

Chlamydia Positivity in American Indian/Alaska Native Women Screened in Family Planning Clinics, 1997–2004

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Background: Previous studies demonstrated high levels of *Chlamydia trachomatis* (CT) infections within American Indian/Alaskan Native (AI/AN) populations but there are few analyses of CT prevalence in these populations over time.

Methods: We analyzed data from 7374 visits at which diagnostic tests for CT were collected in AI/AN women aged 15 to 24 years seen at family planning clinics associated with the Region X Infertility Prevention Project. Trends in population characteristics and test positivity were examined and compared with non-AI/AN women tested in the same setting and time period. Chlamydia positivity was adjusted for changes in diagnostic test type. Multivariable logistic regression was used to identify characteristics associated with infection.

Results: Adjusted CT positivity in AI/AN women rose from 7.8% to 11.0%, which was 1.5 to 2.2 times the non-AI/AN population levels over the study period (absolute difference 2.8%–6.6%). Differences persisted after correction for test type and age. Temporal changes in positivity among AI/AN women were associated with a rise in reported risk behaviors and decline in age of the population being tested. Risk factors associated with positivity among AI/AN women were younger age, ≥ 1 behavioral risks, ≥ 1 clinical findings, partner with chlamydia, chlamydia in past year, and pregnancy related visit.

Conclusions: AI/AN women had consistently higher levels of chlamydia positivity than non-Native women, even after adjustment for age and diagnostic test. Further investigation of risks for chlamydia, related outcomes, access to screening, sexual networks, and enhanced surveillance would be beneficial for improving health in this vulnerable population.

CHLAMYDIA TRACHOMATIS (CT) INFECTIONS ACCOUNT for the largest proportion of sexually transmitted infections reported to the Centers for Disease Control and Prevention (CDC), with an estimated 2.8 million new cases per year in the United States.¹ American Indians/Alaskan Natives (AI/AN) represent a racial minority population within the United States with a unique social, cultural, and biologic background. AI/AN bear a disproportionate burden of illness for many diseases, including sexually transmitted infections.^{1–4}

A high prevalence of chlamydial infection has been reported in AI/AN communities, ranging from 24% to 30% among prenatal patients in the Southwest^{5,6} to 23% of all women screened in a remote Alaskan village.⁷ In 2004, women aged 15 to 44 years screened for chlamydia in 2 Indian Health Service (IHS) regions

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had chlamydia positivities of 10.7% versus 6.3% for women screened in family planning clinics nationwide.⁸ In a recent report, the overall chlamydia rate in 2004 among AI/AN residing in IHS provision areas was 2.3 times higher than the corresponding US rates, with 3 IHS areas having chlamydia rates 4.9 to 6 times higher than the US rate.³ However, there are few analyses of chlamydia infections over time in AI/AN populations.

We sought to more clearly define the clinical epidemiology and trends in test positivity of chlamydial infections in AI/AN women by examining data representing 15- to 24-year-old AI/AN women attending family planning clinics in the Region X Infertility Prevention Project (IPP) network during the years 1997–2004. This represents a cohort of women for whom universal screening for chlamydia was recommended throughout the study period.^{9,10}

Materials and Methods

Sources of Data

Data on chlamydia tests were obtained from the Region X IPP, an ongoing program since 1988 that provides for the screening and treatment of chlamydial infections throughout Alaska, Idaho, Oregon, and Washington states. All women aged 15 to 24 years who presented to family planning clinics enrolled in the IPP and who self-identified as AI/AN, whether as a sole racial category or in combination with another racial or ethnic category, were included in this analysis. Since inception of the IPP in 1988, screening has been recommended for all women aged 24 years and younger for chlamydial infection at least annually as recommended by the CDC and the US Preventive Services Task Force.^{10,11}

All Region X family planning clinics used a common medical record form and laboratory slip to record a standard set of information. Information collected included age, race, ethnicity, specimen collection date, reason for visit, specified clinical exam findings (ectopy, friable cervix, pelvic inflammatory disease, cervicitis), self-reported sexual risk behaviors (having had a new sex partner in the past 60 days, multiple sex partners in the past 60 days, a symptomatic sex partner in the past 60 days, a sex partner who was diagnosed with chlamydia, and condom use during last sex), having had chlamydia in the past year, laboratory test type, and chlamydia test result. CT diagnostic tests with unsatisfactory or indeterminate results were excluded from the analysis.

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Laboratory Methods

CT testing for the family planning clinics was performed by 4 state public health laboratories (Alaska, Idaho, Oregon, and Washington), a county health district laboratory (Spokane), and the University of Washington Chlamydia Laboratory. From 1997 through 2004, these laboratories adopted nucleic acid amplification tests (NAATs) in favor of less sensitive assays. During the study period, non-NAATs included (in order of decreasing usage) enzyme immunoassay (MicroTrak II, Syva and Behring Diagnostic Products, Cupertino, CA); nucleic acid hybridization test (Pace 2, Gen-Probe, San Diego, CA); nucleic acid hybridization assays (Hybrid Capture 2, Digene, Gaithersburg, MD) and cell culture. The majority of NAATs used in Region X were ligase chain reaction tests (LCx, Abbott, Abbott Park, IL) and target capture transcription-mediated amplification assays (Aptima Combo 2, Gen-Probe, San Diego, CA).¹²

Statistical Analyses

Chlamydia positivity was calculated by dividing the number of positive tests by the total number of tests performed. Categorical variables were analyzed with the method of chi-squared, with time trends in demographic variables examined for both heterogeneity and trend. Potential predictors of chlamydia positivity were identified by univariate analysis of odds ratios. Stepwise forward logistic regression modeling was used to identify factors independently associated with chlamydia positivity, including demographic characteristics, clinical findings, self-reported sexual risk behaviors, type of laboratory test (NAAT vs. non-NAAT), and year of test. In comparing observed chlamydia positivity in AI/AN versus non-AI/AN women in Region X, direct standardization was used to correct for age differences between the 2 populations. All values are reported at the 95% confidence interval.

As conversion to a more sensitive laboratory test can result in an increase in observed chlamydia positivity even with no increase in true disease prevalence,^{13,14} we adjusted for change in test type used over time. We used the sensitivity and specificity of each laboratory test method to calculate an adjusted positivity [test-specific adjusted positivity = (test-specific observed positivity + test specificity - 1)/(test sensitivity + test specificity - 1)].¹⁵ Overall adjusted positivity was calculated as a weighted sum of the adjusted positivity for each test type. This method has previously been used in reporting of chlamydia positivity data by the CDC as detailed by Fine and Dicker et al.^{8,12,13} The sensitivity and specificity estimates used for the adjustment were culture (sensitivity 0.747, specificity 1.000); enzyme immunoassay tests with negative gray zone confirmation (sensitivity 0.810, specificity 0.996); other non-NAATs including Gen-Probe Pace 2 and Digene Hybrid Capture 2 assay (sensitivity 0.619, specificity 0.997); and NAATs (sensitivity 0.855, specificity 0.997).^{16,17} We compared the differences in trends for observed and adjusted chlamydia positivity.

Results

From 1997 to 2004, a total of 581,106 CT tests were performed, with 7449 tests performed in AI/AN women. Of the 7449 chlamydia tests performed among women who self-reported as AI/AN, 75 (1.0%) had unsatisfactory, indeterminate, or missing results and were excluded from further analysis. Of the remaining 7374 chlamydia tests, 67% were done in Washington state, 18% in Oregon, 10% in Alaska, and 5% in Idaho. By racial/ethnic categories, 90% of women tested reported being AI/AN alone, 8% reported AI/AN race with Hispanic ethnicity, and 2% reported more than 2 racial/ethnic categories. Nearly all chlamydia tests performed on both

AI/AN and non-AI/AN women were based on cervical specimens (91.4% and 94.5%, respectively) with urine specimens being the next most common specimen site (8.4% and 5.4%, respectively). The use of NAAT-based test methods increased rapidly beginning in 1997. During the study period, the use of NAAT-based tests rose from 13% to 60% in the region at large and from 13% to 78% among AI/AN women. From 1997 to 2004, other test methods used among AI/AN women changed as follows: enzyme immunoassay (46%–0%), culture (27%–0.8%), and non-NAAT nucleic acid hybridization (14%–22%).

Among AI/AN women, those aged 15 to 17 accounted for 30.4% of tests, aged 18 to 19 for 25.8%, and aged 20 to 24 for 43.8% of tests (Table 1). Most women (70.2%) presented for a "routine visit" (initial or annual gynecologic exam, primary care visit, reproductive health exam). Thirteen percent of women had a "pregnancy related" visit, defined as request of a pregnancy test, prenatal care, pregnancy management, or pre/postabortion services, and 16.1% reported the reason for visit as having symptoms (abnormal vaginal or urethral discharge, dysuria, abdominal or pelvic pain, or abnormal vaginal bleeding). Overall, 33.3% of women reported 1 or more behavioral risk factors in the 60 days before testing, including 28.9% with a new partner, 14.5% with more than 1 sex partner, and 3.1% with a symptomatic sex partner. Condom use at last sexual encounter was low at 27.3%. Few women (8.8%) had clinical findings on examination. Seven percent of women reported having a chlamydial infection in the 12 months before the most recent test.

Through the study period, the age structure and risk profile of the AI/AN women aged 15 to 24 being tested at IPP family planning clinics demonstrated considerable variation (Fig. 1). The proportion of women aged 15 to 17 rose from 33.5% in 1997 to a peak of 35.6% in 2000 and then fell to 26.1% in 2004 ($P < 0.0001$). There was a similar rise in reported sexual risk behaviors over this period, with women reporting one or more risk factors of new sexual partner, multiple partners, or symptomatic partner rising from 26.8% in 1997 to a peak of 35.4% in 2000 and then falling to 25.7% in 2004 ($P < 0.0001$). Reported condom use did not vary over time. Toward the end of the study period, more women reported being diagnosed with chlamydia in the past 12 months, rising from 3.9% in 1997 to 8.3% in 2004 ($P = 0.002$).

Compared with women aged 15 to 24 tested at family planning in Region X from 1997 to 2004 who reported non-AI/AN race, there were differences in age and risk profiles. AI/AN women were younger: proportion aged 15 to 17 years, 30.4% versus 22.8% ($P < 0.0001$); aged 18 to 19, 25.8% versus 26.5% ($P = 0.21$); and age 20 to 24, 43.8% versus 50.7% ($P < 0.0001$). AI/AN women were more likely to report having genitourinary symptoms at the time of visit (16.1% vs. 13.2%, $P < 0.001$) and were more likely to present for a pregnancy related visit (13.1% vs. 8.1%, $P < 0.001$) than non-AI/AN women. Sexual behavioral risks in the 60 days before testing were more commonly reported among AI/AN women: new sex partner, 28.9% versus 22.9% ($P < 0.0001$); multiple sex partners, 14.5% versus 9.7% ($P < 0.0001$); symptomatic sex partner, 3.1% versus 2.4% ($P = 0.0004$); and 1 or more behavioral risks, 33.3% versus 25.6% ($P < 0.0001$). Reported condom use at last sex was low in both groups, 27.3% for AI/AN women versus 25.8% ($P = 0.007$). Notably, AI/AN women were more likely to have been diagnosed with chlamydia in the past 12 months, 7.2% versus 3.9% ($P < 0.0001$).

Observed, unadjusted chlamydia positivity for AI/AN women was 8.6% versus 5.2% in the non-AI/AN population. After direct standardization was used to correct for age differences between the AI/AN population and the Region X non-AI/AN population, observed positivity changed minimally (8.6%–8.4%).

TABLE 1. Characteristics of American Indian/Alaska Native Women Aged 15 to 24 Years and *C. trachomatis* Positivity in Region X Family Planning Clinics, 1997–2004

Characteristic	No.	Percent	Chlamydia Positivity (%)
All Women	7374	100.0	8.6
Age group (yrs)			
15–17	2241	30.4	9.9
18–19	1905	25.8	9.7
20–24	3228	43.8	7.0
Reason for visit			
Routine	5015	70.2	7.6
Pregnancy related	937	13.1	10.4
Symptoms	1108	16.1	11.4
New sex partner, past 60 d			
No	5016	71.1	7.2
Yes	2039	28.9	11.7
More than 1 sex partner, past 60 d			
No	6015	85.5	7.5
Yes	1022	14.5	14.0
Symptomatic sex partner, past 60 d			
No	6281	96.9	7.6
Yes	199	3.1	21.6
One or more behavioral risks, past 60 d*			
No	4563	66.7	6.6
Yes	2281	33.3	12.3
Condom use last sex			
No	4982	72.7	8.9
Yes	1870	27.3	7.8
Sex partner with chlamydia			
No	7011	98.2	8.4
Yes	130	1.8	22.3
Mucopurulent cervicitis			
No	6124	95.7	7.9
Yes	277	4.3	22.0
Ectopy			
No	6271	98.0	8.3
Yes	130	2.0	20.0
Friable cervix			
No	6128	95.7	8.0
Yes	273	4.3	19.4
PID			
No	6354	99.3	8.4
Yes	47	0.7	21.3
One or more clinical findings [†]			
No	5841	21.2	7.6
Yes	560	8.8	18.4
Positive chlamydia test, past 12 mo			
No	6549	92.8	8.1
Yes	510	7.2	13.5

*Includes having had a new sex partner, multiple sex partners, or symptomatic sex partner in the past 60 days.

[†]Includes mucopurulent cervicitis, friable cervix, ectopy, and pelvic inflammatory disease (PID).

Trends in chlamydia positivity over time, adjusted for test type, are displayed in Figure 2. Adjusted positivity in AI/AN women rose from 7.8% in 1997 to a peak of 12.1% in 1999, concluding at 11.0% in 2004. These changes in positivity were temporally associated with a rise in reported risk behaviors and a decline in the age of the population being tested. Adjusted chlamydia positivity in non-AI/AN women rose steadily from 4.6% in 1997 to 7.1% in 2004. Comparing test type adjusted positivity by calendar year,

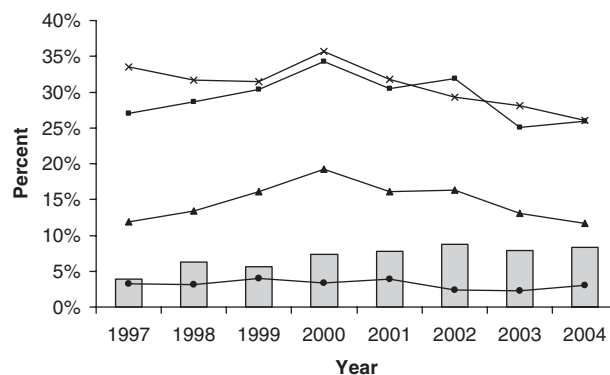


Fig. 1. Trends in characteristics of American Indian/Alaska Native women aged 15 to 24 years screened for chlamydia, Region X family planning clinics, 1997–2004. Gray bar, *C. trachomatis* last 12 mos; ●, symptomatic partner; ▲, multiple partners; ■, new partner; ×, age 15 to 17.

AI/AN women had chlamydia positivity ranging from 1.5 to 2.2 times the non-AI/AN population levels (absolute difference 2.8%–6.6%). At all time points, chlamydia positivity in AI/AN women was higher than that reported in both the non-AI/AN and Region X populations.^{8,12}

Table 2 displays risk factors independently associated with chlamydia positivity among AI/AN women as determined by multivariable logistic regression. Despite the observation that use of NAAT was associated with increased positivity, as expected, several other risks were independently associated with positivity. These included younger age (<20 years), report of one or more behavioral risk factors, presence of one or more clinical findings, report of diagnosis of chlamydia in the past 12 months or of a partner with chlamydia, and presentation for pregnancy related visit. After accounting for each of these factors, there was no independent association of year of visit with chlamydia positivity. Additionally, there was no independent association of positivity with condom use, symptoms at the time of visit, or having a partner with gonorrhea.

Discussion

In comparison to the non-AI/AN population of women being tested for chlamydia infection at Region X IPP family planning clinics, AI/AN women were younger and reported higher levels of behavioral risk factors. AI/AN women had levels of chlamydia positivity ranging from 7.8% to 12.1% during the study period, which was 1.5 to 2.2 times higher than positivity in the non-AI/AN population. These differences persisted even after adjusting for age differentials between the 2 populations.

Factors associated with chlamydia positivity in AI/AN women, including age, test type used, behavioral risks, clinical findings, exposure to chlamydia, and a prior positive test, were similar in type and magnitude to other analyses of Region X data.¹² Of note, a visit related to pregnancy (seeking pregnancy services or pregnancy testing) was associated with chlamydia positivity in this population. A recent survey in South Carolina, part of the Region IV IPP network, found that women aged 15 to 25 years presenting to family planning clinics for pregnancy testing alone had a chlamydia positivity of 15%.¹⁸ These findings emphasize that chlamydia testing should be performed in the population of 15- to 24-year-old AI/AN women seeking pregnancy testing or pregnancy services.

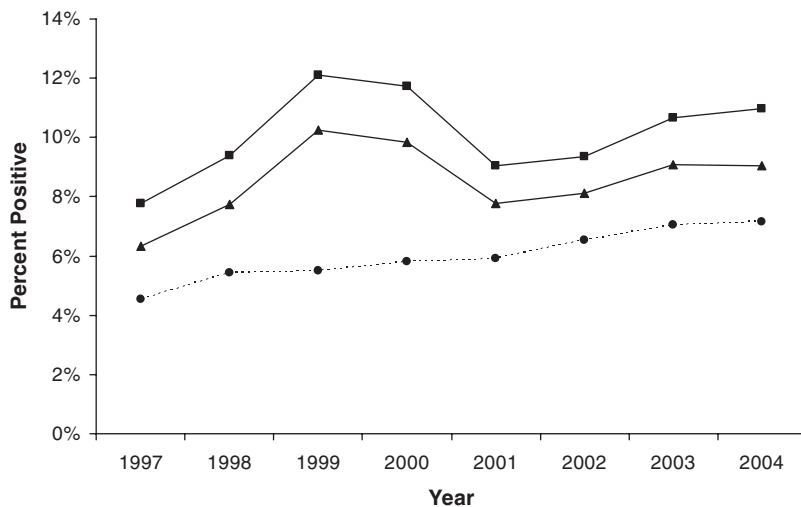


Fig. 2. Trends in unadjusted and test type adjusted chlamydia positivity in American Indian/Alaska Native women aged 15 to 24 years, compared with adjusted chlamydia positivity in non-AI/AN women, Region X family planning clinics, 1997–2004. ●, non-AI/AN adjusted; ▲, AI/AN unadjusted; ■, AI/AN adjusted.

Our analysis is subject to several limitations. First, these data do not necessarily reflect chlamydia positivity for all AI/AN women. AI/AN communities are diverse geographically, socially, and culturally. Importantly, our data do not account for areas within tribal reservation lands, which may have unique issues related to sexual networks and access to screening. A recent report from the CDC highlighted differential chlamydia positivity between aggregate United States data and data arising from counties predominantly served by the IHS. Chlamydia rates in these IHS areas were 2.3 times the national average, with 11 of 12 IHS service areas having rates higher than the US average.³

Second, the IPP program collects data on a limited number of risk factors. AI/AN persons may have as yet unidentified protective factors or risk factors for chlamydial infection. Identifying these factors would be valuable for future prevention and screening programs. Assessment of the influence of substance use, sexual networks, and availability of partner treatment services in this population should be considered.

TABLE 2. Adjusted Risks of Infection With *C. trachomatis* in American Indian/Alaska Native Women Aged 15 to 24 Years Seen in Region X Family Planning Clinics, 1997–2004

Characteristic	Odds Ratio*	95% CI
Age group (yrs)		
15–17	1.45	1.19–1.76
18–19	1.45	1.19–1.76
20–24	Reference	—
Chlamydia test type		
Non-NAAT	Reference	—
NAAT	1.40	1.16–1.69
One or more sexual behavioral risks [†]	1.72	1.42–2.08
One or more clinical findings [‡]	2.53	1.99–3.22
Chlamydia in last 12 mo	1.39	1.05–1.84
Partner with chlamydia	2.13	1.37–3.32
Pregnancy related visit	1.35	1.07–1.71

*Adjusted for age, test type, sexual behavioral risks, clinical exam findings, partner with chlamydia, chlamydia in past 12 month, and pregnancy related visit.

[†]Includes having had a new sex partner, multiple sex partners, or symptomatic sex partner in the past 60 days.

[‡]Includes mucopurulent cervicitis, friable cervix, ectopy, and pelvic inflammatory disease (PID).

Third, we do not have data on the extent of coverage of chlamydia screening for AI/AN women, although previous reports have estimated screening coverage at 50% to 60% in Region X in general.^{19,20} The combined influences of area of residence, urban versus rural versus geographically isolated, and clinic participation in the IPP on screening coverage for AI/AN women is unknown.

Multiple previous studies have disclosed high levels of racial misclassification among AI/AN in public health surveillance systems, including cancer registries, death certificate recording, and reporting of HIV/AIDS and STDs.^{21–30} Studies of mandatory, state level sexually transmitted disease reporting in both Washington and Oregon in 1995–2000 disclosed that 36% and 55%, respectively, of reported STD cases among AI/AN were misclassified. After adjusting for racial misclassification, case ascertainment among AI/AN rose by 29% in Washington and by 76% in Oregon.^{25,28} The data collection protocol used in our study is designed such that clients self-report their racial and ethnic background, hopefully minimizing racial misclassification at the provider level. We did not have the ability to link individual or composite visit data to existing registries of AI/AN populations to aid in verifying the accuracy of the racial reporting in this study.

Additionally, the population being screened over time may be changing. Of note, our analysis demonstrated an increase in women who reported a history of chlamydial infection in the past 12 months. This observation may reflect a true rise in background positivity, a higher-risk group being screened, changes in clinic practice encouraging rescreening, or an increase in the number of women presenting for rescreening following a prior chlamydia diagnosis as now recommended by the CDC.¹⁰

Finally, our data are not linked to individual identifiers; thus, we cannot distinguish between women being screened repeatedly within a defined time period. Chlamydia positivity is an estimate of prevalence, but does not represent true prevalence in the population. Positivity may include women who are tested 2 or more times during a single time period. Previous comparisons of positivity versus prevalence in family planning clinics within the IPP, including Region X, have shown only small differences between positivity and prevalence. In that analysis positivity was similar to or slightly higher than prevalence with an absolute difference of less than 0.5%. Within Region X from 1988 to 1996, on average, 93.8% of women had only 1 chlamydia test per year.³¹ Similar data are not available for the time period of this study for direct comparison.

In summary, AI/AN women continue to suffer from a higher burden of disease caused by CT, as amply demonstrated in our analysis. The explanation for this differential remains unclear. Further investigation of risk factors for CT, related outcomes including pelvic inflammatory disease and tubal infertility, access to screening and treatment, sexual networks, more effective approaches to partner management, and more widespread surveillance would be beneficial to future health improvement and disease control measures in this vulnerable population.

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