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Chlamydia trachomatis *and* Neisseria gonorrhoeae *Prevalence and Coinfection in Adolescents Entering Selected US Juvenile Detention Centers, 1997–2002*

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Background: **Juvenile detention centers offer public health practitioners an opportunity to gain access to large numbers of adolescents at risk for chlamydia and gonorrhea.**

Goal: **To describe the prevalence and coinfection of chlamydia and gonorrhea among adolescents in 14 US juvenile detention centers from 1997 to 2002.**

Study: **We calculated the prevalence of chlamydia and gonorrhea in males and females, stratified by race/ethnicity, age group, and site. We also calculated the proportion of adolescents with chlamydia that were coinfected with gonorrhea and the proportion of those with gonorrhea that were coinfected with chlamydia.**

Results: **The prevalence of chlamydia was 15.6% in 33,619 females and 5.9% in 98,296 males; gonorrhea prevalence was 5.1% in females and 1.3% in males. Of females with gonorrhea, 54% were coinfected with chlamydia, and 51% of males with gonorrhea were coinfected with chlamydia.**

Conclusions: **Chlamydia and gonorrhea prevalence was very high in females in all project sites. In males, chlamydia prevalence was high in some areas; however, gonorrhea prevalence was substantially lower. These prevalence data justify screening for chlamydia and gonorrhea among female adolescents in juvenile detention centers nationally.**

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Chlamydia trachomatis and *Neisseria gonorrhoeae* are the 2 most common reportable diseases in the United States.[1] In 2002, there were 834,555 reported chlamydial infections and 351,852 reported gonococcal infections in the United States.[1] In women, untreated chlamydial and gonococcal infections, which are usually asymptomatic, may lead to serious health consequences such as pelvic inflammatory disease, ectopic pregnancy, and infertility.[2] Epidemiologic and laboratory research have demonstrated that bacterial sexually transmitted diseases (STDs), including gonorrhea and chlamydia, facilitate HIV transmission.[3] Lifetime medical costs associated with chlamydial and gonococcal infections in 15- to 24-year-olds in 2000 were estimated at $325.4 million.[4] Screening for chlamydia and gonorrhea has been shown to be a cost-effective strategy for preventing adverse reproductive health consequences.[5]

Chlamydia and gonorrhea rates are highest in adolescent women aged 15 to 19 years and highest in men aged 20 to 24 years.[1] The Centers for Disease Control and Prevention (CDC) recommends chlamydia screening for pregnant women, annual screening for sexually active adolescents, for women aged 20 to 25, and for older women with risk factors (e.g., those who report new or multiple sex partners).[6] The United States Preventive Task Force recommends routine chlamydia screening for all sexually active women aged 25 years and younger and gonorrhea screening for high-risk asymptomatic women (i.e., commercial sex workers, persons with a history of repeated episodes of gonorrhea, and women under the age of 25 years reporting 2 or more sex partners in the past year).[7] There are no guidelines for screening men.

Urine-based nucleic acid amplification tests for detecting chlamydia and gonorrhea have facilitated screening for these infections in nontraditional settings such as juvenile detention centers. While there are few reports of the prevalence of gonorrhea in this population or of coinfection with chlamydia in incarcerated youth, a high prevalence of chlamydia has been found.[8–11] Based on these findings, screening incarcerated adolescent females for chlamydia has been recommended by the CDC.[12] In 2002, there were 1.4 million arrests of persons under the age of 18 years in the United States,[13] including approximately 1.0 million males and 400,000 females. However, the number of incarcerated adolescents that are routinely screened for these infections is unknown.

This purpose of this analysis was to assess the prevalence and rate of coinfection of chlamydia and gonorrhea in adolescents entering 14

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juvenile detention centers in 6 metropolitan areas with diverse chlamydia and gonorrhea rates from 1997 to 2002 and to identify demographic characteristics associated with these infections.

Methods

In 1996, the CDC began monitoring chlamydia and gonorrhea prevalence in sentinel corrections populations through the Jail STD Prevalence Monitoring Project.[10] Information on arrestee age, race/ethnicity, laboratory test type, and chlamydia and gonorrhea test results is collected electronically and submitted to the CDC on a quarterly and annual basis. State and local health department officials collaborate with juvenile detention center medical staff to assure treatment, counseling, and sex-partner follow-up.

We performed a cross-sectional analysis of chlamydia and gonorrhea test data submitted to the Jail STD Prevalence Monitoring Project from January 1, 1997, to December 31, 2002, for females and males aged 12 to 18 years screened in 14 juvenile detention centers in 6 areas of the United States (Alameda County, CA [includes the city of Oakland]; Los Angeles, CA; San Francisco, CA; Atlanta, GA; Maryland; and New York City, NY). For the purpose of this analysis, data from multiple sites within an area were aggregated. Specifically, data from 7 juvenile detention centers in Maryland's Department of Juvenile Justice system (includes the city of Baltimore) and data from 3 juvenile detention centers in Los Angeles were combined. Chlamydia and gonorrhea test data about females and males were analyzed from all 3 California sites from 1997 through 2002. However, data about males were not available from Alameda, CA, for 2002. We analyzed chlamydia and gonorrhea data from Maryland from 1998 through 2002 and from Atlanta, GA, from 2000 through 2002. Chlamydia data were analyzed from New York City, NY, from 2000 through 2002.

The facilities included in this analysis implemented a protocol of routine urine-based screening for chlamydia and gonorrhea upon entry or at the time of first medical examination at the facility. Testing was conducted on a voluntary basis. Medical staff, employed by the juvenile detention centers, obtained urine specimens and collected demographic information from incarcerated adolescents. These staff also collected information from males on the occurrence of discharge and dysuria. A variety of commercially available nucleic acid amplification tests, including the Abbott LCx assay (Abbott Laboratories, Abbott Park, IL), Becton Dickinson ProbeTec ET assay (Becton, Dickinson and Company, Franklin Lakes, NJ), Gen-Probe Transcription Mediated Amplification and Aptima Combo-2 test (Gen-Probe, Incorporated, San Diego, CA) was used to test for chlamydia and gonorrhea. The Roche Amplicor PCR (Roche Diagnostics Corporation, Basel, Switzerland) was used to test for chlamydia. We analyzed data on demographic characteristics, chlamydia and gonorrhea test results, date of test, screening venue, and symptom status (symptom data were available only for males screened in California).

Chlamydia and Gonorrhea Prevalence

We estimated chlamydia and gonorrhea prevalence by dividing the number of positive test results by the total number of test results that were either positive or negative (inconclusive and unsatisfactory test results were excluded from the denominator). We calculated chlamydia and gonorrhea prevalence by sex for each age group (12–14 years, 15–16 years, 17–18 years), racial or ethnic group (Asians, non-Hispanic blacks, non-Hispanic whites, Hispanics, and other), geographic area, and year (1997–2002). We used SAS version 8 (SAS Institute, Inc, Cary, NC) to assess differences in proportions with the χ^2 and the Cochran-Mantel-Haenszel tests.

Chlamydia and Gonorrhea Coinfection

We calculated chlamydia prevalence for females and males that were infected with gonorrhea. Conversely, we calculated gonorrhea prevalence of adolescents infected with chlamydia. We restricted these analyses to include sites where greater than 80% of female and male detainees that were tested for chlamydia were also tested for gonorrhea.

Results

Chlamydia Prevalence

From January 1, 1997, to December 31, 2002, there were 131,915 chlamydia tests performed in 14 juvenile detention centers. Of these, 33,619 (25%) chlamydia tests were on females, and 98,296 (75%) were on males. Fifty-three percent of the tests performed were on non-Hispanic blacks, 28% of tests were on Hispanics, and non-Hispanic whites accounted for 13% of tests. Almost half (49%) of persons tested were 15 or 16 years old, 29% were 17 or 18 years old, 21% were 12 to 14 years old. Most of the tests were done in Los Angeles (48%); smaller proportions were done in Alameda County, CA (15%), Maryland (13%), San Francisco (9%), NY (9%), and Atlanta (6%).

Of the 131,915 tests, 11,024 (8.4%) were positive for *Chlamydia trachomatis*. The prevalence of chlamydia was approximately 2.5 times higher in females than in males (15.6% versus 5.9%, $P < 0.01$) and was highest in blacks (9.9%), followed by Hispanics (7.3%) and whites (5.8%) (Table 1). Chlamydia prevalence in females did not vary significantly by age group; however, in males, prevalence was associated with older age (χ^2 test for trend; $P < 0.01$). The prevalence of chlamydia varied significantly by project site in females (10.0%–20.0%) and males (3.2%–8.0%); differences persisted after controlling for both race and age group (Cochran-Mantel-Haenszel test; females $P < 0.01$; males $P < 0.01$).

Gonorrhea Prevalence

There were 71,074 gonorrhea tests performed, 29,551 (40%) in females and 41,523 (60%) in males. Tests were on non-Hispanic blacks (61%), Hispanics (18%), and non-Hispanic whites (17%). Almost half (49%) of persons tested were 15 to 16 years old; 29% were 17 or 18 years old, and 22% were 12 to 14 years old. The gonorrhea testing data came from Los Angeles (31%); Alameda County, CA (28%); Maryland (20%); San Francisco (12%); and Atlanta (11%).

Of the 71,074 tests, 2065 (2.9%) were positive for *N gonorrhoeae*. The demographic characteristics of youth at greatest risk for gonococcal infection closely mirrored those at greatest risk for chlamydial infection. Gonorrhea prevalence was 4 times higher in females than in males (5.1% versus 1.3%, $P < 0.01$) (Table 2). In females, gonorrhea prevalence was 3 times higher in blacks compared to nonblacks (7.5% versus 2.4%, $P < 0.01$). Black males were 4.5 times more likely than males of other races to have gonorrhea (1.8% versus 0.4%, $P < 0.01$). Gonorrhea prevalence in females did not vary significantly by age group; however, among males, prevalence increased with age (χ^2 for trend; $P < 0.01$). Gonorrhea prevalence varied significantly by project site among males (0.8%–1.9%) and females (4.3%–8.8%); differences persisted after controlling for both race and age group (Cochran-Mantel-Haenszel test; females $P < 0.01$; males $P < 0.01$).

Chlamydia and Gonorrhea Coinfection

There were 28,375 females tested for both chlamydia and gonorrhea, and 806 (2.8%) females were coinfected; of 30,135 males who

TABLE 1. Chlamydia Prevalence in Incarcerated Adolescents in 14 Juvenile Detention Centers, 1997–2002

	Female		Male	
	Tests	% Positive	Tests	% Positive
Total	33,619	15.6	98,296	5.9
Race/ethnicity*				
Asian	1056	11.2	4255	2.2
Black, non-Hispanic	18,313	17.7	51,289	7.2
White, non-Hispanic	5889	11.1	11,299	3.0
Hispanic	7637	14.9	29,220	5.3
Other†	724	14.2	2233	4.3
Age, years‡				
12–14	8497	15.0	19,753	2.7
15–16	16,963	16.4	48,174	6.1
17–18	8159	14.6	30,369	7.7
Area§				
Alameda County, CA‖	3958	10.0	14,948	3.2
Los Angeles, CA	17,574	15.4	46,760	6.4
San Francisco, CA	3636	14.2	8456	3.4
Maryland	3342	18.2	14038	8.0
Atlanta, GA	2744	19.8	4839	6.6
New York City, NY	2365	20.0	9255	6.3
Year				
1997	3376	15.8	6707	5.4
1998	3902	14.2	9157	5.4
1999	4337	12.4	11,920	5.7
2000	5060	16.1	19,294	5.9
2001	5912	16.5	19,955	5.9
2002	11,032	16.6	31,263	6.2

*$P < 0.01$, χ^2; significant differences among racial/ethnic groups (males and females).
†Includes American Indian and "other" races.
‡$P < 0.01$, χ^2 for trend; significant differences among age groups (males).
§$P < 0.01$, χ^2; significant differences among areas (males and females).
‖Includes the city of Oakland.

were tested for both chlamydia and gonorrhea, 209 (0.7%) were coinfected. Of the 1482 adolescent females with gonorrhea, 806 (54.4%) were coinfected with chlamydia (Table 3). Similarly, of 409 males with gonorrhea, 209 (51.1%) were coinfected with chlamydia (Table 3).

Of the 4378 females with chlamydial infection, 806 (18.4%) were coinfected with gonorrhea (Table 3). Of 1657 males with chlamydial infection, 209 (12.6%) were coinfected with gonorrhea. Gonorrhea coinfection in males with chlamydia was more common in blacks ($P < 0.01$); in females, coinfection was more common in blacks and Asians (χ^2; $P < 0.01$) and it decreased significantly with age (χ^2 for trend; $P < 0.01$) (Table 3).

Symptoms

Three sites (Alameda, CA; Los Angeles, CA; San Francisco, CA) routinely collected data on the occurrence of urethral discharge and dysuria in males. A total of 79 (0.16%) of 47,682 males reported having urethral discharge, and 219 (0.46%) reported having dysuria. Seventeen of 173 (9.8%) males with gonococcal infection reported either discharge or dysuria, and only 20 of 854 (2.3%) males with chlamydial infection reported either symptom.

Discussion

These data indicate that screening incarcerated adolescents for chlamydia and gonorrhea is feasible and productive. The analysis presented here represents the largest number of incarcerated youth on whom chlamydia and gonorrhea prevalence data have been systematically collected. The prevalence of chlamydia in female adolescents in these 14 juvenile detention centers was very high over the 6-year period. However, the overall community case rates, based on the number of reported cases, among females in these 6 jurisdictions were variable (ranging from 478 per 100,000 in San Francisco to 1580 per 100,000 in Baltimore),[1] suggesting that even in areas with relatively low chlamydia case rates, the prevalence in incarcerated adolescent females may be high. Chlamydia prevalence in incarcerated males in these juvenile detention centers was generally at least half that found in females but was 6% or greater in 4 of the 6 areas. Gonorrhea prevalence was also high in incarcerated females but substantially lower in males.

Our finding of high chlamydia and gonorrhea prevalence in incarcerated female adolescents is consistent with the findings of other screening programs of adolescents in nontraditional settings.[14–17] High chlamydial infection rates in female arrestees have been observed in corrections facilities in Chicago (27%), Birmingham (22%), Baltimore (5.9%), and Houston (28.1%).[11,18,19] The median chlamydia prevalence in incarcerated adolescent females in our analysis (16.8%) is 3 times higher than the median prevalence (5.6%) in 15- to 24-year-old females attending selected family planning clinics in 2002.[1] The median gonorrhea prevalence in incarcerated females in our analysis (5.4%) is 5 times higher than the median prevalence in 15- to 24-year-old females in selected family planning clinics (0.9%).[1] These data suggest that

TABLE 2. Gonorrhea Prevalence in Incarcerated Adolescents in 14 Juvenile Detention Centers, 1997–2002

	Female		Male	
	Tests	% Positive	Tests	% Positive
Total	29,551	5.1	41,523	1.3
Race/ethnicity*				
Asian	1002	2.1	1898	0.3
Black, non-Hispanic	15,914	7.5	27,066	1.8
White, non-Hispanic	5293	2.3	6458	0.4
Hispanic	6800	2.5	5645	0.5
Other†	542	3.1	997	0.6
Age, years				
12–14	7259	5.4	8986	0.6
15–16	14,739	5.2	20,272	1.4
17–18	7553	4.7	12,811	1.6
Area‡				
Alameda County, CA§	3940	4.6	14785	0.8
Los Angeles, CA	16,628	4.3	5899	1.4
San Francisco, CA	3432	5.4	5037	1.0
Maryland	2813	6.9	11,510	1.9
Atlanta, GA	2738	8.8	4838	1.8
Year				
1997	3146	4.2	6167	0.8
1998	3828	4.4	7589	0.9
1999	4190	4.3	6841	1.0
2000	4064	4.9	5983	1.6
2001	4905	5.6	6042	1.6
2002	9418	6.1	9447	1.8

*$P < 0.01$, χ^2; significant differences among racial/ethnic groups (females and males).
†Includes American Indian and "other" races.
‡$P < 0.01$, χ^2; significant differences among areas (females and males).
§Includes the city of Oakland.

incarcerated adolescent females should be a priority population for chlamydia and gonorrhea screening programs.

There are few published reports of chlamydia and gonorrhea prevalence in males screened in settings outside of STD clinics. A study among US Army recruits found a chlamydia prevalence of 5.3% and a gonorrhea prevalence of 0.6%.[20] In 1998, Oh et al.[21] reported a chlamydia preva-

TABLE 3. The Distribution of Gonorrhea and Chlamydia Coinfection by Sex, Race/Ethnicity and Age Group in Incarcerated Adolescents

Characteristic	Gonococcal Infections (n)	Coinfected With Chlamydia (%)	Chlamydial Infections (n)	Coinfected with Gonorrhea (%)
Female total*	1482	54.4	4378	18.4
Race/ethnicity				
Asian	21	76.2	115	13.9
Black, non-Hispanic	1180	54.2	2730	23.4
White, non-Hispanic	120	47.5	575	9.9
Hispanic	161	58.4	958	9.8
Age, years				
12–14	380	57.1	1015	21.4
15–16	757	55.1	2305	18.1
17–18	345	49.9	1058	16.3
Male total‡	409	51.1	1657	12.6
Race				
Asian	1	0.0	13	0.0
Black, non-Hispanic	378	51.3	1406	13.8
White, non-Hispanic	21	52.4	192	5.7
Hispanic	9	44.4	46	8.7
Age, years				
12–14	43	48.8	202	10.4
15–16	219	50.7	842	13.2
17–18	147	52.4	613	12.6

*Excludes New York City.
†$P < 0.01$, χ^2 for trend; significant age differences among females with chlamydia coinfected with gonorrhea.
‡Excludes New York City, Los Angeles, and San Francisco.

lence of 6.9% and a gonorrhea prevalence of 4.5% in incarcerated adolescent males; in 2001, Risser et al.[19] found 9.6% of incarcerated adolescent males tested positive for chlamydia. In the 6 areas included in our analysis, the prevalence of chlamydia in incarcerated adolescent males ranged from 3.2% to 8.0%. In the 3 sites that collected information on symptoms, over 95% of males with chlamydia were asymptomatic, and over 90% of males with gonorrhea were asymptomatic, suggesting that testing based on clinically defined symptoms would fail to identify the great majority of these infections. Our estimates are among the highest chlamydia positivity rates reported in adolescent males and suggest that STD control programs expanding chlamydia screening to males should consider this population a priority.

A large proportion of females and males with gonorrhea also were infected with chlamydia (54% in females and 51% in males), supporting the CDC recommendation that patients treated for gonococcal infection also be treated routinely with a regimen effective against uncomplicated genital *C trachomatis* infection.[6] Studies in other settings have documented high coinfection rates as well. Dicker et al.[22] reported that a median of 46% of gonorrhea-positive females aged 15 to 19 years in family planning clinics were coinfected with chlamydia, and 45.5% were coinfected in STD clinics. We found that a large proportion of females and males with chlamydia also were infected with gonorrhea (18% in females and 13% in males). In areas with limited resources, this finding may support the implementation of reflexive testing for gonorrhea upon a positive chlamydia laboratory test.

There are limitations to the approach used in our analysis. The proportion of adolescents screened among the total number admitted to these facilities is unknown. If higher-risk adolescents were screened at a greater rate than lower-risk adolescents, then our prevalence estimates may overestimate the true prevalence among all arrestees. We are unable to comment on prevalence trends in these populations since the number of adolescents screened in many sites increased over the study period, with the programs becoming a routine part of health care services.

We estimate that implementing national screening programs in juvenile detention centers would detect 56,384 chlamydial infections and 18,433 gonococcal infections in females annually and 52,683 chlamydial infections and 11,608 gonococcal infections in males annually. These estimates are based on the overall chlamydia and gonorrhea prevalences found in this study, the 2002 adolescent incarceration rates,[13] and the assumption that 90% of incarcerated female and male adolescents are sexually active[21,23,24] and therefore eligible for screening.

The high chlamydia prevalence in incarcerated females in these 14 juvenile detention centers over the 6-year study period supports the implementation of screening in juvenile detention centers as a method to reach high-risk populations that may have limited access to regular health care. Similarly, the markedly high gonorrhea prevalence in incarcerated females suggests that routine screening for gonorrhea in these settings should be considered. Implementing these programs may require that resources be shifted from other, less productive screening sites.

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