Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* Infection in Pediatric Private Practice

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ABSTRACT. ***Background.*** **Universal screening of sexually active adolescents for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (GC) has been recommended in settings in which prevalence is 2% or greater. Although believed to be above 2%, the prevalence of CT and GC infection in private practice settings has not been clearly established and may affect screening practices.**

Objectives. **To determine CT and GC infection prevalence in 2 pediatric private practices.**

Design. **Cross-sectional study.**

Setting. **Two pediatric private practices in suburban North Carolina.**

Patients. **Convenience sample of patients aged 15 to 24 years who were seen from August 1998 through June 1999.**

Main Outcome Measures. **Prevalence of CT and GC infection.**

Results. **Of 1114 eligible patients, 803 (72%) completed questionnaires and provided urine specimens tested for CT and GC infection using ligase chain reaction assays. Mean age was 17.1 years (standard deviation: 1.8). Most participants were female (63%), white (87%), and from highly educated families (64% of their mothers graduated from college). Sexual activity was reported by 41%. Prevalence of CT infection in all participants was 0.9% (confidence interval [CI]: 0.4%–1.8%); in sexually active participants, 2.1% (CI: 0.9%–4.3%); in sexually active females, 2.7% (CI: 1.0%–5.7%); and in sexually active males, 0.9% (CI: 0.0%–5.1%). One case of GC infection was found.**

Conclusions. **The prevalence of CT and GC infection in this private practice population was much lower than reported in other settings. Screening recommendations may need to be reassessed if other low prevalence populations are found. *Pediatrics* 2001;108(6). URL: http://www.pediatrics.org/cgi/content/full/108/6/e103; *Chlamydia trachomatis, Neisseria gonorrhoeae, pediatrics, primary health care, diagnosis/screening, practice guidelines, sexually transmitted diseases, adolescence.***

ABBREVIATIONS. CT, *Chlamydia trachomatis*; GC, *Neisseria gonorrhoeae*; STD, sexually transmitted disease; CDC, Centers for Disease Control and Prevention; LCR, ligase chain reaction; CI, confidence interval.

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Chlamydia trachomatis (CT) and *Neisseria gonorrhoeae* (GC) genital infections cause serious and costly sequelae, such as pelvic inflammatory disease and infertility.[1] In the United States, the strongest demographic predictor of infection with CT and GC is age, with most infections diagnosed in adolescents and young adults under 25 years of age.[1] Most recent US studies have reported the prevalence of CT infection in adolescent patients seen in sexually transmitted disease (STD), family planning, detention center, and school clinics to be in the range of 6% to 10%,[2–7] but prevalences as high as 24% have been reported in some settings.[2,8] GC infections are less prevalent but still cause significant morbidity.[1,9]

Both the US Preventive Services Task Force and the Centers for Disease Control and Prevention (CDC) recommend routine screening of sexually active female adolescents and high-risk women for CT infection.[10,11] The CDC also recommends screening sexually active adolescent and young adult women for GC infection, and screening sexually active adolescent and young adult men for both GC and CT infection in settings in which the prevalence is 2% or higher.[11] Despite these recommendations, compliance has been less than ideal. A survey of the screening practices of pediatricians and family medicine physicians in the region in which our study was conducted, a region with high incidence of CT and GC infection in STD and family planning clinics, showed that only 25% of physicians screened sexually active adolescent women annually.[14] Reasons for not screening included low estimates of sexual activity among adolescent patients and the belief that the patient population was not at risk.[15]

Information on the prevalence of GC and CT infection in primary care settings is strikingly unavailable. Five studies of the prevalence of CT in primary care settings published since 1989 reported figures for women only.[5,6,17–19] Two of the 5 combined data from primary care sites with specialty sites such as family planning and obstetrics/gynecology clinics,[18,19] and only 3 of the studies collected data on women under 18 years old.[5,6,19] Of those 3, only 1 provided prevalence figures for age strata under 25 years (13% in 15–19 year olds and 6% in 20–24-year-olds),[6] and used highly selective enrollment criteria for participants under 18 years old. One study reported a GC infection prevalence of 2.3% in 15- to

44-year-old patients of private physicians' offices and 3% in patients aged 15 to 19 years old from a combination of primary care and specialty sites.[20] These 6 studies form the basis of current knowledge of CT and GC prevalence in primary care settings, and all reported prevalences higher than the 2% figure accepted as the cost-effectiveness threshold for CT and GC screening. None of these studies reflect CT or GC prevalence among adolescents and young adults seen in general clinic settings.

We conducted a study of the prevalence of CT and GC infection in patients of 2 pediatric private practices. Our hypothesis was that the prevalence of CT and GC in pediatric private practice settings was similar to that in other settings.

METHODS

All procedures were approved by the University of North Carolina Hospitals Committee on the Protection of the Rights of Human Subjects. Parental consent was not required for participation.

Participating Practices

The study was conducted in 2 suburban primary care pediatric private practices in North Carolina. Each practice had 1 satellite office, and all physicians were general pediatricians. By report, both practices screened sexually active female patients for CT and GC infection at the time of their annual pelvic examination. Asymptomatic males were not screened.

Procedures

Between August 1998 and June 1999, research assistants were posted in the waiting rooms of the participating practices 3 to 5 days a week, Monday through Friday, during daytime business hours. All persons aged 15 through 24 years who presented during those times were invited to participate. Patients were excluded if they had taken systemic antibiotics within the previous 30 days, had already participated, or could not read and understand the consent form or questionnaire, which were written in English.

After providing written consent, each participant completed a confidential questionnaire in a private room. The survey asked reasons for the clinic visit, age, gender, self-identified race/ethnicity, highest education completed, mother's education, sexual history, and where they would seek health care if concerned about STD infection. A first-void urine specimen (the first 15 mL of urine stream) was collected from each subject, refrigerated at the site, and transported to the testing laboratory at the end of each day. Some specimens were frozen at –20°C before testing if testing could not be performed within 3 calendar days. All specimens were tested within 7 calendar days of collection and at the same laboratory. Urine specimens were tested for CT and GC DNA using the ligase chain reaction (LCR) assay (LCx, Abbott Laboratories, Abbott Park, IL). Positive test results were reported to the principal investigator, who informed the participant's clinician, who contacted and treated the participant.

Data Analysis

Data entry and analyses were performed using Stata 6.0 (Stata Corp, College Station, TX).[21] The results of the LCR assays, gender, race/ethnicity, and sexual history questions were analyzed as dichotomous variables using the Pearson χ^2 test. The Fisher exact test was used to compare CT and GC infection prevalence by gender and race. The Wilcoxon rank-sum test was used to compare prevalence by age. The preferred site of STD care by gender and sexual history was analyzed using Pearson χ^2 test. A 2-sided P value of less than .05 was considered to indicate statistical significance. Binomial exact methods were used to calculate 95% confidence intervals (CI). Multivariate analysis was not performed because of the low number of positive cases.

RESULTS

Study Sample

Of the 1987 patients approached for the study, 28 (<1%) were ineligible because they were not able to participate in the consent process, 354 (18%) because they had used systemic antibiotics within the past 30 days, 173 (9%) because they were uncertain whether they had used systemic antibiotics within the past 30 days, and 307 (15%) because they had already participated. An additional 11 patients were ineligible for other reasons such as the inability to provide a urine specimen without an in-and-out catheterization procedure.

Of 1114 subjects eligible to enroll in the study, 803 (72%) consented to participate, completed the questionnaire, and provided a urine specimen. The mean age of participants was 17.1 years (standard deviation: 1.8 years). They were predominately female (63%) and white (87% white; 8% black; Table 1). More than half reported that their mothers had graduated from college, suggesting that participants were primarily from higher socioeconomic strata. A total of 331 (41%) participants reported ever "having sex." There was no difference in gender between participants and nonparticipants. Participants were slightly older than nonparticipants (17.1 years vs 16.7 years [$P = .004$]).

Prevalence of CT and GC

The overall prevalence of CT infection was 0.9% (7/803, 95% CI: 0.4%–1.8%; Table 2). The prevalence

TABLE 1. Characteristics of Subjects Screened for CT and GC Infection ($N = 803$)

Characteristic	Value	
	n	Percent
Age (y; mean 17.1)		
All participants		
15–17 y	513	64
18–20 y	244	30
21–24 y	46	6
Sexually active participants		
15–17 y	144	44
18–20 y	154	47
21–24 y	33	10
Gender		
Female	505	63
Male	298	37
Race		
White	698	87
Black	62	8
Other	43	5
Mother's education		
No college	125	16
Some college	131	16
College graduate	333	42
Post-baccalaureate	175	22
Don't know; refused	36	5
Ever "had sex"		
Yes	331	41
No	471	59
Among those who "had sex," number (%) who report history of STD*		
Yes	15	4
No	286	88
Don't know	27	8

* Numbers do not add up to total *N* because of missing responses.

TABLE 2. Prevalence of Chlamydial Infection in 2 Private Practice Pediatric Clinics

CT Infection	Number	Prevalence	95% CI
All participants	7/803	0.9	(0.4, 1.8)
Females	6/505	1.2	(0.4, 2.6)
Males	1/298	0.3	(0.0, 1.9)
White race/ethnicity	3/698	0.4	(0.1, 1.3)
Minority race/ethnicity	4/105	3.8*	(1.1, 9.5)
Sexually active participants	7/331	2.1	(0.9, 4.3)
Females	6/225	2.7	(1.0, 5.7)
Males	1/106	0.9	(0.0, 5.1)
White race/ethnicity	3/276	1.1	(0.2, 3.1)
Minority race/ethnicity	4/55	7.3*	(2.0, 17.6)

* Difference between minority and white sexually active adolescents is statistically significant ($P = .007$ for all participants; $P = .016$ for sexually active participants).

of CT infection in participants who reported a history of sexual activity was 2.1% (7/331, 95% CI: 0.9%–4.3%). Prevalence of CT infection was higher in sexually active women than in sexually active men, although this difference did not attain statistical significance (Table 2). Prevalence was higher among participants identifying themselves as minority race/ethnicity than among those identifying themselves as white (Table 2). Among sexually active participants, those with CT infection tended to be younger (mean age = 16.7 years) than those without CT infection (mean age = 17.9 years; $P = .081$).

The overall prevalence of GC infection in all study participants was 0.1% (1/803, 95% CI: 0.0%–0.7%). The prevalence of GC infection in participants who reported a history of sexual activity was 0.3% (1/331, 95% CI: 0.0%–1.7%). A 20-year-old woman concomitantly infected with CT was the only participant infected with GC.

Symptomatic Versus Asymptomatic Infections

Of the 7 participants who tested positive, only 1 was seeking health care for STD symptoms (a male with urethral discharge). Of the 6 asymptomatically infected participants, 3 were women seeking routine pelvic examinations. These infections would have been detected under usual circumstances because the participating practices screened all sexually active female patients for CT and GC infection during routine annual examinations. The other 3 asymptomatically infected participants were female patients screened only because they participated in the study.

DISCUSSION

In 2 pediatric primary care private practices we found very low prevalences of CT and GC infection, lower than any of the figures reported in US studies of primary care settings published within the last 10 years,[5,6,16–20] and in the range of or lower than the >2% figure used by CDC[11] guidelines as the threshold level for screening. The prevalence of CT infection in sexually active females (2.7%, 95% CI: 1.0%–5.7%) was not only lower than figures reported by other studies of primary care populations, but also lower than in specialized clinic settings that have implemented successful screening programs.[5,8,16,22–25] Furthermore, the prevalence of CT infection in our study population was much lower than those reported by STD clinics in the same counties in which the study sites were located, sites which routinely report figures ranging from 10% to 17%.[26,27]

Potential reasons for this surprisingly low prevalence of CT infection among sexually active youth merit discussion. One potential explanation for this finding is that urine LCR assays for CT have lower sensitivity than endocervical and urethral swab tests for CT, although the prevalence we found in sexually active female participants is still lower than the prevalences that other researchers have reported using the same urine-based technology.[2,4,7,8,20,24,25,28,35,37] Testing technology is not a likely explanation for the low prevalence we found in sexually active male adolescents, because urine LCR tests function as good or better than any other tests available for use with male patients.[28]

We did not collect data to compare sexual behaviors among sexually active participating and nonparticipating groups and therefore cannot exclude the possibility that participants were at lower STD risk than nonparticipants because of factors such as number of partners and condom use. Other possible reasons for the low prevalence we found may be socioeconomic status. Several authors have shown that poverty and low socioeconomic status are characteristics associated with increased risk of STDs, although this is less true for CT than other STD infections.[1,29,30] Most of our participants came from highly educated families living in an affluent area. Although education and affluence are not biologically active characteristics for protection from STDs, they may be markers for decreased STD risk, such as delayed onset of sexual activity, use of safer sexual behaviors, limited numbers of partners, and/or consistent use of condoms. Additionally, STD risk may have been influenced by already low prevalences of CT and GC infection within the participants' sexual networks.

Another possible reason for these low prevalences may relate to antibiotic use in general health care. Eighteen percent (354/1987) of patients approached to participate were excluded because they had taken antibiotics within the previous 30 days. We did not ask the reason for antibiotic use, but did request the names of the antibiotics. Of the 269 persons who provided a name, 146 (54%) had taken an antibiotic that would have effectively treated an uncomplicated CT infection.[30] The high number of patients ineligible because of antibiotic use within the past month raises the question that frequent courses of antibiotics prescribed to our participants over the past many months to years for common diagnoses such as acne and respiratory infections may have resulted in unintentional treatment of asymptomatic CT infections.

The low prevalence of CT infection we found in female adolescents also may be the result of successful screening programs. Participating practices reported routine annual screening of sexually active female patients, and although we did not verify screening practices used before the study, the success of these screening programs may have reduced prevalences to the low levels we found. Other studies have shown significant declines in prevalence when screening programs have been consistently implemented.[5,8,16,22–25] It is also possible that study participants may have gone to other sites for reproductive health care (eg, Planned Parenthood, family planning, and STD/health department clinics) and participated in effective screening programs at these sites, as suggested by our finding that 50% of sexually active participants preferred alternative sites of care for STD concerns (data not shown). This possibility would not explain the low prevalence we found in males because, to our knowledge, there was no routine screening program for male adolescents in the region in which our study was performed. Other limitations include that our sample was small, regional, and relatively homogeneous. Our 28% refusal rate is similar to other studies of STDs in adolescents.[24] Regardless of the explanation for the low prevalence of CT infection, the fact that it was lower than expected calls for more research because of potential screening implications. Although routine universal screening of sexually active adolescents and young adults has been shown to have significant benefits,[5,8,16,22–25] it is expensive and not without potential harms.[28] The proportion of false-positive tests increases as prevalence falls. The LCR assay used in this study is believed to have excellent performance characteristics with a sensitivity in excess of 90% and specificity greater than 97%.[28,38,39] If we assume that the LCR assay for CT infection has a sensitivity of 91% and specificity of 99.5% in a population with 2% prevalence, approximately 29% of positive specimens are false positives. If test specificity is <99.5%, this number would be even greater. False positives may result in substantial psychological stress, have negative impacts on romantic relationships, cause unnecessary stigmatization, and be especially significant for adolescents who find it difficult or even dangerous to inform partners (and perhaps parents) of their infections.

CONCLUSION

We found 2 pediatric private practices in which the prevalences of CT and GC were extremely low. Future research is needed to identify the prevalence of CT infection among adolescents and young adults in private practice settings using larger, more generalizable samples. If prevalences are lower than expected, we need to better understand why and address questions related to universal screening of populations with infection prevalence near or below defined cost-effectiveness thresholds. At present, the weight of the evidence supports current screening recommendations in all settings serving sexually active youth.

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