Chlamydia trachomatis among Patients Infected with and Treated for Neisseria gonorrhoeae in Sexually Transmitted Disease Clinics in the United States

Sheryl B. Lyss, MD; Mary L. Kamb, MD, MPH; Thomas A. Peterman, MD, MSc; John S. Moran, MD, MPH; Daniel R. Newman, MA; Gail Bolan, MD; John M. Douglas Jr., MD; Michael latesta, MA; C. Kevin Malotte, DrPH; Jonathan M. Zenilman, MD; Josephine Ehret, BS; Charlotte Gaydos, MS, MPH, DrPH; and Wilbert J. Newhall, PhD, for the Project RESPECT Study Group

Background: For two decades, treatment guidelines for sexually transmitted diseases (STDs) have recommended empirical co-treatment for chlamydia when patients are treated for gonorrhea. Because the epidemiology of and diagnostic testing for STDs have changed over time, co-treatment may no longer be needed as a clinical or public health strategy.

Objective: To assess the prevalence of chlamydia among patients at STD clinics who are infected with and treated for Neisseria gonorrhoeae and to determine whether co-treatment recommendations are still justified.

Design: Cross-sectional analysis of data from a multisite study.

Setting: Five public STD clinics (Baltimore, Maryland; Denver, Colorado; Long Beach, California; Newark, New Jersey; and San Francisco, California), July 1993 through October 1995.

Patients: 3885 heterosexual patients (2184 men and 1701 women) who agreed to participate in a trial of counseling interventions and had conclusive results from diagnostic tests for gonorrhea and chlamydia performed routinely as part of the trial.

Measurements: Infection with Chlamydia trachomatis as determined by polymerase chain reaction.

Results: Chlamydia trachomatis was detected in 20% (95% CI, 16% to 24%) of 411 men and 42% (CI, 35% to 50%) of 151 women with laboratory-confirmed N. gonorrhoeae. Chlamydia trachomatis was detected in 19% (CI, 15% to 22%) of 410 men and 35% (CI, 28% to 43%) of 154 women with treatment indications for gonorrhea who would not otherwise have been treated for chlamydia: chlamydia prevalence among these patients was significantly higher than among patients without treatment indications for either gonorrhea or chlamydia: 7% in men and 9% in women (relative risk, 2.58 [CI, 1.92 to 3.47] and 4.12 [CI, 3.05 to 5.57], respectively).

Conclusion: The frequent presence of chlamydia among patients at STD clinics who received treatment for gonorrhea, including sex partners of gonorrhea-infected patients, supports continuing current recommendations for co-treatment.
However, over the past decade, estimates of chlamydial infection among persons infected with gonorrhea (that is, co-infection) have varied widely, ranging from 9% to 50% among men and 24% to 67% among women (7–21). Most of these studies, however, included small numbers of patients (7–12) or used less sensitive chlamydia tests (13–17). Furthermore, they addressed only the epidemiologic question of co-infection. Since treatment decisions must often be made before test results are available, the prevalence of chlamydia among patients treated for gonorrhea is more relevant than the prevalence among patients ultimately found to be infected with \textit{N. gonorrhoeae}.

Our analysis had two objectives. First, to investigate co-infection, we sought to determine the prevalence of chlamydia among patients at STD clinics who were infected with \textit{N. gonorrhoeae}. Second, to assess the appropriateness of co-treatment, we sought to determine the prevalence of chlamydia among patients at STD clinics who were treated for gonorrhea, including those treated presumptively as sex partners of gonorrhea-infected persons.

### METHODS

#### Study Design

We performed a cross-sectional analysis using baseline (enrollment) data collected from July 1993 through October 1995 for Project RESPECT, a randomized, controlled trial of counseling interventions (22). The trial was conducted among patients from public STD clinics in Baltimore, Maryland; Denver, Colorado; Long Beach, California; Newark, New Jersey; and San Francisco, California. All English-speaking patients at least 14 years of age who came to the clinics for an STD examination (evaluation of symptoms, screening or routine care, or contact with an infected partner) and who reported penile–vaginal intercourse during the preceding 3 months were asked to participate. Participants found to be infected with HIV and men who identified themselves as homosexual or reported having a male sex partner during the preceding 12 months were excluded. All participants gave written, informed consent, and the institutional review boards at each site reviewed and approved the protocol. Overall, 43% of eligible patients agreed to participate in the 12-month intervention and follow-up. Study participants were routinely tested for gonorrhea, chlamydia, and several other STDs.

#### Definitions

For this analysis, we defined gonococcal infection as a positive culture for \textit{N. gonorrhoeae} from a urethral or endocervical swab in men or women, respectively. We defined chlamydial infection as a positive PCR result from a urine specimen or endocervical swab in men or women, respectively. We included all participants with conclusive test results from both a gonorrhea culture and a chlamydia PCR.

Nongonococcal urethritis was defined as the presence of at least 5 polymorphonuclear leukocytes per high-power field and absence of gram-negative intracellular diplococci on Gram stain. Mucopurulent cervicitis and pelvic inflammatory disease (PID) were defined according to the clinician’s presumptive diagnosis at the initial visit. We considered patients to have been exposed to an STD if they had a referral card or reported that their partner was infected.

We defined indications for treatment by categorizing men and women into mutually exclusive hierarchical groups. We used this approach to 1) distinguish treatment decisions made at the initial consultation from those based subsequently on laboratory test results and 2) exclude patients who would be treated for chlamydia anyway. This allowed us to determine the prevalence of chlamydia among patients treated for gonorrhea who would not, in the absence of co-treatment, be treated with an antimicrobial regimen effective against \textit{C. trachomatis}. We considered that the following patients had other indications for chlamydia treatment: men with nongonococcal urethritis (\textit{C. trachomatis} is the organism most commonly associated with this disorder [23]); women with mucopurulent cervicitis or PID (who are treated for several potential organisms, including \textit{C. trachomatis}); and patients whose partners were diagnosed with chlamydia, nongonococcal urethritis, mucopurulent cervicitis, or PID.

Next, we categorized men into six groups and women into five groups on the basis of treatment indication. We considered men to have treatment indications for chlamydia if they had 1) nongonococcal urethritis by Gram stain or 2) a sex partner with chlamydia, mucopurulent cervicitis, or PID. We considered the remaining men to have treatment indications for gonorrhea if they had 3) gram-negative intracellular diplococci, 4) a sex partner with gonorrhea, or 5) a positive gonorrhea culture. The final group comprised men 6) without treatment indications for either infection.
We considered women to have treatment indications for chlamydia if they had 1) a sex partner with chlamydia or nongonococcal urethritis or 2) a clinical diagnosis of mucopurulent cervicitis or PID. We considered the remaining women to have treatment indications for gonorrhea if they had 3) a sex partner with gonorrhea or 4) a positive gonorrhea culture. The final group comprised women 5) without treatment indications for either infection.

Statistical Analysis

We compared characteristics of patients included in this analysis with those of patients enrolled in the original study. Chlamydia prevalence was determined for patients with laboratory-confirmed gonorrhea and for patients with each of the hierarchical treatment indications. For comparison between groups, we used chi-square tests and relative risks (RRs) with 95% CIs. Mantel–Haenszel weighted RRs were used to calculate summary RRs for stratified analyses, for which Greenland–Robins confidence limits were calculated. The large-sample population proportion method (24) was used to calculate 95% CIs for prevalences.

Role of the Funding Source

Project RESPECT was supported by CDC cooperative agreements. Chlamydia PCR kits were donated by Roche Pharmaceuticals, which was not involved in study design, conduct, analysis, or interpretation.

RESULTS

Study Participants

Of the 4328 patients enrolled in Project RESPECT, 443 were excluded from this analysis because they did not have conclusive results from both a gonorrhea culture and a chlamydia PCR. The remaining 3885 patients (90%), 2184 men and 1701 women, were included. Our sample was similar to the sample in the original study and to the clinic populations in that patients were young (median age, 25 years), were members of racial or ethnic minority groups (59% black, 16% Hispanic, 20% white, and 6% other), had low income ($<5000/y in 43%), and were approximately equally distributed among the five clinics (Baltimore, 18%; Denver, 26%; Long Beach, 19%; Newark, 20%; and San Francisco, 18%).

Gonococcal and Chlamydial Infections among Study Participants

Of 2184 men, 19% (range, 8% to 31%) were infected with N. gonorrhoeae, 16% (range, 9% to 21%) were infected with C. trachomatis, and 4% were infected with both organisms (Table 1). Of 1701 women, 9% (range, 4% to 14%) were infected with N. gonorrhoeae, 15% (range, 6% to 20%) were infected with C. trachomatis, and 4% were infected with both organisms.

Patients Infected with N. gonorrhoeae

Among patients infected with N. gonorrhoeae, C. trachomatis was detected in 20% (CI, 16% to 24%) of 411 men and 42% (CI, 35% to 50%) of 151 women (Table 1). The prevalence of chlamydia among patients with gonorrhea varied among the five clinics, ranging from 10% to 31% among men and from 35% to 50% among women. Among patients with gonorrhea, chlamydia prevalence was higher among men younger than 25 years of age than among older men (27% vs. 13%; RR, 2.17 [CI, 1.42 to 3.31]) and higher among women younger than 25 years of age than among older women (54% vs. 20%; RR, 2.75 [CI, 1.54 to 4.94]). The higher prevalence among younger patients was consistent across all five clinics. Among patients with gonorrhea, women were twice as likely as men to be co-infected with C. trachomatis (42% vs. 20%; RR, 2.15 [CI, 1.64 to 2.82]), even after age group was considered (summary RR, 1.90 [CI, 1.46 to 2.48]).

Patients with Treatment Indications for C. trachomatis

Overall, 702 men (32%) and 619 women (36%) had treatment indications for chlamydia. Among these patients,

Table 1. Laboratory-Confirmed Gonorrhea and Chlamydia, by Sex, Study Site, and Age Group*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Gonorrhea</th>
<th>Chlamydia</th>
<th>Both</th>
<th>Chlamydia in Those with Gonorrhea</th>
<th>Total</th>
<th>Gonorrhea</th>
<th>Chlamydia</th>
<th>Both</th>
<th>Chlamydia in Those with Gonorrhea</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>n (%)</td>
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<td></td>
<td></td>
<td></td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All eligible</td>
<td>2184</td>
<td>411 (19)</td>
<td>345 (16)</td>
<td>81 (4)</td>
<td>20</td>
<td>1701</td>
<td>151 (9)</td>
<td>253 (15)</td>
<td>64 (4)</td>
<td>42</td>
</tr>
<tr>
<td>Site</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Baltimore, MD</td>
<td>414</td>
<td>117 (28)</td>
<td>51 (12)</td>
<td>12 (3)</td>
<td>10</td>
<td>268</td>
<td>37 (14)</td>
<td>48 (18)</td>
<td>13 (5)</td>
<td>35</td>
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<tr>
<td>Denver, CO</td>
<td>418</td>
<td>42 (10)</td>
<td>70 (17)</td>
<td>9 (2)</td>
<td>21</td>
<td>573</td>
<td>42 (7)</td>
<td>70 (12)</td>
<td>18 (3)</td>
<td>43</td>
</tr>
<tr>
<td>Long Beach, CA</td>
<td>389</td>
<td>54 (14)</td>
<td>81 (21)</td>
<td>17 (4)</td>
<td>31</td>
<td>367</td>
<td>32 (9)</td>
<td>73 (20)</td>
<td>13 (4)</td>
<td>41</td>
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<tr>
<td>Newark, NJ</td>
<td>531</td>
<td>164 (31)</td>
<td>102 (19)</td>
<td>37 (7)</td>
<td>23</td>
<td>242</td>
<td>30 (12)</td>
<td>47 (19)</td>
<td>15 (6)</td>
<td>50</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>432</td>
<td>34 (8)</td>
<td>41 (9)</td>
<td>6 (1)</td>
<td>18</td>
<td>251</td>
<td>10 (4)</td>
<td>15 (6)</td>
<td>5 (2)</td>
<td>50</td>
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<tr>
<td>Age</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>≤24 y</td>
<td>905</td>
<td>203 (22)</td>
<td>210 (23)</td>
<td>55 (6)</td>
<td>27</td>
<td>901</td>
<td>100 (11)</td>
<td>194 (22)</td>
<td>54 (6)</td>
<td>54</td>
</tr>
<tr>
<td>≥25 y</td>
<td>1279</td>
<td>208 (16)</td>
<td>135 (11)</td>
<td>26 (2)</td>
<td>13</td>
<td>800</td>
<td>51 (6)</td>
<td>59 (7)</td>
<td>10 (1)</td>
<td>20</td>
</tr>
</tbody>
</table>

* CA = California; CO = Colorado; MD = Maryland; NJ = New Jersey.

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C. trachomatis was detected in 28% of 596 men with non-
gonococcal urethritis and in 23% of 106 other men who were
sex partners of women with chlamydia, mucopurulent
cervicitis, or PID (Table 2). Among women, C. trachomatis
was detected in 22% of 166 sex partners of men with
chlamydia or nongonococcal urethritis and in 19% of 453
other women who received a diagnosis of mucopurulent
 cervicitis or PID. Overall, 27% of 702 men and 19% of
619 women with treatment indications for chlamydia were
actually infected with C. trachomatis.

Patients with Treatment Indications for N. gonorrhoeae
Among the 1482 men and 1082 women without treat-
ment indications for chlamydia, 410 (28%) and 154
(14%), respectively, had treatment indications for gon-
orrhea. Among men, C. trachomatis was detected in 19% of
361 men with gram-negative intracellular diplococci, 11% of
18 other men with gonorrhea-infected sex partners, and
13% of 31 other men with positive gonorrhea cultures
(Table 2). Overall, chlamydial infection was detected in 19%
(CI, 15% to 22%) of 361 men with treatment indica-
tions for gonorrhea who did not have other indications
for chlamydia treatment. The prevalence of chlamydia
among these men was more than 2.5 times the prevalence
among men without treatment indications for gonorrhea
or chlamydia (7%; RR, 2.58 [CI, 1.92 to 3.47]).

Among women, C. trachomatis was detected in 31% of
106 women with gonorrhea-infected sex partners and in
44% of 48 other women with positive gonorrhea cultures
(Table 2). Overall, 35% (CI, 28% to 43%) of 154 women
with treatment indications for gonorrhea but not chla-
mydia were infected with C. trachomatis. The prevalence of
chlamydia among these women was more than four times
the prevalence among women without treatment indica-
tions for either infection (9%; RR, 4.12 [CI, 3.05 to
5.57]). Surprisingly, it also exceeded the chlamydia preva-
ience among women treated for chlamydia because of ex-
posure to C. trachomatis or presence of signs and symptoms
consistent with chlamydial infection (19%; RR, 1.81 [CI,
1.38 to 2.37]).

The prevalence of chlamydia among patients with
 treatment indications for gonorrhea varied among the clin-
ic sites, ranging from 10% to 31% among men and from 18%
to 43% among women (Table 3). In the analysis of
patients with laboratory-confirmed gonorrhea, the preva-
ience of chlamydia was approximately two to three times
higher among younger patients than among older patients
with treatment indications for gonorrhea (for men vs.
women: RR, 2.10 [CI, 1.36 to 3.25] vs. 3.29 [CI, 1.67 to
6.45]). Among patients with treatment indications for gon-
orrhea, women were almost twice as likely to be infected

### Table 2. Chlamydia among Patients, by Mutually Exclusive, Hierarchical Treatment Indication*

<table>
<thead>
<tr>
<th>Treatment Indication</th>
<th>All Patients, n</th>
<th>Patients with Chlamydia, n (%)</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlamydia</td>
<td>702</td>
<td>192 (27)</td>
<td>3.81 (2.98–4.87)</td>
</tr>
<tr>
<td>NGU by Gram stain</td>
<td>596</td>
<td>168 (28)</td>
<td>3.92 (3.05–5.04)</td>
</tr>
<tr>
<td>Sex partner with chlamydia, MPC, or PID</td>
<td>106</td>
<td>24 (23)</td>
<td>3.15 (2.09–4.76)</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>410</td>
<td>76 (19)</td>
<td>2.58 (1.92–3.47)</td>
</tr>
<tr>
<td>Gram-negative intracellular diplococci</td>
<td>361</td>
<td>70 (19)</td>
<td>2.70 (2.00–3.65)</td>
</tr>
<tr>
<td>Sex partner with gonorrhea</td>
<td>18</td>
<td>2 (11)</td>
<td>1.55 (0.41–5.82)</td>
</tr>
<tr>
<td>Positive culture for Neisseria gonorrhoeae</td>
<td>31</td>
<td>4 (13)</td>
<td>1.80 (0.70–4.60)</td>
</tr>
<tr>
<td>Neither chlamydia nor gonorrhea</td>
<td>1072</td>
<td>77 (7)</td>
<td>1.00 (referent)</td>
</tr>
</tbody>
</table>

| **Women**            |                 |                               |                         |
| Chlamydia            | 619             | 120 (19)                      | 2.28 (1.75–2.97)        |
| Sex partner with chlamydia or NGU | 166 | 36 (22) | 2.55 (1.78–3.64) |
| Diagnosis of MPC or PID | 453 | 84 (19) | 2.18 (1.64–2.90) |
| Gonorrhea            | 154             | 54 (35)                       | 4.12 (3.05–5.57)        |
| Sex partner with gonorrhea | 106 | 33 (31) | 3.66 (2.57–5.21) |
| Positive culture for N. gonorrhoeae | 48 | 21 (44) | 5.14 (3.50–7.54) |
| Neither chlamydia nor gonorrhea | 928 | 79 (9) | 1.00 (referent) |

* For description of mutually exclusive, hierarchical treatment indications, see text (Methods, Definitions). MPC = mucopurulent cervicitis; NGU = nongonococcal urethritis; PID = pelvic inflammatory disease.

### Table 3. Chlamydia among Patients with Treatment Indications for Gonorrhea, by Sex, Study Site, and Age Group*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall Chlamydia Infected</th>
<th>Women Chlamydia Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>n</td>
<td>n (%)</td>
</tr>
<tr>
<td>All eligible</td>
<td>410</td>
<td>76 (19)</td>
</tr>
<tr>
<td><strong>Site</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td>123</td>
<td>13 (11)</td>
</tr>
<tr>
<td>Denver, CO</td>
<td>40</td>
<td>7 (18)</td>
</tr>
<tr>
<td>Long Beach, CA</td>
<td>49</td>
<td>15 (31)</td>
</tr>
<tr>
<td>Newark, NJ</td>
<td>168</td>
<td>38 (23)</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>30</td>
<td>3 (10)</td>
</tr>
<tr>
<td>≤24 y</td>
<td>202</td>
<td>51 (25)</td>
</tr>
<tr>
<td>≥25 y</td>
<td>208</td>
<td>25 (12)</td>
</tr>
</tbody>
</table>

* For description of mutually exclusive, hierarchical treatment indications, see text (Methods, Definitions). CA = California; CO = Colorado; MD = Maryland; NJ = New Jersey.
with *C. trachomatis* as were men (RR, 1.89 [CI, 1.41 to 2.54]). This finding persisted even after we stratified by age group (summary RR, 1.70 [CI, 1.27 to 2.27]).

**DISCUSSION**

Because of the changing epidemiology of STDs in the United States, we anticipated that the prevalence of chlamydia among patients treated for gonorrhea might have become low enough to reconsider universal co-treatment. These data suggest otherwise. Patients with laboratory-confirmed gonococcal infection were frequently co-infected with *C. trachomatis* (20% in men and 42% in women). More important, chlamydia was very common among patients with treatment indications for gonorrhea who would not, in the absence of co-treatment, have been treated for chlamydia (19% in men and 35% in women), particularly those younger than 25 years of age (25% in men and 47% in women). In fact, a clinical or epidemiologic indication for gonorrhea therapy was a surprisingly strong predictor of chlamydial infection, as strong a predictor of chlamydia for men and an even stronger predictor for women than common and more direct indicators (nongonococcal urethritis, mucopurulent cervicitis, PID, or chlamydia-infected sex partner).

All patients treated for gonorrhea in whom chlamydial infection has not been ruled out with highly sensitive tests should be co-treated for chlamydia. Differential patterns by race, ethnicity, income, or education are not appropriate criteria for treatment guidelines. Furthermore, although we studied heterosexual patients in STD clinics from 1993 through 1995, a high chlamydia prevalence has been found among other and more recent categories of patients with gonorrhea; testing for chlamydia is not sufficiently rapid, sensitive, and available to accurately identify the subset of patients treated for gonorrhea who are infected with chlamydia; and low prevalences of gonorrhea, chlamydia, or both in a specific setting may not predict low chlamydia prevalences among patients treated for gonorrhea.

Studies conducted more recently and in other settings have confirmed high rates of co-infection among most populations, supporting recommendations for co-treatment. A recent CDC study (25) enrolled patients in 1999–2000 from three of the five clinics participating in Project RESPECT (Denver, Long Beach, and Newark) according to a similar methodology; 22% of heterosexual men and 32% of women with *N. gonorrhoeae* infection were co-infected with *C. trachomatis* (Metcalf C. Unpublished data). In a British genitourinary clinic in 1998, 24% of heterosexual men and 39% of women with gonorrhea also had chlamydia (21). Among gonorrhea-infected women 15 to 24 years of age in the Regional Infertility Prevention Project in 2000, the median prevalence of chlamydia was 43% in family planning clinics across 20 states, 49.2% in prenatal clinics across three states, and 38% in STD clinics across 16 states (16). In a large health maintenance organization, chlamydial co-infection among gonorrhea-infected patients was diagnosed among 43% of women and 23% of men younger than 20 years of age, 29% of women and 8% of men between 20 and 25 years of age, and 22% of women and 5% of men older than 25 years of age (17). Among homosexual and bisexual men with gonorrhea who attended STD clinics, chlamydia was detected in 15% in San Francisco (19); 11% in Glasgow, Scotland (20); and 7% in London, England (21). In the past decade, high rates of co-infection have also been documented in emergency departments (10, 11), youth detention centers (7), and adolescent clinics (9, 12).

The lack of rapid testing for chlamydia and the poor sensitivity and availability of many chlamydia tests compromise the utility of diagnostic chlamydia testing for determining which patients treated for gonorrhea are infected with chlamydia. First, presumptive co-treatment makes sense for patients who are treated for gonorrhea on the basis of a determination made without laboratory testing (for example, because of an infected partner or a positive Gram stain), because many such patients may not return for chlamydia test results. Second, patients with a high pretest probability of chlamydial infection may still have chlamydia despite negative results on tests that are not highly sensitive. For instance, with a chlamydia test sensitivity of 65% for nonamplification tests (26) and a prevalence of 51% among young women treated for gonorrhea because of test results (as in this study; data not shown), 27% to 28% of young gonorrhea-infected women with a negative chlamydia test result would be infected with *C. trachomatis*. Although chlamydia testing is valuable for case ascertainment, follow-up, and partner notification, current chlamydia tests may be inadequate for determining which patients treated for gonorrhea require co-treatment for chlamydia.

Furthermore, overall prevalences of chlamydia, gonorrhea, or both at a clinic may not be reliable determinants of whether co-treatment is appropriate in that setting. Our study was not designed to identify predictors of co-infection at the clinic level because of the small numbers of clinics and of patients with co-treatment indications in some of the clinics. Nonetheless, we noted some preliminary findings. The clinics with higher overall chlamydia prevalence were, indeed, the clinics with the higher chlamydia prevalence among patients treated for gonorrhea, an association stronger for men than for women. The gonorrhea prevalence among men, which varied greatly across clinics, was unrelated to chlamydia prevalence among patients treated for gonorrhea. Most important, low overall prevalences do not necessarily imply low rates of co-infection, particularly for women. In San Francisco, with overall prevalences among women of 6% for chlamydia and 4% for gonorrhea, 18% of those with treatment indications for gonorrhea had chlamydia. Similarly, high rates of co-infection have been observed in settings that typically have low
gonorrhea and chlamydia prevalences, such as family planning clinics (16) and a health maintenance organization (17).

Although the overall chlamydia prevalence was similar among men (16%) and women (15%), chlamydia was substantially more prevalent among women infected with (42%) or treated for (35%) *N. gonorrhoeae* than among similar men (20% or 19%). The higher prevalence of chlamydia among gonorrhea-infected women compared with men has been reported elsewhere (14, 15, 17, 20, 21) and may have several explanations. First, because asymptomatic gonococcal and chlamydial infections are more common in women than in men (27), infections in women may be more likely to persist, providing a longer period during which a woman infected with one organism could acquire an infection with the other. Second, acquisition of infection by a woman or transmission from a man may be enhanced in the presence of co-infection. Third, as gonorrhea rates decline, women with gonorrhea may be those whose positions within sexual networks (28) place them at higher risk for exposure to *C. trachomatis*. In fact, across clinics in our study, the risk for chlamydia among women with gonorrhea compared with those without increased as gonorrhea prevalence decreased (data not shown). Co-infection, particularly in women, may represent a large proportion of infections in communities where prevalences are low. In part for this reason, the overall prevalences of chlamydia, gonorrhea, or both may not be reliable indicators of the prevalence of chlamydia among gonorrhea-infected patients.

Our study has several strengths. We demonstrated high chlamydia prevalence among patients treated for gonorrhea in five cities with geographic diversity and varying gonorrhea and chlamydia prevalences. Our large sample of patients infected with or treated for *N. gonorrhoeae* and the use of amplification tests for diagnosing chlamydia allowed a more valid estimate of chlamydia prevalence than previous studies (7–17). This is one of the first analyses in which chlamydia prevalence has been determined for clinically relevant groups of patients treated for gonorrhea, including patients with gonorrhea-infected sex partners.

Our study also has limitations. Although only 43% of eligible patients participated Project RESPECT, participants were similar in age, race, ethnicity, and education to those who declined participation (22). Participants were more likely than those who declined to be women, to have an STD at enrollment, and to have been previously tested for HIV infection (22). The first two differences are unlikely to affect our results regarding co-infection, since our data were stratified by sex and based on patients infected with or treated for gonorrhea. We may, however, have overestimated overall infection prevalences in the clinic populations. We cannot speculate on how differences in HIV testing history might affect our results. Taken together, we believe that our results regarding co-infection are representative of the clinic populations. We studied only heterosexual patients in STD clinics from 1993–1995; as discussed earlier, chlamydia is common among other groups of patients treated for gonorrhea more recently. The lack of consistent clinical criteria for the diagnoses of mucopurulent cervicitis and PID could have led to an over- or underestimation of chlamydia prevalence among patients treated for gonorrhea. Nonetheless, we believe that the use of the clinicians’ presumptive diagnoses reflects clinical practice and is unlikely to change meaningfully the prevalence of chlamydia among patients treated for gonorrhea.

Chlamydia remains common among patients infected with and treated for gonorrhea across a wide variety of settings. There may be some settings, subpopulations, and geographic areas in which the pattern of co-infection is lower than those reported here. In particular, more data are needed from primary care settings, older heterosexual men, and homosexual and bisexual men. However, unless studies in a specific site suggest otherwise, co-treatment remains an appropriate standard of care.

As infection prevalences and testing technology and availability change, chlamydia prevalence among patients treated for gonorrhea should be monitored. However, the stability of co-infection rates over time (4% to 48% among men and 16% to 63% among women during the 1970s and 1980s [29–53]; 9% to 50% among men and 24% to 67% among women from the mid-1990s to the present [7–21]) suggests that they may change more slowly than rates of gonorrhea or chlamydia. At least in STD clinics, chlamydia prevalence among gonorrhea-infected patients may be a suitable proxy for the more clinically relevant prevalence among patients treated for gonorrhea. As more accurate, less expensive, and rapid chlamydia tests emerge, they may affect the importance of co-treatment as a clinical and public health strategy. The high prevalences of chlamydia among men and women without treatment indicate for either gonorrhea or chlamydia (7% and 9%, respectively), even if slight overestimates, further underscore the value of research on the cost-effectiveness of various approaches for diagnosing and treating chlamydia.

Chlamydial infection remains common among patients at STD clinics who are treated for gonorrhea. Unless chlamydial infection has been ruled out with highly sensitive tests, co-treatment for chlamydia in all persons treated for gonorrhea remains an important and appropriate standard of care.

From Centers for Disease Control and Prevention, Atlanta, Georgia; San Francisco Health Department, San Francisco, California; Denver Public Health, Denver, Colorado; New Jersey Department of Health, Newark, New Jersey; California State University, Long Beach, California; and Baltimore City Health Department and Johns Hopkins University, Baltimore, Maryland.

Acknowledgments: The authors thank Carol Metcalf, MBChB, MPH, and Catherine Lindsey, MPH, for providing the data and conducting the analyses of chlamydial co-infection among gonorrhea-infected patients in
Chlamydia in Patients Treated for Gonorrhea

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RESPECT-2 (Denver, Colorado; Long Beach, California; and Newark, New Jersey, 1999–2000).

Grant Support: Project RESPECT was supported by CDC cooperative agreements.

Potential Financial Conflicts of Interest: Honoraria: J.M. Zenilman (Pfizer, Inc.); Stock ownership or options (other than mutual funds): J.M. Douglas (Pfizer, Inc.).

Requests for Single Reprints: Reprint Services, Office of Communications, National Center for HIV, STD, and TB Prevention, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Mailstop E-07, Atlanta, GA 30333.

Current author addresses and author contributions are available at www.annals.org.

References


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APPENDIX: THE PROJECT RESPECT STUDY GROUP

Baltimore, Maryland: Carolyn Erwin-Johnson, MA; Andrew L. Lentz, MPA; Mary A. Staat, MD, MPH; Dawn Sweet, PhD; Jonathan M. Zenilman, MD (Principal Investigator).

Denver: John M. Douglas Jr. (Principal Investigator); Tamara Hoxworth, PhD; Ken Miller, MPH; William McGill, PhD.

Long Beach, California: Ruth Bundy, PhD (Co–Principal Investigator); Laura A. Hoyt, MPA; C. Kevin Malotte, DrPH; Fen Rhodes, PhD (Principal Investigator).

Newark, New Jersey: Michael Latesta, MA; Eileen Napoli-tano (Co–Principal Investigator); Judy Rogers, MS; Ken Spitalny, MD (Principal Investigator).

San Francisco, California: Gail. A. Bolan, MD (Principal Investigator); Coleen LeDrew; Kimberly A.J. Coleman; Luna Hananel, MSW; Charlotte K. Kent, MPH.

NOVA, Inc., Bethesda, Maryland: Robert Francis, PhD (Principal Investigator); Christopher Gordon; Nancy Rosenshine, MA (Principal Investigator); Carmita Signes.

Centers for Disease Control and Prevention, Atlanta, Georgia: Sevgi Aral, PhD; Robert H. Byers, PhD; Beth Dillon, MSW, MPH; Martin Fishbein, PhD; Sandra Graziano, PhD; Mary L. Kamb, MD, MPH; William Killeen; James Newhall, PhD; Daniel Newman, MA; Thomas A. Peterman, MD, MSc; Karen L. Willis, RN.

Current Author Addresses: Dr. Lyss and Mr. Newman: Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-46, Atlanta, GA 30333.


Drs. Peterman, Douglas, and Newhall: Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-02, Atlanta, GA 30333.

Dr. Moran: Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-61, Atlanta, GA 30333.

Dr. Bolan: STD Control Branch, 1947 Center Street, Suite 201, Berkeley, CA 94704.

Ms. Ehret: Denver Public Health, 605 Bannock Street, Denver, CO 80204.

Mr. Latesta: Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-04, Atlanta, GA 30333.

Dr. Malotte: California State University, Long Beach, 5500 Atherton Street, Suite 400, Long Beach, CA 90815.

Drs. Zenilman and Gaydos: Johns Hopkins University School of Medicine, Ross Research Building, Room 1165, 720 Rutland Avenue, Baltimore, MD 21205.


Drafting of the article: S.B. Lyss, M.L. Kamb, C. Gaydos.


Obtaining of funding: M.L. Kamb, G. Bolan, J.M. Zenilman.

Administrative, technical, or logistic support: M.L. Kamb, T.A. Peterman, G. Bolan, J. Ehret, W.J. Newhall.