School, All Grades	Intervention Schools			Comparison School, Grades 10-12
		All Students, All grades	SHC Non-Users, Grades 10-12	SHC Users, Grades 10-12	
Born in the US	70.1%	71.8%	71.2%	69.5%	68.6%
Hispanic	67.7%	88.1%	89.0%	90.8%	68.9%
Female	37.6%	46.5%	42.2%	52.1%	38.5%
Ever Had Sex: Females	54.1%	47.5%	34.5%	63.0%	58.3%
Ever Had Sex: Males	66.4%	62.4%	62.4%	71.1%	69.0%
n	719	1372	574	617	549

D. Table

TABLE 2. Proportion of High School Students Reporting Receipt of Reproductive Health Education and Counseling

Variable	Intervention and Comparison Schools by Grade								P*			Total	School			P*		
	IS9	CS9	IS10	CS10	IS11	CS11	IS12	CS12	IM	SM			CS	IS		Non-users vs. CS	Users vs. CS	Total
										9th	10th-12th			Non-users	Users			
Health Education. *Has someone, other than a teacher, come to your classroom in high school to talk about?*																		
Abstinence	25%	26%	75%	48%	64%	54%	84%	71%	0.004	0.930	0.001	1844	58%	68%	80%	0.009	0.001	1552
Condoms	35%	39%	86%	63%	84%	68%	95%	86%	0.001	0.735	0.001	1933	72%	85%	91%	0.001	0.001	1627
HIV or AIDS	40%	39%	86%	64%	83%	71%	94%	85%	0.007	0.373	0.001	1922	73%	84%	90%	0.001	0.001	1616
Health Education. *Have you gotten education at school about HIV/STD counseling/testing?*																		
	27%	27%	73%	47%	74%	59%	86%	73%	0.014	0.786	0.001	1990	59%	71%	84%	0.001	0.001	1674
Health Care Provider Counseling. *In the last 12 months, did you and a doctor or other health care provider talk about?*																		
Emergency contraception	5%	13%	15%	15%	21%	12%	34%	21%	0.013	0.046	0.004	1899	16%	17%	30%	0.281	0.001	1602
Birth control	13%	19%	40%	27%	40%	28%	58%	37%	0.033	0.273	0.001	1885	31%	38%	53%	0.012	0.001	1581
Column totals	174	162	365	164	433	215	393	170					711	728	637			

IS = Intervention schools, CS= Comparison school, SHC= School Health Center, IM=Interaction method, SM=Stratification method, User=SHC user, Non-user= SHC non user

*** p values for statistical testing using interaction method (IM) or stratification method (SM). Analyses controlled for gender, Latino ethnicity, and sexual experience**

D. Table

TABLE 3. Ever Use of Specific Contraceptive Methods

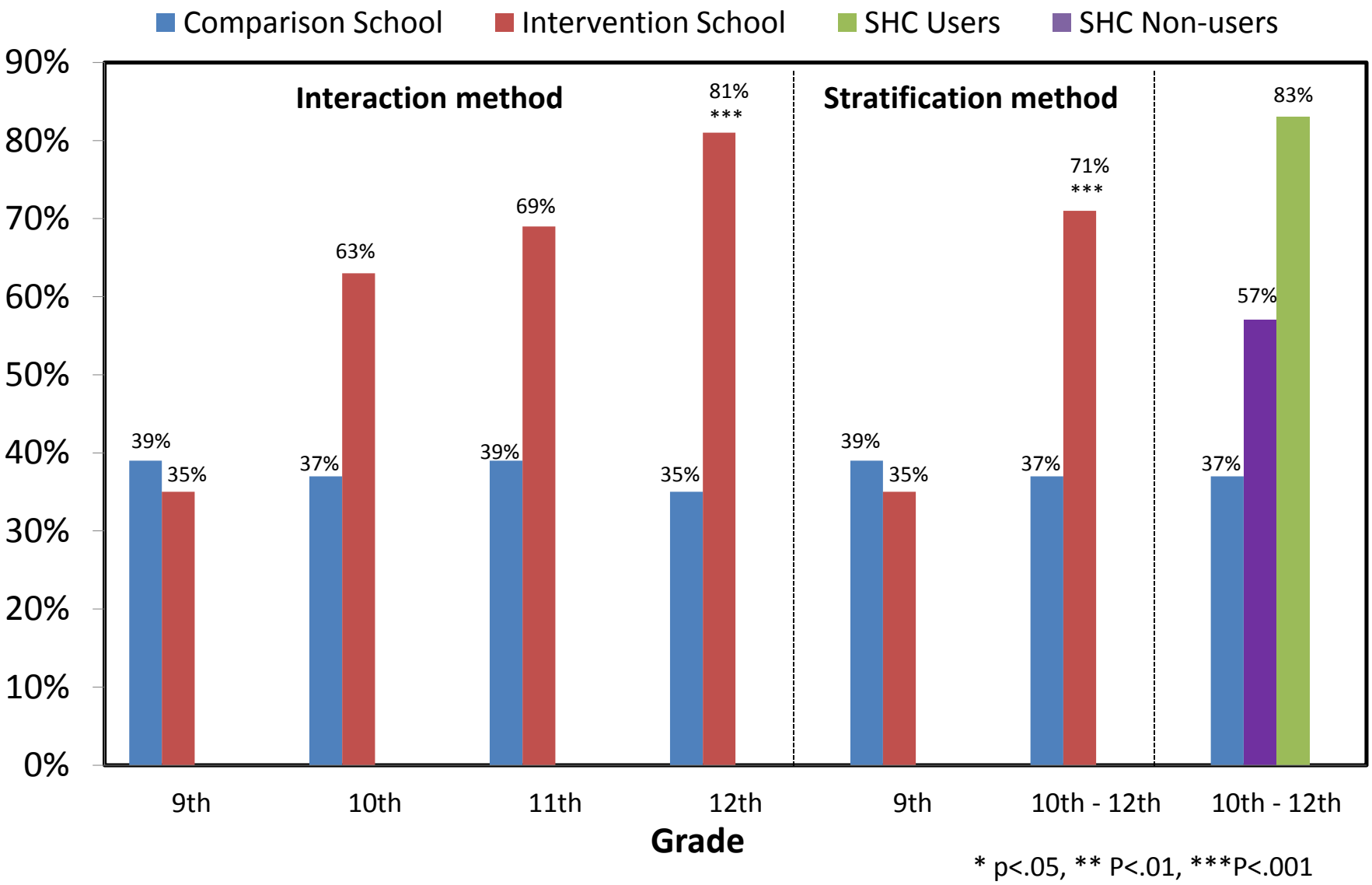
Variable	Intervention and Comparison Schools by Grade								P-Values*					School			P-Values		Total
	IS9	CS9	IS10	CS10	IS11	CS11	IS12	CS12	IM	Total	SM		Total	CS	IS		Non-users vs. CS	Users vs. CS	
											9th	10th-12th			Non-users	Users			
Ever used any of the following methods to prevent pregnancy: Women																			
Condoms	65%	45%	53%	61%	62%	62%	70%	60%	0.386	465	0.187	0.567	465	58%	57%	66%	0.490	0.230	426
Withdrawal	0%	0%	3%	0%	7%	0%	3%	7%	NC	465	NC	0.205	465	2%	3%	5%	0.529	0.159	426
Pills	6%	14%	20%	9%	30%	2%	38%	22%	0.013	465	0.548	0.000	465	11%	16%	36%	0.061	0.001	426
Ring	0%	0%	23%	3%	20%	4%	34%	11%	0.890	465	NC	0.000	426	5%	10%	33%	0.194	0.000	426
Shot	0%	5%	17%	6%	9%	0%	17%	13%	0.007	465	NC	0.033	435	6%	5%	18%	0.848	0.005	426
Patch	12%	0%	5%	0%	11%	2%	13%	11%	0.020	465	NC	0.090	440	4%	11%	11%	0.091	0.131	426
Emergency Contraception	6%	0%	15%	9%	18%	4%	34%	7%	0.471	465	NC	0.001	440	5%	13%	29%	0.071	0.000	426
Column total	17	22	66	33	107	52	123	45						153	104	210			
Ever use of condoms: Men																			
Condoms	25%	54%	60%	53%	66%	55%	71%	47%	0.000	821	0.001	0.000	821	52%	54%	70%	0.026	0.000	694
	53	74	142	76	152	99	150	75						327	275	226			

IS = Intervention schools, CS= Comparison school, SHC= School Health Center, IM=Interaction method, SM=Stratification method, User=SHC user, Non-user= SHC non user

NC = Not calculable, multivariate model would not converge

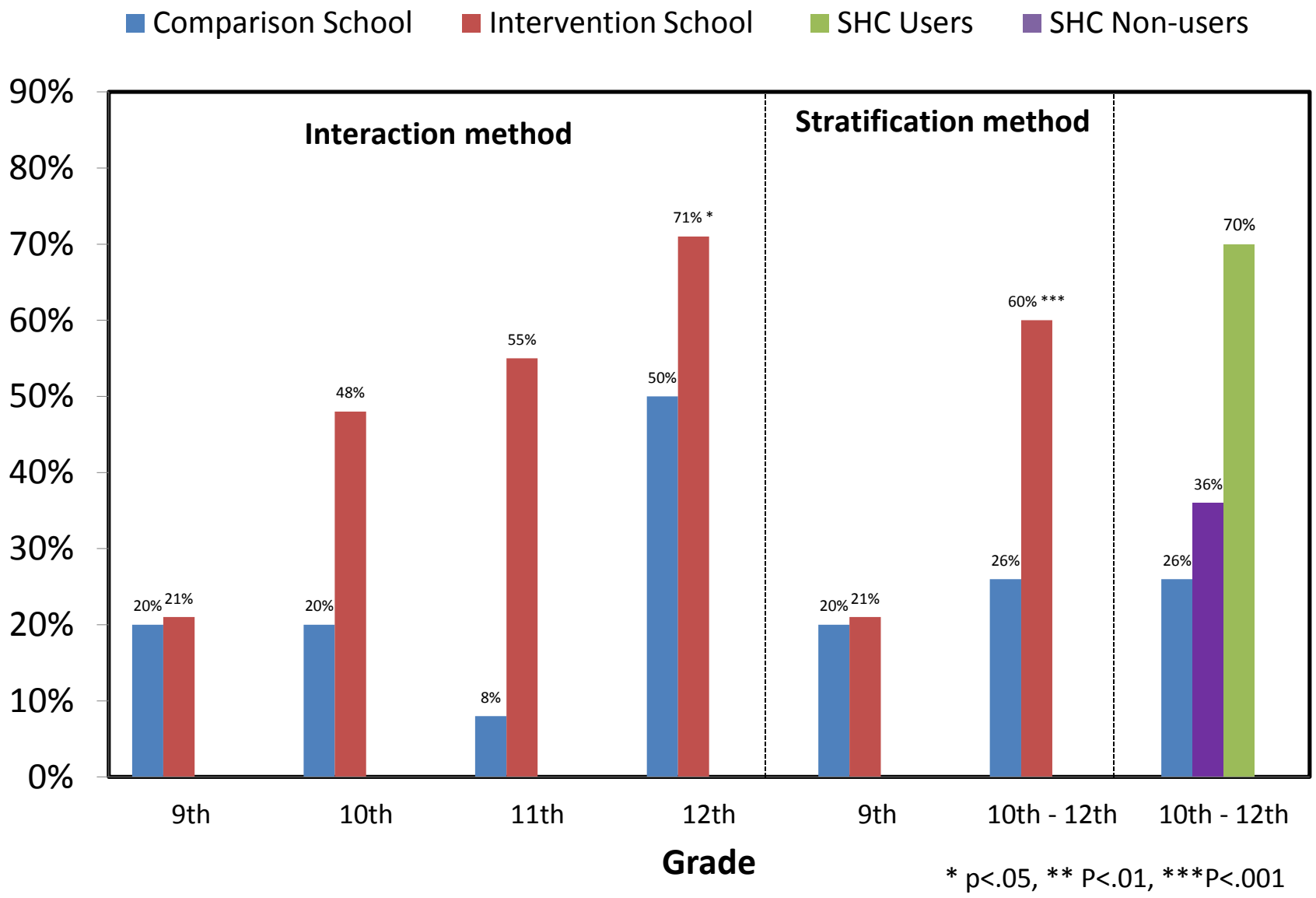
E. Figure

Figure 1. Willingness to Use a School Health Center for Reproductive Health Services



E. Figure

Figure 2. Ever Use of Hormonal Method(s) of Birth Control, Sexually-Experienced Females



Reproductive Health Impact of a School Health Center

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Abbreviations
School Health Center (SHC)
New York City Department of Education (NYC DOE)
Sexually Transmitted Infection (STI)
Youth Risk Behavior Survey (YRBS)
English as a Second Language (ESOL)
Stratification Method (SM)
Interaction Method (IM)

ABSTRACT

Purpose: While school health centers (SHC) may improve access to reproductive health care services and contraception, published data on SHC service use and reproductive health impact are limited.

Methods: Reproductive health indicators among students at four urban high schools in a single building with a SHC in 2009 were compared to students in a school without a SHC, using a quasi-experimental research design (n=2,076 students, 1,365 from SHC school and 711 from comparison school). The SHC provided comprehensive reproductive health education and services, including on-site provision of hormonal contraception.

Results: Students in the SHC school were more likely to report receipt of healthcare provider counseling and classroom education about reproductive health and a willingness to use a SHC for reproductive health services. Use of hormonal contraception measured at various time points (first sex, last sex, ever used) was greater among students in the SHC school. Most 10^{th}-12^{th} graders using contraception in the SHC school reported receiving contraception through the SHC. Comparing students in the non-intervention school to SHC non-users to SHC users, we found step-wise increases in receipt of education and provider counseling, willingness to use the SHC, and contraceptive use.

Conclusions: Students with access to comprehensive reproductive health services via a SHC reported greater exposure to reproductive health education and counseling and greater use of hormonal contraception. SHCs can be an important access point to reproductive health care and a key strategy for preventing teen pregnancy.

Keywords: Contraception, adolescent, school health services, school health center, access to health care

IMPLICATIONS AND CONTRIBUTIONS

Access to school-based, comprehensive reproductive health services was associated with increased use of hormonal contraception and exposure to reproductive health counseling and education. This study and prior research suggest school health centers can improve access to reproductive health service and may contribute to preventing teen pregnancy.

INTRODUCTION

School health centers (SHC) can contribute to the prevention of teen pregnancy – by providing access to comprehensive reproductive health services including hormonal and long acting reversible contraception, contraceptive counseling, and sexuality education. However, not all studies have found a significant impact of SHCs on contraceptive use or teen pregnancy rates (1-7). These mixed results may reflect differences among communities in reproductive health needs of adolescents and access to reproductive health care from other community providers. Likewise, these results may reflect the scope of reproductive health services provided by the SHCs; many SHCs face restrictions on providing comprehensive reproductive health services, particularly in prescribing contraception and in providing contraceptive services on-site (8). Other research has found high acceptance of SHCs by parents, students, and schools; strong parent support for reproductive health services provided in SHCs; and considerable student utilization of SHCs for reproductive health care (9-14). Importantly, no studies have found an adverse impact of SHCs, such as increases in sexual activity (15); one study found a significant delay in sexual initiation (1).

However, despite the establishment of the first SHCs in the United States over 40 years ago, the evidence remains limited of the impact of SHCs. In part, this lack of evidence reflects the challenges of evaluating SHC impact on reproductive health outcomes. SHCs are often implemented before evaluation is considered or baseline evaluation data are collected. Federal funding for rigorous evaluation has been limited. In contrast to school-based sexuality education, where considerable evidence of efficacy exists, relatively few studies of SHC impact have been conducted using quasi-experimental or experimental research designs. As a consequence of this limited evidence base, the U.S. Federal Office of Adolescent Health could not identify any effective

SHC interventions and has declined to fund replications of SHCs as a means to prevent teen pregnancy (16).

To address this lack of evidence-based research, our study used a quasi-experimental research design (described below) developed by Santelli and Kirby to measure the reproductive health impact of a SHC providing comprehensive reproductive health care to four New York City high schools (grades 9-12) sharing the same building. The study measured the willingness of students to use the SHC for reproductive health care, receipt of reproductive health education and contraceptive counseling, and use of contraception – in comparison to a similar New York City high school without an SHC.

METHODS

Ethical approval was obtained from the IRBs at Columbia University Medical Center and the New York City Department of Education. Parents were mailed informational opt-out letters 3-4 weeks before the survey was conducted. Information letters were given to students 1 week before the survey; assent of adolescents was obtained on the day of the survey with a waiver of documentation.

Students under the age of 18 years of age needed written parental permission receive primary care services. Minor adolescents could consent for services covered under the New York State minor consent statute (17) for family planning, sexually transmitted infection (STI) treatment, and mental health care.

Research Design

Our quasi-experimental research design simulated a cohort design but used cross-sectional data from students collected at the beginning of a single school year. In this research design, new 9th

grade students entering the intervention schools in the fall served as baseline research subjects; returning students had varying years of SHC intervention exposure. Therefore, 10th grade students had one year of intervention exposure, 11th grade students had two years of exposure and 12th grade students had three years of exposure. This design assumes maturation changes (e.g., increasing involvement in risk behavior with age) were similar in intervention and comparison schools. Likewise, the design assumes that entering cohorts were similar over time (i.e., there were no marked temporal changes in behaviors or risk factors, such as increasing or decreasing risk involvement in sexual behavior).

An important assumption to our quasi-experimental design is that preexisting, nonintervention factors that influence the health outcomes of students can be measured via a proxy baseline. The assumption was evaluated by examining the equivalence of 9th grade students who are entering the intervention and comparison schools on health behaviors and prior use of health services. Our method provides improved prevision over a post-only quasi-experimental design. A previous study - using the same dataset and evaluation design - found that our design worked well in evaluating the impact of primary care services provided in a SHC (18).

In an ideal research design baseline data should have been collected before school started or before students could access the SHC. Practically we were unable to accomplish that for our study. Thus, while school started in early September, questionnaires were administered between September 29, 2009 and October 2, 2009 at the SHC school and on October 5, 2009 at the comparison school. Based on survey responses, we estimated that approximately 7-10% of 9th grade students in the SHC school were seen at the SHC before the surveys were conducted.

Health Services at the SHC and in Comparison School

The SHC was established in 1995 and services were similar to the Self Center model (1) which combined reproductive health care, counseling in the health center, and classroom education. The SHC was located in a school building housing 2,700 students in four different high schools. (School buildings in NYC commonly contain multiple schools.) The SHC provided primary care and reproductive health services to all four high schools. Clinical staff included two-to-three full time adolescent medicine trained physicians or nurse practitioners and two full time mental health providers. Classroom-based education on pregnancy and STD/HIV prevention was delivered by two health educators who also provided individual reproductive health education and counseling in the SHC. During the year before our survey, the SHC registered 2,732 visits from 876 patients; of these 59% included reproductive care. Students in the SHC were asked to complete an annual health assessment that screens for behavioral risk based on the GAPS and HEADSS and services models (19, 20). Reproductive services included STI testing and onsite treatment, HIV counseling and testing as per New York State standards, urine pregnancy testing, and onsite dispensing of contraception including condoms, emergency contraception, a range of hormonal methods (including birth control pills, patch, ring, injection), and referrals for IUDs and complicated reproductive health care. The SHC used a Quick Start method for starting contraception among female patients.

The comparison school was also housed in a school building with four separate schools and more than 5,000 students. We picked one comparison school (1,316 students) which had the best match on ethnicity and family poverty to the intervention schools, based on NYC DOE data on race/ethnicity and eligibility for free school lunch. Health services for the comparison high school included HIV education, a condom availability program, and a full time nurse who provided first

aid and referral to community care for the four high schools in the building. Intervention and comparison schools primarily served students from northern Manhattan and the Bronx.

Data Collection

A 64 item paper and pencil questionnaire was created that could be completed in one 45 minute class period and modeled after the 2007 New York City Youth Risk Behavior Survey (YRBS). Data were anonymously collected in classrooms, gyms, and auditoriums. We pretested the questionnaire with 14 students from the SHC school. In addition to YRBS questions on demographic factors, sexual behaviors, and drug use we added questions on immigration; general health status; contraceptive use; use of health services; clinical counseling, and sexuality education; and willingness to use the SHC. We used previously validated questions on health behaviors from the YRBS (21) and on clinical care and counseling (22, 23).

We excluded students enrolled in special education classes and classes for English as a Second Language (ESOL) at the intervention school. We attempted to do the same in the comparison school but these students were incompletely excluded. To indirectly estimate the impact of the contamination, we compared item non-response between the samples from the intervention and comparison schools. We expected to see high item non-response among special education and ESOL students. We found no difference between the two samples.

At the intervention school, 1,969 students in grades 9-12 in regular education were eligible to participate. At the non-SHC school 1,316 students were eligible to participate. Across both schools, 35 parents refused permission to participate and 55 students refused to provide assent. Among eligible students, 206 were absent from the SHC school and 170 were absent from the comparison school on the days that the survey was administered. The response rate was 77.3% at the intervention school and 67.2% at the comparison school.

At the data analysis phase, we also excluded 17 students who were repeating 9th grade and 190 incoming 9th grade students who had attended a middle school with an SHC. The latter group had potentially used a middle school SHC and could not be considered a baseline or unexposed group. Our final sample included 2,076 students – 1,365 students from the SHC school and 711 students from the comparison school.

Data Analysis

We measured the school-wide impact of the SHC and used three different statistical methods to test difference between schools; each has specific advantages and provides somewhat different evidence for SHC impact, as explained below. All three methods used multivariate regression (logistic regression or OLS regression) to measure statistical differences and to adjust for demographic differences (in Latino ethnicity, gender, and sexual experience) between schools. In total, we ran 60 separate multivariate analyses; these are presented as p-values in Tables 2 (24 analyses) and 3 (32 analyses) and Figures 1 and 2 (2 analyses for each figure).

The primary (and most rigorous) statistical analysis method (the *Interaction Method*) examined the statistical significance of school-by-grade interaction terms, using 9th graders as baseline subjects. These interaction terms tested whether the association of grade with each dependent variables (e.g., willingness to use a SHC) varied between intervention and comparison schools. For example, we expected willingness to use a SHC to increase by grade at the SHC schools but not at the comparison school. The first 4 sets of bars in Figure 1 provides a visual illustration of the interaction of school and grade; willingness to use a SHC rose with grade but only in the SHC schools. Using the Interaction method, evidence of SHC impact was based on the significance of the interaction term in the multivariate regression.

A secondary (and more simple) statistical method compared 9th grade students and 10th - 12th graders between the two schools controlling for demographic factors. Differences between the intervention and comparison schools at 9th grade were considered to be baseline differences. Differences between schools among 10th through 12th grade students should be consider as intervention effects. We called this statistical method the *Stratification Method.* The SM may be better at finding a SHC impact when the sample size is low. For example, in our analyses of contraceptive use, we included only sexually experienced students. The percentage of students who are sexually experienced is lowest in 9th grade.

We initially examined data separately by gender, but found few differences in the pattern of responses by school therefore we combined data. The exception was contraceptive use and those results are presented by gender. Data analysis on contraceptive use was limited to students reporting sexual experience (i.e. ever had sexual intercourse); this resulted in a reduced sample size for analysis, particularly for 9th graders.

A third statistical method compared SHC users and non-users in the intervention schools to students in the comparison school. These analyses were limited to 10th-12th grade and thus had a smaller sample (n=1,644). While differences between SHC users and non-users may represent either self-selection or SHC impact or both, we found this third method insightful in certain circumstances.

RESULTS

Our analyses of SHC impact focused on four measures: willingness to use a SHC for reproductive health care, receipt of classroom education and health care provider counseling, use of

contraception, and source of contraception. As noted above, statistical testing controlled for (or stratified by) gender, Latino ethnicity, and ever had sexual intercourse.

Description of the Sample

Similar percentages of students in intervention and comparison schools were born in the United States: 72% in the intervention schools and 70% in the comparison school (Table 1). Students in the intervention schools were more likely to be Latino (88% vs. 68%) and female (47% vs. 38%). Somewhat fewer students in the intervention schools were sexually experienced. There were no significant differences between intervention and comparison schools on number of lifetime partners or sexual partners in the last three months, as reported by sexually experienced students (data not shown). Within the SHC schools, users were similar to non-users for place of birth and Latino ethnicity. Users, compared to non-users, were more like to be female (52% vs. 42%) and sexually experienced.

Willingness to Use a School Health Center

Students in the intervention schools were also more likely to report willingness to use a SHC for reproductive health services, compared to students in the comparison school using either the *Interaction Method* (IM) or the *Stratification Method* (SM) (Figure 1). At baseline (9th grade) similar percentages reported a willingness to use the SHC but differences between schools increased sharply by grade. By 12th grade, 81% of students in the intervention schools were willing to use the SHC compared to only 35% at the comparison school. Over 80% of SHC patients (i.e., users) reported willingness to use a SHC for reproductive health services compared with 57% of non-users and 37% of students in the comparison school.

Receipt of Education and Health Care Provider Counseling

Students attending the intervention schools were more likely to report that someone other than a teacher talked with them about abstinence, condoms, and HIV/AIDS in class (Table 2). For the 9th grade, these percentages varied from 25% to 40%. Receipt of education on these three subjects rose in both the intervention and comparison schools but the increase by grade was greater in the intervention school. Compared to students in the non-intervention school, students attending the intervention schools were also more likely to report classroom-based education about HIV and STI counseling. On all three topics, SHC users reported the highest rates of education followed by non-users; and by comparison school students.

Students in the SHC schools reported increased likelihood of having talked with a health care provider about birth control and emergency contraception in the last twelve months compared to students in the non-intervention school. Receipt of provider counseling increased with grade in the comparison school but the increase with grade was greater in the intervention schools. SHC users reported more provider counseling about birth control compared to non-users or students in the comparison school (53% vs. 38% vs. 31%, respectively). A similar pattern of provider counseling was found for emergency contraception.

Contraceptive Use Among Sexually Experienced Students

Ever use of a hormonal method by young women was higher among students in the intervention schools compared to those in the non-intervention school (Figure 2). At 9th grade baseline, ever use of hormonal methods was similar; ever use rose to 71% in grade 12 in the intervention schools and 50% in the comparison school. Ever use was also higher among SHC users (70%) vs. students in the comparison school (26%) (Figure 2).

Young women in the intervention schools were also more likely to have ever used many individual contraceptive methods, including pills and the shot. The SM but not the IM found

differences in ever use of the ring, and emergency contraception (Table 3). Young men in the intervention schools were more likely to have ever used condoms, compared to students in the non-intervention school by the IM and SM. Among young men, SHC users were also more likely to report ever use of condoms (70%) vs. non-users (54%) vs. comparison school students (52%).

Contraceptive use at first intercourse showed a similar pattern. Use of a hormonal method at first intercourse by young women was higher by the SM (p=.008) but not the IM (p=0.394). At 9th grade, first use of a hormonal method was 7% in the intervention schools and 4% in the comparison school; first use rose to 20% in grade 12 in the intervention schools and 2% in the comparison school. Use of condoms at first intercourse by young men was higher by the IM (p=.015) but not the SM (p=0.201).

Contraceptive use at last intercourse was higher among young women in 10th-12th grade in the intervention schools at 30% vs. 20% in the comparison school. SHC users were more likely to have used a hormonal method at last intercourse compared to non-users and comparison school students (34% vs. 22% vs. 20%). Condom use at last sex among young men was not statistically different among the intervention and comparison schools or between users and non-users.

Sources of Contraception

Students reported a variety sources for contraception including the SHC, private providers, hospital and community clinics, family planning clinics, and non-medical sources such as family, friends, and bodegas (non-medical sources were common among students using condoms). Overall, 60% reported receiving contraception from a clinic or health care provider, 16% from friends, families, and bodegas, and 6% from both; 29% reported no source of contraceptive supplies. Young women were more likely to receive contraception from a clinic or health care provider (73%) compared to young men (52%). Among teens who used the SHC, 80% of women

and 41% of men reported the SHC was their usual source of contraception. Use of a clinic or health care provider for contraception was higher among young women who were SHC users (89%), compared to non-users (63%) or comparison school students (50%).

DISCUSSION

This study demonstrates a pattern of improved reproductive health care and education among students in high schools with a SHC providing comprehensive sexual and reproductive health care, compared to students in a school without a SHC. Comprehensive services include reproductive health education in classrooms and counseling and onsite dispensing of contraception. The SHC improved access to health education in classrooms, increased conversations between students and providers, and increased contraceptive use. While not measured directly in our study, these services may have reduced unplanned pregnancies among adolescents. We also found step-wise increases in willingness to use a SHC, receipt of provider counseling, and contraceptive use – comparing students in the non-intervention school to non-users to SHC users. SHC users consistently had the highest percentages using contraception.

Students in the intervention schools were more willing to use a SHC for reproductive health services contrasted to students in the comparison school. In a previous publication, we found that students within the intervention schools were much more likely to believe that their school should have an SHC (18). Previous research has suggested a *learning curve* in student support for school-based services (14); as students know more about the SHC, their willingness to use the SHC increases. Likewise, students may have multiple reasons for not using a SHC, including lack of parental permission, adolescent or parent preference for an existing healthcare provider, lack of

knowledge or misinformation about the SHC, peer influences, and misperceptions/concerns about confidentiality.

Contraception is the most important proximate determinant of teen pregnancy among sexually active youth (25) and previous SHC pregnancy prevention efforts have focused on increasing contraceptive use to reduce teen pregnancy (1,2). In this study, we found increases in contraceptive use among SHC students as measured by ever use, at first intercourse, and use at last intercourse. Likewise, SHC users were more likely to use contraception compared to either non-users or students at the comparison school. Not surprisingly, students attending a school with an SHC were likely to receive contraception at the SHC.

Many school health centers are still restricted from providing various aspects of reproductive health care, although access to reproductive health care via SHCs increased between 1998 and 2008 (8). In 2007-08, 61% of SHC serving high schools were still prohibited from dispensing contraception down from 76% in 1997-98 (26). The mixed results from previous studies regarding the impact of SHC may reflect these restrictions to reproductive health care. Given these restrictions, findings from our study should not be assumed to be typical for all SHCs.

We found substantial differences among SHC users, non-users, and students in the comparison school. The differences may represent SHC impact but also self-selection of students with perceived health problems into the health center. Users and non-users were higher than comparison school students on many measures: this pattern suggests SHC impact not self-selection.

Limitations

We used a quasi-experimental research design which assumes a relatively constant set of admission policies over time and no change in school catchment areas. While school officials reported no changes in these over the prior 4 years, this possibility cannot be ruled out.

Limitations include the difficulty in matching public high schools on key demographic factors that may influence SHC use and use of contraception. While we controlled for these statistically, high schools often have unique histories and features (e.g., leadership of the school, historical events occurring at the school) that are difficult to measure.

We found similar results using our two primary statistical methods: the Interaction Method and Stratification Method; however, discrepancies in statistical results were not uncommon when statistical power declined. The sample sizes were smaller when examining contraceptive use, as the denominators were limited to sexually experienced adolescents and results were stratified by gender. This was particularly an issue at the 9th grade where most adolescents were not sexually experienced. It was also an issue when considering uncommon methods.

Other limitations include the use of self reported data the use of only two schools, and a limited sample size when analyzing contraceptive use. We can say little about long acting reversible contraception, as IUDs in NYC SHCs became available after our data were collected.

A small group of 9th graders (7-10%) has used the SHC in September – before our baseline assessment. This decreased our ability to detect SHC impact.

Implications

SHC's provide essential reproductive health care to adolescents in many communities. We found evidence of a positive impact of a SHC on various reproductive health measures. Such evidence supports efforts to expand the number of SHCs and to enhance services in SHCs not yet providing comprehensive reproductive health care.

In our study, students with access to comprehensive reproductive health services were more likely to use hormonal contraception. Other research finds that increased contraceptive use among teens reduces unintended pregnancy (24, 25). To be maximally effective in reducing teen pregnancy, SHCs must be allowed to prescribe and dispense a full range of contraceptive methods, including hormonal methods and long-acting reversible methods. This will mean addressing political and cultural barriers to providing such care. Improving access to contraceptives through SHCs will require the support of school officials, health care providers, community leaders, students, and parents (1,10,13,14).

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Reviewers' comments:
Response in red below:

Reviewer #1: I have reviewed the revision to the manuscript. I agree with the recommended clarifications and changes, and the authors replies. I believe the article is stronger and will be a major contribution to the literature. I support publishing the article.

Reviewer #2: I found my questions from my initial review adequately addressed and have no additional concerns.

Thanks to both of you.

Reviewer #3: The authors are commended by their responsiveness to the critiques of the earlier draft and their numerous efforts to respond to the feedback. The paper is much clearer to understand and to follow. Additionally, the limitations are clearly written.

Thanks for your careful comments, both the initial set and follow up ones.

There are still a few issues that need further clarification.
First, a minor edit---tense in the following sentence.
Page 9:
Differences between schools among 10th through 12th grade students were consider (should be Considered)

Fixed.

2. While there is greater explanation for the use of Interaction and Stratification Method, the discussion section did not respond/refer to when results where different by the use of different statistical methods---for example, on page 11.

Contraceptive use at first intercourse showed a similar pattern. Use of a hormonal method at first intercourse by young women was higher by the SM (p=.008) but not the IM (p=0.394).

It would be helpful to know how the statistical approaches may have resulted in these findings as part of the discussion. Also, in another section, the authors commented that they ran, 60 separate multivariate analyses. While it might not have been their intent, this makes it sound like the authors were on a "fishing expedition", rather than what was likely a strategic analytic approach.

Differences between the two methods became a problem when examining contraceptive use, because of small numbers of adolescents who are sexually active in the 9th grade or because few adolescents are using less common methods. Thus, we see a very consistent pattern of results between the IM and SM in Table 2, where the analysis sample was not limited. Table 3 shows a number of discrepancies, including discrepancies in p values for ring, patch and EC. For condom and pill use (which are more commonly used methods), there were not discrepancies.

We have added a paragraph to the Limitations to describe this problem.

We found similar results using our two primary statistical methods: the Interaction Method and Stratification Method; however, discrepancies in statistical results were not uncommon when statistical power declined. The sample sizes were smaller when examining contraceptive use, as the denominators were limited to sexually experienced adolescents and results were stratified by gender. This was particularly an issue at the 9th grade where most adolescents were not sexually experienced. It was also an issue when considering uncommon methods.

Finally, Within the SBHC school, there were sexually active students who did not receive family planning care on site...It would be helpful to add additional information on their profile? what might have been factors that precluded them from seeking care there, even when available?

Other research finds that students in schools with a SHC, often use other sources for general health care and for reproductive health care. Reasons that a student might not use the SHC include adolescent or parent preferences for an existing health care provider, lack of parental permission, lack of knowledge or misinformation about the SHC, peer influences, and perceptions/concerns about confidentiality. With the last revision, we have added information on Sources of Contraception to the Results section; over 80% of female clinic users received their birth control at the SHC (see page 12).

We do not have data on why adolescents used other providers and have added a sentence to the discussion about this issue.

Likewise, students may have multiple reasons for not using a SHC, including lack of parental permission, adolescent or parent preference for an existing healthcare provider, lack of knowledge or misinformation about the SHC, peer influences, and misperceptions/concerns about confidentiality.

While the following presents information on this group of non-users in terms of condoms...at the SBHC, additional information would be helpful We are unclear what addition information would be helpful.

Young men in the intervention schools were more likely to have ever used condoms, compared to students in the non-intervention school by the IM and SM. Among young men, SHC users were also more likely to report ever use of condoms (70%) vs. non-users (54%) vs. comparison school students (52%).

Contraceptive use at first intercourse showed a similar pattern. Use of a hormonal method at first intercourse by young women was higher by the SM (p=.008) but not the IM (p=0.394). At 9th grade, first use of a hormonal method was 7% in the intervention schools and 4% in the comparison school; first use rose to 20% in grade 12 in the intervention schools and 2% in the comparison school.

Again, we do not have data on why adolescents used other providers and/or why they were non-users.