

Estimates of Risk for Chlamydia/Gonorrhea Associated with Disciplinary Alternative School Placement in United States Public High Schools

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Abstract

Background: In United States public schools, students in disciplinary alternative schools report engaging in risky sexual behaviors significantly more frequently than students in regular schools. We sought to determine whether the risk of chlamydia or gonorrhea infection in disciplinary alternative schools is significantly higher relative to the risk of infection in regular schools.

Methods: A matched case-control study was retrospectively designed using data obtained from New Orleans public high school students tested for chlamydia and gonorrhea in a school-based screening between the years 2001 and 2003. Cases were 63 African American students tested at a disciplinary alternative school during the school years 2001-2002 (n = 36) and 2002-2003 (n = 27). Each case was matched to 4 controls by date of birth, sex and race among respectively 3029 and 2216 students contemporaneously tested in regular schools. Mantel-Haenszel procedures for matched-pair analysis were used to estimate odds ratios, confidence intervals (CI) and significance tests.

Results: The odds ratio for chlamydia/gonorrhea infection associated with placement in disciplinary alternative school was 2.09 overall (95% CI 1.01, 4.30; p < 0.05), 1.43 (95% CI 0.50, 4.11; p > 0.40) among females and 3.25 (95% CI 1.18, 8.92; p < 0.025) among males.

Conclusions: Behaviorally troubled adolescents in disciplinary alternative school placement are the highest risk group for sexually transmitted infection ever identified in United States public high schools. These students and the disciplinary alternative schools where they are placed would benefit most from screening. They should be considered first for inclusion in any school-wide chlamydia and gonorrhea screening initiative.

Keywords: Infectious disease epidemiology; Matched case-control study; Risk estimate; Sexually transmitted infection; Adolescents

Abbreviations:

CI: Confidence Interval; NAAT: Nucleic Acid Amplification Test; OR: Odds Ratio; STI: Sexually Transmitted Infection; US: Unites States

Introduction

In United States (US) public education, conducts such as terrorism threats, drugs offenses, and alcohol offenses are grounds for automatic placement of offenders in a disciplinary alternative school program by law, but students may also be placed in a disciplinary alternative school at the discretion of school administrators for violations of the school's code of conduct [1]. Behaviors that expose adolescents to the risk of acquiring sexually transmitted infection (STI) include early age of sexual debut, high number of sexual partners, and non-use of condoms during sexual intercourse [2].

These behaviors do not result in placement in disciplinary alternative school, but they are associated with the behaviors that do [3]. Moreover, these sexual behaviors are reported significantly more often by students in disciplinary alternative schools than students in regular schools [4], indicating higher risk of STI in disciplinary alternative than in regular schools. But how much higher is the actual risk of STI associated with placement in a disciplinary alternative school relative to the risk of infection in a regular school has not been determined.

Infections with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are highly prevalent among adolescents in the US [5] including students in public education. With the use of nucleic acid amplification tests (NAATs) for detection of STIs in laboratory specimens that individuals can collect themselves in non-clinical venues, large scale screenings for chlamydia and gonorrhea were conducted over the past 2 decades in public high schools in New Orleans, New York City, and Philadelphia [6-9].

Beyond the determination of infection status among large numbers of in-school adolescents, these screenings provided and still provide

unique opportunities for investigating factors associated with actual risk of STI in this at-risk population.

During the school year 2002-2003, the Philadelphia screening program showed that prevalence for chlamydia/gonorrhea among students tested was highest in disciplinary alternative schools and was lowest in magnet schools [9]. However, most students tested attended regular schools, in whom prevalence among females was significantly lower than among females in disciplinary alternative schools, but not among males [9].

Because prevalence was additionally higher in African Americans and in older students in the school district, race and/or age differences may partially account for the differences observed between the 2 school types if proportionally more African Americans and/or older students were placed in disciplinary alternative than were enrolled in regular schools. That skewed proportionality has been seen in public high schools nationally [4], and it may explain the lack of statistically significant differences in infection rates among males and females in disciplinary alternative compared to males and females in regular schools, when race and age were adjusted for in subsequent analyses [10].

To date, no other school jurisdiction that has conducted large scale screening for chlamydia and gonorrhea in the US has reported data on the distributions of infections by school type, and it has not been determined whether there are significant differences in STI rates between students in disciplinary alternative schools and those in regular schools.

Between the years 2001 and 2003, the New Orleans public school district operated a small-sized disciplinary alternative school (capacity of placement: 41 students) which functioned at full capacity during the 2-year period. In response to requests from the administration of the alternative school, the chlamydia and gonorrhea screening [6,7,11] extended testing to this location.

The outcome of screening at the disciplinary alternative school has never been reported, but like in Philadelphia [9], chlamydia/gonorrhea test positivity was higher than it was in regular schools. Here, we retrospectively designed a matched case-control study to determine whether the risk of chlamydia/gonorrhea test positivity among participants in screening was significantly higher in disciplinary alternative school relative to the risk in regular schools, significance that was not achieved in an analysis of data from the Philadelphia screening program [10].

Methods

Setting

During the school year 1995-1996, a screening for chlamydia and gonorrhea using NAATs in urine specimens was launched in New Orleans public high schools. Details of this screening program, including consent solicitation, screening procedures, counseling and treatment of infected students, and partner notification and referrals, have been provided previously [6,11]. The program protocol was annually reviewed and approved by the institutional review board of the Louisiana State University Health Sciences Center in New Orleans.

Source population

The source population for the current study consisted of all students tested for chlamydia and gonorrhea in the New Orleans school-based

screening during the school years 2001-2002 and 2002-2003, when testing was extended to the disciplinary alternative school. In 2001-2002, 3029/7510 students (40%) were tested in regular schools [6] and 36/41 (88%) were tested at the disciplinary alternative school; in 2002-2003, 2216/6586 students (34%) were tested in regular schools [6] and 27/41 (66%) were tested at the disciplinary alternative school.

During the 2 school years, each urine specimen was tested for chlamydia and gonorrhea by BDProbeTec ET Chlamydia trachomatis and *Neisseria gonorrhoeae* amplified DNA assays (BD Diagnostics, Sparks, Md) [6,7]. A positive laboratory test result determined infection.

Selection of cases and controls

The cases were all of the 63 students (35 males and 28 females, all African Americans) tested for chlamydia and gonorrhea at the disciplinary alternative school during the 2 school years. Race, sex, and date of birth were obtained for every student who provided a urine specimen for testing each year, and these data remained available in the screening program database [6].

For each case, 4 African Americans of the same sex and born on the same day or within few days were selected as controls among students tested at their regular schools during the same school year [12]. Controls were selected independently of their chlamydia and gonorrhea laboratory test results.

Definition of exposure

We defined (STI) exposure as a positive laboratory test result for chlamydia, gonorrhea, or both infections (chlamydia/gonorrhea); this was because risky sexual behaviors expose individuals to the risk of acquiring either STI. Negative test results for both STIs defined non-exposure.

Data analysis

Analysis was stratified by sex because of sex's strong association with chlamydia and gonorrhea infection, the study exposure, in the source population [6,7].

The risks of infection among students in disciplinary alternative school relative to the risks among students in regular schools were estimated using matched-pair analysis procedures. Odds ratios (OR), confidence intervals (CI) and tests of significance for matched-pairs were estimated using the Mantel-Haenszel procedures described in classic papers [13-16], in textbooks [17-19], and applied in research articles by several authors [20,21]. A one-sided χ^2 test was performed; statistical significance was set at $p < 0.05$.

Results

During the 2 school years, respectively 366 and 296 students tested positive for chlamydia or gonorrhea in regular schools, and respectively 7 and 6 students tested positive for chlamydia or gonorrhea at the disciplinary alternative school (Table 1).

The prevalence of either STI among all students tested during the 2 school years was 12.6% (662/5245) in regular schools (95% CI 11.7%-13.6%) and 20.6% (13/63) at the disciplinary alternative school (Table 1, 95% CI 11.9%-33.0%); males: 8.6% (240/2794) in regular schools (95% CI 7.6%-9.7%) and 20.0% (7/35) at the disciplinary alternative school (Table 1, 95% CI 9.1%-37.5%); females: 17.2%

(422/2451) in regular schools (95% CI 15.8%-18.8%) and 21.4% (6/28) at the disciplinary alternative school (Table 1, 95% CI 9.0%-41.5%).

	2001-2002 (n = 36)	2002-2003 (n = 27)	Total (n = 63)
Males	(n = 20)	(n = 15)	(n = 35)
Chlamydia	1 (5.0%)	3 (20.0%)	4 (11.4%)
Gonorrhea	2 (10.0%)	2 (13.3%)	4 (11.4%)
Either STI	2 (10.0%)	5 (33.3%)	7 (20.0%)
Females	(n = 16)	(n = 12)	(n = 28)
Chlamydia	5 (31.3%)	1 (8.3%)	6 (21.4%)
Gonorrhea	0 (0.0%)	0 (0.0%)	0 (0.0%)
Either STI	5 (31.3%)	1 (8.3%)	6 (21.4%)
Total, either STI	7 (19.4%)	6 (22.2%)	13 (20.6%)

Table 1: Participation in (total tested, all African Americans) and yield of screening (total positive/total tested) at the disciplinary alternative school. STI: Sexually Transmitted Infection.

The 63 matched sets showing their chlamydia and gonorrhea laboratory test results are displayed in the online Supplementary Table. Table 2 displays the subset of cases and their matched controls that were included in the matched-pair analyses, in which laboratory test results for either STI were discrepant between the case and at least one

of the controls. For each case, the age, calculated on the day he/she was tested, was similar to the mean age of his/her 4 controls on that day (Table 2), because cases and controls were matched by their dates of birth.

Set #	Age, years		Chlamydia or gonorrhea laboratory test results				
	case	Controls*	Case	Control 1	Control 2	Control 3	Control 4
Males							
51	17	17	+	+	-	-	-
39	19	19	+	-	-	+	-
14	18	18	+	-	-	-	-
20	17	17	+	-	-	-	-
45	17	17	+	-	-	-	-
52	17	17	+	-	-	-	-
54	16	16	+	-	-	-	-
21	16	16	-	+	-	-	+
10	18	18	-	+	-	-	-
42	18	18	-	+	-	-	-
49	17	17	-	+	-	-	-
58	16	16	-	+	-	-	-
1	19	19	-	-	+	-	-
37	20	20	-	-	+	-	-
Females							
57	17	17	+	-	+	-	+

28	16	16	+	-	+	-	-
8	18	18	+	-	-	+	-
11	18	18	+	-	-	-	-
18	17	17	+	-	-	-	-
36	15	15	+	-	-	-	-
38	19	19	-	+	-	+	-
46	17	17	-	+	-	-	+
2	19	19	-	+	-	-	-
3	19	19	-	-	+	-	-
47	17	17	-	-	+	-	-
56	16	16	-	-	+	-	-
30	15	15	-	-	-	+	-
55	16	16	-	-	-	+	-
4	18	18	-	-	-	-	+
31	15	15	-	-	-	-	+
41	19	19	-	-	-	-	+
53	17	17	-	-	-	-	+

Table 2: Cases and their matched controls, all African Americans, in which laboratory test results for chlamydia or gonorrhea were discrepant between the case and at least one of the controls. *mean age of the 4 controls matched to the case, + denotes positive test result for either chlamydia or gonorrhea, - denotes negative test results for both chlamydia and gonorrhea.

In both males and females, the risk of chlamydia/gonorrhea infection was statistically significantly higher (OR = 2.09; 95% CI 1.01, 4.30; p < 0.05) among students in disciplinary alternative school relative to the risk among students in regular schools (Table 3); within sex, the increase in risk was statistically significant among males (OR = 3.25; 95% CI 1.18, 8.92; p < 0.025) but not among females (p > 0.40).

	OR (95% CI)	Chi-square	One-sided p
Males	3.25 (1.18, 8.92)	5.23	<0.025
Females	1.43 (0.50, 4.11)	0.44	>0.40
Total	2.09 (1.01, 4.30)	4.00	<0.05

Table 3: Association between placement in disciplinary alternative school and testing positive for chlamydia or gonorrhea, matched-pair analyses. OR: Odds Ratio; CI: Confidence Interval.

Discussion

Our study showed a significant two-fold increase in the risk of chlamydia/gonorrhea positivity associated with placement in disciplinary alternative school relative to the risk in regular schools. This indicates that high risk sexual behaviors that cluster among US high school students with behaviors that result in placement in a disciplinary alternative school [3] are associated with a two-fold increased risk of chlamydia or gonorrhea infection. That increased risk of chlamydia or gonorrhea infection remained statistically significant

among males. Higher odds ratio of chlamydia/gonorrhea positivity among males in our study is consistent with higher hazard ratios for chlamydia/gonorrhea positivity among males both in regular and in alternative schools compared to females in magnet schools in Philadelphia [10]. This is primarily due to the higher baseline infection rates in females than in males in US high schools [6-9]. Our combined findings indicate that behaviors that result in placement of adolescents in disciplinary alternative school are associated with an added risk of STI which is much higher in males than in females.

We used a case-control study design in which the outcome(s) of interest is (are) the assessment of exposure(s) among cases and controls [12,17,18,22]. Determining exposure through laboratory test results instead of by study subjects' self-reporting strengthened our analysis by eliminating inaccuracies in recall, a major threat to the validity of exposure assessment in case-control studies [12,23]. Also, differences in odds ratios within sexes (3.25 in males and 1.43 in females) and overall (2.09) indicate confounding in our data by sex, which we controlled both at the design stage through matching and at the analysis stage through stratified analysis [17-19]. Nonetheless, this also suggests the possibility of confounding by race in the source population, which however did not affect our analysis because all cases were African Americans and controls were matched to cases by race [12]. But this uniformity of race in our data limits the applicability of our estimates of risks to African American students only. It cannot be inferred from our study that the odds of chlamydia/gonorrhea infection in disciplinary alternative schools is increased 3.25 times in non-African American males and 1.43 times in non-African American

females relative to the odds of infection in same race non-African American males and females in regular schools. However, African Americans are disproportionately placed in disciplinary alternative schools nationwide [1,4,24], and they are also the population subgroup with the highest prevalence of STI [5]. Therefore, African American students were the appropriate population subgroup in which the association between placement in disciplinary alternative school and the risk of chlamydia/gonorrhea infection could be best examined. The known higher frequency of high risk sexual behaviors and the previously documented higher chlamydia/gonorrhea positivity in disciplinary alternative schools than in regular schools [4,9,10] indicate that the statistically significantly higher odds of STI in disciplinary alternative school relative to the odds of infection in regular schools in our study is likely to be valid [12].

Screening uptake at the disciplinary alternative school ($\geq 66\%$) exceeded the highest uptake in regular schools ($\leq 65\%$) [6], even though parental consent was equally required for students younger than 18 and the majority were younger than 18 (Supplementary Table) and therefore needed a parental consent to be tested. But despite the approval of the screening by the administrative authorities of the disciplinary alternative school, the higher student participation in screening, and the higher yield of screening, the disciplinary alternative school was not included as a screening site in the subsequent 2003-2004 and 2004-2005 school years [25]. The decision not to return to the disciplinary alternative school for screening was driven essentially by the small numbers of students available for testing at this location, which however reflected only the relatively small size of the New Orleans public school district. While we were testing 27 students in New Orleans out of 41 eligible during the school year 2002-2003, in the much larger Philadelphia school district the screening program was testing 639 students in disciplinary alternative schools [9]. In consequence, the findings we report here, because they are based only on smaller numbers of observations, which nonetheless did provide an adequate sample size to conduct a case-control investigation [18,22], particularly make strongly the case that the disciplinary alternative school, regardless of its size, is where in US public high schools students at the highest risk of STI are assembled. In fact, these students constitute the highest risk group for STI ever identified and locatable in high schools. Our statistically significant findings suggest that they represent an epidemiologic population which is different from the population school-wide STI screenings reach in regular schools.

The prevalence of STIs is highest among school-age adolescents as a consequence of their involvement in high risk sexual practices, and screenings have been conducted in schools to detect the most common bacterial STIs and to treat students who are found infected [26,27]. But there are currently very limited financial resources available to sustain and expand screenings for STIs in schools [27]. This scarcity of resources necessitates that any effort be directed primarily toward schools where the yield of screening would be higher [28]. In US public education, disciplinary alternative schools are demonstrably those schools. An implication of our findings is that students in disciplinary alternative school placement must be included in testing whenever STI screening can be offered to students in high numbers such as in school-based screening models implemented in New Orleans, New York City and Philadelphia [6-9]; and these students should be considered first when facing the choice of determining where in schools more limited resources for STI screening can be allocated [29,30]. In educational systems elsewhere with no equivalent of the concept of the US disciplinary alternative school, efforts aimed to

“identify students or schools that might most benefit from screening” [31] should be encouraged.

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Conflict of Interests

All Authors, none.

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