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Patterns of Chlamydia/Gonorrhea Positivity Among Voluntarily Screened New York City Public High School Students

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A B S T R A C T

Purpose: Chlamydia trachomatis (CT) and Neisseria gonorrhoeae (GC) are common sexually transmitted infections that disproportionately affect adolescents. Annual screening for CT for sexually active female adolescents is recommended. In 2006, New York City began conducting CT/GC education, screening, and treatment in public high schools. We examine 3-year programmatic outcomes and the relationship between sexual activity, screening, and CT/GC positivity.

Methods: We describe the epidemiology of students who screened and those infected with CT/GC. Univariate, bivariate, and multivariate logistic regression analyses were performed to assess relationships between sex, race/ethnicity, age, sexual activity, and screening status; and the relationship between sexually transmitted infection positivity and sexual activity.

Results: Between July 2006 and June 2009, we educated 57,418 students and screened 27,353 (47.6%) for CT/GC; 1,736 (6.3%) students were reported to be infected with either organism. Students who screened positive were more likely to be females (8.9%), report black race (8.3%) and be ≥ 16 years of age (6.6%–9.7%). Screening rates were 70.6% for students who were sexually active, 27.9% for those who had never had sex, and 47.3% for those who did not respond to the sexual activity question; CT/GC positivity was 7.2%, 1.4%, and 6.1%, respectively.

Conclusions: Black, older adolescent females were most likely to screen positive for CT/GC in this population. A large proportion of students who did not answer the sexual activity question chose to screen for CT/GC and screened positive. School screening programs should offer screening to all students regardless of reported sexual activity. Programs should target females and older adolescents.

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In the United States, Chlamydia trachomatis (CT) is the most frequently reported bacterial sexually transmitted infection (STI) among all age groups and *Neisseria gonorrhoeae* (GC) is the second most commonly reported. Both nationally and in New York City (NYC), adolescents and young adults aged 15–24 years have the highest rates of CT and GC infection [1,2]. In 2009, there were 58,353 cases of CT reported to the New York City Department of

Health and Mental Hygiene (NYC DOHMH), and 64.3% (n = 37,529) of the total cases were reported to be among adolescents and young adults aged 15–24 years [3]. The Centers for Disease Control and Prevention and the U.S. Preventive Services Task Force recommend that all sexually active females under 25 years of age should be screened annually for CT [4,5]. Because CT is largely asymptomatic, adolescents may be unaware of their risk and thus do not seek STI screening services. To address the Centers for Disease Control and Prevention screening recommendation, the asymptomatic nature of CT, and to better serve adolescents at high risk for STIs, several cities have implemented high school CT/GC education, screening, and treatment programs.

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Louisiana was the first to conduct high school STI screening in 1995. Since then, some areas served by Indian Health Service as well as several cities, including Baltimore, Chicago, Los Angeles, Miami, NYC, Philadelphia, San Francisco, and Washington, D.C., have launched similar programs [6–12]. School-based STI screening is an effective way to reach adolescents and young adults and appears to be an economical means of reducing disease burden and preventing pelvic inflammatory disease [13,14].

The 2007 New York City Youth Risk Behavior Survey (NYC YRBS), a local self-administered survey conducted every 2 years among public high school students to monitor a range of health risk behaviors, indicated that 52% of males and 41% of female students in grades 9 through 12 reported having ever engaged in sexual intercourse, and 59% reported ever having had sex before 12th grade [15]. Using the findings of the Louisiana and Philadelphia school-screening programs, which promoted dual CT/GC screening, in the spring of 2006 the NYC DOHMH Bureau of Sexually Transmitted Disease Control, with the support of the NYC Department of Education, began an STI education, CT/GC urine screening, and treatment program for NYC public high school students known as the School-based STD Testing and Education Program for Urban Populations (STEP-UP) [12,16]. STEP-UP is currently active in all five NYC boroughs (Bronx, Brooklyn, Manhattan, Queens, and Staten Island), and targets public schools located in neighborhoods with high adolescent CT rates and public schools lacking onsite health services. From years 2006 to 2009, the New York City Department of Education operated approximately 405 public high schools annually, which served 250,000 students [17]. Current program goals are to reach 110 high schools annually, educate approximately 25,000 students, and screen approximately 12,500 students (50% of those educated). Although New York State Public Health Law allows the right to STI screening without parental consent or notification to the minors under 18 years of age, the STEP-UP program uses passive parental opt-out consent procedures, whereby individual principals are required to send out letters to all parents/guardians notifying them of the school's participation in the STEP-UP program [18]. Principals are then required to withhold any students whose parents/guardians have returned signed opt-out letters from participating in STEP-UP education and screening. To the authors knowledge, <25 parents/guardians return opt-out letters annually. During the educational presentation, students are advised that they should be screened for CT/GC if they have ever had sexual intercourse. However, screening is voluntary and confidential, and students' sexual history is unknown during the screening process.

In 2008, the NYC STEP-UP program introduced a question asking all students whether they had ever been sexually active (vaginal, anal, or oral sex) in order to assess whether we were screening a sexually active population. The question asks about sexual history using the proper terms for anatomic sites. Previously published data had shown that black and Hispanic youth more accurately responded to proper anatomic terms rather than slang terminology [19]. Previous studies have found that adolescents respond to self-reported sexual behavior questions more consistently and honestly than other behavior questions and that data on sexual intercourse are the most consistently reported among any sexual behavior information [20–23]. All students are asked to complete this questionnaire confidentially. The NYC STEP-UP program is one of the first high school screening programs to begin examining self-reported sexual activity among participants. Philadelphia began asking about sexual ac-

tivity during the 2009–2010 school year (M. Salmon, written communication, December 18, 2009) and New Orleans conducted a survey between 2000 and 2003, in which 74.3% of students reported ever having had intercourse [24].

This article examines: (1) the NYC STEP-UP programmatic statistics for the school years 2006–2009, including the number of students educated, screened, and treated, as well as CT/GC positivity by sex, race, and age; (2) the proportion of students who reported previous sexual activity who chose to be screened for CT/GC as compared with the proportion who reported no previous sexual activity in 2008–2009; and (3) the CT/GC screening results among students who reported previous sexual activity compared with those who reported no previous sexual activity and those who did not respond to the sexual activity question.

Methods

Study population

Since July 2006, NYC DOHMH staff have offered classroom-based STI education and urine CT/GC screening to public high school students throughout NYC. Between July 2006 and June 2009, the NYC STEP-UP program screened 27,353 students for CT/GC in 244 high schools. By year, STEP-UP went to 44 schools in 2006–2007, 89 schools in 2007–2008, and 111 schools in 2008–2009. Students who screen positive are treated promptly and interviewed to elicit contact information for sex partners.

Data collection

Between years 2006 and 2009, all students, before screening and regardless of whether or not they chose to screen, were asked to complete a form in the classroom with their name, sex, date of birth, race/ethnicity, and address. For students who submitted specimens for CT/GC screening, additional variables for analysis included CT and GC results and treatment status.

Data on sexual activity were available for both screeners and nonscreeners for the 2008–2009 school year only. Sexual activity was ascertained using the following question: "Have you ever had ANY kind of sex—oral, vaginal, or anal sex?" with an option of "yes," "no," or "no response." Respondents who reported "Yes" to this question were considered "sexually active."

Data included all participants between 14 and 19 years of age (97% of all students who participated in the program) and excluded false-positives between years 2006 and 2009 ($n = 141$) and those with inconclusive screening results ($n = 177$). A test was considered to be false-positive if, on notification of a positive CT or GC test, the student reported having no past sexual activity, and the student tested negative on a subsequent retest.

Laboratory methods

Urine specimens were collected at school sites and screened for CT and GC at the NYC Public Health Laboratory using BD ProbeTec Nucleic Acid Amplification Test (Becton Dickinson, Franklin Lakes, NJ).

Data analysis

Data were entered into Microsoft Access and Excel and statistical analyses were performed using SAS (Statistical Analysis Software) version 9.1, 2002–2003.

Table 1
Summary of program outcomes, 2006–2009^{a,b}

Characteristic	Male #n/N (%)	Female #n/N (%)	All #n/N (%)
School year	Number CT/GC positive (row %)		
2006–2007	59/2,172 (2.7)	144/2,090 (6.9)	203/4,262 (4.8)
2007–2008	269/5,933 (4.5)	597/5,806 (10.3)	866/11,739 (7.4)
2008–2009	198/5,596 (3.5)	469/5,756 (8.1)	667/11,352 (5.9)
Total (2006–2009)	526/13,701 (3.8)	1,210/13,652 (8.9)	1,736/27,353 (6.3)
Age	Number CT/GC positive (column %)		
<14	3/167 (1.8)	3/204 (1.5)	6/371 (1.6)
14	17/1,604 (1.1)	81/1,789 (4.5)	98/3,393 (2.9)
15	64/2,722 (2.4)	228/2,926 (7.8)	292/5,648 (5.2)
16	117/3,458 (3.4)	345/3,554 (9.7)	462/7,012 (6.6)
17	149/3,319 (4.5)	346/3,303 (10.5)	495/6,622 (7.5)
18	115/1,664 (6.9)	147/1,344 (10.9)	262/3,008 (8.7)
19	45/556 (8.1)	41/331 (12.4)	86/887 (9.7)
>19	16/211 (7.6)	19/201 (9.5)	35/412 (8.5)
Race/ethnicity			
Black, non-Hispanic	299/5,879 (5.1)	702/6,184 (11.4)	1,001/12,063 (8.3)
White, non-Hispanic	1/137 (0.7)	5/114 (4.4)	6/251 (2.4)
Asian, non-Hispanic	3/248 (1.2)	10/173 (5.8)	13/421 (3.1)
American-Indian/Alaskan native, non-Hispanic	2/111 (1.8)	11/123 (8.9)	13/234 (5.6)
Hispanic	176/6,346 (2.8)	422/6,155 (6.9)	598/12,501 (4.8)
Unknown	6/172 (3.5)	10/204 (4.9)	16/376 (4.3)
Other	39/808 (4.8)	50/699 (7.2)	89/1,507 (5.9)

^a Excludes false positives and inconclusive results.

^b Screening data by age and race/ethnicity are by column percentages.

We analyzed CT/GC screening positivity by sex, age, and race/ethnicity, and provided results for each year of program completion for the years 2006–2009. Additionally, we evaluated screening practices among all students and examined screening practices by sexual activity for the 2008–2009 school year. STEP-UP defines a school year starting July 1 and ending June 30 of the following year. We excluded students from the analysis of CT/GC screening status if they had missing data for sexual activity, age, or race/ethnicity, respectively.

Univariate and bivariate analyses were used to assess relationships between sex, race/ethnicity, age, sexual activity, and screening status; and the relationship between positivity and sexual activity. Associations with sex were evaluated using Pearson χ^2 tests. Crude and adjusted odds ratios (AOR) and 95% confidence intervals (CI) were obtained for the associations of sex, sexual activity, age, and race/ethnicity with CT/GC screening. Significant covariates, including sex, sexual activity, age, and race/ethnicity, were entered into the final logistic regression model using forward stepwise selection.

Results

Between July 2006 and June 2009, STEP-UP educated 57,418 students and screened 27,353 (47.6%) students for CT/GC, of whom 1,736 (6.3%) students screened positive for either or both infections. In all, 1,621 (93.4%) students who screened positive were found to be infected with CT alone, whereas 54 (3.1%) positive students were infected with GC alone and 61 (3.5%) positive students had CT/GC co-infection. Overall, 1,664 (95.9%) of students who screened positive were treated. Students who were not treated were either unlocatable or refused treatment. During the 2008–2009 school year alone, the program provided educational presentations to 23,974 students, of whom 11,352 (47.4%) chose to be screened for CT/GC and 648 (97.2%) were treated. Since the inception of STEP-UP, CT/GC positivity among females has been higher than males (8.9% vs. 3.8% from 2006 to

2009). STEP-UP data show that CT/GC positivity increases with age for both males and females, ranging from 98 (2.9%) among 14-year-olds to 86 (9.7%) among 19-year-olds. Of all race/ethnicity groups, black non-Hispanic females (702 [11.4%]) and males (299 [5.1%]) had the highest positivity (Table 1).

Among the students who answered the sexual activity question in 2008–2009, the number of students educated through STEP UP who reported sexual activity was 10,375 (56.4%). Males (5,147; 64.1%) reported greater sexual activity than females (5,228; 50.4%). Of all sexually active students, 7,326 (70.6%) screened for CT/GC. Approximately 2,241 (28.0%) of those who reported no previous sexual activity chose to screen for CT/GC. Among those who did not respond to the sexual activity question, 1,785 (47.3%) students chose to screen for CT/GC. Overall, more males than females who reported no sexual activity chose to screen for CT/GC. The percentage screened increased for each year of age for both males and females. However, males were more likely to screen than females at every given age. Among both males and females, non-Hispanic black, non-Hispanic American Indian/Alaskan Native, and Hispanic students were most likely to screen for CT/GC (Table 2).

In multivariate analyses, males were more likely to screen for CT/GC than females (AOR: 1.33, 95% CI: 1.25–1.42). Sexually active students were more likely to screen than those reporting no previous sexual activity (AOR: 5.18, 95% CI: 4.83–5.56). As compared with those reporting no previous sexual activity, students who did not respond to the sexual activity question were more likely to screen (AOR: 2.89, 95% CI: 2.64–3.17). As compared with students aged 16 years (median age of screeners), those younger than 14 years were significantly less likely to screen (AOR: .06, 95% CI: .05–.07), whereas both 18-year-olds (AOR: 1.19, 95% CI: 1.06–1.34) and students older than 19 years (AOR: 1.61, 95% CI: 1.21–2.15) were significantly more likely to screen. Hispanics were more likely to screen for CT/GC than their black, non-Hispanic counterparts. (AOR: 1.09, 95% CI: 1.02–1.17) (Table 3).

Table 2CT/GC screening status by self-reported sexual activity, age, and race/ethnicity, STEP-UP, 2008–2009^{a,b,c,d}

Characteristic	Male Screened/educated #n/N (%)	Female Screened/educated #n/N (%)	All Screened/educated #n/N (%)
Sexual activity			
Yes	3,646/5,147 (70.8)	3,680/5,228 (70.4)	7,326/10,375 (70.6)
No	988/2,883 (34.3)	1,253/5,148 (24.3)	2,241/8,031 (27.9)
No response	962/1,925 (50.0)	823/1,851 (44.5)	1,785/3,776 (47.3)
Age			
<14	91/1,291 (7.1)	80/1,465 (5.5)	171/2,756 (6.2)
14	627/1,178 (53.2)	753/1,834 (41.1)	1,380/3,012 (45.8)
15	1,040/1,838 (56.6)	1,183/2,559 (46.2)	2,223/4,397 (50.6)
16	1,359/2,137 (63.6)	1,479/2,670 (55.4)	2,838/4,807 (59)
17	1,311/1,921 (68.2)	1,367/2,318 (59.0)	2,678/4,239 (63.2)
18	744/1,029 (72.3)	629/975 (64.5)	1,373/2,004 (68.5)
19	302/405 (74.6)	175/275 (63.6)	477/680 (70.1)
>19	122/156 (78.2)	90/131 (68.7)	212/287 (73.9)
Race/ethnicity			
Black, non-Hispanic	2,339/3,822 (61.2)	2,505/5,142 (48.7)	4,844/8,964 (54.0)
White, non-Hispanic	76/203 (37.4)	66/193 (34.2)	142/396 (35.9)
Asian, non-Hispanic	125/269 (46.5)	93/293 (31.7)	218/562 (38.8)
American-Indian/Alaskan native, non-Hispanic	48/78 (61.5)	46/87 (52.9)	94/165 (57.0)
Hispanic	2,640/4,421 (59.7)	2,699/5,205 (51.9)	5,339/9,626 (55.5)
Unknown	70/678 (10.3)	75/735 (10.2)	145/1,413 (10.3)
Other	298/476 (62.6)	272/554 (49.1)	570/1,030 (55.3)

^a Excludes false positives (n = 2) and inconclusive results.^b Chi-square testing conducted to examine differences between students who screened versus non-screeners.^c Excludes students with missing values for sexual activity, age or race/ethnicity.^d All χ^2 analysis were statistically significant at $p < .001$.

CT/GC positivity among sexually active students was 526 (7.2%), compared with 32 (1.4%) for those who had never had sex and 109 (6.1%) for nonresponders. The CT/GC positivity for male nonresponders was similar to that of sexually active males (i.e., 38 [4.0%] vs. 156 [4.3%]). Female nonresponders had a slightly lower CT/GC positivity (71; 8.6%) than sexually active females

(370; 10.1%). Females reporting no previous sexual activity had a CT/GC positivity of 28 (2.2%) (Table 4).

Discussion

CT/GC school screening programs have been successfully implemented in several cities throughout the United States. The NYC STEP-UP program began in 2006 and has been expanding. Since the program's inception, nearly 58,000 students were educated and 28,000 were screened for CT/GC. The substantial resources required by such a large program are warranted as overall positivity (2006–2009) was found to be 6.3%, with higher positivity among females and peak positivity in the older ages for both males and females.

STEP-UP began asking about sexual activity in year 2008. NYC STEP-UP participants reported higher sexual activity rates than the NYC YRBS participants (56.4% vs. 46.1%, respectively). The difference may be because of STEP-UP's focus on schools located in high CT/GC morbidity neighborhoods. Almost half of the students who did not respond to the sexual activity question still chose to be screened for CT/GC.

Students who did not respond to the sexual activity question were as likely to screen positive as those who reported being sexually active. Male and female students may be under social pressure or feel embarrassed about answering a question pertaining to sexual history [25]. Female students who reported no previous sexual activity still had 2.2% CT/GC positivity, suggesting that they inaccurately reported their history of sexual behavior. Conversely, very few males who reported no previous sexual activity were CT/GC positive (0.4%), suggesting that males may more accurately report previous sexual behavior. However, males were more likely to screen than females and true prevalence of CT/GC may be underestimated if males who never had sex chose to screen [7,26,27].

Table 3Predictors of CT/GC screening status, STEP-UP, 2008–2009^a

Characteristic	CT/GC screening	
	Adjusted OR (95% CI)	p value
Sex		
Male	1.33 (1.25–1.42)	<.01
Female	Referent	
Sexual activity		
Yes	5.18 (4.83–5.56)	<.01
No	Referent	
No response	2.89 (2.64–3.17)	<.01
Age		
<14	.06 (.05–.07)	<.01
14	.85 (.77–.94)	<.01
15	.84 (.77–.92)	<.01
16	Referent	
17	1.03 (.94–1.13)	.58
18	1.19 (1.06–1.34)	<.01
19	1.20 (1.00–1.45)	.05
>19	1.61 (1.21–2.15)	<.01
Race/ethnicity		
Black, non-Hispanic	Referent	
White, non-Hispanic	.49 (.39–.62)	<.01
Asian, non-Hispanic	.72 (.60–.88)	<.01
American-Indian/Alaskan native, non-Hispanic	1.35 (.94–1.93)	.1
Hispanic	1.09 (1.02–1.17)	<.01
Unknown	.16 (0.13–.20)	<.01
Other	1.29 (1.12–1.50)	<.01

^a Excludes false positives (n = 2) and inconclusive results.

Table 4
CT/GC positivity by sex and self-reported sexual activity, STEP-UP, 2008 – 2009^a

CT/GC Result	Male			Female			All		
	Sexual activity		χ^2	Sexual activity		χ^2	Sexual activity		χ^2
	Yes #n/N (%)	No #n/N (%)		Yes #n/N (%)	No #n/N (%)		Yes #n/N (%)	No #n/N (%)	
Positive	156/3,646 (4.3)	4/988 (.4)	<.01	370/3,680 (10.1)	28/1,253 (2.2)	<.01	526/7,326 (7.2)	32/2,241 (1.4)	109/1,785 (6.1)
Negative	3,490/3,646 (95.7)	984/988 (99.6)	<.01	3,310/3,680 (89.9)	1,225/1,253 (97.8)	<.01	6,800/7,326 (92.8)	2,209/2,241 (98.6)	1,676/1,785 (93.9)

^a Excludes false positives (n = 2) and inconclusive results.

The major limitation of our analysis is that the data assessing sexual activity are self-reported; validating this information would be difficult. Students completed forms, regardless of whether they chose to test, in a classroom setting next to each other. Although staff emphasize the confidential nature of the forms and the screening process, students may feel that their answers are not private and that others may look at their responses. Motivational bias or the social context may influence either over- or under-reporting of answers to previous sexual activity [21,26]. Students filling out their forms are not required to complete the sexual activity question in order to be screened; however, during the presentation we encourage all students to complete forms accurately, and we also discuss the importance of sexual history as a risk factor for infection. Additionally, vaginal, anal, and oral sex are well-defined in the presentation to clarify any preconceived definitions and minimize incomplete or inaccurate reporting of sexual activity. Another limitation is the issue of false-positive test results identified during the 3 years of implementation (n = 141). Given that an estimated 28% of students who have never had sex still chose to screen for CT/GC (Table 2), we would expect this to lower the prevalence of CT/GC in the pool of students screened, and therefore to lower the positive predictive value of the test. We plan to use this information to continue strengthening our message to students that CT/GC screening is only recommended for those who are sexually active.

Finally, we analyze CT morbidity using standardized neighborhood areas which are defined by zip codes [28]. After neighborhoods are ranked, we attempt to have strong penetration in schools located in the top 10 neighborhoods. Given that schools are selected on the basis of location in high CT morbidity neighborhoods, we expect that high schools participating in STEP-UP may have a higher overall CT/GC positivity than would other NYC high schools. Thus, positivity findings are not necessarily representative of all NYC public high schools.

For the upcoming school year, STEP-UP plans to make additional changes to the sexual activity question. The question will be edited to match the YRBS to make direct comparisons. In addition, we are considering assessing whether students have screened for CT/GC outside of STEP-UP to measure community screening coverage.

We recommend that school screening programs emphasize previous sexual activity as a risk factor for CT/GC and indication for screening, but not limit screening on the basis of the responses. Our findings show that nonresponders may have similar risks for CT/GC as those who are sexually active, and suggest that students may not always honestly answer sexual behavior questions. School screening programs should be clear about risk factors associated with STIs and should consider using any local youth sexual risk behavior data to target specific neighborhoods for CT/GC screening programs. Furthermore, programs should expect higher CT/GC positivity rates among both older and female students; thus, programs should target these populations [11].

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