

Risk Factors for Chlamydia Among Young Women in a Northern California Juvenile Detention Facility: Implications for Community Intervention

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Objectives/Goal: Chlamydia infections are increasing in California, with rates highest in young women aged 15 to 24. Juvenile detention facilities are important venues for screening high-risk youth who may not otherwise access care. We, therefore, sought to identify risk factors for urogenital chlamydia among young women in a county juvenile detention facility between 2002 and 2005.

Study Design: With the state Chlamydia Screening Project (ClASP), young women booked into the county detention facility were offered urine-based screening for urogenital chlamydia. Demographics, sexual history, and behavioral risk factors were self-reported through questionnaires completed during specimen collection.

Results: Nine hundred and thirty-nine young women were screened for chlamydia. The 5% positivity rate remained steady over the 33-month study. Vaginal sex was reported by 82% of women, oral sex by 50%, and anal sex by 30%. Only 9% reporting anal sex always used condoms. In multivariate analysis, little distinguished those with urogenital chlamydia. Women from the southern region of the county (adjusted odds ratio, 3.5; 1.4–8.7) and surrounding urban centers (3.7; 1.2–11.4) had higher odds of infection, as did those with 2 to 3 lifetime partners (3.2; 1.2–8.2)—although there was no linear relationship between partner number and infection. Those who had been in drug/alcohol treatment had lower odds of infection (0.1; 0.01–0.6).

Conclusions: Our findings support universal chlamydia testing of young women detainees. The high prevalence of unprotected anal sex highlights an important modifiable HIV risk behavior in these adolescents. Risk factors reported here should inform the integration of prevention and treatment services in correctional settings and substance abuse treatment centers.

SINCE 1995, REPORTED *Chlamydia trachomatis* cases have steadily increased in California, with an overall case rate in 2005 of 352 infections per 100,000 population.¹ The highest rates are among young women aged 15 to 24, with 2000 to 2500 infections reported per 100,000 population. Sexually active adolescents, especially girls, also carry a disproportionate burden of disease sequelae. Although 75% of chlamydia infections in women do not have acute symptoms, up to 40% of untreated cases progress to pelvic inflammatory disease. In 2000, the estimated direct medical

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costs related to chlamydia infection among people aged 15 to 24 years totaled \$248 million.^{2,3}

Despite the Centers for Disease Control and Prevention's recommendations for annual chlamydia screening in all sexually active women aged 25 years and younger,⁴ in California, it is estimated that less than half of this target group has been tested in the last 12 months.⁵ Venues found to have the highest prevalence of chlamydia infection among young women include jails, juvenile detention facilities, and alternative high schools.⁵ Urine-based nucleic acid amplification tests for detecting chlamydia have improved the feasibility of screening programs in these nontraditional settings. According to recent national data, there is an average of 14,590 female offenders housed on any given day in juvenile justice residential facilities; each year, about a half million young women pass through the juvenile detention system.⁶ Health care delivery is especially important in this group as more young women than young men are at risk of entering prison with sexually transmitted diseases (STDs) and HIV/AIDS. Although arrested for less serious crimes than boys, girls frequently come from homes with substance abuse and domestic violence. Their life experiences also include high rates of physical and sexual abuse.⁷

Prior screening efforts among young women in juvenile detention facilities describe chlamydia prevalence rates from 10% to 20%.^{8–11} Chlamydia infection among young women detainees has previously been associated with increased age^{12,13} and nonwhite race.^{8,11–14} In a California study with data from 12 local health jurisdictions, women who identified themselves as black were 3 times more likely to be infected with chlamydia, and those who identified themselves as Hispanic were 2.2 times more likely to be infected, compared to detainees who identified as non-Hispanic whites.¹² With regard to substance abuse, ever injecting drugs¹⁵ and recent alcohol use¹³ have been associated with STD status in incarcerated girls.

Because it is important to know what a client brings to the treatment setting when planning, developing, and providing services,⁷ this study sought to evaluate the relationship between risk behaviors and chlamydia infection among young women detained in a northern California county between 2002 and 2005. In addition, we sought to identify behavioral risk factors that could inform risk reduction counseling and interventions in the community.

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Methods

Project Design

Through state funds, resources for the Chlamydia Screening Project (ClASP) were made available to local health jurisdiction STD control programs in 2002. In California, this includes 58 county and 3 independent city health departments. By 2005, 22 correctional facilities in 17 counties with juvenile justice censuses of at least 50 young women detainees per year participated in ClASP. State support included test kits for urine nucleic acid amplification tests, azithromycin for treatment, and technical support for data entry and analysis. Local health jurisdictions provided staff time, and the local public health laboratory conducted the testing.

In San Mateo County, ClASP was conducted in the only juvenile correctional facility beginning October 2002. All young women booked into the facility during that time were eligible to be screened for urogenital chlamydia infection through this project. Correctional health and STD program staff were responsible for data collection and transportation of urine specimens. Positive chlamydia results were conveyed by telephone from the public health laboratory to clinical staff at the correctional facility within 1 day of result availability. An intracounty mail system was used to deliver negative results. Young women infected with chlamydia received client-centered counseling and were treated with azithromycin 1 g in a single dose by correctional clinic staff for women still incarcerated (>95% of those with positive results). If young women testing positive were released from the correctional facility before results were known, health department staff attempted to contact them by phone or in person and provide field-delivered therapy or referral for treatment. Follow-up of participants found to be infected with chlamydia was done by the County STD program staff for purposes of treatment confirmation and partner notification services. As a public health screening initiative, this project was designated nonresearch public health practice. Confidentiality was maintained for all participants.

Data Collection

A supplemental survey was developed by the San Mateo County Health Department to accompany the standard assessment questionnaire. It was self-administered by participants screened for chlamydia between October 2002 and June 2005. The survey collected the following data: age, race/ethnicity, residential zip code, education level, sexual history, and substance use behaviors. Sexual history included number of lifetime sexual partners; condom use with vaginal, oral, and anal sex; history of prior sexually transmitted infections; and sex with anonymous partners. Condom use was evaluated on a 4-point scale where 1 = never and 4 = always, and then dichotomized as always (4) or less than always (1–3). Number of lifetime partners was categorized as 0 to 1, 2 to 3, and 4 or more. Additional risk behaviors in the previous 12 months were also assessed, including alcohol/drug use and treatment, gang membership, domestic violence, exchange of sex for drugs/money, and homelessness. Participants completed these questionnaires at the time of urine sample collection. Electronic databases were created using Access software (Microsoft, version 2000).

Laboratory Methods

Specimen collection, storage, transport, and testing were conducted in accordance with the manufacturer's specifications. Urine specimens were collected from each participant and refrigerated. Within 24 hours, specimens were transported to the local public health laboratory for testing with Gen-Probe Aptima Combination CT-GC amplified assay (Gen-Probe, San Diego, CA).¹⁶

Data Analysis

All young women screened were eligible for inclusion in the analysis. Those with missing age or chlamydia test result were later excluded. Test positivity was used as a proxy for chlamydia prevalence.¹⁷ We evaluated the association between covariates and chlamydia positivity by calculating crude odds ratios and 95% confidence intervals for each demographic and risk behavior. To evaluate the independent effect of each factor on chlamydia positivity, a multivariate logistic regression model was developed that included all covariates found to be significant in the bivariate analyses. Data were analyzed using SPSS statistical software (Chicago, IL, version 13) and statistical significance was defined as $P < 0.05$.

Results

Between October 2002 and June 2005, there were 2735 young women booked into the juvenile detention facility. About one-third of these, 939 (34%), were screened for chlamydia, usually within 2 to 3 days of booking. Among those screened, 914 (97%) completed the participant questionnaire and had satisfactory test results, available an average of 6.7 days after testing. The chlamydia prevalence in this group was 5% (47 of 914). Almost all (95%) were treated by correctional health staff within the facility.

Although the screening percentage increased significantly over the study period, from 9% to 74%, chlamydia positivity rates remained steady around 5% (range, 0%–9%). Using standard information gathered for each detainee at booking, no differences were observed by age or race/ethnicity among those screened for ClASP versus those booked but not screened. During the study period, 86 young women were booked more than once (mean, 3.1; range, 2–12).

Demographics, sexual history, substance use, and selected risk situations of participants are summarized in Table 1. The young women screened during this period were between 14 and 17 years old, with a mean age of 15.8 years. Most detainees were of Hispanic ethnicity (41%) or non-Hispanic whites (30%). Educational attainment was commensurate with their age group. Zip codes of participants' usual residence were distributed proportionally throughout the county.

Most of the young women (87%, $n = 794$) were sexually active, reporting vaginal, oral, and/or anal sex. While 19% had only 1 lifetime partner, an additional 19% reported 6 or more lifetime partners (mean, 4.2). Only half (46%) of those who had vaginal sex ($n = 748$) reported always using condoms. For young women reporting anal sex ($n = 271$), only 9% reported always using condoms for this activity. Seventeen percent reported a prior STD and 8% reported sex with an anonymous partner within the previous year.

Substance use was also common, with almost three-quarters (72%) reporting alcohol and/or drug use in the past year. Alcohol (51%) and marijuana (49%) were the most commonly used substances. Methamphetamine use was reported by 26% of young women. Almost one-quarter of participants (22%) had been in an alcohol or drug treatment program in the previous year. The young women also reported histories of high-risk social situations. In the previous 12 months, 11% had been in a gang, 8% had been victims of domestic violence, and 7% had been homeless.

Characteristics associated with chlamydia infection at the time of detention are summarized in Table 2. Women with chlamydia infection were more likely to live in the south part of the county or in large cities neighboring the county, be black or Hispanic, have 2 to 3 lifetime sexual partners, and always use condoms for vaginal sex (i.e., 4 on a scale where 1 = never and 4 = always). Young women who had been in alcohol or drug treatment were less likely to have chlamydia infection. Women with chlamydia infection did not differ from those who were uninfected by age, education, sexual

TABLE 1. Demographic Characteristics, Sexual History, and Substance Use Among Young Women in a Northern California Juvenile Detention Facility, 2002–2005 (n = 914)

	Total	
	No.	Percent of Sample
Demographics		
Mean age, yr ± standard deviation	15.8	±1.3
Race/ethnicity		
Asian	116	12.7
Black	117	12.8
Hispanic	373	40.8
White	271	29.6
Other/unknown	37	4.0
County Regions (n = 880)		
North	273	31.0
Mid	222	25.2
South	269	30.6
Coast	41	4.7
Other	75	8.5
Education completed (n = 898)		
Less than high school	193	21.5
Some high school	646	71.9
High school graduate or greater	59	6.6
Sexual history		
Ever sexually active	794	86.9
Lifetime partners, mean ± standard deviation (n = 856)	4.2	±7.2
Ever had STD	153	16.7
Sex with anonymous partner (previous 12 mo)	71	7.8
Types of sexual activity*		
Vaginal sex	748	81.8
Oral sex	454	49.7
Anal sex	271	29.6
Condom use, vaginal sex (among those reporting vaginal sex, n = 748)		
Always	343	45.9
More than half	176	23.5
Less than half	146	19.5
Never	83	11.1
Condom use, oral sex (among those reporting oral sex, n = 454)		
Always	57	12.6
More than half	33	7.3
Less than half	140	30.8
Never	224	49.3
Condom use, anal sex (among those reporting anal sex, n = 271)		
Always	25	9.2
More than half	12	4.4
Less than half	28	10.3
Never	206	76.0
Substance use in previous 12 mo		
Alcohol	465	50.9
Marijuana	445	48.7
Methamphetamine	236	25.8
Cocaine	150	16.4
Ecstasy	120	13.1
Any above drugs (n = 783)	565	72.2
Been in alcohol/drug treatment program	204	22.3
Risk situation in previous 12 mo		
Gang membership	99	10.8
Domestic violence victim	75	8.2
Homelessness	60	6.6

*Type of sexual activity (i.e., vaginal, oral, and anal sex) were ascertained from questions about condom use during specific types of sex, with the option, "do not have (that type of) sex."

history, condom use with oral or anal sex, self-reported STD history, anonymous sex, drug or alcohol use, or other risk situation (including gang membership, domestic violence, and homelessness).

Factors independently associated with chlamydia infection were then modeled using multivariate logistic analysis (Table 2). After adjusting for all other variables in the model, young women residing in the southern region of the county were 3.5 times more likely to test positive for chlamydia than those in the northern region (OR: 3.5; 1.4–8.7); women residing in other regions were 3.7 times more likely than those in the northern region to test positive. Having 2 to 3 lifetime partners also increased the odds of infection (OR: 3.2; 1.2–8.2). Young women who had been in alcohol or substance abuse treatment in the previous year were about 10 times less likely to be infected as were those who had not been in treatment (OR: 0.1; 0.0–0.5).

Discussion

This study did not find clear predictors of chlamydia risk among young women detainees, highlighting the high rates of sexual activity and risk in this population and reinforcing the need for universal screening. Testing all young women detainees ensures that those with asymptomatic disease are identified, and addresses barriers related to self-reporting sexual activity, or personnel time needed to gather adequate sexual histories.¹⁸

To our knowledge, this is the first study describing types of sexual activity for juvenile detainees. Eighty-seven percent of young women reported being sexually active: vaginal sex was reported by 82%, oral sex by 50%, and anal sex by 30%. The prevalence of unprotected anal sex (9% reported always using condoms for anal sex compared with 46% always using condoms for vaginal sex) documents HIV risk in these young women.

From 2001 through 2005, the majority of AIDS cases diagnosed among adolescent and young adult women in 33 US states were attributed to high-risk heterosexual contact. The ratio of male to female adolescents and young adults with a diagnosis of HIV infection increases with age at diagnosis. In 2005, young women accounted for 36% of adolescents aged 13 to 19 years who were diagnosed with HIV infection, compared with 28% of young adults aged 20 to 24 years and 25% of those aged 25 and older.¹⁹ Unprotected anal sex in adolescent women, as reported in this study, emerges as an important and under addressed HIV risk factor that merits direct public health attention.

The prevalence of sexual activity and substance abuse risk factors reported in our study is consistent with that previously reported among young women in juvenile detention. We found that 87% of young women reported being sexually active, compared with 92% reported by Kelly et al. among detainees in Texas.¹⁵ While Crosby and colleagues¹⁴ evaluated behaviors over the previous 2 months instead of the past year, as in our assessment, prevalent behaviors were comparable. Adolescents in our sample were less likely to have used alcohol (51% in our sample vs. 66% in Crosby), but marijuana (49% for both studies), methamphetamine (26% vs. 15%), and ecstasy (13% vs. 14%) use were similar.

This study found that previous drug or alcohol treatment was associated with a reduced risk of chlamydia infection. These women may have received more comprehensive risk reduction counseling or had improved access to testing and medical services while participating in drug or alcohol treatment programs. Other studies have reported acceptance rates greater than 80% for STD testing^{20,21} and hepatitis B vaccination²¹ in drug treatment facilities. These findings support the integration of STD treatment and HIV prevention services into alcohol and drug treatment programs.

We also found that county geographic region of residence before detention was associated with chlamydia infection. Young

TABLE 2. Bivariate and Multivariate Analyses of Factors Associated With Chlamydia Infection Among Young Women in a Northern California Juvenile Detention Facility, 2002–2005 (n = 914)

	% Positive (5%, n = 47)	Unadjusted		Adjusted (Reduced Model)	
		Odds Ratio	95% CI for Unadjusted OR	Odds Ratio	95% CI for Adjusted OR
Demographics					
Mean age (yr)	16.0 ± 1.3	1.14	0.90–1.43	—	—
Race/ethnicity					
White	2.6	1	—	1	—
Asian	6.0	2.42	0.83–7.07	1.54	0.48–4.99
Black	7.7	3.14	1.14–8.65	1.82	0.60–5.53
Hispanic	5.9	2.36	1.00–5.62	1.60	0.60–4.26
Other/unknown	5.4	2.16	0.43–10.79	3.44	0.60–19.67
County regions (n = 880)					
North	2.6	1	—	1	—
Mid	4.5	1.79	0.67–4.79	2.21	0.79–6.17
South	8.2	3.38	1.42–8.06	3.47	1.39–8.68
Coast	2.4	0.95	0.11–7.93	1.91	0.19–18.81
Other	9.3	3.91	1.33–11.53	3.69	1.20–11.41
Education completed (n = 898)					
Less than high school	6.7	1	—	—	—
Some high school	4.5	0.65	0.33–1.28	—	—
At least high school	8.5	1.28	0.44–3.76	—	—
Sexual history					
Ever sexually active	5.7	3.54	0.85–14.81	—	—
Lifetime partners (n = 856)					
0–1	2.8	1	—	1	—
2–3	8.7	3.24	1.41–7.46	3.16	1.22–8.15
4 or more	4.5	1.61	0.67–3.85	2.35	0.86–6.37
Ever had STD	7.2	1.56	0.78–3.14	—	—
Anonymous sex, previous 12 mo	5.6	1.03	0.36–2.95	—	—
Always use condoms (vs. less than always)					
Vaginal sex (n = 748)	7.3	1.91	1.00–3.64	1.73	0.87–3.41
Oral sex (n = 454)	7.0	1.69	0.58–5.20	1.70	0.47–6.23
Anal sex (n = 271)	8.0	1.25	0.27–5.78	0.77	0.13–4.46
Substance use, previous 12 mo					
Alcohol	4.5	0.77	0.43–1.39	—	—
Marijuana	4.5	0.77	0.43–1.39	—	—
Methamphetamine	4.2	0.77	0.38–1.57	—	—
Cocaine	2.7	0.46	0.16–1.30	—	—
Ecstasy	3.3	0.60	0.21–1.71	—	—
Any above drugs (n = 783)	5.0	0.71	0.37–1.35	—	—
Been in alcohol/drug treatment	0.5	0.07	0.01–0.52	0.08	0.01–0.58
Risk situation, previous 12 mo					
Gang membership	4.0	0.79	0.28–2.26	—	—
Domestic violence victim	6.7	1.39	0.53–3.64	—	—
Homelessness	8.3	1.77	0.67–4.66	—	—

women who lived in the southern part of the county or in neighboring large cities had higher odds of infection than those from the north. This may reflect the higher overall STD rate in the south—that region also has the highest rates of HIV/AIDS.²² This could also be a result of better access to testing in the more urbanized northern region of the county, and thus reinforces the importance of screening and treating young women in detention who may not otherwise have adequate access to these services.

We found that, while detainees who reported 2 or 3 lifetime sex partners had higher odds of chlamydia infection than those reporting fewer, young women with more than 3 total partners did not have significantly increased risk. Other researchers have reported a similar nonlinear association among young women in juvenile detention.^{8,23} Our hypothesis is that women with few partners were not infected because they had lower risk, whereas those with many partners were not infected because of increased condom use.²⁴ It is the group in the middle—with the combination of some risk and

little condom use—that was most likely to be infected. This complex relationship has been demonstrated in studies assessing women's risk perceptions and protective behaviors with their regular and casual sex partners.^{25–27} Further research on the correlations between partner number, risk perceptions, and condom use in this population is necessary to test this hypothesis.

Another possible explanation for this finding is inaccurate reporting of condom use. Of note, 13% of the sample reported no prior sexual activity, yet 1.7% of these tested positive for chlamydia. Others have reported similar discordant findings between reported sexual activity and chlamydia prevalence.^{3,13}

One of the goals throughout the project was to increase the proportion of young women who were screened. By expanding screening to weekend bookings and strengthening cooperation between public and correctional health—through periodic methods review and sharing quarterly progress reports—screening increased from 9% in the first quarter to 74% during the last quarter

data were collected for this study. These techniques have proven successful for other collaborating correctional facilities and public health infrastructures.⁷ Future research should evaluate how screening rates could be further increased, as well as if those young women remaining untested are a result of detainee refusal or inadequate personnel/facility resources.

Where resources do not permit universal chlamydia screening among young women in detention, our results support the use of an algorithm based on risk factors associated with chlamydia infection. For example, this study found that information about geographic residence, partner number, and prior substance abuse treatment could help identify those most at risk for infection. Others have used similar algorithms in correctional settings.²⁸

There are limitations to the approach used in our analysis. Exposures were assessed via self-report, and biases toward null associations may have been introduced due to difficulty respondents may have had comprehending questions or a desire to provide socially acceptable answers. Additionally, about 9% of young women were booked more than once during the study period and tested each time, resulting in a potential underestimation of chlamydia infection and associations with selected risk factors, especially if those with less risky behaviors were more likely to be tested repeatedly.

Despite these limitations, this study allowed unique insight into a population at risk for STDs and HIV, and adds to the literature supporting the feasibility of implementing STD screening in juvenile detention facilities. The chlamydia prevalence found here, 5%, while lower than that reported by others, is consistent with the fact that the overall chlamydia rate in San Mateo County for young women 15 to 24 years during the study period (1.6%) was lower than that for the state (2.3%).²⁹ Importantly, however, a chlamydia prevalence of 5% fulfills the threshold for cost effectiveness of universal screening in detention facilities.^{30,31}

Our findings support universal chlamydia testing in young women detainees. The high prevalence of unprotected anal sex identifies an important HIV risk factor in these young women. Public health efforts should promote condom use for anal sex in adolescent and reproductive age women. These behavioral data support a more comprehensive approach to STD testing and HIV prevention in adolescents that integrates services into substance abuse and correctional settings serving high risk youth.

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