

Chlamydia Prevalence Trends Among Women and Men Entering the National Job Training Program From 1990 Through 2012

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Background: Evaluating chlamydia prevalence trends from sentinel surveillance is important for understanding population disease burden over time. However, prevalence trend estimates from surveillance data may be misleading if they do not account for changes in risk profiles of individuals who are screened (case mix) and changing performance of the screening tests used.

Methods: We analyzed chlamydia screening data from a sentinel surveillance population of 389,555 young women (1990–2012) and 303,699 young men (2003–2012) entering the US National Job Training Program. This period follows the introduction of national chlamydia screening programs designed to prevent transmission and reduce population disease burden. After ruling out bias due to case mix, we used an expectation-maximization–based maximum likelihood approach to account for measurement error from changing screening tests, and generated minimally biased long-term chlamydia prevalence trend estimates among youth and young adults in this sentinel surveillance population.

Results: Adjusted chlamydia prevalence among women was high throughout the study period, but fell from 20% in 1990 to 12% in 2003, and remained between 12% and 14% through 2012. Adjusted prevalence among men was steady throughout the study period at approximately 7%. For both women and men, adjusted prevalence was highest among Black and American Indian youth and young adults, and in the Southern and Midwestern regions of the United States throughout the study period.

Conclusions: Our minimally biased trend estimates provide support for an initial decrease in chlamydia prevalence among women soon after the introduction of national chlamydia screening programs. Constant chlamydia

prevalence in more recent years suggests that screening may not be sufficient to further reduce chlamydia prevalence among high-risk youth and young adults.

Chlamydia trachomatis (chlamydia) infection is usually asymptomatic, but can result in serious reproductive sequelae if left untreated. In response to the high burden of chlamydia among young women, the Centers for Disease Control and Prevention introduced a federally funded chlamydia screening program in the Northwestern region of the US in 1988. By 1995, screening programs were implemented in all regions of the United States as part of the Infertility Prevention Project.^{1,2} The screening programs strengthened clinical, educational, laboratory, and surveillance operations related to chlamydia and supported screening and treatment services for low-income, sexually active women attending public clinics. The goals were to identify and treat infections, which in turn prevents transmission and reduces incidence and prevalence.³

At the population level, a reduction in chlamydia prevalence should be observable in sentinel populations if national screening programs have widespread impact.⁴ A primary source for sentinel surveillance of chlamydia in the United States is the National Job Training Program (NJTP), a vocational training program for socioeconomically disadvantaged adolescents and young adults administered by the Department of Labor.^{5–7} The NJTP has maintained consistent eligibility criteria over time and screens all entrants for chlamydia, making it a stable, high-risk population ideal for monitoring chlamydia prevalence. Among NJTP enrollees, chlamydia prevalence trends spanning short periods (2–7 years) between 1990 and 2008 have shown modest decreases,^{8–11} but trend estimates over longer periods have not been reported.

Observed prevalence trends from sentinel surveillance should be interpreted cautiously because of potential biases. Two important sources of bias that can affect prevalence trend estimates are time-varying measurement error from changing screening tests and sentinel population risk profiles. Changes in measurement error can bias prevalence trend estimates when new screening technologies with different sensitivities and specificities are used.^{3,12} Changes in population risk profiles, which we refer to as “case mix,” can bias prevalence trend estimates when the relative proportions of high- and low-risk individuals screened in a sentinel population fluctuate.³ These biases may mask changes in prevalence over time, and trend estimates that do not properly account for changes in measurement error and case mix may be misleading.

We examined chlamydia prevalence trends over 23 years among female NJTP enrollees and over 10 years among male NJTP enrollees, accounting for potential biases associated with changing screening tests and case mix, to provide minimally biased estimates within a high-risk population over an extended period.

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MATERIALS AND METHODS

Study Population

We analyzed annual cross-sectional chlamydia screening data from NJTP enrollees from 1990 through 2012. US residents age 16 through 24 years who meet low-income criteria and face barriers to employment can enroll in the NJTP. Universal chlamydia screening of NJTP entrants began in 1990 for women and 2003 for men. Screening was performed by a national contract laboratory that used several tests. From 1990 through 1997, cervical swabs were tested by Pathfinder Enzyme Immunoassays (EIA) (Sanofi Diagnostics Pasteur, Inc, Redmond, WA). From 1998 through 2006, screening was done with Gen-Probe PACE 2 DNA hybridization probe (Gen-Probe Inc., San Diego, CA) of cervical swabs or urine (men only), or beginning in March 2000, BD ProbeTec ET strand displacement assay (SDA) (Becton-Dickinson, Sparks, MD) of urine (women and men). After 2006, screening was done by BD ProbeTec ET of vaginal or cervical swabs or urine (women and men).

Eligible participants for these analyses were women and men entering the NJTP who had a recorded chlamydia screening test result. Enrollees were excluded if their chlamydia test result, race/ethnicity, region of residence, or screening test type was unknown.

Screening Test Sensitivity and Specificity

Pairs of sensitivity and specificity estimates for each screening test and sample type were generated through targeted meta-analyses of existing literature. We searched PubMed and Scopus using medical subject heading terms and keywords related to chlamydia screening and diagnostic accuracy (Appendix 1, <http://links.lww.com/OLQ/A236>). We included studies conducted in North America or Europe that reported the diagnostic accuracy of the Pathfinder EIA, Gen-Probe PACE 2, and BD ProbeTec ET, and from which counts of true positive, true negative, false positive, and false negative tests could be extracted or calculated. Bivariate generalized linear mixed effects models with a logit link were used to generate summary sensitivity and specificity estimates and corresponding 95% confidence intervals (CI) (Table 1).

Case Mix

Chlamydia prevalence and case rates are associated with race/ethnicity and geography, with Black youth and youth in the South having the highest burden.^{5,13,14} To assess potential bias from longitudinal changes in the demographics of NJTP enrollees, we examined the racial/ethnic and geographical distributions of

enrollees over time. We visually inspected the distributions of race/ethnicity and enrollment region using stacked bar charts, and observed a uniform distribution over time for both factors (Figures S2, <http://links.lww.com/OLQ/A238> and S3, <http://links.lww.com/OLQ/A239>). We also examined temporal trends in enrollment by these factors using logistic regression, with race/ethnicity or region as the dependent variable, and study year (continuous) as the independent variable. No meaningful variation in the relative proportion of race/ethnicity and region over time was observed (results not shown). As these analyses suggested that no meaningful case mix variation occurred, we excluded this potential bias from further consideration in calculating adjusted chlamydia prevalence trend estimates.

Prevalence Trends

We modeled chlamydia prevalence trends using an expectation-maximization (EM)-based maximum-likelihood approach that accounts for measurement error due to imperfect screening test sensitivity and specificity.¹⁵ This approach uses EM to estimate a maximum-likelihood logit regression model when the outcome is measured with uncertainty, and allows the sensitivity and specificity of screening tests to vary across observations. Our models accounted for sensitivity and specificity estimates generated from our meta-analyses. Chlamydial infection (positive or negative) was the dependent variable in all models and study year (continuous) was the independent variable. The functional form of year was assessed using Akaike Information Criteria and visual inspection, and included quadratic spline terms with three knots in models for women and a quadratic term in models for men. Parameter estimates from maximum-likelihood regression models were used to calculate the predicted probability (prevalence) of chlamydia across study years. Ninety-five percent CIs were obtained by bootstrapping ($n = 200$). We compared trends from the EM maximum-likelihood regression model (adjusted trends that account for time-varying measurement error) to trends from a logistic regression model (unadjusted trends that do not account for time-varying measurement error) to assess the impact of changing screening tests on prevalence trend estimates. We also stratified by race/ethnicity and region to examine subgroup differences.

Sensitivity Analyses

We conducted sensitivity analyses to account for random and systematic error in the estimates of test sensitivity and specificity that were used to model prevalence. To account for random error, we modeled prevalence using the upper and lower bounds of the 95% CI around our summary sensitivity and specificity estimates. To account for systematic error, we re-estimated GenProbe

TABLE 1. Summary Sensitivity and Specificity Estimates of Chlamydia Screening Tests

Screening Test (Sample Type)	No. Studies ^(Ref)	Sensitivity (95% CI)	Specificity (95% CI)
Women			
Pathfinder EIA (Swab)*	2 ^(1s, 2s)	72.92 (39.07–91.88)	99.64 (98.14–99.93)
Gen-Probe PACE 2 DNA Probe (Swab) [†]	11 ^(1s,3s-12s)	80.07 (76.66–83.08)	99.21 (98.43–99.60)
BD ProbeTec ET SDA (Urine) [‡]	4 ^(14s,16s-18s)	87.82 (83.74–90.99)	99.10 (97.66–99.66)
BD ProbeTec ET SDA (Swab) [§]	6 ^(13s-18s)	87.49 (81.27–91.86)	99.47 (98.69–99.79)
Men			
Gen-Probe PACE 2 DNA Probe (Urine) [†]	3 ^(5s,9s,19s)	72.09 (60.07–81.61)	99.17 (97.04–99.77)
BD ProbeTec ET SDA (Urine) [‡]	3 ^(14s,16s,17s)	94.04 (91.54–95.83)	98.21 (91.32–99.65)

*Used for screening from 1990 through 1997.

[†]Used for screening from 1998 through 2006 for women, and 2003 through 2006 for men.

[‡]Used for screening from 2000 through 2012 for women, and 2003 through 2012 for men.

[§]Used for screening from 2007 through 2012.

PACE 2 and BD ProbeTec ET sensitivity and specificity using more selective inclusion/exclusion criteria for the meta-analyses. We excluded studies that used the test of interest in their reference test definition (reference test bias) or performed repeat testing. We used these new estimates to model adjusted prevalence. We did not reestimate sensitivity and specificity of the Pathfinder EIA due to the small number of studies in the initial meta-analysis.

Analyses were performed in Stata version 14.1 (College Station, TX, 2015).

RESULTS

Screening Test Sensitivity and Specificity

Sensitivity increased over the study period. The estimated sensitivity of EIA, DNA probe, and SDA for women was 73%, 80%, and 87%, respectively (Table 1). Among men, sensitivity of DNA probe and SDA was 72% and 94%, respectively. All tests had specificities greater than 98%.

Chlamydia Prevalence Among Women

From 1990 through 2012, 439,992 women were screened for chlamydia. Relatively few women had an uninterpretable screening test result ($n = 3466$, 0.8%), or missing race/ethnicity ($n = 26,905$, 6.1%) or region ($n = 17,097$, 3.9%). Chlamydia screening test type was unknown for a small number of women throughout the study period ($n = 2969$, 0.7%), and these data were considered missing. After excluding women with uninterpretable test results or missing data, 389,555 women (89% of women screened for chlamydia) were included in analyses.

Most women were Black (58%) and approximately half lived in the South (45%) (Table 2). Two thirds were age 16 through 19 (69%), and few reported symptoms (3%). Approximately 36% of women were tested for chlamydia via EIA, 24% were tested by DNA probe, and the remainder was tested via SDA of swabs (12%) or urine (28%).

Unadjusted chlamydia prevalence was high overall, ranging between 15% and 10%. Unadjusted prevalence declined modestly from 1990 through 2003, before rising slightly through 2009 (Fig. 1).

After accounting for measurement error associated with different screening tests, we observed a higher prevalence of chlamydia across all years and a sharper decline in adjusted prevalence in the first half of the study, relative to unadjusted estimates (Fig. 1). Adjusted prevalence was highest in 1990 at approximately 20%, and steadily decreased to 12% by 2003. From 2004 through 2012, adjusted prevalence was relatively steady and rose to 14% before dropping to 12%.

Black women had the highest prevalence of chlamydia throughout the study, followed by American Indian, Hispanic, and White women (Fig. 2). For all race/ethnicities, adjusted prevalence declined early on, with the sharpest decline occurring among American Indian women (24% to 12%) and Black women (23% to 14%). Among Hispanic and White women, adjusted prevalence declined from approximately 15% to 10% and 13% to 7% respectively. Adjusting for time-varying measurement error revealed a larger decline in prevalence for all race/ethnicities early in the study, relative to unadjusted trends (Figure S4, <http://links.lww.com/OLQ/A240>). In the second half of the study, adjusted chlamydia prevalence remained relatively steady among White and Hispanic women. Adjusted prevalence in Black women rose modestly from 14% to 17% between 2003 and 2008, before beginning to drop. American Indian women experienced an increase in adjusted prevalence from 2008 through 2012 (12% to 16%).

Chlamydia prevalence was highest throughout the study among women in the South, followed by the Midwest, Northeast,

and West. In all regions, adjusted prevalence was high in 1990, ranging between 16% among women in the West to 21% among women in the South (Figs. 3 and S5, <http://links.lww.com/OLQ/A241>). Adjusted prevalence among women declined in the first half of the study in all regions, and leveled out in the second half among women in the West and Northeast. Modest increases in adjusted prevalence occurred among women in the South and Midwest between 2004 and 2009.

In sensitivity analyses, neither the magnitude nor shape of the overall prevalence trend was substantially altered by using the lower and upper bounds of the 95% CI around test sensitivity and specificity estimates (Figure S6, <http://links.lww.com/OLQ/A242>). Reestimated test sensitivity and specificity values were very similar to initial estimates, and modeling trends with reestimated values also had minimal influence on the overall trend (results not shown).

Chlamydia Prevalence Among Men

From 2003 through 2012, 370,047 men were screened for chlamydia. Few men had an uninterpretable test result ($n = 1288$, 0.3%), or were missing race/ethnicity ($n = 21,976$, 5.9%). Region and chlamydia screening test type were missing for 7486 (2.0%) men and 35,598 (9.6%) men respectively. Overall, 303,699 men (82% of men screened for chlamydia) were included in analyses.

Half of the men were Black (51%) and lived in the South (49%) (Table 2). Two thirds (67%) were aged 16 through 19 years. Few men reported symptoms (1%). Almost all men were screened with SDA (99%). Unadjusted chlamydia prevalence remained stable throughout the study, and fluctuated between 8% and 9% (Fig. 1).

After accounting for measurement error, the adjusted prevalence of chlamydia among men decreased slightly in all years relative to unadjusted estimates but remained steady over time at approximately 7% (Fig. 1). Black men had the highest adjusted prevalence across all years (approximately 11%), followed by American Indian (approximately 5%), Hispanic (approximately 4%), and White men (approximately 1%) (Figs. 2 and S7, <http://links.lww.com/OLQ/A243>). Adjusted prevalence was consistently highest among men in the South, followed by the Midwest, Northeast, and West (Fig. 3 and S8, <http://links.lww.com/OLQ/A244>). Adjusted prevalence estimates generated from the upper and lower bounds of the 95% CI around test sensitivity and specificity did not substantially alter trends (Figure S9, <http://links.lww.com/OLQ/A245>).

DISCUSSION

Sentinel surveillance of chlamydia among NJTP enrollees provides a unique opportunity to assess chlamydia prevalence trends in high-risk youth and young adults and gain insights into the possible impact of the national chlamydia screening program. After ruling out bias due to case mix and adjusting for time-varying measurement error associated with changing screening tests, chlamydia prevalence among women declined from 20% to 12% during the first 14 years of the study, and remained between 12% and 14% through 2012. Adjusted chlamydia prevalence among men was stable from 2003 through 2012 (approximately 7%). For women and men, adjusted prevalence was highest among Black and American Indian youth and young adults, and youth and young adults in the South and Midwest throughout the study. Despite longstanding national screening and treatment programs,⁵ chlamydia remains highly prevalent among youth and young adults entering the NJTP.

The decline in chlamydia prevalence among women entering the NJTP during the 1990s coincided with scale-up of the

TABLE 2. Characteristics of National Job Training Program Enrollees and Unadjusted Chlamydia Prevalence, 1990–2012

Characteristic	Women (n = 389,555)				Men (n = 303,699)			
	No. Tested (Col %)	No. Positive	Unadjusted		No. Tested (Col %)	No. Positive	Unadjusted	
			Prevalence (%) ^{*†}				Prevalence (%) [*]	
Age, y								
16–19	270,483 (69.4)	36,075	13.3	204,778 (67.4)	16,147	7.9		
20–24	119,072 (30.6)	10,709	9.0	98,921 (32.6)	8567	8.7		
Race/ethnicity								
Black	224,936 (57.8)	32,424	14.4	155,045 (51.1)	19,031	12.3		
White	91,173 (23.4)	6737	7.4	95,994 (31.6)	2761	2.9		
Hispanic	61,449 (15.8)	6186	10.1	44,822 (14.8)	2713	6.1		
American Indian	11,997 (3.1)	1437	12.0	7838 (2.6)	507	6.5		
Region								
Midwest	71,291 (18.3)	8672	12.2	51,361 (16.9)	4423	8.6		
Northeast	67,385 (17.3)	7007	10.4	45,730 (15.1)	2893	6.3		
South	174,056 (44.7)	24,288	14.0	149,464 (49.2)	14,983	10.0		
West	76,823 (19.7)	6817	8.9	57,144 (18.8)	2415	4.2		
Symptoms at Entrance								
Yes	12,270 (3.2)	1834	15.0	3707 (1.2)	673	18.2		
No	377,285 (96.9)	44,950	11.9	299,992 (98.8)	24,041	8.0		
Test (sample type)								
EIA (swab)	141,932 (36.4)	17,811	12.6	—	—	—		
DNA Probe (swab)	92,145 (23.7)	9463	10.3	—	—	—		
DNA Probe (urine)	—	—	—	954 (0.3)	83	8.7		
SDA (swab)	47,690 (12.2)	6779	14.2	—	—	—		
SDA (urine)	107,788 (27.7)	12,731	11.8	302,745 (99.7)	24,631	8.1		
Year of Test								
1990	10,143 (2.6)	1518	15.0	—	—	—		
1991	18,086 (4.6)	2588	14.3	—	—	—		
1992	18,922 (4.9)	2380	12.6	—	—	—		
1993	20,132 (5.2)	2484	12.3	—	—	—		
1994	19,994 (5.1)	2722	13.6	—	—	—		
1995	18,151 (4.7)	2276	12.5	—	—	—		
1996	21,115 (5.4)	2235	10.6	—	—	—		
1997	15,389 (4.0)	1608	10.4	—	—	—		
1998	12,106 (3.1)	1424	11.8	—	—	—		
1999	12,709 (3.3)	1459	11.5	—	—	—		
2000	10,189 (2.6)	1138	11.2	—	—	—		
2001	5892 (1.5)	653	11.1	—	—	—		
2002	6443 (1.7)	674	10.5	—	—	—		
2003	16,095 (4.1)	1598	9.9	16,206 (5.3)	1447	8.9		
2004	17,936 (4.6)	1862	10.4	32,593 (10.7)	2766	8.5		
2005	19,114 (4.9)	1758	9.2	33,637 (11.1)	2849	8.5		
2006	19,339 (5.0)	2611	13.5	32,652 (10.8)	2699	8.3		
2007	20,825 (5.3)	2811	13.5	33,147 (10.9)	2683	8.1		
2008	21,494 (5.5)	2743	12.8	33,158 (10.9)	2624	7.9		
2009	21,288 (5.5)	2518	11.8	31,435 (10.4)	2411	7.7		
2010	21,948 (5.6)	2669	12.2	30,421 (10.0)	2346	7.7		
2011	22,162 (5.7)	2646	11.9	31,661 (10.4)	2581	8.2		
2012	20,083 (5.2)	2409	12.0	28,789 (9.5)	2308	8.0		

*Unadjusted prevalence was calculated as the total number of positive tests divided by the total number tested. Estimates differ slightly from estimates derived from logistic regression models.

†A total of 9038 and 9717 women were tested for chlamydia in 2001 and 2002, respectively. Due to administrative changes in reporting, race/ethnicity was missing for approximately 35% of women in 2001 and 2002, and these women were excluded from analyses. Unadjusted prevalence excluding women with missing race/ethnicity in 2001 and 2002 (reported above) was similar to unadjusted prevalence including women with missing race/ethnicity in 2001 and 2002 (10.8% and 10.5%, respectively).

national screening program, possibly providing indirect support for the early success of screening programs in reducing chlamydia prevalence, specifically among high-risk young women.¹⁶ The decline in prevalence stopped in 2003, raising the possibility that ongoing screening efforts for high-risk young women are insufficient to reduce prevalence further.

Adjusted chlamydia prevalence among men was steady throughout the study. Screening for men started in 2003, when the prevalence among women began to stabilize. The flat trend suggests that ongoing prevention efforts have been ineffective at reducing

chlamydia among men since 2003. This trend is perhaps unsurprising, as screening programs have primarily targeted women.

We observed large disparities in chlamydia prevalence by race/ethnicity and region, with black and American Indian youth and young adults, and youth and young adults in the South having consistently higher prevalence compared to other races/ethnicities and regions. Prevalence in these groups also increased modestly during the latter half of the study. The overall trends among women appear to be driven by prevalence trends among black women and women residing in the South and Midwest, based on

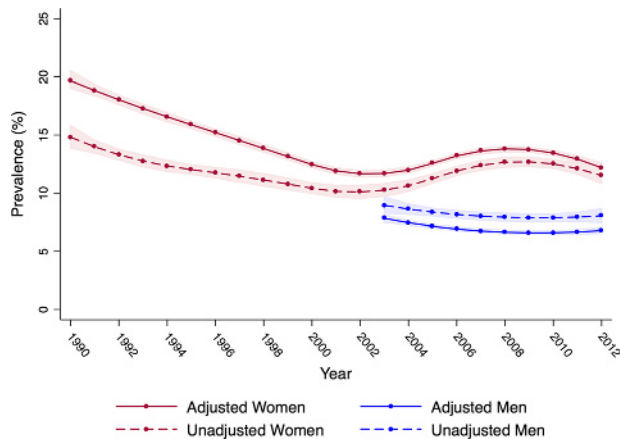


Figure 1. Adjusted and unadjusted chlamydia prevalence among women entering the NJTP ($n = 389,555$) from 1990 to 2012 (red lines), and men entering the NJTP ($n = 303,699$) from 2003 to 2012 (blue lines). Adjusted prevalence estimates and 95% CIs account for measurement error associated with use of increasingly sensitive chlamydia screening tests over time (Pathfinder EIA of swabs [1990–1997], Gen-Probe PACE 2 DNA hybridization probe of swabs or urine [1998–2006], and BD ProbeTec ET SDA of urine [2000–2012] or swabs [2007–2012]). Adjusted estimates were modeled using an EM algorithm incorporated into logistic regression. Unadjusted estimates were generated from a logistic regression model, and do not account for changes in the diagnostic accuracy of tests.

similarities in trend shape. Similar racial and regional disparities have been observed among large population-based surveys and public high school students.^{13,14,17–19} Targeted chlamydia prevention efforts for these groups could be considered to address these racial and regional disparities.

The relatively stable chlamydia prevalence trends among women and men after 2003 and racial/ethnic and regional disparities in trends highlight the need for a comprehensive understanding of factors that drive these trends. Future research could examine whether stable trends among NJTP enrollees have persisted after 2012 and investigate why trends have stopped declining and what is driving disparities in prevalence, particularly among Black women and women residing in the South and Midwest.

Our findings differ from previously reported chlamydia prevalence trends among NJTP enrollees with respect to trend direction, duration, and validity. In previous reports, prevalence declined but was estimated only over the short term.^{8–11} While focusing on shorter periods may avoid bias from changing tests, it prohibits long-term trend estimation across periods with different tests. We examined 23-year prevalence trends to generate a comprehensive picture of chlamydia prevalence over time, and observed no substantial decline after 2003.

We also used robust methods to account for measurement error due to changing screening tests. In previous trend estimates, measurement error was addressed by adjusting for screening tests in generalized linear models or restricting by test type.^{9,10} These methods do not properly account for test sensitivities and specificities.²⁰ To generate more valid prevalence estimates that correctly account for measurement error, we estimated screening tests' diagnostic accuracy through meta-analyses, and used EM-based maximum-likelihood regression to incorporate sensitivities and specificities into prevalence trend estimation. We examined several sensitivity and specificity estimates to account for random and systematic error that may have influenced our diagnostic accuracy estimates. Sensitivity analyses showed that adjusted

prevalence trend estimates were generally unaffected by a range of plausible screening test sensitivity and specificity values.

We also evaluated the need to account for case mix by examining race/ethnicity and region of residence of NJTP enrollees over time. The NJTP entrance criteria for socioeconomic status, education, and age were constant throughout the study,⁶ and we did not observe meaningful variation in race/ethnicity or region over time. We could not assess whether other characteristics of NJTP enrollees changed over time, so although entrance criteria were consistent, enrollees' risk profiles, particularly their sexual behavior, may have changed. For example, nationally, condom use among high school students increased from 1991 through 2003 but decreased between 2003 and 2015, indicating that potential changes in sexual behaviors could be a source of residual case mix biases.²¹

Multiple factors other than the screening program and biases in surveillance data could have influenced chlamydia prevalence trends. These factors include changes in sexual activity, increased condom use, and older age of sexual debut. Decreased

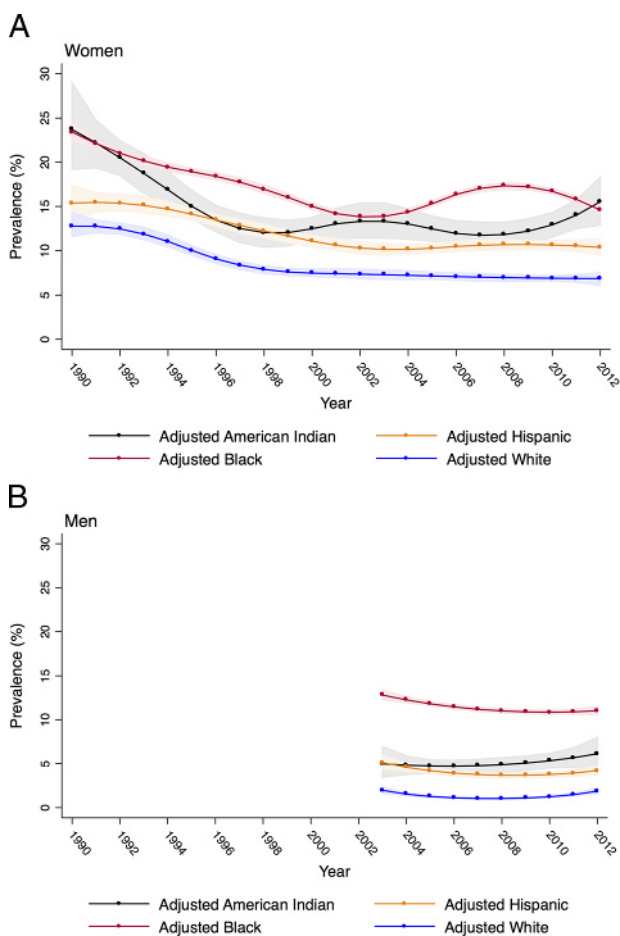


Figure 2. Adjusted chlamydia prevalence and 95% CIs among Hispanic ($n = 61,449$), Black ($n = 224,936$), White ($n = 91,173$), and American Indian ($n = 11,997$) women entering the NJTP, 1990–2012 (Panel A) and Hispanic ($n = 44,822$), black ($n = 155,045$), white ($n = 95,994$), and American Indian ($n = 7,838$) men entering the NJTP, 2003–2012 (panel B). Adjusted prevalence was modeled using an EM algorithm incorporated into logistic regression to account for measurement error due to changes in the diagnostic accuracy of chlamydia screening tests over the study period.

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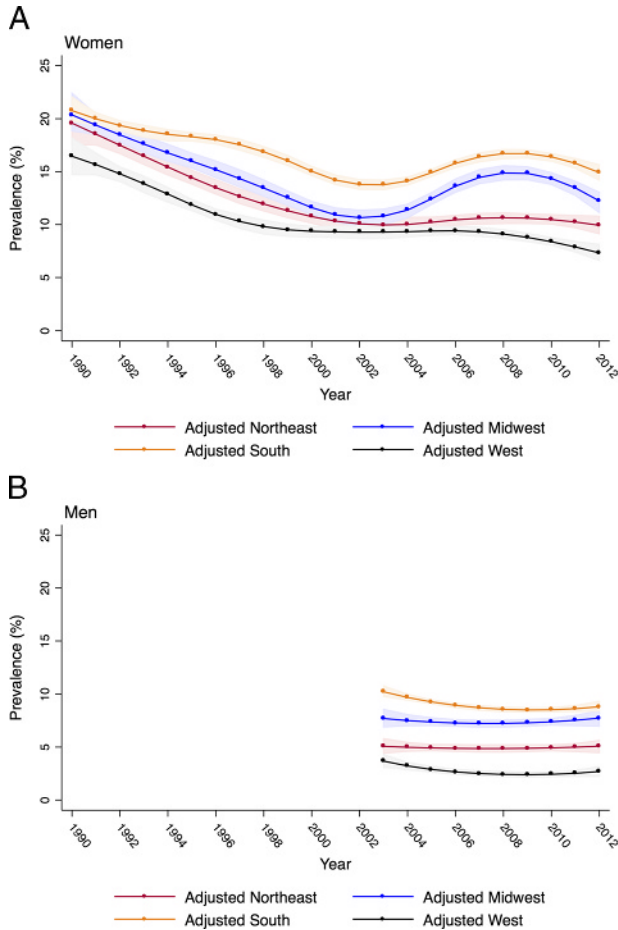


Figure 3. Adjusted chlamydia prevalence and 95% CIs among women entering the NJTP in 4 regions of the US, 1990–2012 (Midwest: $n = 71,291$; South: $n = 174,056$; West: $n = 76,823$; Northeast: $n = 67,385$) (Panel A) and men entering the NJTP in 4 regions of the United States, 2003 to 2012 (Midwest: $n = 51,361$; South: $n = 149,464$; West: $n = 57,144$; Northeast: $n = 45,730$) (panel B). Adjusted prevalence was modeled using an EM algorithm incorporated into logistic regression to account for measurement error due to changes in the diagnostic accuracy of chlamydia screening tests.

sexual activity and increased condom use drove falling teen pregnancy trends,²² which declined in parallel with chlamydia in the 1990s, suggesting that multiple factors played a role in the early decline of chlamydia. But teen pregnancy continued to drop steadily through 2012 while chlamydia trends plateaued or rose.

Our study is the first to generate long-term chlamydia prevalence trend estimates among NJTP enrollees while properly accounting for biases that influence observed prevalence in sentinel populations. We observed an initial decline in chlamydia prevalence among women, followed by a period of relative stability. We also observed stable trends among men. The trends offer indirect evidence that chlamydia screening programs may have been initially effective among women on a population level, but the ongoing impact of screening in the current social context may be insufficient to further reduce prevalence. Chlamydia prevalence among high-risk youth and young adults remains alarmingly high and supports ongoing screening and prevention efforts.

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