Urine-Based Screening of Adolescents in Detention to Guide Treatment for Gonococcal and Chlamydial Infections

Translating Research Into Intervention

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Objectives: To determine the utility of urine-based ligase chain reaction assays for Neisseria gonorrhoeae and Chlamydia trachomatis in (1) the acceptability of such testing to adolescent detainees, (2) the potential use of these tests for identifying asymptomatic infections, and (3) the effectiveness of this approach for ensuring treatment of infected adolescents.

Design: Cross-sectional screening and verification of treatment for infected cases.

Subjects: Adolescents admitted to a short-term juvenile detention center.

Main Outcome Measures: Neisseria gonorrhoeae and C trachomatis infection rates, and timing and location of treatment for infected patients.

Results: Refusal rate was 1.5%. Of 263 participants, 46 (17.5%) were female subjects. Chlamydia trachomatis infections were identified in 28.3% of the female and 8.8% of the male subjects. Neisseria gonorrhoeae infections were present in 13.1% of the female and 2.8% of the male subjects. Overall, 37 participants (14%) were positive for N gonorrhoeae, C trachomatis, or both, only one of whom had symptoms. Almost 70% (25/36) of asymptomatic infected subjects were treated within 28 days of screening. A treatment was documented in 36 of the 37 infected youth, including 20 who were followed up and treated after release from the detention center, by 6 months after testing.

Conclusion: Urine ligase chain reaction tests were effective for identifying and guiding treatment of unsuspected N gonorrhoeae and C trachomatis infections in teenagers admitted to a short-term detention center where traditional swab specimens may be difficult to obtain.

Arch Pediatr Adolesc Med. 1998;152:52-56

Sexually transmitted diseases (STDs) due to Chlamydia trachomatis and Neisseria gonorrhoeae are disproportionately common among adolescents and young adults. Although US gonorrhea rates decreased 58% between 1985 and 1995, sexually active adolescents continue to have the highest rates of infection. In contrast with gonorrhea, C trachomatis infection rates steadily climbed during the same period, in part due to increased testing by clinicians. Similar to gonorrhea, however, the highest prevalence of chlamydial infections occurs in sexually active young people. Among adolescents, those in juvenile detention facilities represent a group in whom STDs (and other health hazards such as illegal drug use) are particularly common, but for whom STD diagnosis and management are often hindered by the logistical constraints of confinement. Nevertheless, youth are an important population for STD control programs. Each year more than 500,000 adolescents are detained in public youth detention facilities in the United States. Despite their high-risk behaviors and high prevalence of infections, many of these subjects may not reliably seek health care or be provided care to address these problems adequately.

Nucleic acid amplification tests for N gonorrhoeae and C trachomatis such as ligase chain reaction (LCR) provide sensitive and specific STD diagnosis and can use urine as an analyte for testing. They have been suggested for simplification of STD screening in both males and females. At the same time, however, identifying infected subjects is only one of several steps needed to accomplish STD

Editor’s Note: If ever there was a great “twofer” (noninvasive drug and STD [sexually transmitted disease] screening in high-risk adolescents), this is it! We need to get those adolescents where they are, and if where they are is in detention. . . .

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SUBJECTS, MATERIALS, AND METHODS

STUDY SUBJECTS AND STUDY SETTING

Consecutive adolescents admitted to the Jefferson County Youth Detention Center (JCYDC), Birmingham, Ala, between September 1996 and January 1997 had urine specimens collected for drug screening and were approached to participate in this study. Within 72 hours of admission, study personnel spoke with each detainee to explain that his or her urine specimen also could be tested for *C. trachomatis* and *N. gonorrhoeae* and asked permission to use it for this purpose. Verbal consent was obtained both to test the urine specimen and to notify the subject if a positive result was obtained. For this study, the only exclusion criteria were a history of antibiotic use in the preceding 14 days and failure to consent to participate. The study was approved by the Institutional Review Board for Human Subject Use of the University of Alabama at Birmingham and the administration and the medical authority of the JCYDC.

SPECIMEN COLLECTION

For urine drug screening, each subject had provided a non-sterile 30- to 50-mL, voided urine specimen in a sterile plastic cup at the time of admission to the JCYDC. Following removal of 1 aliquot for urine toxicologic screening, the remaining specimen was saved in a sealed plastic container at 4°C until consent was obtained by the STD project staff. Specimens from consenting detainees were transported to the University of Alabama at Birmingham STD Research Laboratory and tested using the LCR assay for the detection of *C. trachomatis* and *N. gonorrhoeae* nucleic acids.

INTERVIEW AND HISTORICAL DATA COLLECTION

In addition to demographic data, behavioral and medical histories and a history of health care service use in the past year were obtained from each participant by confidential interview. At the time of interview, each subject was provided information about community-based adolescent clinics and coupons for free visits to the adolescent clinics.

LABORATORY METHODS

In the STD Research Laboratory, 1-mL aliquots of unspun urine were pipetted into polyethylene tubes and stored at 4°C until LCR testing, which was performed within 4 days of specimen collection. Urine samples were processed as previously described. The LCR assay was performed according to manufacturer’s instructions for *N. gonorrhoeae* and for *C. trachomatis*. Drug screening was performed by radioimmunoassay for amphetamines, phenylcyclidine, methaqualone, methadone, barbiturates, benzodiazepines, cocaine and its metabolites, cannabinoids (marijuana), and opiates (‘74047’ nine-drug panel, Lab Corporation of America, South Haven, Miss).

MANAGEMENT OF STD-POSITIVE SUBJECTS

Efforts to notify and treat infections identified by LCR testing were initiated on receipt of test results. If the youth was still in detention, treatment was provided at the on-site clinic in the JCYDC. If the youth had been released, efforts were made to contact him or her by telephone or mail as well as with assistance of JCYDC counselors or probation officers, when necessary. Infected patients were treated as recommended by the Centers for Disease Control and Prevention, Atlanta, Ga, using azithromycin or doxycycline.

RESULTS

Of 267 adolescents approached for the study, only 4 males (1.5%) refused to participate. For all 263 subjects enrolled, urine specimen volumes were sufficient for LCR testing. Reflecting the composition of youth typically admitted to JCYDC, 46 (17.5%) were female and 217 (82.5%) were male. Demographic and historical characteristics of the participants are given in Table 1. Participants’ ages ranged from 12 to 18 years. The mean age
(± 2 SD) at first sexual intercourse was 13.7 ± 1.2 years for female subjects and 12.6 ± 2.2 years for male subjects. Female subjects (15.3 ± 1.3 years) typically reported that their current steady partners were 2 to 3 years older (18.0 ± 3.0 years; range, 15-33 years). In contrast, male subjects (15.7 ± 1.3 years) typically reported steady partners of about the same age (16.4 ± 2.6 years; range, 12-34 years).

*Table 1. Characteristics of 263 Participants*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Female Subjects (N=46)</th>
<th>Male Subjects (N=217)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD age, y</td>
<td>15.3±1.3</td>
<td>15.7±1.3</td>
</tr>
<tr>
<td>Range</td>
<td>12-18</td>
<td>12-18</td>
</tr>
<tr>
<td>Race</td>
<td>Black 69.6</td>
<td>83.4</td>
</tr>
<tr>
<td>White</td>
<td>30.4</td>
<td>16.6</td>
</tr>
<tr>
<td>Dropped out of school</td>
<td>30.4</td>
<td>36.4</td>
</tr>
<tr>
<td>No medical care in 1 year</td>
<td>39.1</td>
<td>47.7</td>
</tr>
<tr>
<td>History of treatment for sexually transmitted disease</td>
<td>77.5</td>
<td>40.0</td>
</tr>
<tr>
<td>Have a steady sexual partner</td>
<td>85.0</td>
<td>72.8</td>
</tr>
<tr>
<td>No. of lifetime partners ≥5</td>
<td>52.2</td>
<td>61.7</td>
</tr>
<tr>
<td>No. partners in last 4 mo &gt;1</td>
<td>32.6</td>
<td>48.0</td>
</tr>
<tr>
<td>History of running away from home</td>
<td>62.2</td>
<td>21.2</td>
</tr>
<tr>
<td>Spent night(s) at shelter</td>
<td>22.2</td>
<td>4.7</td>
</tr>
<tr>
<td>Stayed in group homes</td>
<td>17.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Spent nights with friends or relatives</td>
<td>22.2</td>
<td>12.3</td>
</tr>
<tr>
<td>Belong to a gang</td>
<td>13.3</td>
<td>23.9</td>
</tr>
<tr>
<td>Raped or forced to have sex</td>
<td>31.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Had sex for money</td>
<td>4.4</td>
<td>3.9</td>
</tr>
<tr>
<td>History of drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marijuana</td>
<td>75.6</td>
<td>80.0</td>
</tr>
<tr>
<td>Cocaine</td>
<td>8.9</td>
<td>4.7</td>
</tr>
<tr>
<td>History of treatment for drug abuse</td>
<td>17.8</td>
<td>13.4</td>
</tr>
</tbody>
</table>

*Unless otherwise indicated, all values are expressed as percentages.*

*C. trachomatis* AND *N. gonorrhoeae* INFECTION RATES

Thirty-seven participants, 15 (33%) of the 46 female subjects and 22 (10%) of the 217 male subjects were LCR test-positive for *N. gonorrhoeae*, *C. trachomatis*, or both. *Chlamydia trachomatis* infections were present in 13 (28.3%) of the 46 female subjects and 19 (8.8%) of the 217 male subjects. *Neisseria gonorrhoeae* infections were present in 6 (13.1%) of the 46 female subjects and 6 (2.8%) of the 217 male subjects. Four female (8.7%) and 3 male (1.4%) subjects had both infections.

**DRUG SCREENING RESULTS**

Urine drug screening test results were available in 45 female (98%) and 202 male (93%) subjects: 14 (31%) of the 45 female and 113 (55.9%) of the 202 male subjects were positive for marijuana; 7 (15.6%) of the 45 female and 18 (8.9%) of the 202 male subjects were positive for cocaine; benzodiazepines were found in 1 female and 7 male subjects; 1 female subject was positive for barbiturate; and 1 male subject was positive for opiate.

**CORRELATES OF GONORRHEA OR CHLAMYDIAL INFECTION**

In male subjects, the only variable significantly associated with the presence of *C. trachomatis* and *N. gonorrhoeae* was a report of receiving medical care in preceding year that was associated with decreased likelihood of infection (P=.04; odds ratio, 0.36; 95% confidence interval, 0.12-1.04). Although not statistically significant, male subjects with cocaine metabolites in their urine were also somewhat more likely to have infections (P=.09). In female subjects, no variable was significantly associated with a positive gonorrhea or chlamydial test. Though not statistically significant, female subjects who had a history of marijuana use were again somewhat more likely to be infected than those who did not (P=.09).

**TREATMENT OF STD CASES**

Of 37 subjects with infections diagnosed, only 1 (a female with chlamydial infection) presented with symptoms of dysuria and lower abdominal pain warranting syndromic treatment at enrollment. Of 36 asymptomatic infected patients, 19 (53%) were treated in the JCYDC on-site clinic; 16 before release and 3 after readmission to the detention center. Overall, 25 (69.4%) of the 36 asymptomatic infected patients were treated within 4 weeks of screening (Table 2).

Of 20 adolescents released from JCYDC before laboratory test results were available, 9 (45%) were subsequently treated in 1 of 2 community-based adolescent clinics, 7 (35%) received treatment from other providers after receiving follow-up telephone calls; and the whereabouts of 1 female (5%) with *C. trachomatis* infection remained unknown 6 months after the screening date. Three other detainees (15%) remained untreated until they were readmitted to the JCYDC, 51, 145, and 189 days after the initial screening.

**Table 2. Treatment of Subjects Positive for *Chlamydia trachomatis* and/or *Neisseria gonorrhoeae* (N=37)**

<table>
<thead>
<tr>
<th>Timing of Treatment, No. of Days After Interview</th>
<th>No. (%) of Subjects</th>
<th>Location of Treatment and Remarks*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 (2.7)</td>
<td>Symptomatic at enrollment (F)</td>
</tr>
<tr>
<td>In 1-5 d</td>
<td>16 (43.2)</td>
<td>On-site in detention (7 F, 9 M)</td>
</tr>
<tr>
<td>In 6-28 d</td>
<td>9 (24.3)</td>
<td>In community-based adolescent clinic by our staff (1 F, 8 M)</td>
</tr>
<tr>
<td>In &gt;28 d</td>
<td>3 (8.1)</td>
<td>On readmission to detention center (1 F), 145 (1 M), and 189 (1 F) days after screening</td>
</tr>
<tr>
<td>Date unknown</td>
<td>7 (18.9)</td>
<td>By other providers, reported by participants by telephone (3 F, 4 M)</td>
</tr>
<tr>
<td>Unknown outcome</td>
<td>1 (2.7)</td>
<td>Unable to contact (F)</td>
</tr>
</tbody>
</table>

*F indicates female subjects; M, male subjects.*

Screening high-risk adolescents for asymptomatic infection is an important component of STD control...
efforts. Compared with adults, adolescents and young adults are at higher risk for acquiring STDs for several reasons: their rates of partner change are, on average, higher than for older adults; they may be more likely to engage in unprotected intercourse; they may select partners at higher risk; and they are biologically more susceptible to infection due to larger zones of cervical ectopy. Furthermore, asymptomatic infections are an important target for disease control efforts because they disproportionately contribute to continued transmission of infections within communities. In light of dismal success rates of sexual contact tracking in adolescent STD cases, a large-scale screening of high-risk adolescent populations is the essential component of STD control.

Among youth, a large group at particular risk are those referred to the juvenile justice system, as clearly delineated in our study (Table 1). In 1990, public juvenile detention facilities in the United States reported more than 558,000 admissions. Many studies have already documented increased STD risk in these youth, who may also have limited access to health care and who, by virtue of their relatively large number of partners, may place many others at risk. In addition, as previously reported by our group, more than 50% of gonorrheal infections and 90% of chlamydial infections among male detainees are asymptomatic and, therefore, would be detected only by screening.

Despite the documented risk, the relatively high infection rates, and the recommendation of the National Commission on Correctional Health Care that treatment and prevention of STDs are essential health care services for detained juveniles, a routine STD diagnostic screening is not always possible in short-term detention facilities. Routine screening for large numbers of asymptomatic detainees using traditional genital examination for collection of swab specimens is time-consuming, expensive, and is often compromised by competing priorities within the judicial processes. In contrast, urine specimen collection and transport is easily performed. Thus the availability of a highly sensitive and specific STD screening technology using nonswab specimens provides an opportunity to improve screening for large numbers of at-risk adolescents who may be hard-to-reach through the usual clinic settings. In addition, the noninvasive nature of these tests eliminates the potentially unpleasant experience of undergoing a pelvic examination or urethral swab specimen collection while in confinement.

All female and more than 98% of the male subjects approached for this study agreed to participate. This high acceptance rate is consistent with prior observations in our adolescent medicine clinic which indicates that urine-based screening is readily acceptable to most youth, even if they do not perceive themselves to be at risk of infection.

Not only did our screening efforts identify a substantial number of asymptomatic infections but also we were able to inform the vast majority of infected youth about their test results to guide treatment. In only 4 cases (3 female and 1 male subject) were we unable to ensure treatment either at the JCYDC or following release and 3 of the 4 untreated cases were treated on readmission to the JCYDC, even though as long as 6 months after testing. Thus overall, treatment could not be documented in only 3%. Particularly noteworthy is that 19 (53%) of the 36 asymptomatic patients who were treated received treatment after they left the JCYDC. Assistance from the probation officers and substance use counselors were helpful in locating many of these youth who did not return to their homes after release.

The LCR-based urine screening linked with a drug screening program was extremely effective in identifying and treating unsuspected N gonorrhoeae and C trachomatis infections in these high-risk adolescent detainees and provided an opportunity to expand screening to youth who might not otherwise receive STD screening. More importantly, this approach could be instrumental for many adolescents to facilities that provide comprehensive care for treatment (9 cases in our study) or for long-term primary care. We consider urine-based screening as a starting point for provision of STD care. Subjects with positive tests should be carefully evaluated for complications such as pelvic inflammatory diseases or epididymitis and for possible coinfection with other STDs not readily identifiable with urine-based screening.

In summary, this study demonstrates the potential for STD screening using nonswab specimens to efficiently identify substantial numbers of infected subjects in a setting where provision of health care may be difficult, providing opportunities to identify and treat asymptomatic adolescent STD cases that otherwise might have been missed. Considering the large number of youth confined in the US public youth detention centers each year, this approach could make an important public health contribution to STD control if applied nationwide. This approach constitutes a focused intervention that is likely to prove cost-effective for STD control.

Accepted for publication August 1, 1997.

This study was supported in part by grants C60117041 (Dr Oh and Mr O’Cain) and R30/CCR413570 (Drs Hook and Oh) from the Centers for Disease Control and Prevention, and 5U19AI38514 (Drs Hook and Oh) from the National Institute of Allergy and Infectious Diseases.

We thank Rosie Florence for assisting data collection work. We also thank Jane R. Schwebke, MD, and Ronald A. Feinstein, MD, of University of Alabama at Birmingham, and Stuart Berman, MD, of the CDC for their constructive critique on the manuscript. We also acknowledge residents and staff of the JCYDC for their cooperation and support.

Poster presentation at the North American Society for Pediatric and Adolescent Gynecology, Cincinnati, Ohio, April 3 and 4, 1997.

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