Gonorrhea and Chlamydia in the United States among Persons 14 to 39 Years of Age, 1999 to 2002

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Background: Nationally representative surveys of chlamydia and gonorrhea are an important measure of disease burden and progress of screening programs.

Objective: To measure chlamydia and gonorrhea prevalence in the United States.


Participants: 6632 NHANES respondents.

Measurements: Urine specimens were tested for chlamydia and gonorrhea. Results were weighted to represent the U.S. civilian, noninstitutionalized population between 14 and 39 years of age.

Results: Prevalence of gonorrheal infection was 0.24% (95% CI, 0.16% to 0.38%). Prevalence of gonorrheal infection was higher among non-Hispanic black persons (1.2% [CI, 0.7% to 1.9%]) than among non-Hispanic white persons (0.07% [CI, 0.02% to 0.24%]). Among those with gonorrheal infection, 46% also had chlamydial infection. Prevalence of chlamydial infection was 2.2% (CI, 1.8% to 2.8%) and was similar between males (2.0% [CI, 1.6% to 2.5%]) and females (2.5% [CI, 1.8% to 3.4%]). Among females, the highest prevalence was in those age 14 to 19 years; whereas among males, it was highest in those age 14 to 29 years. Prevalence was higher among non-Hispanic black persons (6.4% [CI, 5.4% to 7.5%]) than non-Hispanic white persons (1.5% [CI, 1.0% to 2.4%]). Among females with a history of gonorrhea or chlamydial infection, prevalence of gonorrhea was 16.7% (CI, 5.5% to 50.7%).

Limitations: The specificity of urine-based assays for chlamydia and gonorrhea is limited, and the possible misclassification of sexual experience status may have affected the accuracy of some estimates.

Conclusions: The findings support current recommendations to screen sexually active females age 25 years or younger for chlamydia, to retest infected females for chlamydial infection, and to co-treat individuals with gonorrhea for chlamydia.

Methods

Survey Design

The NHANES is a series of cross-sectional surveys designed to provide national statistics on the health and nutritional status of the general household population through household interviews, standardized physical examinations, and the collection of biological samples in special mobile examination centers. In 1999, NHANES became a continuous survey, with data released every 2 years. The sampling plan of the survey is a stratified, multistage, probability cluster design that selects a sample representative of the U.S. civilian noninstitutionalized population. Data pre-
Accurate information about the prevalence of sexually transmitted diseases is essential to the development of screening programs that effectively reduce disease burden.

These data from the 1999–2002 National Health and Nutrition Examination Survey estimate the prevalence of gonorrhea and chlamydia among the U.S. population age 14 to 39 years to be 0.24% and 2.2%, respectively. Chlamydia prevalence was highest among younger women and persons with a history of gonorrhea or chlamydia infection.

Although these are the most recently available data, they are more than 5 years old and did not permit estimation of prevalence by geographic region.

These data support current screening and treatment recommendations for chlamydia.

—The Editors

sent in this paper are from the 1999–2002 survey years. (Additional years of data on gonorrhea and chlamydia were collected in the NHANES survey for the 2003–2004 cycle, but testing was performed by using a different laboratory test, the Becton Dickinson ProbeTec [Becton Dickinson, Franklin Lakes, New Jersey], owing to the discontinuation of the Abbott LCx [Abbott Laboratories, Abbott Park, Illinois].) Disclosure risks with the NHANES 2003–2004 gonorrhea data led the National Center for Health Statistics, Centers for Disease Control and Prevention [CDC], to withhold the release of the gonorrhea data for public use. The chlamydia data did not demonstrate any disclosure risks, but because a different laboratory test was used, we felt it prudent to publish data through 2002 only. Once the 2005–2006 data are available for gonorrhea and chlamydia, the 2003–2004 data can be better assessed and a data update through 2006 can be published (2005–2006 data are anticipated to be released in mid- to late 2008 if no quality control issues arise).

Our sample includes 6632 participants, age 14 to 39 years, who were sampled from randomly selected U.S. locations. Adolescents (age 14 to 17 years), African Americans, and Mexican Americans were oversampled to improve precision of estimates for these subgroups. Race or ethnic group was categorized on the basis of the participant’s self-reported information as non-Hispanic white, non-Hispanic black, or Mexican American. Participants who did not fit into 1 of these categories were classified as “other” and were analyzed with the total sample but not in race or ethnic subgroups. All participants provided written informed consent. For minors (age <18 years), parents gave written consent, accompanied by the minor’s assent. An institutional review board at CDC reviewed and approved the study protocol.

Sexual behavior data were collected in the mobile examination center during a private, audio, computer-assisted, self-interview. Sex was defined as vaginal, oral, or anal intercourse. In our analyses, we defined “sexually experienced” as reporting ever having had sex. Questions about history of gonorrhea and chlamydia diagnoses were asked only of sexually experienced persons 18 to 39 years of age. All NHANES participants who were tested for

C. trachomatis and N. gonorrhoeae were given an opportunity to obtain their test results by telephone by using a confidential identification number. Reminder letters were sent to adults, and telephone calls were made to minors to encourage participants to call to learn about their test results.

Laboratory Testing

Urine specimens collected from participants were processed in the mobile examination center and shipped to CDC for C. trachomatis and N. gonorrhoeae testing by using a ligase chain reaction assay (LCx, Abbott Laboratories), according to the manufacturer’s instructions. Although it is not recommended for routine clinical practice, specimens positive for C. trachomatis or N. gonorrhoeae were retested from the original urine specimen by using the same assay for detection for the purposes of this survey. No retests yielded discrepant results. Specimens with negative results were not retested. After completion of data collection, Abbott Laboratories issued a recall for certain lots of N. gonorrhoeae LCx assay kits in 2002 (5). No affected lots were used in our survey. Abbott Laboratories discontinued marketing of both the N. gonorrhoeae and C. trachomatis LCx assay kits in 2003. In a letter to its customers, dated 10 January 2003, the manufacturer stated that discontinuation of the product was “due to manufacturing issues.”

Statistical Analysis

We performed statistical analyses by using SAS for Windows software, version 9.1 (SAS Institute, Cary, North Carolina), and SAS-callable SUDAAN (RTI, Research Triangle Park, North Carolina). Analyses performed with SUDAAN accounted for the complex survey design by incorporating the survey weights and using a Taylor series linearization to calculate variance estimates (6). Data were weighted to account for the unequal probability of selection and nonresponse to the interview and examination.

We estimated the number of infections in the population by multiplying the 2000 U.S. Census figures for the noninstitutionalized civilian U.S. population (7) age 14 to 39 years by the weighted prevalence estimate. We calculated 95% CIs for the prevalence estimates by using a log transformation. We performed significance tests for the association between chlamydia and gonorrhea and other variables by using a chi-square statistic. The chi-square statistic was based on a test for no interaction in a log-linear model
that was fit to the log of the estimated cell proportions (LLCHISQ test statistic in SUDAAN). We used logistic regression to test for the presence of a linear trend across the categories of an independent variable. We considered \( P \) values of 0.05 or less to be statistically significant. No adjustments were made for multiple comparisons. We computed the relative standard errors for each weighted estimate. The relative standard error summarizes how large the sampling variability is relative to the size of the point estimate—the higher the relative standard error, the less reliable the estimate. Relative standard errors greater than 30% are considered to be unstable and should be interpreted with caution.

We performed logistic regression to identify the variables that were associated with \( C. \) trachomatis infection (logistic regression was not performed with \( N. \) gonorrhoeae infection as the outcome because of the small number of infected respondents). Survey variables associated with infection in the medical literature were considered for entry into our model. We included interview and mobile examination center data in the model only if the question had been asked of all persons age 14 to 39 years in the survey (for example, questions of history of gonorrhea or chlamydia diagnosis were not included). We included sex, age, and number of lifetime sexual partners in the model regardless of statistical significance on the basis of well-established epidemiologic evidence that these are important factors associated with chlamydia. This was followed by adding variables in order of statistical significance by using a step-up approach to the baseline model. The criteria for the variable to remain in the model were based on a \( P \) value of 0.05 or less (by Satterwaite adjusted F test). Once all variables added into the baseline model were statistically significant and no further variables met the entry criteria, we reassessed all variables excluded from the model for data-based confounding. We entered each excluded variable individually into the model and retained it if any variable estimate changed by more than 30%. Once a model with all relevant main effects was selected, we evaluated all pairwise interactions. Pairwise interactions between sex and each variable in the model allowed us to explore whether any of the main effects differed between males and females.

**Role of the Funding Source**

Funding, design, conduct, and analysis of the study were provided by CDC.

**Results**

Among persons originally selected to participate in NHANES 1999–2002 (includes all age groups), 83% responded to the household interview. Among interviewed persons age 14 to 39 years (\( n = 7229 \)) and age 14 to 17 years (\( n = 2459 \)), 91.7% and 92.5%, respectively, had both chlamydia and gonorrhea test results.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Participants Tested, n</th>
<th>Prevalence (95% CI), %</th>
<th>( P ) Value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>6632</td>
<td>0.24 (0.16–0.38)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3096</td>
<td>0.16 (0.08–0.33)†</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Female</td>
<td>3536</td>
<td>0.33 (0.21–0.53)</td>
<td></td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>14–19 y</td>
<td>3333</td>
<td>0.61 (0.37–0.98)</td>
<td></td>
</tr>
<tr>
<td>20–29 y</td>
<td>1712</td>
<td>0.21 (0.08–0.57)</td>
<td></td>
</tr>
<tr>
<td>30–39 y</td>
<td>1587</td>
<td>0.07 (0.02–0.30)</td>
<td></td>
</tr>
<tr>
<td>Race or ethnic group</td>
<td></td>
<td></td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>2293</td>
<td>0.07 (0.02–0.24)§</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>1603</td>
<td>1.19 (0.74–1.92)</td>
<td></td>
</tr>
<tr>
<td>Mexican American</td>
<td>2160</td>
<td>0.41 (0.13–1.35)§</td>
<td></td>
</tr>
<tr>
<td>Prevalence of ( C. ) trachomatis among those with ( N. ) gonorrhoeae</td>
<td></td>
<td>36</td>
<td>45.7 (24.1–86.8)</td>
</tr>
</tbody>
</table>

* \( C. \) trachomatis = \( Chlamydia \) trachomatis; \( N. \) gonorrhoeae = \( Neisseria \) gonorrhoeae.
† Chi-square test.
‡ Relative standard error between 30% and 50%.
§ Relative standard error >50%.

**Prevalence of Genital Gonorrheal Infection**

Of the 6632 samples tested, 36 were positive for gonorrheal infection. The estimated prevalence of gonorrhea in the noninstitutionalized civilian U.S. population age 14 to 39 years in 1999–2002 was 0.24% (95% CI, 0.16% to 0.38%), corresponding to approximately 247 000 (CI, 165 000 to 392 000) prevalent infections (Table 1). Non-Hispanic black persons had a significantly higher prevalence than did non-Hispanic white and Mexican-American persons (\( P < 0.01 \)). Chlamydial co-infection among those with gonorrheal infection in the overall sample was 45.7% (CI, 24.1% to 86.8%). Sexual experience was reported by 47% of participants age 14 to 19 years, 91% of those age 20 to 29 years, and 97% of those age 30 to 39 years. When we limited our analysis to only sexually experienced individuals, gonorrhea prevalence was 0.92% (CI, 0.50% to 1.69%), 0.25% (CI, 0.09% to 0.68%), and 0.08% (CI, 0.02% to 0.33%), respectively.

Six respondents who reported not being sexually experienced tested positive for gonorrheal infection. Prevalence of gonorrhea among all sexually inexperienced respondents was 0.11% (CI, 0.04% to 0.31%). The 6 respondents were 14 to 19 years of age. Three were non-Hispanic black, and the other 3 were Mexican American. Two of these 6 respondents also tested positive for chlamydial infection.

**Prevalence of Genital Chlamydial Infection**

Of the 6632 samples tested, 241 were positive for chlamydial infection. The prevalence of chlamydia in the noninstitutionalized civilian U.S. population age 14 to 39 years in 1999–2002 was 2.2% (CI, 1.8% to 2.8%), corre-
sponding to 2,291,000 (CI, 1,857,000 to 2,838,000) prevalent infections.

Overall prevalence was similar between females and males (Table 2); however, the distribution of infection differed by age between the sexes. Among females, prevalence was highest among those age 14 to 19 years. Prevalence was similar for females age 20 to 29 years and 30 to 39 years ($P > 0.05$). Among males, prevalence did not significantly differ between those age 14 to 19 years and those age 20 to 29 years ($P > 0.05$). Prevalence decreased in males age 30 to 39 years (Table 2). Prevalence among females who had a positive urine test for pregnancy was 2.0% (CI, 1.2% to 3.2%).

Non-Hispanic black persons had a higher prevalence than non-Hispanic white persons. This difference was significant for males ($P < 0.01$) and females ($P < 0.01$) (Table 2). Non-Hispanic black persons age 14 to 19 years had the highest prevalence of any other group, but not at a statistically significant level (Figure).

When we restricted the analysis to sexually experi-

### Table 2. Prevalence of Chlamydia trachomatis, by Selected Characteristics*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tested, n</td>
<td>Prevalence (95% CI), %</td>
<td>Test, n</td>
</tr>
<tr>
<td>Total</td>
<td>6632</td>
<td>2.2 (1.8–2.8)</td>
<td>3536</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14–19 y</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–29 y</td>
<td>3333</td>
<td>3.4 (2.7–4.2)</td>
<td>1649</td>
</tr>
<tr>
<td>30–39 y</td>
<td>1712</td>
<td>2.5 (1.9–3.4)</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>1587</td>
<td>1.3 (0.7–2.4)‡</td>
<td>887</td>
</tr>
<tr>
<td>Race or ethnic group</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>2293</td>
<td>1.5 (1.0–2.4)</td>
<td>1256</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>1603</td>
<td>6.4 (5.4–7.5)</td>
<td>830</td>
</tr>
<tr>
<td>Mexican American</td>
<td>2160</td>
<td>3.1 (2.3–4.2)</td>
<td>1129</td>
</tr>
<tr>
<td>Marital status</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>1653</td>
<td>1.2 (0.6–2.4)‡</td>
<td>1026</td>
</tr>
<tr>
<td>Never married</td>
<td>4158</td>
<td>3.2 (2.4–4.1)</td>
<td>1995</td>
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<tr>
<td>Living with partner</td>
<td>352</td>
<td>2.4 (0.9–6.3)‡</td>
<td>211</td>
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<tr>
<td>Education level</td>
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<td></td>
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<tr>
<td>&lt;High school</td>
<td>4871</td>
<td>3.2 (2.5–4.0)</td>
<td>2472</td>
</tr>
<tr>
<td>&gt;High school</td>
<td>1756</td>
<td>1.0 (0.6–1.7)</td>
<td>1061</td>
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<tr>
<td>Annual household income</td>
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<tr>
<td>&lt;$20,000</td>
<td>2185</td>
<td>3.8 (2.9–5.0)</td>
<td>1214</td>
</tr>
<tr>
<td>≥$20,000</td>
<td>4151</td>
<td>1.6 (1.1–2.3)</td>
<td>2169</td>
</tr>
<tr>
<td>Age at first sex§</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;14 y</td>
<td>679</td>
<td>5.0 (3.1–7.9)</td>
<td>250</td>
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<tr>
<td>≥14 y</td>
<td>3683</td>
<td>2.0 (1.6–2.5)</td>
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<tr>
<td>Number of lifetime sexual partners</td>
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</tr>
<tr>
<td>0</td>
<td>1705</td>
<td>1.1 (0.5–2.2)‡</td>
<td>840</td>
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<tr>
<td>1</td>
<td>905</td>
<td>0.8 (0.5–1.3)</td>
<td>602</td>
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<td>2</td>
<td>574</td>
<td>1.7 (1.2–2.6)</td>
<td>356</td>
</tr>
<tr>
<td>3–5</td>
<td>1121</td>
<td>2.9 (2.0–4.1)</td>
<td>642</td>
</tr>
<tr>
<td>&gt;5</td>
<td>1562</td>
<td>2.8 (2.1–3.8)</td>
<td>673</td>
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<tr>
<td>Gonorrhea or chlamydia diagnosis (past 12 mo)¶</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>78</td>
<td>11.7 (4.4–31.4)‡</td>
<td>52</td>
</tr>
<tr>
<td>No</td>
<td>3278</td>
<td>2.0 (1.5–2.6)</td>
<td>1823</td>
</tr>
<tr>
<td>Prevalence of N. gonorrhoeae among those with C. trachomatis</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>241</td>
<td>5.0 (2.5–9.9)‡</td>
<td>150</td>
</tr>
</tbody>
</table>

* C. trachomatis = Chlamydia trachomatis; N. gonorrhoeae = Neisseria gonorrhoeae.
† Chi-square test.
‡ Relative standard error between 30% and 50%.
§ Results for sexually active participants only.
¶ Relative standard error >50%.
† Results for sexually active participants age 18–39 years only.
enced persons, the differences in prevalence between the 14- to 19-year age group and the 2 older age groups increased. Prevalence among sexually experienced persons age 14 to 19 years was 6.0% (CI, 4.8% to 7.6%), a significantly higher estimate than that among those age 20 to 29 years (2.6% [CI, 1.9% to 3.4%]) and age 30 to 39 years (1.2% [CI, 0.7% to 2.2%]).

Persons reporting age at first sex before age 14 years were more likely to be infected than those reporting first sex at age 14 years or older (P < 0.01) (Table 2). A test of trend revealed a statistically significant association between infection and increasing number of lifetime sexual partners (P < 0.01).

Respondents with a reported diagnosis of chlamydial or gonorrheal infection in the past 12 months were more likely than were those without this history to have chlamydial infection (Table 2). After further stratification by sex, this association was statistically significant for females (P < 0.01). Although the association was not statistically significant for males, we observed an increased prevalence among males who had a history of these diagnoses (Table 2).

Nineteen respondents who reported not being sexually experienced tested positive for chlamydial infection. Prevalence of chlamydia among all sexually inexperienced respondents was 1.1% (CI, 0.5% to 2.2%). Fourteen of the 19 respondents (74%) were 14 to 19 years old. Nine were non-Hispanic black, 7 were Mexican American, and 3 were non-Hispanic white persons. Two of these 19 respondents also tested positive for gonorrheal infection.

A multivariate model (Table 3) examining independent factors associated with chlamydial infection (which included race or ethnicity, age, sex, education, annual household income, number of lifetime sexual partners, and a statistically significant interaction between age and sex), demonstrated that non-Hispanic black persons were more likely than non-Hispanic white persons to be infected (P < 0.01). Females age 14 to 19 years (P < 0.01), but not those age 20 to 29 years (P > 0.05), were more likely than females age 30 to 39 years to be infected. Males age 14 to 19 years (P ≤ 0.05) or 20 to 29 years (P < 0.01) were more likely than those age 30 to 39 years to be infected. Individuals with a high school or lower level of education (P ≤ 0.05) or an annual household income less than $20 000 (P ≤ 0.05) were also more likely to be infected. Persons with 0 to 2 lifetime sexual partners were less likely to be infected than were individuals with 3 to 5 (P < 0.01) or more than 5 lifetime sexual partners (P < 0.01) (Table 3).

**DISCUSSION**

The findings from NHANES 1999–2002 document the large number of persons age 14 to 39 years who are infected with chlamydia (2.2% prevalence; 2.3 million estimated infections) and the relatively low prevalence of gonorrhea (0.24% prevalence; 250 000 estimated infections) in the United States. The survey is the first nationally representative, population-based prevalence study of gonorrhea and chlamydia in the United States that includes adolescents and adults and both sexes.

A major strength of population-based prevalence studies of gonorrhea and chlamydia (such as NHANES) in measuring the actual burden of disease is the ability to...
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Detect infection, whether symptomatic or asymptomatic. Few studies have attempted to quantify the proportion of gonorrheal or chlamydial infections that are asymptomatic; estimates from community screening sites in New Orleans, Louisiana, demonstrated that as many as 45% of gonorrheal infections and 77% of chlamydial infections were asymptomatic (8). In NHANES, no questions were asked about symptoms, and we could not distinguish symptomatic infections from asymptomatic infections. Measuring asymptomatic infection burden is important because asymptomatic infections are less likely to be treated. The duration of untreated chlamydial infection may be as long as 1 to 2 years, and the infection can be transmitted to partners—contributing to long-term sequelae among women (9).

The national disease burden from chlamydia among men has not been studied extensively, and 2 previous population-based studies on chlamydia showed a prevalence ranging from 3.1% to 5.7% among young men (age 15 to 26 years) (10, 11). The NHANES findings document roughly equal prevalence of gonorrhea and chlamydia between males and females and decreasing prevalence of both infections with increasing age. However, the distribution of chlamydial infection across age groups was different for the 2 sexes: females age 20 to 29 years and 30 to 39 years had decreased prevalence, whereas decreased prevalence among males was limited to those 30 to 39 years of age. The NHANES 1999–2002 data are the first to document the decreased prevalence of chlamydia among men age 30 years or older. If male screening programs for chlamydia are being considered, screening men age 30 years or older seems difficult to justify. Similarly, limiting male screening to adolescents (age <20 years) would fail to detect the considerable burden among men 20 to 29 years of age, as demonstrated in NHANES.

Young women, who are targeted for chlamydia screening and are at risk for long-term sequelae, had an unacceptably high burden of chlamydial infection. Several professional health care agencies and organizations (such as CDC [12], the American College of Preventive Medicine [13], and the U.S. Preventive Services Task Force [14]) have issued universal screening recommendations for sexually experienced females age 25 years or younger. Adherence to these recommendations, however, is incomplete. Levine and colleagues (15) estimated that only 60% of sexually active adolescent females were screened nationwide in 2000. The Health Employer Data Information Set (HEDIS) measure for coverage of chlamydia screening of sexually active females age 16 to 20 years at participating managed care organizations was 34.4% in 2005 (16).

Current guidelines for screening focus primarily on women and reflect a strategy that may require reconsideration, given the role of male infections in female infertility. Because of the roughly equal prevalence of chlamydia between men and women, male screening may be of public health benefit, especially if the correct age group is targeted. Other strategies, such as improved partner notification and expedited partner treatment (17), also need further exploration.

The NHANES also highlights the disproportionately high burden of chlamydial and gonorrheal infections among adolescents and non-Hispanic black persons. Although similar findings have been reported in surveillance data (18) and among subgroups of the U.S. population (10, 19, 20), the NHANES data add further evidence that significant disparities exist at the national level in the general U.S. population.

Racial disparities in gonorrhea were particularly sizable. The prevalence point estimate among non-Hispanic black persons was 17 (CI, 4.5 to 50.0) times that among non-Hispanic white persons. The finding is probably related to differences in socioeconomic status, education level, access to health care services, sexual behavior, and sexual networks (21). Because data on some of these variables of interest (geography and urbanicity) were unavailable at the time of these analyses and because the number of positive test results for gonorrhea was small, we could not control for these factors in our analyses.

A multivariate model of chlamydial infection demonstrated that race or ethnicity was an independent predictor of infection after controlling for income, education, and number of lifetime sexual partners. More detailed demographic and socioeconomic data than those collected in NHANES, as well as dynamic transmission models (21–23) using NHANES data, are needed to examine this association.

Adolescents, a group with considerable disease burden from gonorrheal and chlamydial infection, account for a large proportion of the infections, especially since only 47% of adolescents were sexually experienced in our sample. Likely factors contributing to the higher gonorrhea and chlamydia prevalence among adolescents are more unprotected intercourse, increased substance use, and less frequent health care-seeking behavior (24). Adolescent females may be more susceptible to infection owing to increased ectopy of the adolescent cervix (1).

The high prevalence of chlamydia (16.7%) among women with a previous diagnosis of either chlamydia or gonorrhea in the past 12 months is consistent with findings from studies that examined retesting for chlamydia (25). The high prevalence likely represents reinfection (by infected sexual partners) or persistent infection and underscores the importance of current CDC guidelines where providers are “strongly encouraged to retest all women treated for chlamydial infection . . . within the following 3–12 months” (12).

We observed a high rate of chlamydial co-infection (45.7%) among persons infected with gonorrhea. This finding supports the current CDC recommendation to co-treat for chlamydia in all persons infected with gonorrheal infection (unless a diagnosis of chlamydial infection has been excluded) (12).
The NHANES estimates are similar to those reported in nationally representative surveys of chlamydial infection in Great Britain and China (26, 27). A review of suggested articles and a search for articles in PubMed using the free text search terms “gonorrhea,” “chlamydia,” “nationally representative,” “survey,” and Medical Subject Headings terms “Neisseria gonorrhoeae,” “Chlamydia trachomatis,” “United States,” and “prevalence” yielded 4 articles with population-based estimates of chlamydia that were based on complex survey methods similar to those used in NHANES. Estimates from NHANES 1999–2002 are consistent with results of the 4 population-based studies in the United States measuring gonorrhea and chlamydia prevalence. The 4 studies include a study of women age 18 to 29 years in northern California, which reported a 3.2% chlamydia prevalence (19); a study among men and women age 18 to 35 years living in Baltimore, Maryland, which reported a chlamydia prevalence of 3.0% (the study also reported a gonorrhea prevalence of 5.3%, which is not consistent with NHANES results) (20); a study of a nationally representative sample of young men age 18 to 26 years, which reported chlamydia prevalence of 3.1% to 4.5% (10); and a follow-up survey of a nationally representative sample of school-age children, which reported chlamydia prevalence of 4.2% and gonorrhea prevalence of 0.43% among men and women age 18 to 26 years (11).

In our survey, some respondents who reported not being sexually experienced were found to have gonorrheal or chlamydial infection. Possible explanations include respondents’ misclassification of sexual experience status, lack of specificity of the LCx test, or both factors (28). The chlamydia LCx assay product insert reports (for asymptomatic infections) a test sensitivity of approximately 90% to 94% and specificity estimates of 95% to 98% (29). The gonorrhea LCx assay package insert reports a sensitivity of approximately 86% to 92% and specificity greater than 99% (30). On further examination of respondents from the entire NHANES 1999–2002 sample who reported never having sex, analysis of unweighted data revealed that 17 women tested positive for pregnancy, 41 were positive for herpes simplex virus 2, and 6 tested positive for Trichomonas vaginalis.

The findings from NHANES 1999–2002 highlight for the first time the considerable burden of disease of chlamydia and the relatively low prevalence of gonorrhea across a broad age range in the general U.S. population. Chlamydia and gonorrhea prevalence is similar among both females and males, but the age distribution is different, and sexually active adolescents, especially girls, carry a disproportionate burden of disease. Extant recommendations for screening must be widely and consistently implemented to achieve reductions in disease burden. Despite the considerable prevalence of chlamydia in males, the value of screening males needs to be better defined. The significant racial disparities that persist in the United States between black and white people underscore the need for improved access to testing and treatment for all segments of our population and efforts to increase screening coverage.

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Acknowledgments: The authors thank Drs. Kevin Fenton and Tom Peterman for their critical review of the manuscript.

Potential Financial Conflicts of Interest: None disclosed.

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Congratulations to Todd Pollack, MD, winner of the 2006 Annals Personae prize. Dr. Pollack’s photograph was published on the cover of the 3 April 2007 issue (vol. 146, no. 7) and is reprinted below.
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