

# Risk Behaviors, Medical Care, and Chlamydial Infection Among Young Men in the United States

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Primary prevention of sexually transmitted diseases (STDs) involves adopting safer sexual behaviors, whereas secondary prevention involves detecting and treating infected persons to reduce transmission to sexual partners. Our study examined *Chlamydia trachomatis* (referred to here as “chlamydial infection”) among young men for the purpose of making recommendations for improving primary and secondary prevention of the disease. We based our examination on the National Surveys of Adolescent Males (NSAM).

## METHODS

NSAM included two surveys: a 1995 nationally representative survey of 1729 men aged 15 to 19 years (which had a 75% response rate)<sup>1</sup> and a 1988 nationally representative survey of 1880 men aged 15 to 19 years (which had a 74% response rate).<sup>2</sup> Seventy-five percent of the respondents to the 1988 survey were reinterviewed in 1995.

Data for the teenaged sample were collected from 470 men aged 18 to 19 years who were part of the 1995 survey; data for the young adult sample were collected from 995 men aged 22 to 26 years who were part of the 1988 survey and who were reinterviewed in 1995. Both the teenaged and the young adult sample weights depend on the original sample probabilities and on poststratification adjustments made to correspond with census data. The young adult sample weights also include longitudinal adjustments to compensate for attrition between 1988 and 1995.

Respondents were interviewed about their background, behaviors, and attitudes. They then completed self-administered questionnaires about sensitive topics, including STD symptoms. After the interview and questionnaire were completed, respondents older than 18 years were asked for a urine specimen. They were informed that the specimen would be tested for STDs and not for drugs and that

**Objectives.** This study assessed factors related to chlamydial infection among young men in the United States.

**Methods.** Data were from interviews of nationally representative samples of 470 men aged 18 to 19 years (teenagers) and 995 men aged 22 to 26 years (young adults) and from urine specimens tested by means of polymerase chain reaction.

**Results.** Although a majority of the men reported occasional unprotected intercourse, only a minority perceived themselves to be at risk for contracting a sexually transmitted disease (STD). Chlamydial infection was detected in 3.1% of the teenagers and 4.5% of the young adults. A minority of those infected had symptoms or had been tested for STDs; very few had been diagnosed with STDs.

**Conclusions.** Chlamydial infection is common but usually asymptomatic and undiagnosed. Primary and secondary prevention efforts should be increased, particularly among young adult men. (*Am J Public Health*. 2002;92:1140–1143)

positive cases would be reported to health departments where legally required.<sup>3</sup> Respondents received \$10 to \$20 for the interview and an additional \$10 to \$20 for the specimen. Some interviews were conducted by telephone; in these cases, urine specimens were not collected.

After urine specimens were collected, they were packed in ice, frozen, and shipped overnight (still packed in ice) to the Centers for Disease Control and Prevention (CDC) for analysis. Commercial polymerase chain reaction (Amplicor, Roche Diagnostic Systems) was used to test the specimens for chlamydial infection.<sup>4</sup> All positive cases were confirmed by ligase chain reaction; there were no discordant positives.

Laboratory results were not available for all respondents. Results were unavailable for 382 of the 1377 young adult respondents (28%); 14% were unavailable for logistical reasons (primarily because interviews were conducted by telephone, but also because of shipping damage, etc.) and 14% were unavailable because of respondent refusal. Results were unavailable for 108 of the 578 teenaged respondents (18%), 6% for logistical reasons and 12% because of respondent refusal.

We conducted extensive analyses to determine whether the missing data caused nonresponse biases.<sup>5</sup> Respondents for whom labo-

ratory results were missing were not at higher risk for chlamydial infection than were those for whom results were present. Using multiple imputation methods,<sup>6,7</sup> we determined that the nonresponse bias was negligible. We used actual laboratory results in our analyses of the young adult respondents and teenaged respondents. All analyses were weighted and adjusted to take into account the complex sampling design.

## RESULTS

### STD Risk Behaviors and Perceived Risk

Three fourths of the teenagers and nine tenths of the young adults surveyed were sexually active (Table 1). Three fourths of the sexually active teenagers had engaged in at least 1 act of unprotected sexual intercourse during the past year. Among the young adults, three fourths of those who were single and sexually active and almost all of those who were married or cohabiting had engaged in unprotected intercourse during the past year.

Only 15% of the teenagers reported having 3 or more sexual partners during the past year; the rate was two times higher for Black teenagers than for non-Black teenagers. One third of the single, sexually active young adults, but few of the married or cohabiting young adults, reported having 3 or more part-

**TABLE 1—STD Behaviors, Perceptions, Symptoms, Testing, and Diagnosis Among US Teenaged and Young Adult Men**

	Men Aged 18–19 Years				Men Aged 22–26 Years				
	All	Black	Non-Black	Sexually Active	All	Black	Non-Black	Married or Cohabiting	Single, Sexually Active
Unweighted sample size <sup>a</sup>	470	139	331	357	995	371	624	356	543
Sexual behaviors									
Had sex with female during past year	73.4%	85.6%	71.4%*	100.0%	88.6%	91.2%	88.2%	99.2%	100.0%
Had any unprotected sex during past year	54.9	60.7	54.0	73.3	77.3	78.5	77.1	98.2	76.4***
Had 3 or more female partners during past year	14.9	27.8	12.8***	20.3	18.0	29.3	16.0***	3.7	33.6***
Had sex with high-risk partner during past year <sup>b</sup>	2.9	4.6	2.7	3.9	6.8	13.6	5.6***	6.4	7.3
STD perceptions									
Believes he is at some risk for STDs	40.7	37.1	41.3	42.2	26.4	33.6	25.2*	12.7	39.9***
Believes last sexual partner is at some risk for STDs <sup>c</sup>	24.7	27.1	24.3	24.7	16.1	14.6	16.4	4.8	25.2***
STD symptoms									
Ever had STD symptoms <sup>d</sup>	20.3	25.4	19.5	21.9	20.9	31.5	19.1***	17.0	22.1
Had STD symptoms during past year	7.4	14.9	6.2*	8.4	8.2	11.4	7.7	6.1	8.5
Health access									
Has health insurance	78.1	83.2	77.3	77.9	74.1	74.3	74.1	76.1	71.8
Had physical exam during past year	67.6	68.0	67.6	67.2	55.3	63.5	53.8**	56.9	59.0*
STD testing									
Had STD test during past year	15.8	36.2	12.6***	19.4	17.3	32.0	14.8***	15.6	21.1**
Had STD test during past year (among those symptomatic)	25.6	56.4	13.8**	30.1	33.5	53.9	28.7*	29.8	46.5
STD diagnosis									
Medical professional said he had an STD during past year	2.7	13.7	1.0***	3.7	1.6	5.7	0.9***	0.4	2.8**
Told he had an STD during past year <sup>e</sup>	11.4	35.7	0.3***	12.4	8.1	15.9	5.4**	1.8	12.1

Note. Significance tests compare levels for Black vs. non-Black men among the 18–19 year olds and for Black vs. non-Black and for married/cohabiting vs. single sexually active men among 22–26 year olds.

<sup>a</sup>Sample sizes are unweighted; all other estimates are weighted.

<sup>b</sup>Defined as having had sexual intercourse with a prostitute or an injection drug user or having had anal or oral sex with a male.

<sup>c</sup>Among those sexually active.

<sup>d</sup>Symptoms include burning on urination or abnormal genital discharge.

<sup>e</sup>Among those with STD test.

\* $P < .1$ ; \*\* $P < .05$ ; \*\*\* $P < .01$ .

ners during the past year. Only 3% of the teenagers reported having sexual intercourse with a high-risk partner during the past year; the percentage was twice as high for young adults.

Although most of the sexually active teenagers and young adults had unprotected intercourse during the past year, only two fifths felt themselves to be at some risk for contracting an STD. Fewer believed that their female partners were at risk; one fourth of both the sexually active teenagers and the single young adults believed that their last female partner was at some risk for contracting an STD.

### Symptoms and Medical Care

About one fifth of both the teenagers and the young adults reported ever having had

symptoms related to chlamydial infection, whereas 8% or fewer had had symptoms during the past year. Whether the respondents were sexually active was not significantly related to STD symptoms (data not shown). Some of the men who were not sexually active might have had urethritis of nonsexual etiology or might have misreported their sexual behaviors.

Although the great majority of the respondents had health insurance and had received a physical exam during the past year, only one sixth had been tested for STDs. (We do not know for which STDs they were tested.) Only one fourth of the symptomatic teenagers and one third of the symptomatic young adults had been tested. Very few of the respondents, even among

those who had been tested, had been diagnosed with an STD.

Black men were more likely to have been tested for STDs or to have been diagnosed with an STD than were non-Black men. Black men also were more likely to have a history of STD symptoms. But even among the men with symptoms, Black men were more likely than non-Black men to have been tested for STDs.

### Prevalence of Infection, Symptoms, and Medical Care

According to PCR test results, 3.1% of the teenagers and 4.5% of the young adults had chlamydial infections.<sup>5</sup> Most of those with symptoms did not test positive, however, and many of those who did test posi-

**TABLE 2—STD Symptoms and Medical Care Received Among US Teenaged and Young Adult Men With and Without Chlamydial Infection**

	Men Aged 18–19 Years		Men Aged 22–26 Years	
	Tested Positive for Chlamydial Infection	Tested Negative for Chlamydial Infection	Tested Positive for Chlamydial Infection	Tested Negative for Chlamydial Infection
Unweighted sample size	26	444	66	929
Had STD symptoms during past year	23.4%	6.9%*	7.5%	8.2%
Had a physical exam during past year	75.0	67.4	59.6	55.1
Had an STD test during past year	45.7	14.8**	16.9	17.3
Ever told he had an STD	26.5	2.0**	9.6	6.5
Told he had an STD during past year	26.5	2.0**	3.3	1.5
Had any unprotected sex during past year	87.3	53.9***	88.4	76.8*
Had 3 or more female partners during past year	37.7	14.1	31.0	17.4
Had sex with high-risk partner during past year	10.8	2.7	4.1	6.9

\* $P < .1$ ; \*\* $P < .05$ ; \*\*\* $P < .01$ .

tive were asymptomatic: 10.1% of the symptomatic teenagers and 4.1% of the symptomatic young adults were infected, compared with 2.7% of the asymptomatic teenagers and 4.5% of the asymptomatic young adults.

As shown in Table 2, the great majority of infected teenagers and young adults were asymptomatic; only 23% of the infected teenagers and 8% of the infected young adults had experienced symptoms during the past year. Most of the infected men from both groups had access to routine health care, but only a minority had been tested for STDs. Teenagers who had been tested for STDs during the past year were more likely to be infected than those who had not, but no such relationship existed among the young adults. A small minority of the infected men had been diagnosed with an STD during the past year (27% of the teenagers and 3% of the young adults).

Men who had unprotected sexual intercourse were more likely to be infected than those who had not ( $P < .01$  for teenagers;  $P < .1$  for young adults). Some of those who were infected had reported no unprotected sexual intercourse in the past year. This apparent discrepancy could be attributable to (1) misreporting about condom use,<sup>9</sup> (2) condom failure,<sup>10</sup> (3) transmission of infection despite condom use (e.g., by epidermal contact rather than by fluid transfer), (4) false-positive

laboratory results, or (5) becoming infected more than 1 year ago.

## DISCUSSION

Most of the young men with chlamydial infection were asymptomatic and undiagnosed. A minority of those infected had been tested for STDs, and probably only a fraction of the STD tests were for chlamydial infection. Thus, most of the chlamydial infections were not detected. Chlamydial infection screening of women has increased in the past decade, and the CDC recommends that all sexually active adolescent females be screened for chlamydial infection at each pelvic exam.<sup>11</sup> However, the agency has no equivalent recommendations for young men, although in 1998 a CDC advisory committee recommended routine screening of young men to help prevent HIV transmission.<sup>12</sup>

At any point in time, 3% to 5% of teenaged and young adult men in the United States have a chlamydial infection. Given that some receive treatment or otherwise clear their infection, the percentage who become infected must be even higher. These estimates are conservative, because surveys probably undercount certain high-risk groups, such as homeless or incarcerated men. Men who engage in unprotected intercourse are more likely to have chlamydial infection than those who do not. Such risky sexual behavior has double consequences: when a man has un-

protected sexual intercourse, he not only may become infected himself but also may transmit the infection to future partners. A study of couples found that about 70% of those with chlamydial infection also had an infected current partner.<sup>13</sup>

Primary prevention of chlamydial infection should begin with reducing the percentage of men who engage in unprotected intercourse; data indicate that this percentage fell during the late 1990s, primarily owing to increased condom use.<sup>1</sup> Efforts to reduce the incidence of chlamydial infection should continue with measures designed to increase public awareness of STD risks, especially among single young adults. Most single young adult men in the United States have occasional unprotected intercourse, but few view themselves as susceptible to STDs, and even fewer believe that their partners are susceptible. This lack of awareness means that men fail to seek testing or treatment for STDs, even when they have symptoms.

Because most men with chlamydial infection are asymptomatic, screening efforts broader than those currently in place should also be considered. Most young women obtain routine gynecological care, during which STD-related risks may be evaluated; however, a comparable system of routine reproductive health care for young men does not exist.<sup>14</sup> Those who provide primary care for men need to promote an increased awareness of STDs among their young patients.

Future research can help identify whether widespread screening of young men for chlamydial infection is appropriate. The cost-effectiveness of such screening depends in part on whether it will help prevent sequelae (e.g., pelvic inflammatory disease) among these men's female sexual partners. If STD screening for young men is to become more widespread, it could be incorporated into existing components of primary care (e.g., physical exams for sports, school, or employment). Although this strategy was infeasible in the past, the availability of new DNA-based methods now makes STD testing possible in the primary care setting.<sup>15</sup> ■

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### Contributors

Leighton Ku designed the study and wrote the article. Michael St. Louis analyzed and interpreted data and contributed to the writing of the article. Carol Farshy conducted laboratory analyses and interpreted laboratory findings. Sevgi Aral interpreted the relationship between behaviors and infection. Charles Turner provided statistical advice. Laura Lindberg interpreted risk behaviors and coordinated data editing. Freya Sonenstein conceptualized and led the National Surveys of Adolescent Males. All authors participated in conceptual design, reviewed analysis and reports, and reviewed drafts.

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### References

1. Sonenstein FL, Ku L, Lindberg LD, Turner CF, Pleck JH. Changes in sexual behavior and condom use among teenaged males: 1988 to 1995. *Am J Public Health*. 1998;88:956-959.
2. Sonenstein FL, Pleck JH, Ku LC. Sexual activity, condom use, and AIDS awareness among adolescent males. *Fam Plann Perspect*. 1989;21:152-158.
3. Ku L, Sonenstein FL, Turner CF, Aral SO, Black CM. The promise of integrated representative surveys about sexually transmitted diseases and behavior. *Sex Transm Dis*. 1997;24:299-309.
4. Bauwens JE, Clark AM, Loeffelholz MJ, et al. Diagnosis of *Chlamydia trachomatis* urethritis in men by polymerase chain assay of first-catch urine. *J Clin Microbiol*. 1993;31:3013-3016.
5. St. Louis ME, Ku L, Aral S, Black C, Williams S, Sonenstein F. Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections among young men in the United States: results of a representative national survey. Paper presented at: International Society for Sexually Transmitted Disease Research, July 27, 1999, Denver, Colo.
6. Little RJA, Rubin DB. *Statistical Analysis With Missing Data*. New York: John Wiley & Sons; 1987.
7. Heitjan D, Little R. Multiple imputation for the Fatal Accident Reporting System. *Applied Stat*. 1991; 40:13-29.
8. Porter LE, Ku L. Use of reproductive health services among young men, 1995. *J Adolesc Health*. 2000; 27:186-194.
9. Zenilman JM, Weisman CS, Rompalo AM, et al. Condom use to prevent incident STDs: the validity of self-reported condom use. *Sex Transm Dis*. 1995;22: 15-21.
10. Warner L, Clay-Warner J, Boles J, Williamson J. Assessing condom use practices: implications for evaluating method and user effectiveness. *Sex Transm Dis*. 1998;25:273-277.
11. Centers for Disease Control and Prevention. Recommendations for the prevention and management of *Chlamydia trachomatis* infections, 1993. *MMWR Morb Mortal Wkly Rep*. 1993;42:1-39.
12. Centers for Disease Control and Prevention. HIV prevention through early detection and treatment of other sexually transmitted diseases—United States. Recommendations of the Advisory Committee for HIV and STD Prevention. *MMWR Morb Mortal Wkly Rep*. 1998;47:1-24.
13. Quinn TC, Gaydos C, Shepherd M, et al. Epidemiologic and microbiologic correlates of *Chlamydia trachomatis* infection in sexual partnerships. *JAMA*. 1996; 276:1737-1742.
14. Sonenstein F, ed. *Young Men's Sexual and Reproductive Health: Toward a National Strategy*. Washington, DC: Urban Institute Press; 2000.
15. Turner CF, Rogers SM, Miller HG, et al. Untreated gonococcal and chlamydial infection in a probability sample of adults. *JAMA*. 2002;287:726-733.