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Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* and repeat infection among pregnant urban adolescents

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Abstract

BACKGROUND—Negative maternal and fetal consequences associated with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* during pregnancy make diagnosis essential. The CDC recommends routine screening for sexually transmitted infections at the first prenatal visit, and third trimester repeat screening, specifically for *C. trachomatis*, is recommended for women under age 25 or at increased infection risk. The impact of repeat screening on diagnosis during pregnancy is not well documented among adolescents.

METHODS—A prospective cohort of 125 pregnant adolescents with at least one prenatal screen for *C. trachomatis* and *N. gonorrhoeae* was analyzed. All participants received prenatal care and delivered at one urban teaching hospital in Washington, DC. Screening results were documented for both sexually transmitted infections. Descriptive and univariate analyses were performed to describe disease prevalence.

RESULTS—Thirty-one percent of pregnant adolescents were diagnosed with either *C. trachomatis* or *N. gonorrhoeae* infection during pregnancy. Of the 75% (95/125) of patients who had more than one screening test, 11% (10/95) had a re-infection, and 7% (7/95) had a new infection on repeat testing. Nine percent (9/95) had recurrent *C. trachomatis*, while 4% (4/95) had a new diagnosis. Three percent (3/95) had recurrent *N. gonorrhoeae*, while 4% (4/95) had a new diagnosis. Some experienced co-infection at either initial or repeat testing.

CONCLUSIONS—Screening for *C. trachomatis* and *N. gonorrhoeae* is recommended during pregnancy. In this sample of pregnant adolescents, the overall high incidence and recurrence of *C. trachomatis* and *N. gonorrhoeae* support CDC screening and re-screening recommendations, regardless of initial test results.

Keywords

teen pregnancy; adolescent; sexually transmitted infections; prenatal care; *Chlamydia trachomatis*; *Neisseria gonorrhoeae*

BACKGROUND

For the approximately 500,000 adolescents under the age of 20 who give birth each year (1), prenatal care represents an opportunity to screen for sexually transmitted infections (STIs).

Spontaneous abortion, preterm birth, low birth weight, congenital infections and abnormalities are all associated with STIs in pregnancy. Diagnosis and treatment of STIs such as *C. trachomatis* and *N. gonorrhoeae* is important to improve obstetrical outcomes (2, 3).

Annual STI screening is recommended in this age group, regardless of pregnancy status (4). Nearly half of the 19 million new STIs diagnosed annually in the U.S. occur among young women and men aged 15 to 24 years. The greatest number of *C. trachomatis* and *N. gonorrhoeae* cases are reported among adolescent girls aged 15 – 19 years, with minorities disproportionately affected (5). A recent systematic review supports a re-screening interval of 3 to 6 months for women of all ages who screened positive for *C. trachomatis* or *N. gonorrhoeae*, given that median re-infection rates were 14% and 12%. Age less than 20 years was consistently associated with higher re-infection rates during this follow-up period (6). For those who test positive for an STI at entry to prenatal care, this 3- to 6- month window may occur during pregnancy.

Both the Centers for Disease Control and Prevention (CDC) and The American Congress of Obstetricians and Gynecologists (ACOG) advocate STI screening at first prenatal visit and suggest re-screening those at increased infection risk during the third trimester. The CDC specifically advocates for third trimester *C. trachomatis* re-screening in pregnant women under age 25 and those at increased risk (4). Recent data suggest late pregnancy re-screening may diagnose either re-infection or new STIs (7, 8, 9). However, these studies are not specific to adolescents. Furthermore, optimal screening interval and recommended screening frequency among pregnant adolescents is not well documented.

In this study, we examine the rates of two of the most common bacterial STIs, *C. trachomatis* and *N. gonorrhoeae*, among a cohort of pregnant adolescents. We report the prevalence of each infection on initial and repeat testing. Among adolescents with repeat prenatal testing, we identify re-infections and new infections after initial negative screening.

METHODS

This is a secondary analysis of a prospective cohort of pregnant adolescents. Patients beginning prenatal care between February 2003 and April 2005 with planned delivery at Washington Hospital Center in Washington, DC were eligible for enrollment in a comprehensive adolescent parenting program, the Teen Alliance for Prepared Parenting (TAPP) Program. This program provides comprehensive obstetric and postpartum care, with integrated social work services at an urban academic medical center (10). Patients are seen by attending physician providers or by resident physicians with attending supervision. A substantial proportion of teens who give birth in Washington, DC deliver at this clinical site. In 2006, 999 births to adolescents age 15 – 19 in Washington, DC were documented; 704 delivered at our hospital.

For study inclusion, individuals had no prior contact with the program, were 18 years of age or less at enrollment, and planned to deliver at the affiliated hospital. Enrolled individuals were excluded from final analysis if they did not complete prenatal care at the affiliated hospital. One person was excluded because results of STI testing were not available. Data for all patients were evaluated through retrospective chart review of medical records.

Routine STI screening was performed at entry to prenatal care, including testing for *C. trachomatis* and *N. gonorrhoeae* with either endocervical culture or urine nucleic acid amplification tests. Confirmed diagnosis was noted in the medical record by a provider, and treatment was provided for each STI diagnosis. Patients diagnosed with either were treated

according to CDC guidelines. Standard clinic treatment is 1 gram oral azithromycin for *C. trachomatis* and 125 mg intramuscular ceftriaxone for *N. gonorrhoeae*.

Repeat testing was performed in the third trimester of pregnancy. Some patients had more than two screenings for *C. trachomatis* and *N. gonorrhoeae*. If diagnosis occurred early in pregnancy, a test-of-cure was performed four weeks after diagnosis and treatment. Additional screening was then performed at approximately 36 weeks gestation.

Pertinent demographic characteristics were extracted from the medical record. We calculated percentages of either *C. trachomatis* or *N. gonorrhoeae* at initial and repeat screening. Descriptive and univariate statistics were performed with Stata 10 (College Station, TX). IRB approval was obtained through Medstar Research Institute, Washington, DC.

RESULTS

During the study period, 227 pregnant adolescents age 12–18 years were eligible for enrollment. Of those, 146 enrolled, and 125 met inclusion criteria for analysis. Twenty enrolled participants transferred care prior to delivery, and one participant did not have documented results of *C. trachomatis* or *N. gonorrhoeae* on medical record review. Nearly two-thirds (63%) of the sample initiated prenatal care prior to 20 weeks gestation. The median age at delivery was 17 years. Eighty-four percent were African-American, 78% were nulliparous, and 88% delivered at term. (Table 1)

Just over one-fourth of the sample (26%; 32/125) was diagnosed with either *C. trachomatis* or *N. gonorrhoeae* infection at entry to prenatal care. Seventy-six percent (95/125) of patients had repeat testing for *C. trachomatis* and *N. gonorrhoeae* during prenatal care, regardless of initial test results. Re-infection occurred in 11% (10/95), and 7% (7/95) were positive only on repeat testing. (Table 1) Nearly one-third of the sample (31%; 10/32) was diagnosed with an infection at least once during pregnancy. Thirty-one percent (10/32) of those who had an STI at initial testing had another infection diagnosed during pregnancy.

Diagnosis of *C. trachomatis* and *N. gonorrhoeae* were also evaluated separately. For *C. trachomatis*, 19% (24/125) were diagnosed at entry to prenatal care. Nine percent (9/95) had a recurrent infection, and 4% (4/95) were diagnosed with new *C. trachomatis* only on repeat testing. Ten percent (13/125) were diagnosed with *N. gonorrhoeae* at entry to prenatal care. Three percent (3/95) had a recurrent infection, and 4% (4/95) were diagnosed with new *N. gonorrhoeae* only on repeat testing. (Table 2)

One participant was diagnosed with *N. gonorrhoeae* on initial testing and was then diagnosed with both STIs on repeat testing. Two other participants who were diagnosed with both infections on initial testing were found to have only one on repeat testing. One of these had *C. trachomatis* and the other had *N. gonorrhoeae* on repeat testing. No patients who were initially diagnosed with one evaluated STI were diagnosed with only the other on repeat testing.

A test-of-cure was documented as negative in some of these re-infections. Among the nine who had a second *C. trachomatis* diagnosis, three had a documented negative test-of-cure before diagnosis of re-infection. Among the other six, the subsequent screening interval occurred between four and fourteen weeks after initial diagnosis. Among the three who had a second *N. gonorrhoeae* diagnosis, two had a documented negative test-of-cure before diagnosis of reinfection.

DISCUSSION

In this sample of urban pregnant adolescents, just over one-fourth tested positive for either *C. trachomatis* or *N. gonorrhoeae* at initial screening, and nearly one-third tested positive at least once during prenatal care.

Sexual risk behavior does not decrease once an adolescent becomes pregnant. Young pregnant women are one-fifth as likely to use condoms compared with those who have never been pregnant (11, 12, 13). Between 19% and 39% of pregnant adolescents had at least one STI in pregnancy, according to a recent systematic review of risk behavior among pregnant adolescents and adolescent mothers (12).

Urban areas such as Washington, DC have particularly high numbers of STI diagnoses. During the years included in this analysis, 2003 – 2005, the prevalence of *C. trachomatis* and *N. gonorrhoeae* were, respectively, 6.4% and 3.3% among 15 – 19 year old African-American females in the Washington, DC area (14). The prevalence of each STI we report is substantially higher among pregnant, sexually active females of similar age and ethnicity. Prenatal care may present a critical period in which to screen, treat, and counsel sexually active adolescents.

The strengths of this study include our high retention rate (86%). Twenty patients who were not analyzed did not complete care at our clinical site, typically due to a change in living situation or insurance that required a transfer of care. Only one participant was followed through delivery and did not have a documented *C. trachomatis* or *N. gonorrhoeae* result identified during medical record review.

Our primary limitation is the possibility of persistent infection instead of re-infection with either *C. trachomatis* or *N. gonorrhoeae*. While this cannot be entirely eliminated, concerted clinical efforts were made to ensure appropriate treatment. The six patients with suspected *C. trachomatis* re-infection but no negative test-of-cure had documentation in the medical record of patient contact, discussion of diagnosis, or copies of mailed prescriptions for azithromycin. Likewise, for the one patient with suspected re-infection with *N. gonorrhoeae* but no negative test-of-cure, the medical record notes a prescription was given for cefixime. While not standard clinic protocol to treat *N. gonorrhoeae* with oral cefixime, this may have been the most effective means of treating that patient. The likelihood of persistent infection after treatment with oral azithromycin, intramuscular ceftriaxone, or oral cefixime for these infections is low, as each is considered effective treatment, approximately 92–95% (4, 15). To decrease this persistent infection concern further, expedited sexual partner treatment may be implemented, as it has been shown to be more effective for both *N. gonorrhoeae* and *C. trachomatis* treatment when compared to standard partner referral (16).

Adolescents without an STI when they began care appeared to benefit from re-testing. That nearly one-third had either *C. trachomatis* or *N. gonorrhoeae* infection at some point during pregnancy illustrates the importance of screening. Efforts to develop targeted interventions to reduce acquisition of STIs, in conjunction with routine prenatal care, should be supported and strengthened. Partnering with local health departments and community organizations that reach at-risk adolescents may be an integral component to identifying at-risk pregnant adolescents. These young pregnant women, as well as their sexual partners, must be a priority in STI prevention.

Pregnancy represents an opportune time to intervene for adolescents at risk for sexually transmitted infections. Routine screening at start of prenatal care is an opportunity for counseling on safe sexual behavior, regardless of infection status. Condom use as well as testing and treatment of all sexual partners should be encouraged. Data on sexual behavior

was not specifically collected for this study, but it should be documented during prenatal care. Knowing a patient's number of sexual partners, sexual activity before and after STI diagnosis, and frequency of condom use may help identify patients at increased infection risk.

Overall, repeat STI screening for all adolescents may be warranted, given the high prevalence of infection, suspected re-infection, and new diagnosis only on repeat testing. We encourage prenatal providers to routinely re-screen pregnant adolescents for STIs, even those not infected at entry to prenatal care.

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Summary

Repeat testing for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* among urban, pregnant adolescents identified a high incidence of new and repeat infection.

Table 1

Baseline characteristics of pregnant adolescents

Patient characteristic	Median or percent n = 125
Median age at delivery (years)	17
African-American	84%
Nulliparous	78%
Term delivery	88%

Table 2

C. trachomatis or *N. gonorrhoeae* testing and diagnosis

STI diagnosed	Initial test (n = 125)		Re-infection diagnosed on subsequent testing (n = 95)		New infection diagnosed on subsequent testing (n = 95)	
	n	%	n	%	n	%
One or both of the two measured STIs	32	26%	10	11%	7	7%
<i>C. trachomatis</i>	24	19%	9	9%	4	4%
<i>N. gonorrhoeae</i>	13	10%	3	3%	4	4%