Rural Gonorrhea in the Southeastern United States: A Neglected Epidemic?

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Some rural counties in the southeastern United States are experiencing high rates of gonorrhea; however, existing knowledge of epidemiologic patterns of gonorrhea within communities is from urban areas. This paper describes the epidemiology of gonorrhea within a rural county of North Carolina and compares it with the patterns described for large cities. Data include gonorrhea reports from private physicians and the county health department from August 11, 1992, to August 10, 1993, and ethnographic interviews. The rate among males (1,602 cases per 100,000 person-years) was twice that among females. The risk of reinfection within 6 months of an initial infection (12.9%) was high compared with risks in urban settings. Although case numbers did not cluster by geographical area as described for some cities, case rates did. Factors favoring transmission in rural communities include greater poverty and fewer health care resources than in urban settings, the exchange of sex for crack cocaine, and a lack of anonymity that may cause some people to avoid seeking treatment or acknowledging risky sexual behaviors in a clinical setting. Addressing high rural rates will entail improving access to care, taking extra measures to ensure confidentiality, and dispelling the myth that high rates are limited to cities. Am J Epidemiol 1996;143:269-77.

gonorrhea; rural health; rural population; sexually transmitted diseases

The association between sexually transmitted diseases (STDs) and inner cities is well established. The 1982 Centers for Disease Control and Prevention surveillance statistics indicated that gonorrhea was reported in cities with populations greater than 200,000 at twice the rate of smaller cities and rural areas (1). The epidemiology of gonorrhea in urban settings has been characterized by the following: a minority of patients accounting for a disproportionately large number of cases through repeat infections, with more frequent reinfection among black people and those younger than 20 years old (2–7); a geographical clustering of cases into a few, contiguous, low income “core” census tracts, surrounded concentrically by “adjacent” and “peripheral” census tracts containing smaller numbers of cases (8–10); and a male to female ratio of cases increasing from parity in core census tracts to 1.3:1 in peripheral census tracts (8). Sex with street prostitutes and the exchange of sex for crack cocaine have been linked to gonorrhea transmission (11–15).

Gonorrhea rates have been declining nationally for the last two decades. By 1992, the rate in US cities was less than half the 1980 rate (16). Meanwhile, rates of gonorrhea and other STDs have increased in some smaller cities and rural areas. From 1991 to 1993 in North Carolina, the sex-, race-, and age-adjusted rates for both gonorrhea and syphilis in rural counties surpassed those in urban counties (17). Syphilis rates from 1986 to 1990 throughout the South increased most in rural counties (18). In 1985 in South Carolina, rural residence was identified as a risk factor for STDs (19). Even among large US cities (more than 200,000 population), median gonorrhea rates in 1992 were inversely related to population size (489.6, 385.6, and 285.2 cases per 100,000 person-years in the bottom, middle, and top tertiles, respectively) (16). Recently, high rates of acquired immunodeficiency syndrome and human immunodeficiency virus infection have also shifted to small cities and rural areas (20, 21).

In spite of these trends, the epidemiology of STDs within rural communities seldom has been studied. This is probably due to the following: the small populations of rural towns yielding small numbers of cases to study, even when rates are high; the location of most STD researchers and research facilities in large cities; and the stereotyping of rural life as being
"cleaner" and more wholesome than city life, resulting in the assumption that STDs are less likely.

The only epidemiologic information available to guide research priorities and prevention efforts in rural areas is that obtained in cities. But can urban findings be generalized to rural populations? Are demographic factors associated with rates of infection the same in urban and rural settings? Are rural cases distributed in a contiguous core with concentric, adjacent, and peripheral areas? Do repeat infections play the same role in the rural epidemiology? Moreover, what features of rural communities might affect STD rates?

To answer these questions, we have studied the epidemiology of STDs in a rural county of North Carolina. A "rural county" is one meeting the US Bureau of Census definition for a nonmetropolitan area. A metropolitan area is composed of a city with a population of at least 50,000, the county in which the city is located, and contiguous counties with which it is socially and economically integrated. Remaining counties are nonmetropolitan (22). Our study was part of the Sexually Transmitted Epidemic Prevention (STEP) Project and was conducted in a North Carolina county we refer to as STEP County. The dramatic increase in the recent rates of gonorrhea in STEP County are shown in figure 1. We describe here the epidemiology of gonorrhea in this county based on cases reported from August 11, 1992, to August 10, 1993, in addition to data from ethnographic interviews. We then draw comparisons with the epidemiology described for urban settings.

**MATERIALS AND METHODS**

STEP County, with a 1993 estimated population of approximately 67,000, is in the eastern portion of the state. About 37,000 live in the principal town, which is approximately 50 miles from a major urban area. The majority of residents are white; 38 percent are black. The Hispanic population, constituting less than 1 percent of the census, varies seasonally with the flow of migrant laborers. Major sources of economic activity are tobacco processing, light manufacturing (e.g., garments), and farming (more than 600 farms are located in the county) (23).

The county has 28 primary care physicians (family practice, internal medicine, obstetrics and gynecology, pediatrics) in private practices in addition to other hospital-based and specialty physicians. The 350-bed community hospital has an emergency room staffed by physicians 24 hours per day. During the period for which we report results, all physicians' offices were located in the principal town. Most of the practices use the hospital laboratory for diagnosis of STDs; a few use a private reference laboratory in another county. Diagnosed cases of gonorrhea are reported to the county health department. Private physicians reported an estimated 72 percent of all gonorrhea they diagnosed (24).

The public STD clinic, located in the principal town, operates 6 hours per day on weekdays and is staffed by nurses. During the period of study, all STD clinic clients were screened for gonorrhea (from the endo-
cervix of women and the urethra of men) if they were not in the clinic for reasons such as a pregnancy test, test of cure, human immunodeficiency virus test, or treatment after diagnosis in the family planning clinic. Specimens were incubated on Martin-Lewis media for 24–48 hours at 35.0°C in a 3–10 percent CO2 atmosphere in the on-site laboratory. Determination of the presence of *Neisseria gonorrhoeae* was based on Gram-negative diplococci in a Gram stain, characteristic colonial morphology in cultures, and a positive oxidase test. Patients diagnosed with gonorrhea were treated with 125 mg of ceftriaxone.

The proportion of cases experiencing a repeat infection within 6 months of their initial infection (the 6-month cumulative incidence of reinfection) was calculated for those initially diagnosed during the first 6 months of the study (through February 10, 1993). Infections diagnosed within 15 days of the first infection were considered failures in treatment for the initial infection rather than reinfection.

Cases diagnosed in non-county residents were excluded from the calculation of county rates. County population figures were projected for 1993 from the 1990 census by the North Carolina Office of State Planning (Log into North Carolina (LINC) online database, version 3.0, Raleigh, North Carolina, North Carolina State Data Center, 1993).

Cases with residences in the principal town were located on a census block group map. Mapping by block groups, which are subunits of census tracts, was more informative since there are 28 block groups in the town but only six census tracts. Because the town limits do not coincide with block group delineations, mapping within the town was limited to block groups completely within the town limits. We refer to these as town block groups. An estimated 7,450 people live inside the town limits but outside the 28 block groups; they comprise 20 percent of the population living in the town limits and 19 percent of the county population living outside the 28 town block groups. 1992 population estimates and demographic characteristics for block groups were provided by Claritas, Inc. (Arlington, Virginia). Following Rothenberg, core block groups were those, ranked by the number of cases, that contained half of the cases; adjacent block groups contained the next 30 percent, and the block groups with the final 20 percent of cases were peripheral (8).

Information about the county and practices among residents, including illegal behaviors such as prostitution and drug use, was obtained through ethnographic interviews, 1–2 hours in length, conducted individually with 20 clients in the public STD clinic. To obtain similar information from people who may avoid the STD clinic, we also interviewed 16 inmates in the county jail. Each respondent was paid $20. Interviews were taped and transcribed. Nota Bene text analysis software was used for data reduction. Interviews were coded for behavioral and social categories relevant to STDs. Responses receiving the same code were then read to identify major themes.

**RESULTS**

**Proportional morbidity**

During the 12-month period, there were 822 cases of gonorrhea (530 male, 292 female) reported in STEP County, including coinfections, repeat infections, and infections among nonresidents. Private physicians reported about one quarter (24.6 percent) of the cases. Privately reported cases were predominantly (65.4 percent) female; thus, nearly half (45.2 percent) of all female cases were reported by private clinics. The proportion of reported cases who were black or younger than 20 years of age did not vary appreciably between public and private sources.

During the year, there were 3,239 visits to the county STD clinic, of which 2,576 (79.5 percent) were eligible for our study and 2,508 (97.4 percent of those eligible) were tested for gonorrhea.

**Repeat infections**

The 822 cases reported in the county were diagnosed in 713 people: 87 people (12.2 percent) experienced more than one infection during the 1-year period. The 196 cases experienced by people repeatedly infected during the year were about one quarter (23.8 percent) of all gonorrhea cases in the county.

Among the 357 people diagnosed with gonorrhea during the first 6 months, 46 (12.9 percent) were again diagnosed with gonorrhea during the 6 months after the index infection. All but one of the repeaters were black; the risk of reinfection among blacks was 13.5 percent. Men were 1.8 times more likely than women to become reinfected; and compared with people 20 years of age or older, those younger than 20 were essentially equally likely to become reinfected (risk ratio = 1.1).

**Rates among county residents**

Forty-three (5.2 percent) of the infections were in non-county residents. The remaining results are reported only for county residents. Gonorrhea was reported at a rate of 1,156 cases per 100,000 person-years. The rate among blacks was 36 times that among whites (2,863 vs. 80 cases per 100,000 person-years).

The rate among men (1,602 cases per 100,000 person-years) was twice that among women (incidence
Among males, those aged 20–24 had the highest incidence (6,732 cases per 100,000 person-years). Females aged 15–19 experienced the highest rate among females (4,014 cases per 100,000 person-years) (figure 2). Their rate was less than that among men in this age group but was nearly five times that among women aged 20–64 years (incidence density ratio = 4.8).

Geographical distribution

Of the 779 cases of gonorrhea among county residents, 732 (94 percent) had addresses that could be mapped; 9 (1 percent) had only a post office box, and 38 (5 percent) had unusable address data. Of the mappable gonorrhea cases, 516 (70 percent) were in the 28 town block groups. The rate of mappable infections in the town block groups (1,746 cases per 100,000 person-years from 516 cases) was three times (incidence density ratio = 3.1) the rate in the remainder of the county (571 cases per 100,000 person-years from 216 mappable cases).

 Ranked by case numbers, seven of the 28 town block groups contained half (48 percent) of the gonorrhea cases in the town, making them core block groups; another seven were adjacent and 14 were peripheral (figure 3). The core block groups were not contiguous and did not form a concentric pattern. The male to female ratio of cases was not near parity in the core and was lowest in the adjacent block groups (1.8:1, 1.5:1, and 1.9:1 in the core, adjacent, and peripheral block groups, respectively).

Mapping gonorrhea by rates instead of case numbers, however, did reveal a pattern of contiguity and concentricity (figure 4). The seven block groups with the highest rates contained 209 of the mappable cases (among 4,867 people for a rate of 4,294 cases per 100,000 person-years) and 13 (42 percent) of the 6-month gonorrhea repeaters in the 28 town block groups. The rate of infection was correlated with block group median income ($R = 0.74, p < 0.01$) but not population density ($R = 0.27, p = 0.16$).

Ethnographic information

Three themes regarding gonorrhea transmission and STDs in general were prominent in the ethnographic interviews: 1) private physicians as a barrier to STD treatment, 2) lack of anonymity, and 3) the exchange of sex for drugs or money.

A number of low-income women who have had STDs remarked on the difficulty of getting an appointment with a private physician and how their visits to some private physicians were often brief. One woman's physician neglected to test her for an infection.

Several people underscored a lack of anonymity in the county, remarking that everyone in the town

![FIGURE 2. Age- and sex-specific gonorrhea rates in STEP County, North Carolina, August 11, 1992, to August 10, 1993. •, males; ■, females.](image-url)
FIGURE 3. Distribution of gonorrhea case numbers in the 28 block groups of the principal town of STEP County, North Carolina, August 11, 1992, to August 10, 1993. Block group categories: □, core; ■, adjacent; □, peripheral. See text for ranking of block groups, following Rothenberg (8).

People in the principal town described exchanging sex for drugs or money to buy drugs. Although some women acknowledged using heroin, the exchange of sex was mentioned only in the context of cocaine addiction. One person noted that drug dealers in the town were selling not only cocaine but also prescription drugs, such as penicillin.

DISCUSSION
Rates and proportions

The rate of reported gonorrhea in the principal town of this rural county was higher than that reported in 1992 for the city (Atlanta, Georgia) with the second highest rate in the nation (1,632 cases per 100,000 person-years). Richmond, Virginia, had the highest rate in the nation, with 1,806 cases per 100,000 person-years. The gonorrhea rate in the rural county that we studied was also six times the rate for New York City (298 cases per 100,000 person-years) (17).

The town rate is a conservative estimate since a proportion of the cases that could not be mapped probably belong in the town block groups. The high rate in STEP County may be due in part to more thorough reporting resulting from a significant proportion of cases diagnosed in the public clinic and relatively thorough reporting by private physicians (24). However, the rate in Seattle-King County, Washington, during a period of active laboratory surveillance in 1986 and 1987 was still only one fourth the rate in STEP County during this study (25). Moreover, the rate in STEP County in 1993 was higher than the rate in 1980 (figure 1) in contrast to decreasing rates since 1980 in US cities (16).

The gonorrhea rates were highest among black people and men. The 36-fold greater rate of gonorrhea for blacks compared with whites is 44 percent greater than the rate ratio of 25 observed in King County, Washington, but similar to the national rate ratio of 39 between non-Hispanic blacks and whites (16, 25). Although cases in women in STEP County were more likely than cases in men to be reported from private physicians, we do not have adequate data to judge the
degree to which biases in private physicians' failures to detect or report infections contribute to the high sex- and race-specific rate ratios.

Rothenberg attributed a 1.1:1 male to female case ratio in core census tracts of urban upstate New York to transmission from asymptomatically infected men (8). A high ratio, such as that in STEP County, could reflect greater underreporting of female cases, male homosexual activity, males having sex with prostitutes or women from another area, or a long duration of infection among women through asymptomatic infection or postponement of seeking care for an infection. Although an absence of street prostitutes is notable in STEP County, there is evidence for each of the other phenomena.

The proportions of infected people who are repeaters and cases experienced by people repeatedly infected in STEP County are similar to those reported in Indianapolis (15 percent of people infected and 21.6 percent of cases) (2). Cumulative incidences, in which each person is followed for a standard period of time, provide a clearer comparison than proportional morbidity measures. The 6-month risk of reinfection in STEP County was relatively high: 1.3 times the 6-month risk in Denver, Colorado (9.4 percent); higher than the 12-month risk in Schenectady, New York (9.7 percent); and similar to the 12-month risk in the state of Alaska (10–13 percent) (5–7).

Our cumulative incidence data indicate a greater risk of reinfection among blacks and males, but not among younger people. The proportional data from urban settings suggest a greater risk among blacks and younger people (usually less than 20 or 25 years of age) but among males only in some instances (2, 4, 5, 7). The relatively high risk of reinfection among men, including those aged 20 years or more, may be a factor contributing to the high rates of gonorrhea among men in STEP County.

Geographical patterns

We did not find the contiguous and concentric geographical pattern of cases demonstrated in a number of other cities (8–10). Although this different pattern could reflect in part the unique epidemiology of gonorrhea in a small town, it is more likely a result of limitations in mapping cases rather than rates. Since a case count, on which core mapping is based, does not take into account the underlying population size, sparsely populated geographical units are underrepresented even when they are experiencing high rates of infection. More generally, an emphasis on numbers of
cases rather than rates is probably one reason rural counties with high rates have been relatively unnoticed. In reporting STD surveillance data only for states and cities with populations greater than 200,000, the Centers for Disease Control and Prevention may inadvertently perpetuate the impression that STDs are a problem limited to big cities (16). A ranking of counties by rates would reveal a mix of urban and rural "hot spots."

The location of cases may be important when proximity is an issue. A case map can be used, for example, in deciding where to locate a clinic to minimize the average travel distance of those most likely to use it. While some have suggested that case maps also reflect clustering of sexual networks (9, 13), mapping networks with this technique may be less helpful in a small town where the entire town may approximate the size of a single city census tract. Moreover, there is probably much sexual mixing between the relatively small block groups.

Infection rates were highest in a cluster of contiguous, low-income block groups of the principal town. In contrast to observations in upstate New York and King County, Washington, population density was not related to the incidence (8, 25). Crowding does not facilitate sexual transmission as it does airborne transmission (26). Therefore, the relation between incidence and density in the two urban settings suggests that density may have been a proxy variable for income-related factors and that the relation between density and income is different in this rural county.

A comparison of the epidemiology of gonorrhea in STEP County with data from urban areas published within the last 20 years is summarized in table 1. Any differences in the epidemiology of gonorrhea between STEP County and a particular urban area studied 10 or more years ago could be attributable in part to trends in factors determining gonorrhea rates as well as urban-rural differences. When viewed altogether, the striking features in this rural county are the high rates, particularly among men, which may be driven in part by a relatively high risk of reinfection.

Factors contributing to high rural rates

Reasons for the high rates in this rural county include factors that are known to occur in urban settings but that may occur in different proportions in a rural community. These include the STD-related behaviors of individuals as well as social, economic, and institutional aspects of their environment. Data on the behaviors of STEP County public clinic clients are being analyzed.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>STEP County</th>
<th>Urban settings</th>
<th>Reference(s)</th>
</tr>
</thead>
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<tr>
<td>Proportional morbidity</td>
<td>1.8:1</td>
<td>1.1:1</td>
<td>8</td>
</tr>
<tr>
<td>Male to female ratio in <em>core</em> geographical areas</td>
<td>12.2</td>
<td>15</td>
<td>2</td>
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<tr>
<td>Repeat infections</td>
<td>23.8</td>
<td>21.6</td>
<td>2</td>
</tr>
<tr>
<td>Percentage of gonorrhea patients with repeat infections†</td>
<td>12.9</td>
<td>9.4</td>
<td>6</td>
</tr>
<tr>
<td>Greater risk among</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blacks</td>
<td>Yes</td>
<td>Yes</td>
<td>2–5</td>
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<tr>
<td>Males</td>
<td>Yes</td>
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<td>Younger people‡</td>
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<td>Yes</td>
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<td>Rate in 1992 relative to 1980</td>
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<tr>
<td>Black to white ratio</td>
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<tr>
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<td>25</td>
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<td>8–10</td>
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<td>Area rates correlated with population density</td>
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<td>Yes</td>
<td>8, 25</td>
</tr>
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* STEP, Sexually Transmitted Epidemic Prevention (Project). (STEP County is so named to protect the confidentiality of the community.)
† During a 12-month period.
‡ Cut points vary from 20 to 25 years of age.
In rural counties of North Carolina in 1990, unemployment was 44 percent greater and the proportion of the population in poverty was 60 percent more than in urban counties of the state. Because of the lower income relative to urban populations, fewer rural residents can afford health care; those who can afford it must choose from 30 percent fewer primary care physicians (23). Rural physicians maintain about the same number of office hours as urban physicians; however, they see more patients and thus spend less time with each patient (27). The brevity of a visit to a private physician in STEP County was noted by women we interviewed.

Additional factors at the time of the study may have affected the desire or ability of infected people to seek care quickly. Although 38 percent of the STEP County population is black and more than 90 percent of STDs are reported among blacks, no black physician practiced in the county. The absence of a clinician with whom a black patient could culturally identify may have discouraged some from seeking care or speaking forthrightly about their risk factors during a clinic visit (28). Also, the inability of some people to get an appointment in the public clinic resulted in prolonged infection. Recently, however, two black family physicians have opened a community health center, and the public clinic now accommodates walk-ins.

To these economic and institutional factors are added the use of cocaine and the exchange of sex for drugs, a practice that is likely to increase the frequency of sex without regard for the risk of receiving or transmitting an infection. Along with these exchanges described by residents, crack houses have been operating in rural STEP County in recent years (29). The exchange of sex for crack cocaine has been observed also in other rural communities (30).

One social reality of small towns is a lack of anonymity. A perceived inability to visit the clinic privately may lead some to postpone a visit until symptoms become too bothersome. A longer infection will increase the likelihood of sequelae and, if the infected person continues to have sex, can result in transmission to others. For antibiotic-resistant infections, an effort to avoid the clinic through self-treatment may only serve to prolong an infection and give the infected person a false sense that he or she is safe from transmitting infection to others. Reluctance in the clinic to acknowledge some sexual practices increases the chance that infection of some sites, such as the rectum, may remain undiagnosed.

Although other rural counties in the state also experience high rates of gonorrhea, the nature of rurality varies in different regions of the country. For this reason, the findings from this rural North Carolina county may not apply, for example, to rural populations in western states. Within North Carolina and perhaps elsewhere in the South, however, the high rates of STDs and the prevalence of cocaine in rural counties stand in contrast to the stereotype in the television series "Mayberry RFD" in which rural North Carolina was portrayed as quaint and far removed from the troubles of urban life. The first step toward addressing high rural rates is dispelling the myth that STDs are not a rural problem. Additional steps are likely to include enhancing employment opportunities and improving access to care, including care of high quality that is culturally sensitive and takes extra measures toward confidentiality to address the lack of anonymity in a rural community.

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