# Risk Factors for Repeated Gonococcal Infections: San Francisco, 1990–1992

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**Gonococcal (GC) infections are very common and are sustained by a core group of persons who often have repeated GC infections. Identifying individual risk factors for repeated GC infection is essential so that infection control programs can develop better strategies for decreasing the incidence of GC infection. A case-control study among high-risk persons found that being African American, having previous chlamydia infection, and having less than a high-school education were associated with repeated GC infections. Remarkably, measures of sexual behavior and access to health care were not associated with repeated GC infections. These findings suggest that among high-risk persons, the community prevalence of GC infection is more important in predicting risk for repeated GC infections than individual behavior. Interventions should include continued use of resources in high-prevalence communities and better understanding of the roles social and economic discrimination play in the risk for GC infections.**

In the absence of an effective vaccine, the prevention of gonococcal (GC) infections relies on identifying and treating infected persons and in modifying behaviors that place individuals at risk for GC infection. Despite existing prevention efforts, GC infections remain a significant problem in the United States and throughout the world [1, 2]. GC infections are among the most common of bacterial diseases, are frequently reacquired, and are sustained by a core group of persons who engage in high-risk behaviors and who have a high prevalence of infection [2–13]. Therefore, an increased understanding of risk factors, particularly behavioral risk factors, within the core group of persons with repeated GC infections is essential so that infection control programs can develop better strategies for decreasing the incidence of GC infection.

During the 1970s, studies defined the importance of repeated GC infections and described the demographic characteristics of persons who have repeated GC infections [3–9]. Factors associated with repeated infections included younger age, black race, being single, having less than a high school education, having a history of a previous sexually transmitted disease (STD), and having other concomitant STDs. The usefulness of some of these studies was limited in assessing currently important behavioral factors, such as partner selection and coupling dynamics, and in determining the role of access to health care because of study design or scope of data collection.

In 1990, during an increase in the number of cases of GC infection in San Francisco, we undertook a case-control study to identify patterns that might be associated with repeated GC infections. We assessed demographic and new behavioral factors, such as frequency, duration, and types of sexual partnerships; health-care utilization and perceived access; and illicit substance use. This report describes the results of that study.

## Methods

*Patients.* From August 1990 through June 1992, we prospectively examined the San Francisco City and County STD control database each day to identify new records of case-patients with repeated GC infections. A case of repeated GC infection was defined as a heterosexual patient age 15–24 years who was identified in the database with a current diagnosis of gonorrhea and either a history of gonorrhea within the past 2 years or a history at any time of pelvic inflammatory disease (PID) associated with gonococcal infection. Control-patients were selected from persons who were identified in the database with a current diagnosis of gonorrhea within 2 weeks of the date of diagnosis of the case-patient and who had no known history of gonorrhea. Recruiters were blinded to the case-control status of the patient. A disease-control investigator made up to three attempts to recruit patients into the study by letter, telephone, and field visits. Case-patient and control-patient

Received 13 August 1997; revised 23 December 1997.

This study was approved by the University of California, San Francisco, Committee on Human Research. Informed consent was obtained from all study participants.

Grant support: NIH AI-21912.

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**The Journal of Infectious Diseases 1998; 177:1766–9**

0022–1899/98/7706–0051$02.00

histories were confirmed by questioning the patient and examining individual patient medical records. Patients unable to be located or ineligible were replaced with the next available patient in the database. The demographic characteristics of case- and control-patients enrolled in the study were compared with the demographic characteristics of all cases from the STD control database during the same time period.

*Data collection.* Information about patient demographics, health, sexual behavior, and illicit substance use patterns was recorded during a private face-to-face interview by trained interviewers using a structured questionnaire. Questions about health-care access included frequency of medical visits, setting of provider, and medication usage. Data on sexual and drug use behavior were collected for patient and sex partners for the 2 months before the interview and for the patient's lifetime. Patients were asked to categorize their sex partners as (1) main or regular partners and (2) non-main or casual partners. Information about sex partner demographics, health, sexual behavior, and illicit substance use patterns was collected for each category of sex partner.

*Statistical methods.* Comparisons of cases and controls were done by $t$ and $\chi^2$ tests for association. Variables that were not normally distributed were also examined by the Mann-Whitney $U$ test. Fisher's exact test was used for contingency tables with cells smaller than 5 cases. $P < .05$ was considered statistically significant for bivariate comparisons.

Multivariate analysis involved the selection of all variables identified in the bivariate analysis as significantly distinguishing between groups at $P < .10$. To facilitate comparison between odds ratios, patients were classified by age as to whether they were older than the median of 20 years. Logistic stepwise regression with backward elimination was used to identify variables uniquely related to group membership at $P < .10$.

## Results

During the study period, 185 persons with newly diagnosed GC infection were enrolled: 94 had a history of previous GC infections and 91 had no prior history of GC infection. The mean age (±SD) of the study population was 20 (±2) years; 65% were male, 80% were African American, 7% were Hispanic, 5% were white, 1% were Asian, and 7% were classified as other. Most repeat cases (76%) had 1 previous infection; the maximum was 26. Demographic comparisons of study enrollees with all reported cases of GC infection in San Francisco County during this same period demonstrated that the demographics of the study population were similar. During the enrollment period, 2634 cases of GC infection were reported in San Francisco residents ages 15–24 years. Of these, 57% were male, 64% were African American, 11% were Hispanic, 11% were white, 3% were Asian, and 11% were other. Mean age (±SD) was 20 (±2.5) years.

Patients with repeated GC infections did not differ from patients with first-time GC infection with respect to any of the following variables: number of medical visits in the past year or 5 years, ability to identify a regular doctor, having a partner with an STD, being told by the health department they had been exposed to an STD, smoking, douching, number of years of sexual activity, number of lifetime sex partners, number of sex partners in the previous 2 months, frequency of having a new sex partner in the previous 2 months, frequency of condom use in the previous 2 months, frequency of condom use by any partner type (main or non-main partner) in their most recent sexual encounter, reporting intoxication during sex by any partner type in the previous 2 months, or receiving money for sex in the previous 2 months.

Patients with repeated GC infections were more likely to be African American but less likely to be employed or have a high school education (table 1). Patients with repeated GC infections were also more likely to report a history of chlamydia infection or another STD, including syphilis, chancroid, PID, nonspecific urethritis, mucopurulent cervicitis, trichomoniasis, venereal warts, and herpes, and were more likely to have received drugs for sex. Subanalysis revealed that of the 9 persons who reported receiving drugs for sex, 7 recalled that the drug was crack cocaine.

Cases and controls did not differ by age of their partner when the data were stratified by patient's sex. Cases and controls differed significantly, however, regarding the race of their partner, particularly a non-main partner. Patients who had repeated GC infections were more likely to identify their most recent partner as being of their own race than were patients with first-time GC infection ($P = .04$). Patients who had repeated GC infections were more likely to have African American partners (odds ratio = 2.3; 95% confidence interval, 1.1–4.7). However, when race of partner was stratified by patient's race, this was no longer statistically significant.

**Table 1.** Selected characteristics of study patients with and without repeated gonococcal (GC) infections, San Francisco, 1990–1992.

| Patient characteristic | Gonococcal infection % | | |
|---|---|---|---|
| | First-time ($n = 91$) | Repeated ($n = 94$) | $P$ |
| Demographics | | | |
| African American | 71 | 88 | .004 |
| Currently employed | 37 | 24 | .04 |
| ⩾High school education | 65 | 50 | .04 |
| Sexually transmitted disease (STD) history | | | |
| Ever having sex partner inform patient of STD | 22 | 33 | .09 |
| Report of prior chlamydia infection | 15 | 37 | .03 |
| Report of prior STD other than GC infection | 35 | 57 | <.001 |
| Reported receiving drugs for sex | 2 | 10 | .03 |
| Race | | | |
| Any partner African American | 36 | 56 | .01 |
| Non-main partner who is same as patient | 67 ($n = 57$) | 82 ($n = 68$) | .04 |

**Table 2.** Adjusted odds ratios (ORs) in the multivariate logistic regression model for repeat gonococcal infections, San Francisco, 1990–1992.

| Factor | Adjusted OR (95% confidence interval) |
|---|---|
| African American | 2.96 (1.29–6.77) |
| Completed high school | 0.47 (0.23–0.95) |
| Previous chlamydia infection | 2.94 (1.38–6.26) |

Multivariate analysis was used to identify factors associated with patients with repeated GC infections. Logistic regression analysis (table 2) indicated that patients with repeated GC infections were more likely to be African American and have had a previous chlamydia infection but were less likely to have completed high school.

## Discussion

The results of this study suggest that among high-risk persons, measures of sexual behavior, such as number of partners, number of new partners, years sexually active, and condom use, are not associated with repeated GC infections. In addition, no associations were found between measures of health care access (e.g., number of medical visits within the past year or past 5 years and being able to identify a regular provider) and having repeated GC infections. On the other hand, patients with repeated GC infections were more likely to be African American, to have a history of chlamydia infection, and to have not completed high school.

The lack of findings related to individual sexual behavior and the persistent association of African American race and lack of high school education with repeated GC infections in this study and others [4–6, 9, 11] underline the importance of community prevalence in a person's risk for repeated GC infections. The majority of subjects in this study were African American. African Americans in San Francisco are likely to be lower in economic status than whites, thus the findings that being African American increased the odds of repeated infections and higher education decreased the odds suggest that economic status and discrimination can play a part in the risk for repeated GC infections. Analysis of our results by race allowed for the identification of disadvantaged groups (African Americans who have increased rates of GC infection) and showed that the risk of reinfection is high in African Americans independent of specific sexual behaviors and utilization of health services.

Individuals are likely to choose partners who have characteristics similar to their own because of the increased likelihood that persons with similar sociodemographic characteristics will congregate in social situations where partnering might occur [11, 14, 15]. If a given community has an increased prevalence of infection, it follows that a person who has sex within this community will have an increased risk of infection and, in this study, increased risk of repeated GC infections.

The association of lack of high school education with repeated GC infections may suggest factors relating to sexual mixing, but it also could suggest economic and social limits that affect partner selection. Further study is needed to clarify this association. The association with previous chlamydia infection and repeated GC infections might be explained by sexual mixing within a group at high risk for STDs. In addition, previous chlamydia infection might be a marker for biologic susceptibility for GC infection.

This study was limited by several factors. The classification of case or control status relied on retrospective data obtained from self-report, provider records, and the STD control morbidity database. It is unlikely that cases were misidentified since case status depended on documented GC infection, but control status may have been misidentified by absence of documented GC infection or by a patient's unawareness of previous GC infection. This could have led to differential misclassification in which controls were more similar to cases and could have resulted in underestimates of the observed associations or an inability to find true associations. A second limitation was the relative homogeneity of the study population, which could have prevented the detection of other factors associated with repeated GC infections.

These findings add to those of previous studies showing that certain minority populations and those with less formal education are at increased risk for repeated GC infections [4–6, 9]. Our study indicates that areas for intervention should include continued targeting of prevention and control resources to African Americans in San Francisco and increased efforts to understand the roles that social and economic discrimination play in partner selection and individual risk for STDs.

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