

Screening Criteria for *Chlamydia trachomatis* In Family Planning Clinics: Accounting For Prevalence and Clients' Characteristics

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The reliability of eight self-reported risk factors as criteria for screening women for Chlamydia trachomatis was evaluated in four family planning clinics in New York State that serve diverse populations. In all, 8,920 women were screened in these clinics; the rates of infection ranged from 2% to 7%. Results of multivariate analyses showed that age was the most important predictor of chlamydial infection in the three clinics where prevalence was 4% or higher; women aged 20–24 were 3–4 times as likely as older women to be infected, and those aged 13–19 were 4–6 times as likely. In these three clinics, screening all women aged 26 or younger (62–80% of the clinic population) would identify about 90% of infected women; in the clinic with the lowest prevalence rate, age was not a reliable criterion. The prevalence of self-reported risk factors varied by clinic, and these factors generally were not reliable indicators of infection. Using the presence of at least one self-reported risk factor as a screening criterion, 80–87% of clinic clients would be screened, and about 90% of infected women would be identified. The presence of clinical signs of chlamydial infection does not increase the reliability of age as a screening criterion.

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Chlamydia trachomatis has become the most common sexually transmitted bacterial infection in the United States.¹ For women, complications from chlamydia may lead to serious reproductive and infectious conditions, including pelvic inflammatory disease, ectopic pregnancy and infertility.² Some 50–70% of infected women who have a vaginal delivery pass the infection on to their infants, who then are at risk for neonatal conjunctivitis or pneumonia.³ The risk of human immunodeficiency virus seroconversion among women with chlamydia is 3–5 times that among women who are not infected.⁴ Total costs (direct and indirect) associated with chlamydia infections exceed \$2.4 billion; roughly 80% of these costs are associated with infection in women.⁵

However, the infection is often asymptomatic in women and therefore difficult to identify except through screening. Thus, about 50% of infected women may

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not seek treatment. Untreated chlamydial infection can persist for a year or more, leading to sustained risks of transmission.⁶

In 1988, the New York State Department of Health's Bureau of Sexually Transmitted Disease (STD) Control initiated a screening program to assess the prevalence of chlamydial infection among women attending public health clinics throughout the state. In this article, we use data from this program to assess the reliability of established self-reported risk factors as a means to identify women with chlamydia infection and to identify factors that would facilitate selective screening.

Methodology

Program Sites and Population

Initial testing under the state program was conducted at 31 family planning sites between June 1988 and December 1989. In all of these clinics, the decision to test women was based on their responses to a questionnaire asking about the presence of eight factors that are associated with chlamydia:⁷ whether they had come to the clinic for gonorrhea testing, had had unprotected sex within the past three months, were using the pill, had genital symptoms (discharge, lower abdominal pain or pain on urination), were pregnant,* had had more than one sexual partner in the past three months, had been informed by their partner of possible infection or had had an abnormal Pap smear within the past year.

Women who reported any of these risk factors were tested.

To validate the use of these questions as criteria for selective screening for chlamydia, staff members at one clinic in northeastern New York (Clinic A) both administered the questionnaire and tested all women making an initial or annual visit (visits that included a routine pelvic examination), as well as those who came in with complaints of genital symptoms. Women from Clinic A are the only ones from the 1988–1989 testing to be included in this analysis. Clinical signs of infection—namely, cervical abnormalities[†] and moderate to heavy vaginal or cervical discharge—were also assessed, and women were classified according to whether or not they had such signs.

To test the reliability of the questionnaire across populations with varying prevalence rates and demographic profiles, the Bureau of STD Control conducted further chlamydia testing at three family planning clinics in southeastern New York (Clinics B–D) between June 1992 and December 1993. Women attending these clinics were tested at their initial and annual visits or if they had genital symptoms.

Data and Analyses

Some 1–5% of test results in the various clinics were categorized as “suspicious”[‡] or were based on unsatisfactory speci-

*Pregnancy was considered a risk factor for a number of reasons: A woman may have become infected at the same time she became pregnant; cervical changes during pregnancy increase a woman's susceptibility to infection; and pregnant women generally have a higher infection rate than those who are not pregnant.

†Erythema (inflammation), friability (bleeding upon swabbing) and unspecified abnormalities.

‡The laboratory techniques used to identify chlamydia were an enzyme immunoassay (Chlamydiazyme, Abbott Labs, Chicago) in 1988–1989 and a direct fluorescent antibody slide test (Microtrak, Syva, Palo Alto, Calif.) in 1992–1993. False positive test results were minimized through use of “suspicious” zones: for the enzyme immunoassay, any reading between cutoff and a spectrophotometer reading of 0.4; and for the direct fluorescent antibody test, a sample containing fewer than 10 elementary bodies. (See: S. S. Hipp, Y. Han and D. Murphy, “Assessment of Enzyme Immunoassay and Immunofluorescence Tests for Detection of *Chlamydia trachomatis*,” *Journal of Clinical Microbiology*, 25:1938–1943, 1987; and S. S. Hipp and F. B. Coles, “The Virtues of Chlamydia Culture,” *Clinical Microbiology Newsletter*, 16:37–39, 1994.)

Table 1. Percentage distribution of women screened for chlamydia and percentage infected, by demographic and risk characteristics, four family planning clinics, New York State, 1988–1989 and 1992–1993

Characteristic	Clinic A (N=4,393)		Clinic B (N=1,601)		Clinic C (N=980)		Clinic D (N=1,946)	
	Screened	Infected	Screened	Infected	Screened	Infected	Screened	Infected
Total	100.0	7.2	100.0	6.2	100.0	4.0	100.0	2.2
Age								
13–19	27.0	10.6*	21.5	14.5*	20.1	8.6*	20.9	2.7
20–24	43.4	7.9*	28.4	6.8*	36.3	4.5*	37.8	2.3
≥25	27.3	2.9	47.2	2.3	43.3	1.4	40.7	1.9
Race/ethnicity								
White	94.1	6.9	9.8	3.2	28.1	3.2	84.6	1.8
Black	2.0	11.5	70.1	7.2	32.0	7.1*	4.4	5.9*
Hispanic	1.1	8.2	9.8	3.2	22.1	0.5	5.3	5.3
Other	0.9	20.0*	2.5	5.0	2.2	4.6	1.9	8.3*
Visit was for gonorrhea treatment								
Yes	1.4	20.6*	2.1	12.1	2.2	4.6	0.4	12.5
No	97.0	7.0	91.1	6.2	94.1	4.0	97.2	2.2
Unprotected sex in past three months								
Yes	29.3	8.0	49.2	8.4*	40.4	5.1	33.7	3.7*
No	69.2	6.8	44.9	4.2	57.7	3.4	64.1	1.4
Current pill use								
Yes	56.4	7.6	26.2	6.2	34.0	5.1	49.1	1.7
No	41.8	6.6	68.1	6.4	64.2	3.5	48.4	2.9
Genital symptoms†								
Yes	26.0	8.1	38.2	7.8	31.4	3.6	20.3	3.1
No	72.0	6.9	55.4	5.3	66.0	4.3	76.9	2.1
Multiple sex partners in past three months								
Yes	13.7	13.8*	10.5	10.4*	7.0	8.7	7.7	4.7
No	84.9	6.1	83.9	5.9	91.0	3.7	90.4	2.1
Partner may have infection								
Yes	3.1	17.5*	5.1	9.8	3.8	8.1	2.9	10.5*
No	94.9	6.8	88.7	6.1	93.4	3.9	94.1	2.0
Abnormal Pap smear within past year								
Yes	13.4	9.7*	25.2	5.5	20.5	6.0	14.9	2.1
No	83.5	6.8	66.1	6.7	74.1	3.7	80.4	2.2
Any risk factors								
Yes	87.3	7.5*	84.1	6.8	80.3	4.3	83.4	2.3
No	12.7	4.7	15.9	3.6	19.7	2.6	16.6	1.6

*In the univariate analysis, statistically significant difference in rate of infection at $p < .05$; the reference groups were women aged 25 and older, whites and those not reporting each risk factor. †Discharge, lower abdominal pain or pain on urination. Notes: Screening took place in 1988–1989 in Clinic A and in 1992–1993 in the remaining clinics. Percentage distributions may not add to 100% because of missing information.

mens; these results were eliminated from the analyses. In addition, since no more than 2% of women in any clinic were pregnant at the time of the visit, this risk factor was eliminated. For the 1992–1993 data, if a woman made multiple visits to the clinic, only data for the first visit were included.

In univariate analyses, we used the chi-square statistic with continuity correction and, when appropriate, Fisher’s exact test to identify variables that are significantly associated (at the 5% level) with chlamydial infection. To determine which factors are independently predictive of chlamydial infection, we entered variables that were statistically significant in the uni-

variate analysis into a stepwise logistic regression.⁸ The analyses are based on women for whom all variables were known (83–94% in each clinic); since these subgroups contained 85–94% of infected women, this restriction does not substantially affect the results.

Results
Women’s Characteristics

The demographic characteristics of the 8,920 women screened varied somewhat by clinic (Table 1). Clinic A had the largest proportion of clients who were teenagers (27% vs. 20–22%) and the smallest proportion who were aged 25 or older (27% vs. 41–47%). Clinics A and D served predominantly

white women (94% and 85%, respectively), and Clinic B served mostly black women (70%). In Clinic C, women were more evenly divided by race or ethnicity.

Some 80–87% of the women had at least one risk factor for chlamydia. While 29–49% reported having engaged in unprotected intercourse within the previous three months, only 7–14% said they had had more than one sex partner during that time.

On the other hand, the absence of risk factors was also notable in some instances. No genital symptoms were present in 55–77% of the women, and 66–84% had not had an abnormal Pap smear within the past year.

Correlates of Infection

The prevalence of chlamydial infection was 7% in Clinic A, 6% in Clinic B, 4% in Clinic C and 2% in Clinic D. The rate of infection ranged from 2% to 8% among women who had any risk factors and from 2% to 5% among those who had none. Women reporting a risk factor almost always had a higher rate of infection than those without the same characteristic; the most obvious differences were noted in factors pertaining to risky behavior (unprotected intercourse and multiple partners) and STD-related clinic visits (gonorrhea treatment and infected partner).

Results of the univariate analysis showed that in the three clinics with rates of 4% or higher, women younger than 25 had a significantly elevated risk of infection: Those aged 20–24 had about triple the risk of older women, while women aged 13–19 had 4–7 times the risk. Odds ratios for the variables measured on the questionnaire were generally greater than 1.0, but most were not statistically significant.

Findings from the multivariate analysis (Table 2) did not vary remarkably from the univariate results. Age remained the most significant factor, and the magnitude of risk was roughly the same as in the univariate results. Race or ethnicity had the strongest influence in Clinic D, where non-white women were 3–5 times as likely as whites to be infected.

A few items that had been significant in the univariate analysis were no longer significant in the multivariate analysis—unprotected intercourse in Clinic D, multiple sex partners in Clinic B and abnormal Pap smear in Clinic A. The self-reported risk factors that remained significant had moderate effects, roughly doubling the risk.

Data from Clinic A allowed us to examine the correlates of infection among women with no clinical signs of chlamy-

Table 2. Odds ratios (and 95% confidence intervals) from multivariate analysis showing effects of demographic and risk characteristics on the likelihood of chlamydia infection, by clinic

Characteristic	Clinic A	Clinic B	Clinic C	Clinic D
Age				
13–19	3.9 (2.6–5.8)	6.1 (3.4–11.1)	4.9 (2.1–16.7)	na
20–24	2.9 (2.0–4.3)	2.9 (1.6–5.5)	3.3 (1.3–9.8)	na
Race/ethnicity				
Black	na	na	2.6 (1.1–6.0)	3.3 (1.2–9.0)
Other	3.1 (1.3–7.3)	na	na	4.9 (1.4–17.6)
Risk characteristic				
Visit was for gonorrhea treatment	2.3 (1.1–4.7)	na	na	na
Unprotected sex in past three months	na	1.8 (1.1–2.8)	na	1.9 (1.0–3.6)
Multiple sex partners in past three months	2.2 (1.7–2.9)	1.8 (1.0–3.2)	na	na
Partner may have infection	2.4 (1.4–3.9)	na	na	3.7 (1.3–10.5)
Abnormal Pap smear in past year	1.3 (1.0–1.8)	na	na	na

Notes: na=not applicable, because the variable did not have a significant effect in the univariate analysis. The reference groups are women aged 25 and older, whites and those not reporting each risk factor.

dia. In all, 64% of women visiting the clinic had no clinical signs, and 44% of the 315 infected women at this site were identified in this group. Among women with no clinical signs, those seeking gonorrhea treatment and those who had had more than one sex partner in the past three months had a slightly increased risk of infection, but those younger than 25 were at considerable risk. Teenagers had 3.6 times the risk of women aged 25 and older, and those in their early 20s had 2.3 times the risk.

Evaluation of Screening Criteria

Table 3 shows the proportion of all clients who would need to be tested for chlamydia and the proportion of infected women who would be identified by using different screening criteria. With the Bureau of STD Control's method (testing all women with at least one risk factor), 80–87% of women would be screened, and approximately 90% of those infected would be identified. However, in Clinics A, B and C, using age as the only criterion, the testing of smaller proportions of women would identify even higher proportions of those with chlamydia. For example, in these three clinics, if all women aged 26 and younger (62–80% of the clinic population) were screened, 90–92% of infected women would be identified.

In Clinic D, where the prevalence rate was lower, age was not a good discriminant factor. Approximately 90% of infected women would be identified only by including all those younger than 30, which would require testing nearly 83% of the clinic population.

The data from Clinic A show that regardless of the presence or absence of clinical signs, if all women aged 25 or younger were screened, 75% of clients would be tested and about 90% of infected women would be identified (Figure 1, page 166).

Discussion

This study shows that selecting women for chlamydia testing on the basis of their self-reported risk factors is not a significant improvement over universal screening. Although using any of eight self-reported risk factors resulted in the identification of more than 87% of all positive cases, this required screening of more than 85% of our study population.

By contrast, in the three clinics where prevalence was 4% or greater, screening women aged 26 or younger (62–80% of all women) would have identified approximately 90% of those with chlamydial infection. However, in Clinic D, where prevalence was only 2%, age was not a significantly better screening criterion than self-reported risk factors; in cases like this, using some combination of selected risk factors (if these are known), clinical signs and age might be the most cost-effective method of selecting women for testing.

Our study has several limitations. Although the findings from Clinic A showed that more than 90% of infected women were identified when screening was restricted to those aged 25 or younger, regardless of clinical status, information on clinical signs of infection was not obtained from the other three clinics. Another limitation was the possibility that the prevalence of risk factors and risk-related behavior may have changed since the initial data were obtained. For example, condom use may have increased since 1989 because of concerns about infection with the human immunodeficiency virus.

The New York State family planning program offers STD services through 59 providers with 193 clinic sites statewide. During 1995, approximately 560,000 clinic visits were made by women, and about 150,000 tests for chlamydia were conducted. According to one laboratory report, which included test results from more than half of family planning clinics in 1995, the chlamydia prevalence rate was 3% overall, but 2% or lower at many clinics.⁹ This raised the question of what recommendations for testing should be set for such clinics.

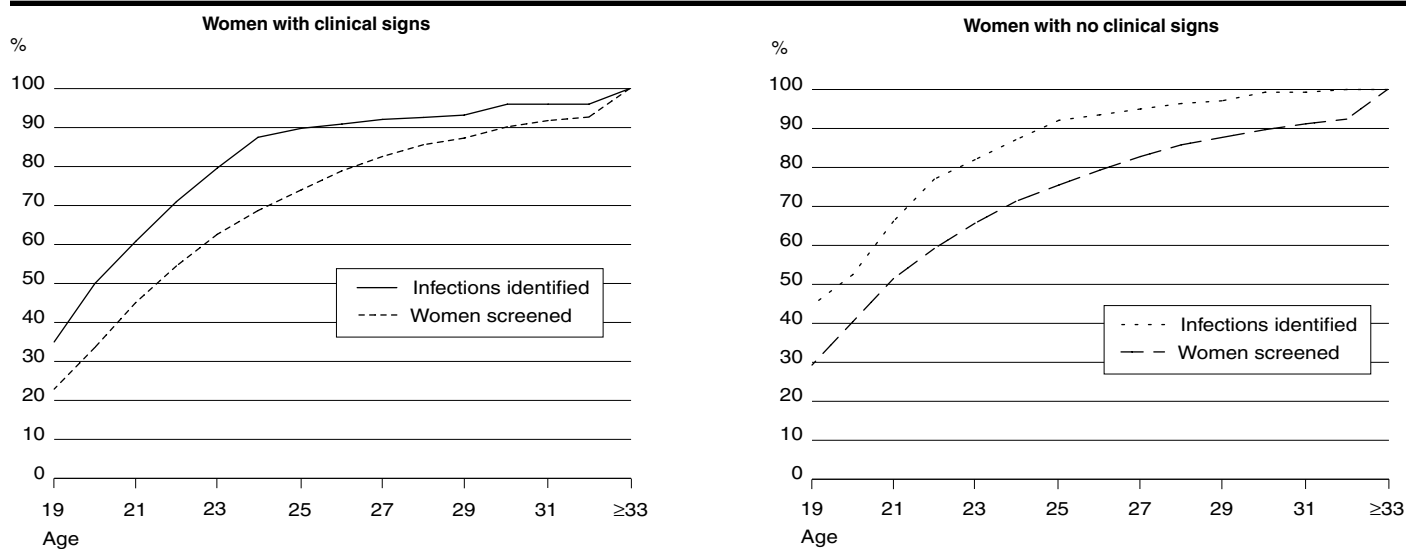
Several studies have established the validity of risk factors for targeting populations with *C. trachomatis* infection, especially where prevalence is low.¹⁰ Although some studies have concluded that universal screening would be cost-effective in populations with a chlamydia prevalence of 2% or more,¹¹ screening programs in public health clinics are constrained by available funding, and limited resources must continue to be applied where they will be able to detect and treat as much infection as possible. For instance, re-

Table 3. Percentage of infected women identified and percentage of all clinic clients screened, by screening criterion, according to clinic

Screening criterion	Clinic A		Clinic B		Clinic C		Clinic D	
	Infections identified	Women screened	Infections identified	Women screened	Infections identified	Women screened	Infections identified	Women screened
≥1 self-reported risk factors	91.8	87.3	89.8	84.1	86.8	80.3	88.4	83.3
Maximum age*								
19	39.7	27.0	51.5	24.4	43.6	20.4	25.6	20.9
20	51.1	37.9	55.6	30.2	56.4	27.1	34.9	27.0
21	63.2	49.2	61.6	35.3	59.0	34.4	48.8	33.8
22	73.7	57.5	66.7	41.0	69.2	43.4	55.8	43.3
23	80.6	64.6	76.8	46.9	76.9	50.9	62.8	52.1
24	87.3	70.3	82.8	52.8	84.6	56.7	65.1	58.6
25	90.8	75.0	87.9	57.7	84.6	61.4	67.4	65.0
26	92.1	79.5	89.9	62.3	92.3	65.4	83.7	70.6
27	93.3	85.7	91.9	67.3	92.3	69.8	83.7	75.7
28	94.3	87.7	93.9	71.6	94.9	74.7	83.7	79.4
29	94.9	89.9	93.9	75.4	97.4	77.7	90.7	82.5
30	97.5	89.9	95.0	78.6	97.4	81.4	90.7	85.3
≥31	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Lower age limit of women in this study was 13.

Figure 1. Percentage of infected women identified and percentage of all clients screened, by age, according to presence of clinical signs of infection



Notes: Lower age limit of women in this study was 13. Data are from one New York State clinic in which 4,393 women were screened in 1988–1989.

searchers who modified screening criteria recommended by the Centers for Disease Control and Prevention on the basis of the characteristics of their population screened 64% of clients and identified 92% of infected women.¹²

Although further studies are needed to evaluate more effective screening criteria in clinics where the prevalence of infection is low, this study shows that effective screening criteria based on risk factors that tend to be present in one clinic population may not be effective screening criteria in other populations.

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