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Abbreviations*

NCCDPHP	National Center for Chronic Disease Prevention and Health Promotion
NCEH	National Center for Environmental Health
NCEHIC	National Center for Environmental Health and Injury Control
NCID	National Center for Infectious Diseases
CIO	Centers/Institute/Offices
NCPS	National Center for Prevention Services
IHPO	International Health Program Office
EPO	Epidemiology Program Office
NIOSH	National Institute for Occupational Safety and Health

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Surveillance for Gonorrhea and Primary and Secondary Syphilis Among Adolescents, United States — 1981–1991

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Abstract

Problem/Condition: During the 1980s, an increasing proportion of adolescent women reported having had premarital sexual intercourse, thus potentially placing an increasing number of young persons at higher risk of acquiring a sexually transmitted infection.

Reporting Period Covered: To determine rates and examine trends of sexually transmitted infections among adolescents, we analyzed data for reported cases of gonorrhea and primary and secondary syphilis among 10- to 19-year-olds for 1981 through 1991.

Description of System: Summary data for cases of gonorrhea and primary and secondary syphilis that were identified and reported to state health departments were sent annually to CDC. These data included total number of cases by disease (gonorrhea, primary and secondary syphilis), sex, racial/ethnic group (white, not of Hispanic origin; black, not of Hispanic origin; Hispanic; Asian/Pacific Islander; or American Indian/Alaskan Native), 5-year age group, and source of report (public, private).

Results: From 1981 through 1991, 24%–30% of the reported morbidity from gonorrhea and 10%–12% of the reported morbidity from primary and secondary syphilis in the United States affected the adolescent age groups. Some of the highest rates of gonorrhea during that time period were among 15- to 19-year-olds. Gonorrhea rates among adolescents increased or remained unchanged from 1981 through 1991, while the rates among older age groups decreased. Although primary and secondary syphilis rates were lower among adolescents than older age groups, adolescents contributed to the epidemic of syphilis that occurred from 1987 through 1990. Differences in reported rates of both syphilis and gonorrhea among white, black, and Hispanic adolescents increased during the latter half of the 1980s.

Interpretation: Reporting biases could account for some the differences among rates for white, black, and Hispanic adolescents. However, if gonorrhea has been underreported for any racial group, the high rates of gonorrhea among 15- to 19-year-olds represented an underestimate of the true infection rate. Increases in sexual activity among adolescents and a lack of clinical services in settings convenient to adolescents could have contributed to the increasing rates of gonorrhea and syphilis among these young persons during this time period.

Actions Taken: If gonorrhea and other sexually transmitted infections are cofactors for facilitating the transmission of human immunodeficiency virus (HIV), the high incidence of gonorrhea in some locales among some populations of adolescents could

result in dramatic increases in HIV acquisition, a situation that demands attention from public health organizations.

INTRODUCTION

During the 1980s, an increasing proportion of adolescent women reported that they engaged in premarital sexual intercourse (*1*). Consequently, an increasing number of adolescents were at a higher risk of acquiring a sexually transmitted infection during that time period. To determine rates and examine trends of sexually transmitted infections among adolescents, we analyzed data for reported cases of gonorrhea and primary and secondary syphilis among 10- to 19-year-olds for 1981 through 1991.

METHODS

Summary data for cases of gonorrhea and primary and secondary syphilis that were identified and reported to state and local health departments from 1981 through 1991 were sent annually to CDC. These data included total number of cases by disease (gonorrhea, primary and secondary syphilis), sex, racial/ethnic group (white, not of Hispanic origin; black, not of Hispanic origin; Hispanic; Asian/Pacific Islander; or American Indian/Alaskan Native), 5-year age group, and source of report (public or private). The data were analyzed by race/ethnicity so that specific groups can be targeted for prevention efforts. The data were reported from all 50 states and the District of Columbia and from six large metropolitan areas in the United States (New York City, Philadelphia, Baltimore, Chicago, San Francisco, and Los Angeles).

Age-, race/ethnicity-, and sex-specific rates were calculated by using estimates of the population for 1981–1989 and data from the 1990 census for 1990 and 1991 (*2,3*). For calculation of regional rates of gonorrhea, states were grouped into four regions of the United States as defined by the Bureau of the Census: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); and West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming).

For the purposes of this analysis, any persons in the 10- to 14-year-old and the 15- to 19-year-old age groups were considered adolescents.

RESULTS

Gonorrhea

From 1981 through 1991 (and previously), gonorrhea was the most frequently reported sexually transmitted disease in the United States. Approximately 24%–30% of the reported morbidity from gonorrhea during that time period was in the adolescent age groups. In 1991, some of the highest reported rates of gonorrhea were among 15- to 19-year-olds (Table 1). Specifically, the gonorrhea rate among 15- to 19-year-old females in 1991 was 1,043.6 cases per 100,000 population, and the rate among 15- to

TABLE 1. Rates* of gonorrhea,† by sex and age — United States, 1981–1991

	Year										
	1981	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
Males											
10–14	**23.0**	**21.4**	**20.8**	**23.0**	**29.8**	**28.7**	**29.3**	**34.1**	**33.5**	**31.0**	**32.4**
15–19	**868.4**	**874.6**	**854.9**	**818.1**	**924.1**	**935.5**	**883.4**	**904.6**	**952.7**	**950.3**	**882.6**
20–29	1,576.6	1,561.1	1,371.2	1,232.8	1,323.0	1,246.9	1,063.8	992.1	955.1	897.7	779.6
≥30	221.8	226.4	189.8	169.6	190.8	193.6	182.7	183.3	191.3	169.1	145.5
All Ages	573.3	572.2	506.1	458.0	497.6	480.8	424.4	406.6	402.6	371.1	327.2
Females											
10–14	**65.6**	**63.9**	**69.3**	**78.2**	**94.6**	**105.8**	**95.1**	**92.8**	**99.1**	**102.3**	**99.2**
15–19	**1,253.7**	**1,254.3**	**1,218.9**	**1,195.4**	**1,362.1**	**1,371.7**	**1,203.8**	**1,133.5**	**1,148.2**	**1,177.4**	**1,043.6**
20–29	940.1	939.7	874.4	824.8	901.8	890.8	775.8	711.5	697.9	692.7	595.0
≥30†	54.0	56.1	50.5	49.5	54.8	57.9	53.9	55.7	53.8	54.8	47.5
All Ages	356.0	353.0	329.5	313.6	343.8	341.9	296.2	273.7	266.0	263.0	229.6

*Per 100,000 population.
†Excludes cases from Georgia, Idaho, and Indiana for 1983, from Maryland for 1982–1983, from Massachusetts for 1983 and 1990, from New York for 1983–1984, and from Tennessee for 1984.

19-year-old males was 882.6. Gonorrhea rates among adolescent females were consistently higher than the rates for adolescent males during the 11-year period.

Over the surveillance period, gonorrhea rates decreased among all age and sex groups except 10- to 14-year-old males, 10- to 14-year-old females, and 15- to 19-year-old males. The rates for these groups in 1991 were, respectively, 41%, 51.2%, and 1.6% higher than in 1981. Although overall increases in gonorrhea rates were observed for these groups, different patterns of reported disease morbidity were observed for whites, blacks, and Hispanics. Specifically, gonorrhea rates decreased slightly among 10- to 14-year-old white and Hispanic males from 1987 through 1991, but increased among black males during that time period (Figure 1). Similarly, the gonorrhea rate among 15- to 19-year-old white and Hispanic males decreased steadily from 1985 through 1991, but the rate increased among black males (Figure 2). Among 10- to 14-year-old females, gonorrhea rates increased for both black and Hispanic females from 1987 through 1991, while the rates decreased for white females during that same time period (Figure 3). In addition, even though the overall rates of gonorrhea among 15- to 19-year-old females decreased during the decade, race/ethnicity-specific analyses indicated that the decrease occurred only among white and Hispanic females (Figure 4). Gonorrhea rates among 15- to 19-year-old black females remained relatively unchanged during the 11-year period.

In all regions of the United States in 1991, some of the highest rates of gonorrhea were among 15- to 19-year-olds. Gonorrhea rates among 15- to 19-year-old whites were highest in the South (325.0 cases per 100,000 population for white females and 124.4 cases per 100,000 population for white males) (Table 2). Rates among Hispanic 15- to 19-year-olds were highest in the Northeast. Specifically, in the Northeast the rates for Hispanics were reported as 749.3 cases per 100,000 population for females and 720.7 per 100,000 population for males. The reported gonorrhea rate for blacks was high in all regions of the country. In 1991, depending on the region, the proportions with infections were approximately 3.5%–7.3% among 15- to 19-year-old black females and 4.0%–7.0% among 15- to 19-year-old black males.

Primary and Secondary Syphilis

From 1981 through 1991, approximately 10%–12% of the reported primary and secondary syphilis morbidity was from the adolescent age groups. The rates for 10- to 14-year-old males were the lowest among all age groups (Table 3). Specifically, the rates ranged from 0.3 to 0.6 cases per 100,000 population during this 11-year period. From 1981 through 1991, rates of primary and secondary syphilis among 15- to 19-year-old males were similar to the rates among males ≥30 years of age. For example,

TABLE 2. Gonorrhea rates* for 15- to 19-year-olds, by region, race/ethnicity, and sex — United States, 1991

Region	White		Black		Hispanic		Total population	
	Male	Female	Male	Female	Male	Female	Male	Female
Northeast†	41.8	136.5	7,061.6	7,325.6	720.7	749.3	516.3	701.1
South§	124.4	325.0	5,677.1	5,080.4	228.7	329.3	1,378.3	1,427.7
Midwest	82.4	264.8	6,012.6	5,790.8	74.7	119.0	897.6	1,149.6
West	61.3	209.0	3,956.5	3,569.6	230.7	231.6	365.0	485.3

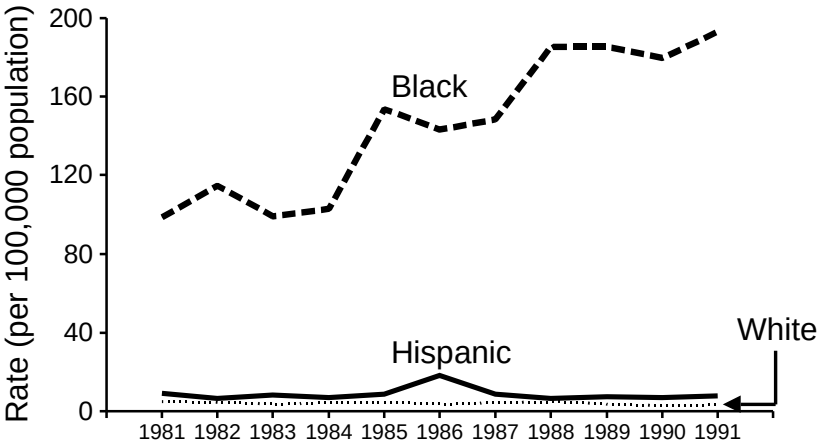
*Per 100,000 population.
†Excludes cases from New York.
§Excludes cases from Kentucky and Maryland.

TABLE 3. Rates* of primary and secondary syphilis,† by sex and age — United States, 1981–1991

	Year										
	1981	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
Males											
10–14	**0.6**	**0.5**	**0.6**	**0.4**	**0.4**	**0.6**	**0.3**	**0.3**	**0.4**	**0.5**	**0.4**
15–19	**20.0**	**21.6**	**18.5**	**15.9**	**13.7**	**14.5**	**15.5**	**15.8**	**18.8**	**20.5**	**18.1**
20–29	56.4	59.9	53.9	46.3	43.9	42.3	49.4	49.8	52.1	53.8	44.8
≥30	16.5	17.9	16.0	14.0	13.7	13.7	17.6	19.9	22.7	23.9	19.6
All Ages	24.1	25.9	23.3	20.2	19.2	18.9	22.7	24.0	26.4	27.5	22.8
Females											
10–14	**1.3**	**1.5**	**1.6**	**1.2**	**1.3**	**1.3**	**1.8**	**1.8**	**2.2**	**3.1**	**2.5**
15–19	**18.4**	**19.0**	**17.7**	**16.5**	**15.8**	**16.7**	**22.5**	**27.4**	**30.9**	**38.4**	**35.0**
20–29	19.2	21.6	22.0	19.9	20.4	23.1	32.7	41.1	49.0	53.9	46.4
≥30	2.8	3.2	3.3	3.1	3.3	3.5	5.2	6.5	8.2	10.4	9.3
All Ages	7.6	8.3	8.3	7.6	7.7	8.4	11.8	14.5	17.2	20.0	17.6

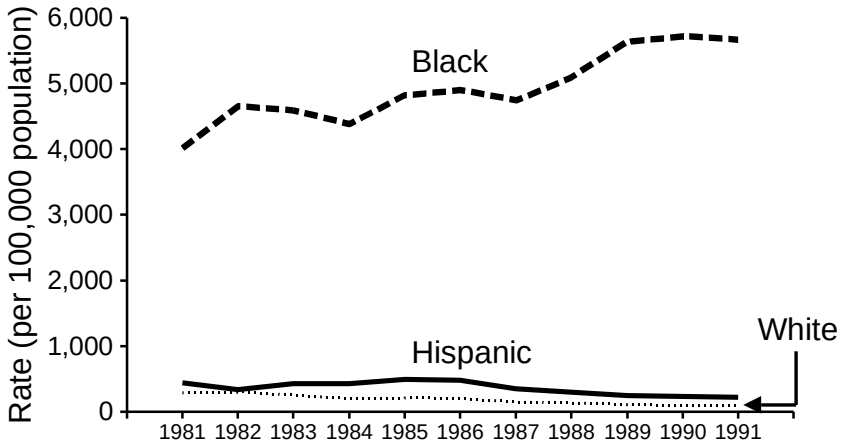
*Per 100,000 population.
†Excludes cases from New York for 1983–1984 and from Tennessee for 1984.

FIGURE 1. Rates of gonorrhea among 10- to 14-year-old males, by race/ethnicity — United States, 1981–1991



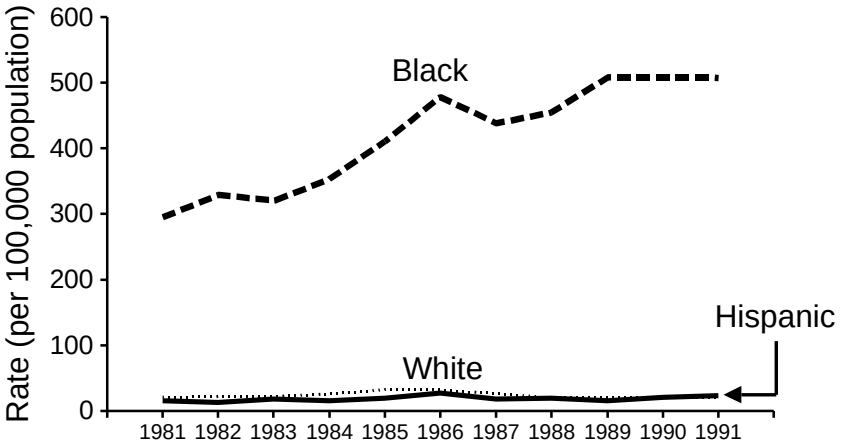
Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

FIGURE 2. Rates of gonorrhea among 15- to 19-year-old males, by race/ethnicity — United States, 1981–1991



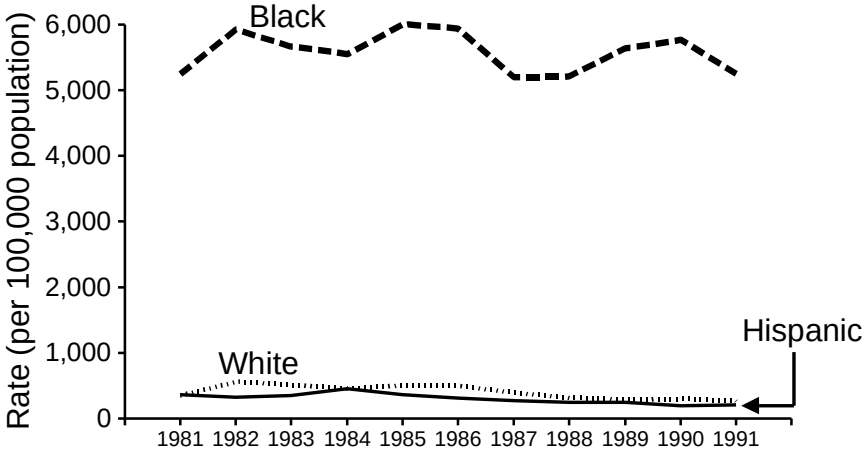
Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

FIGURE 3. Rates of gonorrhea among 10- to 14-year-old females, by race/ethnicity — United States, 1981–1991



Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

FIGURE 4. Rates of gonorrhea among 15- to 19-year-old females, by race/ethnicity — United States, 1981–1991



Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

the rate among 15- to 19-year-olds in 1991 was 18.1 cases per 100,000 population, compared with the rate of 19.6 for males ≥30 years of age. Although rates of primary and secondary syphilis were highest among 20- to 29-year-old males throughout this period, rates among 15- to 19-year-old males rose 41% in the last half of the decade, contributing to the overall 21% increase in syphilis rates among males that occurred from 1987 through 1990.

Primary and secondary syphilis rates among 15- to 19-year-old females were lower than the rates among 15- to 19-year-old males from 1981 through 1983. However, rates among females increased 112% from 1984 through 1991. By 1991, the primary and secondary syphilis rate for 15- to 19-year-old females (35 cases per 100,000 population) was almost twice the rate for 15- to 19-year-old males. Similarly, the primary and secondary syphilis rate among 10- to 14-year-old females increased 108% from 1984 through 1991. The rates for 10- to 14-year-old females were approximately 2–3 times those for 10- to 14-year-old males from 1981 through 1986, but were more than 5.5 times the rates for males from 1987 through 1991. Primary and secondary syphilis rates for adolescent females were much higher in 1991 than 1981, reflecting the dramatic increase in syphilis among females of all ages in the latter half of the 1980s.

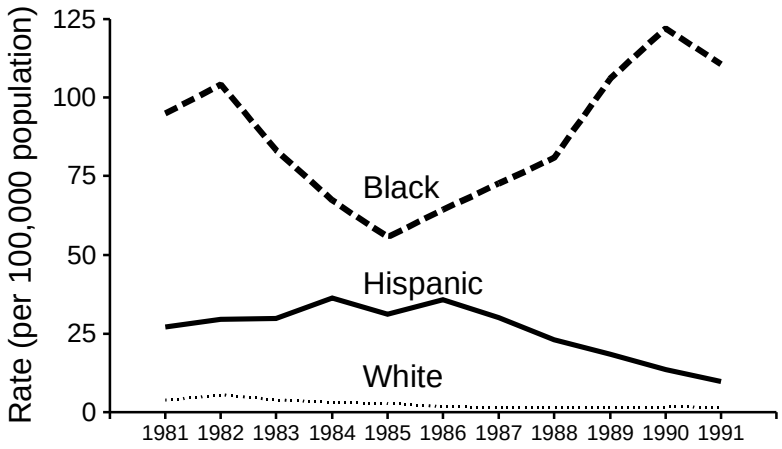
Differences in race/ethnicity-specific primary and secondary syphilis rates among 15- to 19-year-olds increased steadily from 1986 through 1991 (Figure 5). For example, in 1985 the primary and secondary syphilis rate for 15- to 19-year-old black males was almost twice the rate for Hispanic males and 20 times higher than the comparable rate for white males. By 1991, the rate for 15- to 19-year-old black males was 11 times higher than the rate for Hispanic males and 85 times higher than the rate for white males. The increase in these ratios resulted from a decrease in rates for 15- to 19-year-old white and Hispanic males from 1986 through 1991 and an increase in rates for 15- to 19-year-old black males during this time period.

Similarly, although primary and secondary syphilis rates increased from 1986 through 1990 for white, black, and Hispanic 15- to 19-year-old females, differences in race/ethnicity-specific rates also increased during this time period (Figure 6). Specifically, rates for black females increased more than 150% from 1986 through 1990 compared with increases of <50% in the other racial/ethnic groups.

DISCUSSION

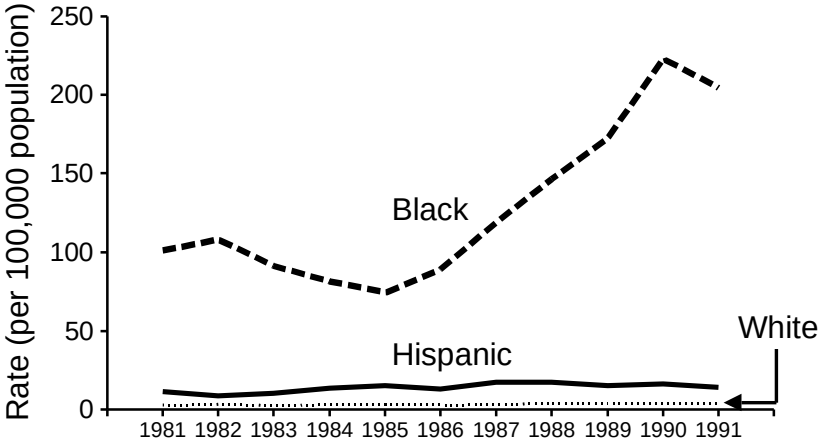
During the period 1981 through 1991, 24%–30% of the reported morbidity from gonorrhea and 10%–12% of the reported morbidity from primary and secondary syphilis in the United States were from the adolescent age groups. Although gonorrhea rates among older age groups decreased during this 11-year period, gonorrhea rates among adolescents increased or remained unchanged, with rates among adolescent females consistently higher than rates among adolescent males. In 1991, some of the highest rates of gonorrhea were among 15- to 19-year-olds, specifically, 882.6 cases per 100,000 population for males and 1,043.6 cases per 100,000 population for females. Although primary and secondary syphilis rates were lower in adolescents than in older age groups, adolescents contributed to the epidemic of syphilis that occurred from 1987 through 1990. Differences in reported rates of both syphilis and gonorrhea among white and Hispanic and black adolescents increased during the latter half of the 1980s.

FIGURE 5. Rates of primary and secondary syphilis among 15- to 19-year-old males, by race/ethnicity — United States, 1981–1991



Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

FIGURE 6. Rates of primary and secondary syphilis among 15- to 19-year-old females, by race/ethnicity — United States, 1981–1991



Excludes cases from Connecticut for 1984--1986, from the District of Columbia for 1984, from Florida for 1981 and 1983--1985, from Georgia for 1983, from Idaho for 1983, from Illinois for 1982--1984, from Indiana for 1983, from Kentucky for 1986--1991, from Maryland for 1982--1983 and 1989--1991, from Massachusetts for 1983 and 1990, from Michigan for 1984--1985, from Nebraska for 1982--1986, from New Jersey for 1982--1985 and 1990, from New York for 1981--1991, from Tennessee for 1984, from Virginia for 1982--1985, and from Wisconsin for 1982--1985.

Reporting biases could account for some of these results. Specifically, reporting from public clinics is more comprehensive than reporting from private health-care sources (*4*). Thus, syphilis and gonorrhea rates may have been underestimated for persons more likely to use private clinics. Such underreporting could explain some, but probably not all of the differences among rates for white, black, and Hispanic adolescents. Such differences in risk among racial/ethnic groups may reflect social, economic, behavioral, or other factors, rather than race/ethnicity directly. If gonorrhea has been underreported for any race/ethnicity-sex group, the already high rates of gonorrhea for 15- to 19-year-olds would represent an underestimate of the true infection rate in the total population.

The increasing rates of gonorrhea and syphilis among adolescents from 1981 through 1991 are consistent with findings of an increase in the proportion of adolescent women who reported having had premarital sex during the 1980s (*1*). Furthermore, first sexual experiences occurred at younger ages during this time period. Early initiation of sexual intercourse is associated with an increased number of sex partners and thus, a greater risk of sexually transmitted infections. However, the increase in the proportion of adolescent women having premarital sex and the decrease in the age at first sexual experience occurred to a greater extent in white women, while the increases in gonorrhea and syphilis rates occurred to a greater extent in black women.

In some studies condom use was shown to increase among sexually active adolescents during the 1980s. Those studies also indicated that fewer than half of the adolescents who used condoms did so all the time (*5*). Inconsistent use of condoms in high-risk settings could have increased the risk of acquiring a sexually transmitted infection and could have accounted for some of the increasing rates among adolescents.

A lack of available clinical services in settings that are convenient to adolescents could have hindered secondary prevention of sexually transmitted infections during the 1980s (*5*). More specifically, care is particularly fragmented for adolescents, and a lack of readily accessible services could have resulted in increases in the amount of time between exposure to an infection, awareness of the symptoms, and diagnosis and treatment. Furthermore, health professionals may not be likely to address issues of sexually transmitted infections or sexuality among adolescents. All these factors could have led to longer periods of untreated infection and consequently to increased transmission of sexually transmitted diseases among adolescents.

If left untreated, gonorrhea will lead to pelvic inflammatory disease (PID). However, many of the other consequences of sexually transmitted infections in adolescent women occur later in life (*5*). Acute PID increases a woman's risk of recurrent PID, chronic pelvic pain, infertility, and ectopic pregnancy. Thus, strategies to prevent these adverse reproductive outcomes must address the health-care, educational, and risk-reduction needs of adolescents. Such strategies require an understanding of how to influence sexual and health-care-seeking behavior. In addition, prevention programs must ensure that those providing health care to adolescents are adequately trained and that they sufficiently appreciate the need to recognize, diagnose, and treat sexually transmitted infections among these young patients and their partners. The high rates of gonorrhea and other sexually transmitted infections among adolescents can be decreased through prevention program activities that promote greater awareness, proper diagnosis and treatment, and follow-up of sex partners. Better measures of PID

and other adverse consequences of sexually transmitted infections should be developed and monitored to further ensure that these prevention program activities successfully decrease complications from sexually transmitted infections in adolescents.

Finally, some studies suggest that infection with gonorrhea—and possibly other sexually transmitted infections—may be a cofactor for facilitating the heterosexual transmission of human immunodeficiency virus (HIV) (*6*). If this is the case, the incidence of gonorrhea in some locales among some populations of young adults may result in dramatic increases in HIV acquisition, a possibility that demands attention from public health organizations and other providers of health care.

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Surveillance for Primary and Secondary Syphilis — United States, 1991

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Abstract

Problem/Condition: From 1986 through 1990, an epidemic of syphilis occurred throughout the United States. In 1991, the number of reported cases of primary and secondary (P&S) syphilis in the United States declined for the first time since 1985.

Reporting Period Covered: To examine how this decline reflected sex-specific, race/ethnicity-specific, and regional patterns of syphilis morbidity, we analyzed data for syphilis cases reported to CDC from 1984 through 1991.

Description of System: Summary data for cases of syphilis reported to state health departments were sent quarterly and annually to CDC. The quarterly data from each state included total number of syphilis cases by sex, stage of disease (primary, secondary, early latent, and late latent), and source of report (public or private). The annual data from each state included total number of P&S syphilis cases by sex, racial/ethnic group (white, not of Hispanic origin; black, not of Hispanic origin; Hispanic; Asian/Pacific Islander; or American Indian/Alaskan Native), 5-year age group, and source of report.

Results: The decline in both the number and rate of reported syphilis cases in 1991 occurred in every racial group in the United States and in both sexes. This decline also occurred in every region of the United States except the Midwest, where the total P&S syphilis rate increased 37.3% from 1990 through 1991. Despite the increase in syphilis rates in the Midwest, the highest rates of P&S syphilis in 1991 were reported from the South.

Interpretation: The reasons for the decline in syphilis are unclear. No data exist to conclusively identify which STD control program activities affected the level of syphilis morbidity or to what extent those activities may have contributed to the decline. Changes in drug use and limited immunity to *Treponema pallidum* may have accounted for some of the decrease in syphilis incidence. Higher levels of poverty in the South and poor access to health-care services associated with poverty probably contributed to continued high levels of disease transmission in the South.

Actions Taken: Better evaluation of STD control program activities will be necessary to help determine the most effective strategies for preventing and controlling syphilis in different high-risk populations.

INTRODUCTION

From 1986 through 1990, an epidemic of syphilis occurred throughout the United States. In 1990, more than 50,000 cases of primary and secondary (P&S) syphilis were reported, the highest number of cases since 1948. However, in 1991, the number of reported cases of P&S syphilis in the United States declined for the first time since

1985. A total of 42,943 cases of P&S syphilis were reported, representing a 15% decline from the number of cases reported in 1990. The purpose of this analysis is to a) examine how this decline reflected different sex-specific, race/ethnicity-specific, and regional patterns of syphilis morbidity; b) discuss possible reasons for the decline; and c) identify where the highest rates of syphilis occurred in 1991.

METHODS

Summary data for cases of syphilis reported to state health departments from 1984 through 1991 were sent quarterly and annually to CDC. The quarterly data from each state included total number of syphilis cases by sex, stage of disease (primary, secondary, early latent, and late latent), and source of report (public, private). The annual data from each state included total number of P&S syphilis cases by sex, racial/ethnic group (white, not of Hispanic origin; black, not of Hispanic origin; Hispanic; Asian/Pacific Islander; or American Indian/Alaskan Native), 5-year age group, and source of report (public or private). Data were analyzed by race/ethnicity so that prevention efforts can be targeted for the needs of specific groups.

P&S rates were calculated by using estimates of the population for 1984 through 1989, as well as data from the 1990 census for 1990 and 1991 (*1,2*). To compute regional rates of P&S syphilis, states were grouped into the four regions of the United States as defined by the Bureau of the Census: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); and West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming).

TABLE 1. Number of reported primary and secondary (P & S) syphilis cases and rates,* by sex — United States, 1986–1991

Year	Number of reported cases			P&S syphilis rate			Male-to-female rate ratio
	Total	Male	Female	Total	Male	Female	
1984	28,607	20,576	8,031	12.1	17.9	6.6	2.7
1985	27,131	18,994	8,137	11.4	16.4	6.7	2.4
1986	27,667	18,782	8,885	11.5	16.1	7.2	2.2
1987	35,585	22,785	12,800	14.7	19.3	10.3	1.9
1988	40,474	24,616	15,858	16.6	20.7	12.6	1.6
1989	45,826	27,052	18,774	18.6	22.5	14.8	1.5
1990	50,578	28,490	22,088	20.3	23.5	17.3	1.4
1991	42,943	23,594	19,311	17.3	19.5	15.1	1.3

*Per 100,000 population.

RESULTS

In 1991, 42,943 cases of P&S syphilis were reported to CDC (Table 1). That number represented a 15% decrease from the 50,578 cases reported in 1990 and the first decrease since 1985. The rate of P&S syphilis in the United States also declined from 20.3 cases per 100,000 population in 1990 to 17.3 in 1991. The male-to-female P&S rate ratio decreased steadily from 1984 through 1991, reflecting the larger percentage increase in rates among females during the epidemic period and the smaller percentage decrease in rates among females from 1990 through 1991.

In 1991, the male-to-female P&S rate ratio was highest among Hispanics (1.7), intermediate among whites (1.5), and lowest among blacks (1.3) (Table 2). The P&S syphilis rates for all race/ethnicity-sex groups were lower in 1991 than in 1990. However, the P&S rates among blacks continued to be much higher than the rates among whites and Hispanics. Specifically, the 1991 P&S syphilis rate among blacks was approximately 10 times higher than the rate among Hispanics and more than 60 times higher than the rate among whites.

Early latent syphilis rates declined somewhat less than P&S syphilis rates from 1990 through 1991 (Table 3). Specifically, early latent syphilis rates declined 2.7% from 22.3 cases per 100,000 population in 1990 to 21.7 in 1991. Early latent syphilis was more common among females than males (22.4 cases per 100,000 population in females vs. 20.9 in males). Consequently, rates of all early syphilis (primary, secondary, and early latent) were almost the same for males and females.

The 1991 P&S syphilis rates were lower than the 1990 rates in all regions of the United States except the Midwest (Table 4). In the Midwest, the 1991 total P&S syphilis rate of 10.3 per 100,000 population was 37.3% higher than the 1990 rate of 7.5. From 1990 through 1991, the total P&S syphilis rate decreased 32.6% in the Northeast, 11%

TABLE 2. Primary and secondary syphilis rates,* by race/ethnicity and sex — United States,† 1990–1991

	White		Black		Hispanic	
Gender	1990	1991	1990	1991	1990	1991
Total	2.6	2.0	140.1	121.4	15.0	12.3
Males	3.3	2.4	162.9	138.2	20.1	15.5
Females	2.0	1.6	119.8	106.5	9.7	9.1
Male-to-Female Ratio	1.6	1.5	1.4	1.3	2.1	1.7

*Per 100,000 population.
†Excludes data from Kentucky for 1990 and 1991.

TABLE 3. Early syphilis rates,* by stage and sex — United States, 1990–1991

	Primary/secondary		Early latent		All early	
Gender	1990	1991	1990	1991	1990	1991
Total	20.3	17.3	22.3	21.7	42.6	38.9
Male	23.5	19.5	21.3	20.9	44.8	40.3
Female	17.3	15.1	23.2	22.4	40.6	37.5
Male-to-Female Ratio	1.4	1.3	0.9	0.9	1.1	1.1

*Per 100,000 population.

in the South, and 41.6% in the West. Despite the increase in P&S syphilis in the Midwest and the decrease in all other regions, the South continued to have the highest rates of syphilis in 1991. Specifically, the 1991 P&S syphilis rate in the South of 30.0 cases per 100,000 population was almost twice the rate in the Northeast, almost three times the rate in the Midwest, and 4.5 times the rate in the western region of the United States.

In 1991, the highest rates of P&S syphilis were reported from states in the South: Louisiana (70.0 cases per 100,000 population), Mississippi (48.0), Georgia (45.6), South Carolina (43.8), and Alabama (39.4) (Table 5). Approximately 81% of the states in the South had P&S rates higher than the Year 2000 objective of 10 cases per 100,000 population, compared with 44% of the states in the Northeast, 33% of the states in the Midwest, and no states in the West. In 1991, the highest rates in the Northeast were reported from New York (21.3 cases per 100,000 population), the highest rates in the Midwest from Illinois (21.4), and the highest rates in the West from Arizona (9.1) and California (9.0).

DISCUSSION

The 42,943 cases of P&S syphilis reported in 1991 represented the first decline in the number of reported syphilis cases since 1985. This decline in both the number and rate of reported syphilis occurred in every race/ethnicity-sex group in the United States. The decline was observed in every region of the United States except the Midwest, where the total P&S syphilis rate increased 37.3% from 1990 through 1991. Despite the increase in syphilis rates in the Midwest, the highest rates of P&S syphilis in 1991 were reported from the South.

These findings are consistent with previous analyses of the regional trends in syphilis in the United States in the latter half of the 1980s (*3*). The biggest declines in P&S rates were in the West, where the epidemic occurred earlier (beginning in 1986 and peaking in 1987) and where rates were below the pre-epidemic level by 1991. In contrast, in the Midwest, where the epidemic began later (1988), rates continued to increase in 1991. The 1991 decrease in P&S rates in the South and Northeast represented the first decreases since the epidemic began in those regions in 1987.

The reasons for the current decline in syphilis rates are unclear. A renewed priority and increased resources were given to syphilis control programs after the epidemic was recognized in the mid-1980s. The activities of STD control programs during the epidemic period included traditional approaches such as partner notification, as well as alternative approaches, including an emphasis on risk reduction through counseling and education and targeted screening and prevention efforts in specific

TABLE 4. Primary and secondary syphilis rates,* by region and sex — United States, 1990–1991

	Total rates		Male rates		Female rates	
Region	**1990**	**1991**	**1990**	**1991**	**1990**	**1991**
Northeast	22.4	15.1	26.0	17.7	19.0	12.7
South	33.7	30.0	38.2	33.3	29.4	26.8
Midwest	7.5	10.3	8.9	11.7	6.1	8.9
West	11.3	6.6	14.1	7.9	8.5	5.3

*Per 100,000 population.

TABLE 5. Number of reported primary and secondary syphilis cases and rates,* by region and state — United States, 1991

Region, state	Number of reported cases	Rate
Northeast	**7,677**	**15.1**
Connecticut	455	13.8†
Maine	5	0.4
Massachusetts	492	8.2
New Hampshire	20	1.8
New Jersey	1,085	14.0†
New York	3,830	21.3†
Pennsylvania	1,731	14.6†
Rhode Island	57	5.7
Vermont	2	0.4
South§	**25,597**	**30.0**
Alabama	1,594	39.4†
Arkansas	895	38.1†
Delaware	194	29.1†
Florida	2,723	21.0†
Georgia	2,954	45.6†
Kentucky	112	3.0
Louisiana	2,955	70.0†
Maryland	1,013	21.2†
Mississippi	1,234	48.0†
North Carolina	2,006	30.3†
Oklahoma	215	6.8
South Carolina	1,526	43.8†
Tennessee	1,507	30.9†
Texas	5,005	29.5†
Virginia	871	14.1†
West Virginia	29	1.6
Midwest	**6,172**	**10.3**
Illinois	2,446	21.4†
Indiana	196	3.5
Iowa	68	2.4
Kansas	202	8.2
Michigan	1,303	14.0†
Minnesota	68	1.6
Missouri	572	11.2†
Nebraska	18	1.1
North Dakota	0	0.0
Ohio	657	6.1
South Dakota	1	0.1
Wisconsin	641	13.1†
West	**3,497**	**6.6**
Alaska	7	1.3
Arizona	334	9.1
California	2,669	9.0
Colorado	80	2.4
Hawaii	10	0.9
Idaho	7	0.7
Montana	6	0.8
Nevada	63	5.2
New Mexico	31	2.0
Oregon	89	3.1
Utah	10	0.6
Washington	185	3.8
Wyoming	6	1.3

*Per 100,000 population.
†Above the Year 2000 Objective of 10 cases per 100,000 population.
§Includes the District of Columbia.

communities and for specific populations (*4–6*). However, no data exist to conclusively identify which of these STD control program activities affected the level of syphilis morbidity or to what extent those activities may have contributed to the decline.

A change in some underlying factor may have affected disease transmission and contributed to the observed decline in syphilis. For example, drug use, in particular crack cocaine use, was found in a number of studies to be associated with an increased risk of sexually transmitted infections (*7–9*). Drug use appeared to mediate high-risk behaviors such as the exchange of sex for drugs or money. Thus, a decline in crack cocaine use or a change in patterns of its use could have resulted in a decline in these high-risk behaviors and a consequent decline in syphilis morbidity.

Little is known about why primary and secondary syphilis rates in the South have continued to be highest among all regions of the United States. Several studies have indicated that poverty is highly correlated with syphilis rates (*10–13*). Historically, among the four regions of the United States, the South has had a disproportionately large share of the population with incomes below the poverty level. More than 38% of the total U.S. population below the poverty level lived in the South in 1991 (*14*). The poor often have reduced access to health-care services and use them less, which in turn leads to delays in treatment and longer durations of untreated infection (*15*). These factors probably contributed to continued high levels of disease transmission in the South.

Although syphilis declined in the United States in 1991, incidence remains high in minority populations and in the South and has continued to increase in the Midwest. In addition, the prevalence of untreated infection will remain high in reproductive-aged women after incidence has begun to decline, leading to continuing high risk for congenital syphilis. If STD programs are to meet the challenge of reducing the continued high rates of syphilis in these populations in the 1990s, STD control program activities must be better evaluated. More specifically, meaningful measures of program activity that can be correlated with disease trends will assist in determining the most effective strategies for preventing and controlling syphilis in different high-risk populations.

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An Evaluation of Surveillance for *Chlamydia trachomatis* infections in the United States, 1987–1991

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Abstract

Problem/Condition: Chlamydia is the most common sexually transmitted bacterial pathogen in the United States; however, no precise data on the prevalence and incidence of chlamydia infection are available because currently no comprehensive national surveillance system exists for chlamydia. Despite the absence of such a system, states do report numbers of male and female chlamydia cases to CDC on a quarterly basis.

Reporting Period Covered: This report summarizes and reviews the chlamydia surveillance data received by CDC from 1987 through 1991.

Description of System: Summary data on cases of chlamydia reported to state health departments were sent quarterly to CDC in Atlanta, Georgia. The quarterly data from each state included total number of chlamydia cases by sex and by source of report (public, private).

Results: From 1987 through 1991, the number of states with legislation mandating reporting of chlamydia increased twofold. The reported chlamydia rate from those states also doubled during the same time period, from 91.4 cases per 100,000 population in 1987 to 197.5 cases per 100,000 population in 1991.

Interpretation: This twofold increase in the rate of chlamydia reported to CDC did not represent a doubling in chlamydia prevalence or incidence during this time period. Instead, the increase resulted from the increase in the number of states with reporting laws and from the initial attempts of those states to identify and report diagnosed chlamydia infections.

Actions Taken: More accurate measures of the number of chlamydia infections and of trends in the chlamydia infection rate are needed to justify, develop, and evaluate public health programs to control chlamydia infections. An outline of possible surveillance activities for local communities is presented.

INTRODUCTION

Chlamydia is the most common sexually transmitted bacterial pathogen in the United States (*1,2*). Chlamydia infections are a major cause of infant pneumonia and neonatal conjunctivitis and of pelvic inflammatory disease and subsequent tubal infertility and ectopic pregnancy in women (*3*). Although the prevalence of genital chlamydia among women has been reported to range from 8% to 40% (*4*), no precise

data for the prevalence and incidence of chlamydia infection are available because currently no comprehensive national surveillance system exists for chlamydia. A combination of factors has affected our ability to establish a national chlamydia surveillance program and to analyze and interpret chlamydia surveillance data: a) a lack of inexpensive, widely available diagnostic tests for chlamydia, b) a large percentage of asymptomatic infections that can only be detected through active screening programs, c) limited resources to support active screening programs, d) a lack of public health laws in all states requiring that health-care providers and laboratories report cases, and e) a lack of resources in local areas to manage and report information on the large number of chlamydia infections. The absence of a nationwide surveillance system for chlamydia has necessitated the use of nongonococcal urethritis as a surrogate in monitoring trends in chlamydia infections and the use of gonorrhea case counts to estimate the number of chlamydia infections each year (*1,5*).

Despite the absence of a comprehensive national chlamydia surveillance system, states do report numbers of chlamydia cases among males and females to CDC on a quarterly basis. The following report summarizes and reviews the data received by CDC from 1987 through 1991.

METHODS

The surveillance case definition for chlamydia involves a laboratory-based diagnosis, namely: a) isolation of *C. trachomatis* by culture or b) demonstration of *C. trachomatis* in a clinical specimen by antigen detection methods (*6*). Summary data on cases of chlamydia reported to state health departments from 1987 through 1991 were sent quarterly to CDC in Atlanta, Georgia. The quarterly data from each state included total number of chlamydia cases by sex and by source of report (public, private). Rates of chlamydia infection were calculated by using estimates of the population for 1987 through 1989 and data from the 1990 census for 1990 and 1991 rates (*7,8*).

The status of chlamydia reporting legislation was ascertained through a telephone survey of sexually transmitted disease programs in each state. Data were included in this analysis only from those states that had legislation requiring chlamydia reporting, and only for those years in which legislation was effective for the entire 12 months of the year (Table 1). No legislation requiring chlamydia reporting was effective for at least a 1-year period from 1987 through 1991 in the District of Columbia and in the following states: Alabama, Alaska, Arkansas, Colorado, Florida, Louisiana, Maryland, Michigan, Mississippi, New York, Nevada, Pennsylvania, Utah, and West Virginia.

To compute regional rates of chlamydia, we grouped states into the four regions of the United States as defined by the Bureau of the Census: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, Rhode Island, Vermont); South (Delaware, Georgia, Kentucky, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia); Midwest (Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); and West (Arizona, California, Hawaii, Idaho, Montana, New Mexico, Oregon, Washington, Wyoming).

TABLE 1. States with legislation mandating chlamydia reporting and years in which legislation was effective for entire 12 months — United States, 1987–1991

State	Years in which legislation was effective				
	1987	1988	1989	1990	1991
Arizona	■	■	■	■	■
California				■	■
Connecticut				■	■
Delaware				■	■
Georgia	■	■	■	■	■
Hawaii					■
Idaho	■	■	■	■	■
Illinois			■	■	■
Indiana		■	■	■	■
Iowa	■	■	■	■	■
Kansas	■	■	■	■	■
Kentucky	■	■	■	■	■
Maine	■	■	■	■	■
Massachusetts	■	■	■	■	■
Minnesota	■	■	■	■	■
Missouri	■	■	■	■	■
Montana	■	■	■	■	■
Nebraska	■	■	■	■	■
New Hampshire	■	■	■	■	■
New Jersey					■
New Mexico			■	■	■
North Carolina	■	■	■	■	■
North Dakota			■	■	■
Ohio	■	■	■	■	■
Oklahoma		■	■	■	■
Oregon		■	■	■	■
Rhode Island		■	■	■	■
South Carolina			■	■	■
South Dakota		■	■	■	■
Tennessee	■	■	■	■	■
Texas		■	■	■	■
Vermont					■
Virginia				■	■
Washington		■	■	■	■
Wisconsin	■	■	■	■	■
Wyoming	■	■	■	■	■

RESULTS

In 1987, only 18 states had legislation requiring chlamydia reporting (Figure 1). By 1991, the number of states with such legislation had increased to 36. Likewise, the reported chlamydia rate from those states with reporting legislation also increased more than twofold during the same time period, from 91.4 cases per 100,000 population in 1987 to 197.5 cases per 100,000 population in 1991.

In 1991, 28 (78%) of the 36 states with legislation requiring chlamydia reporting reported chlamydia infection rates above the year 2000 objective of 170 cases per 100,000 population (Table 2). The highest reported rates of chlamydia were in the midwestern and western regions of the United States. Specifically, the reported rate of chlamydia was 233.4 cases per 100,000 in the Midwest (117,550 cases), 210.3 in the West (96,791 cases), 177.1 in the South (92,367 cases), and 133.8 in the Northeast (28,011 cases).

Reported chlamydia rates for women far exceeded those for men in the United States during the period 1987 through 1991 (Table 3). Furthermore, although the reported chlamydia rates for men increased only slightly during this time period, the reported rates among women increased 106%. Specifically, the reported rate among women in 1987 was 138.0 cases per 100,000 population, 3.3 times higher than the reported rate among males of 41.9 cases per 100,000 population. By 1991, the reported rate among females was approximately six times higher than the rate reported for males (281.2 cases per 100,000 population vs. 47.7 cases per 100,000 population).

FIGURE 1. Number of states with legislation requiring chlamydia reporting and reported rates of chlamydia infection — United States, 1987–1991

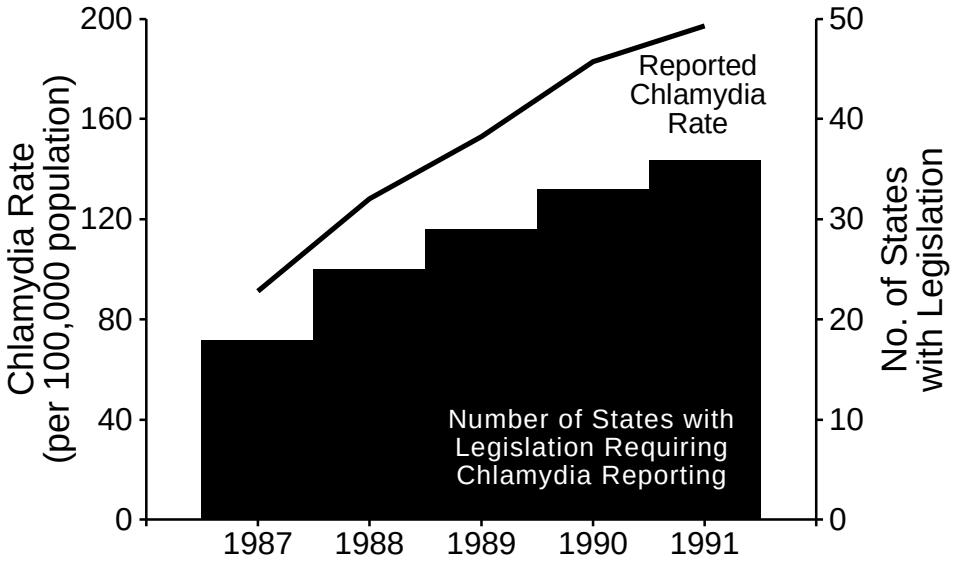

TABLE 2. Reported cases and rates* of chlamydia, by region and state — United States, 1991

Region, state	Number of reported cases	Reported chlamydia rate
Northeast	**28,011**	**133.8**
Connecticut	7,840	238.5†
Maine	2,698	219.7†
Massachusetts	10,898	181.1†
New Hampshire	1,929	173.9†
New Jersey	1,716	22.2
Rhode Island	2,071	206.4†
Vermont	859	152.6
South	**92,367**	**177.1**
Delaware	882	132.4
Georgia	7,284	112.4
Kentucky	5,524	149.9
North Carolina	11,502	173.5†
Oklahoma	4,036	128.3
South Carolina	5,700	163.5
Tennessee	5,360	109.9
Texas	32,560	191.7†
Virginia	19,519	315.5†
Midwest	**117,550**	**233.4**
Illinois	21,826	190.9†
Indiana	11,897	214.6†
Iowa	6,638	239.1†
Kansas	6,786	273.9†
Minnesota	8,184	187.1†
Missouri	10,800	211.1†
Nebraska	3,336	211.4†
North Dakota	1,324	207.3†
Ohio	32,235	297.2†
South Dakota	2,150	308.9†
Wisconsin	12,374	253.0†
West	**96,791**	**210.3**
Arizona	11,243	306.7†
California	51,191	172.0†
Hawaii	3,260	294.2†
Idaho	2,418	240.2†
Montana	2,177	272.4†
New Mexico	4,676	308.6†
Oregon	7,325	257.7†
Washington	13,299	273.3†
Wyoming	1,202	265.0†

*Per 100,000 population.
†Above Year 2000 objective of 170 cases per 100,000 population.

TABLE 3. Comparison of cases and rates* of chlamydia among males and females — United States, 1987–1991

Year	Males		Females		Female-to-male ratio
	Cases	Rate	Cases	Rate	
1987	13,531	41.9	47,295	138.0	3.3
1988	21,306	43.1	109,026	209.3	4.9
1989	25,544	43.9	157,271	256.8	5.8
1990	36,172	46.1	214,733	262.9	5.7
1991	39,534	47.7	243,276	281.2	5.9

*Per 100,000 population.

DISCUSSION

The twofold increase in the rate of chlamydia reported to CDC from 1987 through 1991 did not represent a doubling in chlamydia prevalence or incidence during that time period. Instead, this increase resulted from the increase in the number of states with reporting laws and the initial attempts of those states to identify and report diagnosed chlamydia infections. Likewise, the higher reported rates of chlamydia in the Midwest and the West reflected the substantial resources that were committed to organized screening programs in those regions in the mid- to late 1980s (*9,10*). The higher reported rates of chlamydia for women from 1987 through 1991 may have reflected the increased detection of asymptomatic infection in women through screening. The lower rates in men suggested that many of the sex partners of women with chlamydia infection were not diagnosed, treated, or reported during this period.

More accurate measures of the number of chlamydia infections and trends in the chlamydia infection rates are needed to justify, develop, and evaluate public health programs to control chlamydia infections. To encourage reporting of chlamydia infections by laboratories and health-care providers, every state should have reporting laws requiring that identified chlamydia infections be reported to appropriate boards of health (*11*). However, as much as 25% of men and 70% of women with chlamydia infections may be asymptomatic (*4*). Thus, periodic expanded screening efforts must be initiated to better estimate the prevalence of chlamydia infections in local communities. Such screening efforts should be carried out in a variety of settings, e.g., prenatal clinics, family planning clinics, sexually transmitted disease clinics, adolescent health clinics, correctional facilities and detention centers, hospital emergency departments, student health centers, neighborhood health centers or health maintenance organizations, or drug treatment centers. The prevalence of chlamydia infections in the local communities can then be estimated from the number of persons tested and the number of those persons with positive test results. In addition, these expanded screening efforts could be instrumental in identifying persons with asymptomatic infections who continue to contribute to the transmission of chlamydia infections in a community (*10*).

To better monitor secular trends in the chlamydia infection rate, ongoing, universal screening should be conducted within a small number of clinic populations (sentinel surveillance sites) in local communities (*11*). Data should be collected not only on the number of persons tested and the number with positive results in these sentinel sites, but also on the demographic characteristics and selected risk factors of all screened patients. Those data will then allow public health officials to estimate disease frequency, determine secular trends, and focus prevention programs by identifying those at high risk for the disease. Furthermore, monitoring secular trends in these sentinel sites should assist programs in evaluating their chlamydia prevention efforts. For example, decreases in the prevalence of chlamydia infection in these sites could indicate movement from prevalent to incident disease detection or a true decline in the rate of disease transmission due to routine screening, appropriate treatment, or partner notification.

The establishment of better chlamydia surveillance programs in local areas is a crucial first step in being able to more accurately estimate the number of chlamydia infections in the United States each year and to monitor disease trends. Improved chlamydia detection programs, in particular active screening programs in high-risk populations, are even more critical to preventing chlamydia infections and decreasing

the $2 billion health-care costs associated with chlamydia infections in the United States annually (*12*).

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Sentinel Surveillance for Antimicrobial Resistance in *Neisseria gonorrhoeae* — United States, 1988–1991

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Abstract

Problem/Condition: The prevalence of antimicrobial resistance in *Neisseria gonorrhoeae* in the United States has been increasing since the mid-1970s.

Description of System: The Gonococcal Isolate Surveillance Project (GISP) was established in 1986 to monitor trends of antimicrobial resistance in *N. gonorrhoeae*. GISP is a sentinel surveillance system consisting of 26 publicly funded sexually transmitted disease clinics and five regional laboratories. At each clinic, urethral isolates are obtained from the first 20 men diagnosed with gonorrhea each month; these isolates are shipped to one of the regional laboratories, where the susceptibilities of the organisms to a panel of antibiotics are determined.

Reporting Period Covered: This report describes the results of surveillance for antimicrobial resistance in *N. gonorrhoeae* from January 1991 through December 1991. These results are compared with data obtained from January 1988 through December 1990.

Results and Interpretation: In the 1991 GISP sample, 32.4% of isolates were resistant to penicillin or tetracycline. The proportions of isolates with high-level, plasmid-mediated resistance to penicillin, tetracycline, or both drugs have increased significantly ($p < 0.001$) in the GISP sample during 1988–1991. No documented clinical treatment failures have been related to decreased susceptibility of *N. gonorrhoeae* to either ceftriaxone or ciprofloxacin, which belong to the classes of antibiotics currently recommended for gonococcal therapy.

Action Taken: Because of the demonstrated ability of *N. gonorrhoeae* to develop resistance to antimicrobial agents, surveillance to guide therapy recommendations will be continued.

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INTRODUCTION

Although the overall reported incidence of gonorrhea has been decreasing since the mid-1970s in the United States, antimicrobial resistance in *Neisseria gonorrhoeae* has been increasing during the same period (*1*). Antimicrobial resistance in *N. gonorrhoeae* can be mediated by plasmid or chromosomal mechanisms and may occur to a single antimicrobial agent or to multiple agents (*2*). Strains with plasmid-mediated resistance include penicillinase-producing *N. gonorrhoeae* (PPNG), which produces a penicillin-cleaving β-lactamase. This enzyme makes PPNG strains resistant to all penicillins and first-generation cephalosporins but does not affect their susceptibility to second- and third-generation cephalosporins. Strains with plasmid-mediated resistance to tetracyclines are termed tetracycline-resistant *N. gonorrhoeae* (TRNG). Tetracycline resistance in these strains is due to the presence of the TetM determinant (*3*). Gonococcal isolates with both the β-lactamase and tetracycline-resistance plasmids are termed PPNG/TRNG. Chromosomally mediated resistance occurs as a result of one or more mutations in the gonococcal genome, which may result in a variety of phenotypic expressions, such as altered membrane permeability (*3*).

Although PPNG isolates can be identified by simple, inexpensive, standardized tests for β-lactamase, the methods required to identify plasmid-mediated tetracycline resistance or chromosomally mediated resistance are more complex, expensive, and difficult to standardize. Many public health laboratories do not have adequate resources to perform these tests. Furthermore, for antimicrobial resistance testing results to be comparable within or between various laboratories, intra- and inter-laboratory standardization of testing methods must be established and maintained. The Gonococcal Isolate Surveillance Project (GISP) was created to address these issues. The recent conversion of some public health laboratories to non-culture-based methods of testing for gonorrhea, which reduces the number of isolates available for susceptibility testing, increases the importance of having a national system in place to monitor trends in gonococcal antimicrobial resistance.

GISP is a national sentinel surveillance system that was established in 1986 to estimate prevalence and to monitor trends of antimicrobial resistance in *N. gonorrhoeae*. Beginning in 1991, CDC stopped collecting antimicrobial resistance data detected through systems other than GISP. Beta-lactamase testing for PPNG, which accounted for most of the antimicrobial resistance in gonorrhea previously reported to the CDC by state and local health departments, has been discontinued in many areas because penicillins are no longer recommended therapy for gonorrhea. GISP is currently the only national surveillance system for monitoring gonococcal antimicrobial resistance. Results from GISP have been used to guide CDC in recommending treatment for gonorrhea (*4*). This report describes the results of surveillance for antimicrobial resistance in *N. gonorrhoeae* from January 1991 through December 1991; these results are compared with data obtained from January 1988 through December 1990.

METHODS

GISP Data Collection Procedures

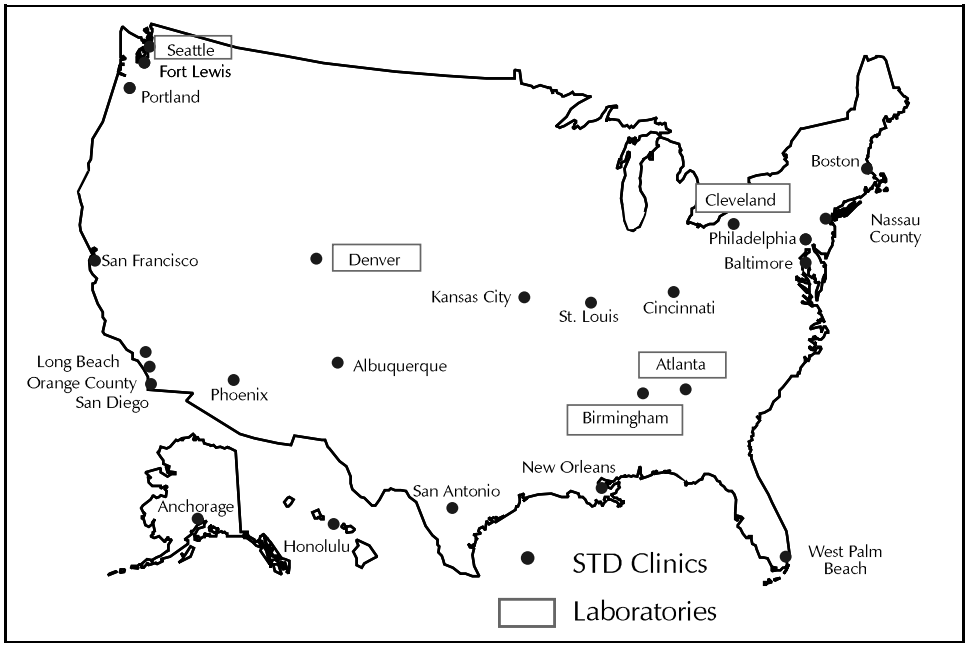
The GISP system currently includes 26 publicly funded sexually transmitted disease (STD) clinics* and five regional laboratories (Figure 1). At the clinics, gonococcal isolates and demographic and clinical data on the corresponding patients are collected. Urethral specimens are collected from the first 20 men diagnosed with gonorrhea each month. The specimens are subcultured to obtain a pure culture, frozen, and shipped to one of the regional laboratories. Demographic and clinical information, abstracted from medical records, is sent directly from the clinics to CDC for analysis. At the regional laboratories, isolate susceptibilities to a panel of antibiotics are determined by the agar dilution technique (*5*), and β-lactamase testing is performed. Regional laboratories send results of susceptibility testing and a sample of resistant isolates to CDC for confirmation, further testing, and analysis.

Susceptibility and Resistance Definitions

Definitions of antimicrobial susceptibility and resistance are based on criteria established by the National Committee for Clinical Laboratory Standards (NCCLS) (Table 1) (*6–9*). Isolates having a minimum inhibitory concentration (MIC) of ≥2 μg of

*Since January 1988, six clinics have joined the GISP system, and one clinic has discontinued participation. Data from the Minneapolis clinic, which joined the system in September 1992, are not included in this report.

FIGURE 1. Locations of sentinel sexually transmitted (STD) clinics and regional laboratories participating in the Gonococcal Isolate Surveillance Project — United States, 1991



penicillin or tetracycline/mL or ≥128 μg of spectinomycin/mL are defined as being resistant to the corresponding agent. More than 15% of persons infected with a strain defined as resistant by these criteria would be expected not to respond to therapy with the corresponding agent (*7*). Clinical treatment failures related to decreased susceptibility of *N. gonorrhoeae* to ceftriaxone or ciprofloxacin have not yet been reported in the United States; however, the NCCLS has established susceptible criteria for these agents. Isolates having an MIC of ≤0.25 μg of ceftriaxone/mL or ≤0.06 μg of ciprofloxacin/mL are defined as being susceptible to these agents. The clinical importance of isolates with MICs higher than those defining the susceptible criteria for ceftriaxone and ciprofloxacin is not known.

TABLE 1. Susceptibility criteria for *N. gonorrhoeae* isolates — National Committee for Clinical Laboratory Standards

Antimicrobial agent	Minimum inhibitory concentration (μg/mL)			
	Susceptible	Moderately susceptible*	Intermediate†	Resistant
Penicillin	≤0.06	0.12–1.0	NA	≥2.0
Tetracycline	≤0.25	0.50–1.0	NA	≥2.0
Spectinomycin	≤32.0	NA	64.0	≥128.0
Ceftriaxone§	≤0.25	NA¶	NA	NA
Ciprofloxacin§	≤0.06	0.125**	NA	NA

*Moderately susceptible organisms have a documented lower clinical cure rate (85%–95% compared with ≥95% for susceptible strains.
†An intermediate result indicates a lack of clinical experience in treating patients infected with organisms having these MICs.
§For these antimicrobial agents, the absence of resistant strains precludes defining any results categories other than susceptible.
¶NA = not applicable.
**Criteria are for in vitro-selected mutants. Clinical significance is not known.

TABLE 2. Definitions of plasmid- and chromosomally mediated resistance to penicillin and tetracycline

- Penicillinase-producing *N. gonorrhoeae* (PPNG): ß-lactamase positive and MIC <16 μg tetracycline/mL
- Plasmid-mediated tetracycline-resistant *N. gonorrhoeae* (TRNG): MIC ≥16 μg tetracycline/mL and ß-lactamase negative
- PPNG/TRNG: ß-lactamase positive and MIC ≥16 μg tetracycline/mL
- Chromosomal resistance to penicillin: non-PPNG, non-TRNG with MIC ≥2 μg penicillin/mL and MIC <2 μg tetracycline/mL
- Chromosomal resistance to tetracycline: non-PPNG, non-TRNG with MIC ≥2 μg tetracycline/mL and MIC <2 μg penicillin/mL
- Chromosomal resistance to penicillin and tetracycline: non-PPNG, non-TRNG with MIC ≥2 μg penicillin/mL and MIC ≥2 μg tetracycline/mL

For analyses described in this paper, six mutually exclusive categories of resistance have been defined for plasmid- and chromosomally mediated resistance to penicillin and tetracycline (Table 2). Isolates are defined as PPNG if they are β-lactamase-positive. Isolates are defined as TRNG if they have a tetracycline MIC of ≥16 μg/mL. Isolates that are both β-lactamase-positive and have a tetracycline MIC of ≥16 μg/mL are defined as PPNG/TRNG. Isolates with plasmid-mediated resistance typically have MICs much higher than those of isolates with chromosomally mediated resistance. Therefore, in grouping isolates into plasmid- and chromosomally mediated resistance categories, a hierarchical classification system is used; among isolates that are resistant to penicillin or tetracycline according to NCCLS criteria, those that do not have plasmid-mediated resistance to either of these drugs according to the above definitions are considered to have chromosomally mediated resistance.

Statistical Tests

Descriptive statistics were performed on the 1991 GISP data. Extended Mantel-Haenszel chi square test for trend statistics with p values were calculated to identify statistically significant trends in levels of the various types of resistance during the 4-year period 1988–1991.

RESULTS

Susceptibility data were collected for 5,238 gonococcal isolates in 1991. As in previous years, the demographic composition of the 1991 GISP sample was similar to that of all reported gonorrhea episodes in males in the United States (Table 3) (*10*). The percentage distribution of reported gonorrhea episodes among the various racial/ethnic categories is presented to illustrate that the GISP sample is similar in demographic composition to all reported gonorrhea episodes in males nationwide. Differences in gonorrhea incidence among racial/ethnic groups may reflect social, economic, behavioral, or other risk factors, rather than race/ethnicity directly.

The majority (73.9%) of gonorrhea episodes in the GISP sample were diagnosed in non-Hispanic black men, with 12.7% and 9.4% of episodes being diagnosed in Hispanic and non-Hispanic white men, respectively. Because of the selection of some sentinel STD clinic sites located in areas with large Hispanic populations, Hispanic men are overrepresented in GISP compared with the national sample. The mean age of men in the GISP sample was 26.9 years (range: 13–78 years). Of the 4,700 men in

TABLE 3. Racial composition of nationally reported gonorrhea episodes and GISP sample — 1991

Racial/Ethnic category	Nationally reported episodes (males)	% of national sample	GISP reported episodes (males)	% of GISP sample
White, non-Hispanic	31,655	10.2	492	9.4
Black, non-Hispanic	265,015	85.2	3,872	73.9
Hispanic	12,404	4.0	663	12.7
Asian/Pacific Islander	960	0.3	67	1.3
Native American	1,001	0.3	15	0.3
Unknown race	—	—	129	2.5
TOTALS	**311,035**	**100.0**	**5,238**	**100.0**

the GISP sample for whom sexual orientation data were available, 4.7% reported a history of same-sex sexual activity, and 95.3% reported only heterosexual activity.

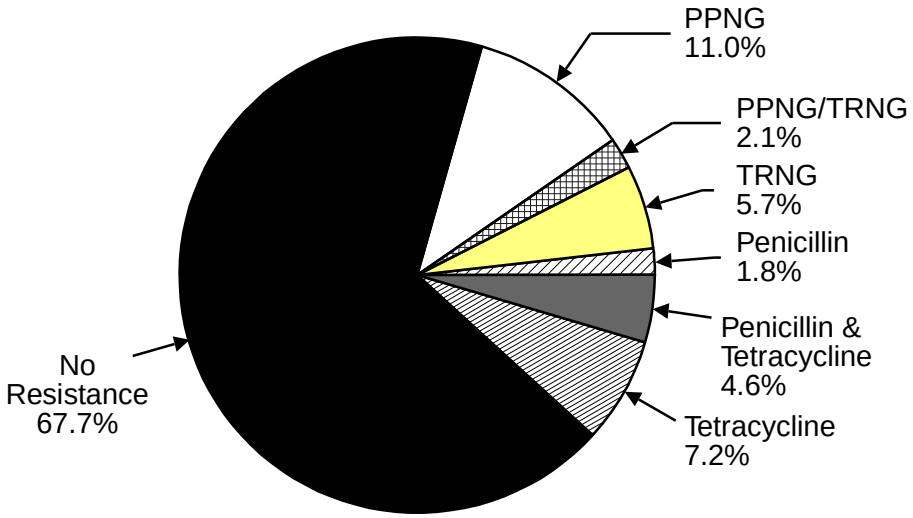
Of the isolates in the 1991 GISP sample, 32.4% were found to be resistant to penicillin or tetracycline. Eleven percent of the isolates were classified as PPNG, 5.7% were classified as TRNG, and 2.1% were classified as PPNG/TRNG. Chromosomal resistance to tetracycline alone was identified in 7.2% of the 1991 isolates, and chromosomal resistance to both penicillin and tetracycline* and to penicillin alone was identified in 4.6% and 1.8% of the isolates, respectively (Figure 2).

From 1988 through 1991, the proportion of GISP isolates with various types of plasmid-mediated resistance (PPNG, TRNG, PPNG/TRNG) increased significantly ($p < .001$) (Figure 3). The proportion of GISP isolates classified as PPNG more than doubled, from 3.2% in 1988 to 7.4% in 1989, and continued to increase in 1990 and 1991. The proportion of GISP isolates classified as PPNG/TRNG increased from 0.3% in 1988 to 2.1% in 1991. The proportion of GISP isolates classified as TRNG also increased substantially from 1988 through 1991, although this proportion was slightly smaller in 1991 than in 1990.

The proportion of isolates in the GISP sample having chromosomally mediated resistance to penicillin also increased significantly ($p < .001$) from 0.5% in 1988 to 1.8% in 1991 (Figure 4). The proportion of isolates with chromosomally mediated resistance to tetracycline decreased significantly ($p < .001$) from 14.8% in 1988 to 7.2% in 1991, with the largest decrease occurring during the period 1988–1989. For the 4-year period

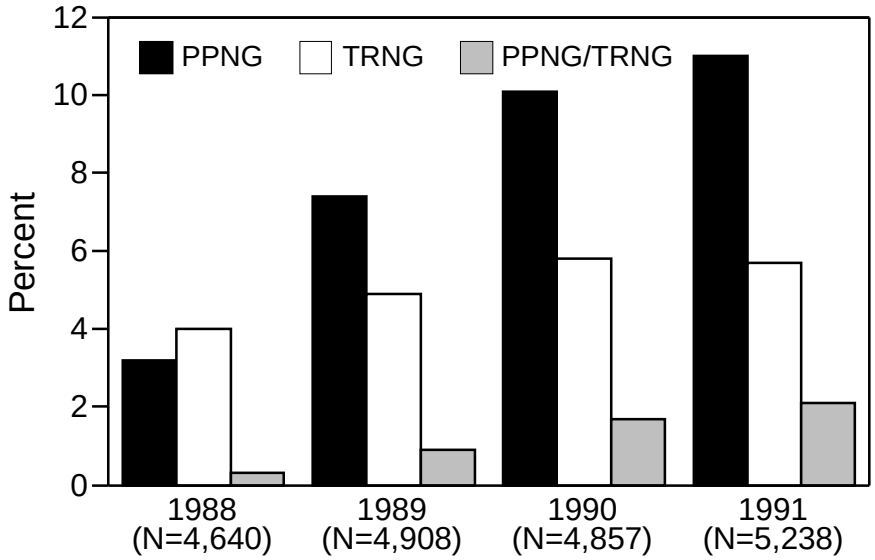
*Isolates in this category are sometimes referred to by the acronym CMRNG, for "chromosomally mediated resistant *Neisseria gonorrhoeae*."

FIGURE 2. Percentage distribution of resistance to penicillin and tetracycline in gonococcal isolates — Gonococcal Isolate Surveillance Project — United States, 1991*



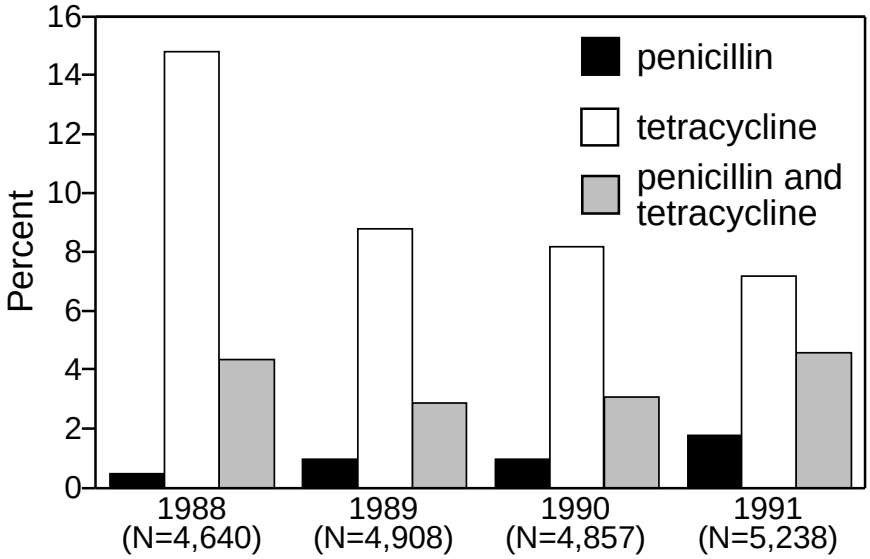
*PPNG=penicillinase-producing *Neisseria gonorrhoeae*.
TRNG=tetracycline-resistant *N. gonorrhoeae*.

FIGURE 3. Trends in percentage of isolates with plasmid-mediated resistance to penicillin and tetracycline, Gonococcal Isolate Surveillance Project — United States, 1988–1991*



*PPNG=penicillinase-producing *Neisseria gonorrhoeae*.
TRNG=tetracycline-resistant *N. gonorrhoeae.*

FIGURE 4. Trends in percentage of isolates with chromosomally mediated resistance to penicillin and tetracycline, Gonococcal Isolate Surveillance Project — United States, 1988–1991



1988–1991, the proportion of GISP isolates having chromosomally mediated resistance to both penicillin and tetracycline did not increase significantly. However, this proportion did increase from 3.1% in 1990 to 4.6% in 1991, the second consecutive year showing an increase.

No isolates in the 1991 GISP sample were found to be resistant to spectinomycin. Both the 1988 and 1990 GISP samples contained one spectinomycin-resistant isolate, whereas four spectinomycin-resistant isolates were found in the 1989 sample.

In 1991, four isolates (three from West Palm Beach and one from New Orleans) were reported to have MICs higher than the current NCCLS criterion for susceptibility to ceftriaxone (0.25 μg/mL). Following initial testing at a regional laboratory, the three West Palm Beach isolates were reported to have ceftriaxone MICs of 0.5 μg/mL. Susceptibilities of two of these three isolates were retested at CDC, where ceftriaxone MICs of 0.004 μg/mL were obtained. Susceptibilities of the New Orleans isolate, which was reported by the regional laboratory as having a ceftriaxone MIC of 1.0 μg/mL, were also retested at CDC, and a ceftriaxone MIC of 0.004 μg/mL was obtained. Each of the four patients from whom these gonococcal strains were isolated was treated with 250 mg of ceftriaxone intramuscularly, plus a 1-week regimen of orally administered doxycycline; all were reported to have responded to therapy. (One of these patients returned to the clinic approximately 1 month following initial therapy and was again diagnosed with and treated for gonorrhea, but this patient's history indicates that he was probably reinfected by an untreated partner). In the 1990 sample, two isolates (both from Atlanta) were reported by the regional laboratory to have ceftriaxone MICs of 0.5 μg/mL. When the susceptibilities of these isolates were retested at CDC, ceftriaxone MICs of 0.015 and 0.008 μg/mL were obtained. One of the two patients from whom these specimens were isolated was successfully treated with 250 mg of ceftriaxone intramuscularly, plus a 1-week regimen of orally administered doxycycline. The other patient was treated with 3 g of orally administered ampicillin, followed by doxycycline. In the 1988 and 1989 GISP samples, no isolates were reported to have MICs higher than the susceptibility criterion for ceftriaxone.

In 1991, 17 isolates were reported to have MICs higher than the NCCLS criterion for susceptibility to ciprofloxacin (0.06 μg/mL). Four of these isolates were submitted from Honolulu; the remaining isolates were submitted from San Antonio (three isolates); Anchorage, Cleveland, and San Diego (two isolates each); and Albuquerque, Boston, Cincinnati, and San Francisco (one isolate each). Ciprofloxacin MICs of 12 of these isolates were retested at CDC, and results within one dilution of the original reported value were obtained for seven of the isolates. Results two dilutions below the original reported value were obtained for an additional two isolates. The highest reported ciprofloxacin MIC in 1991 was 0.5 μg/mL, which was reported for one isolate from Honolulu and one from Boston. The ciprofloxacin MIC of the Honolulu isolate was confirmed by retesting at CDC, where an MIC of 1.0 μg of ciprofloxacin/mL was obtained. The patients infected with gonococcal strains reported to have ciprofloxacin MICs >0.06 μg/mL were all treated with therapies other than ciprofloxacin or other fluoroquinolones. Information on ciprofloxacin susceptibility was available for only 1,709 of the isolates collected in 1990. Of these isolates, seven were reported to have MICs >0.06 μg ciprofloxacin/mL, with the highest reported ciprofloxacin MIC being 0.25 μg/mL. Ciprofloxacin MICs of four of these isolates were retested at CDC, and results within one dilution of the reported value were obtained.

The distribution of ceftriaxone MICs, as observed in the 1991 GISP sample, shifts to the right (i.e., higher) for gonococcal isolates having chromosomal resistance to both penicillin and tetracycline, compared with isolates having no resistance to penicillin or tetracycline (Figure 5). The same is true for ciprofloxacin MICs, although the difference is less dramatic (Figure 6).*

DISCUSSION

The GISP system is intended to provide early warning of increased prevalence of gonococcal antimicrobial resistance or the emergence or introduction of new resistance types in the United States. Because many of the GISP sentinel sites have previously been recognized as "ports-of-import" for resistant strains of *N. gonorrhoeae*, GISP provides a mechanism to monitor the importation of resistant strains. GISP is also useful for monitoring the direction(s) and rate of spread of strains with different types of resistance. The GISP sample is not, however, a random sample of gonococcal infections in the United States and hence may not be entirely representative of all such infections. Furthermore, if gonococcal strains with clinically important resistance to ceftriaxone or ciprofloxacin appear in this country, they will probably not be detected initially by GISP, because the sample represents only a small proportion (approximately 1.0%) of reported gonococcal infections in the United States. However, we anticipate that these resistant strains will become prevalent in a sentinel site soon enough to allow timely revisions of treatment recommendations for gonorrhea.

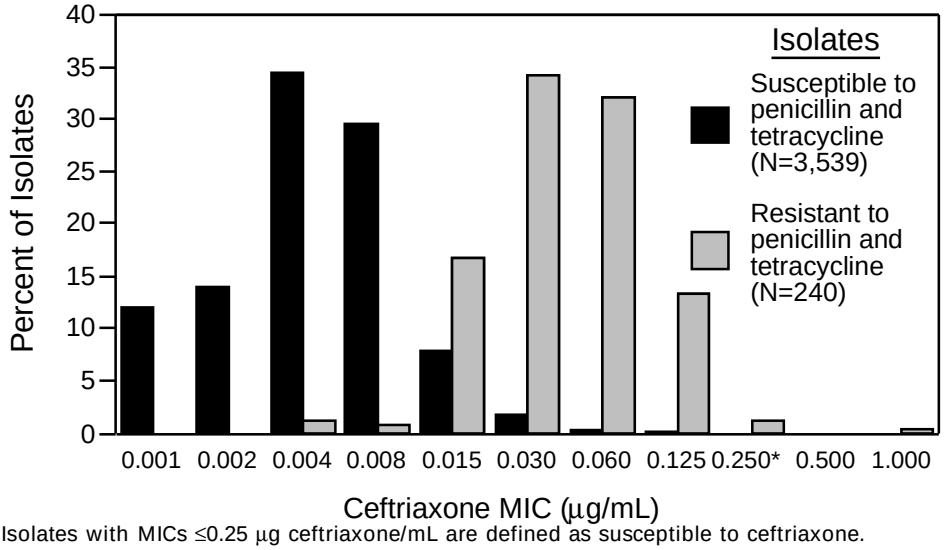
Proportions of gonococcal infections caused by isolates having plasmid-mediated resistance to penicillin (PPNG), tetracycline (TRNG), or both of these drugs (PPNG/TRNG) have increased substantially from 1988 through 1991. Although the proportion of gonococcal infections caused by TRNG isolates did not increase in 1991, TRNG isolates still accounted for 5.7% of gonococcal infections in the GISP system in 1991. Strains having plasmid-mediated resistance to penicillin or tetracycline typically have MICs much higher than the minimum criteria for resistance. For this reason, a large proportion of persons infected with plasmid-mediated resistant isolates are likely not to respond to therapy with the corresponding agent. Therefore, penicillin, ampicillin, amoxicillin, and tetracyclines are no longer recommended as therapy for gonorrhea.

Surveillance for gonococcal strains possessing chromosomally mediated resistance to both penicillin and tetracycline is important because these strains tend to have higher MICs of ceftriaxone and ciprofloxacin, which belong to the classes of antibiotics currently recommended for gonococcal therapy, than do other gonococcal strains (Figures 5 and 6). If clinical resistance to third-generation cephalosporins (such as ceftriaxone), quinolones (such as ciprofloxacin), or related agents develops in *N. gonorrhoeae*, it could emerge first among these strains.

In the United States, no documented clinical treatment failures have been related to reduced gonococcal susceptibility to either ceftriaxone or ciprofloxacin. Although a few isolates in the 1991 GISP sample were reported to have MICs higher than the

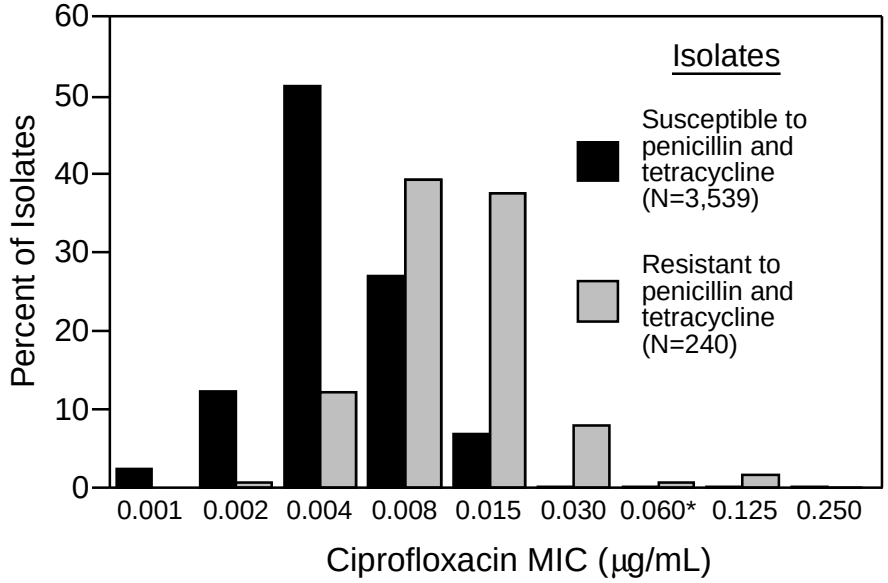
*The distributions of ceftriaxone and ciprofloxacin MICs for isolates with plasmid-mediated resistance to penicillin or tetracycline resembled the distributions for nonresistant isolates, although the distributions for isolates having chromosomal resistance to either penicillin or tetracycline alone were intermediate between those of nonresistant isolates and isolates with chromosomal resistance to both drugs.

FIGURE 5. Distribution of ceftriaxone minimum inhibitory concentrations (MICs) for penicillin-and tetracycline-susceptible isolates vs. isolates with chromosomally mediated resistance to penicillin and tetracycline — Gonococcal Isolate Surveillance Project — United States, 1991.



*Isolates with MICs ≤0.25 μg ceftriaxone/mL are defined as susceptible to ceftriaxone.

FIGURE 6. Distribution of ciprofloxacin minimum inhibitory concentrations (MICs) for penicillin- and tetracycline-susceptible isolates vs. isolates with chromosomally mediated resistance to penicillin and tetracycline — Gonococcal Isolate Surveillance Project — United States, 1991



*Isolates with MICs ≤0.06 μg ciproflocacin/mL are defined as susceptible to ciprofloxacin.

NCCLS criteria for susceptibility to these drugs, no clinical treatment failures have been associated with these isolates. Since, among the isolates that were available for retesting at CDC, none of the reported high ceftriaxone MICs could be confirmed, the original reported values may have been incorrect. Alternatively, although we believe that MICs are generally stable, the reported values may have been accurate, but these isolates may have lost their resistance to ceftriaxone upon subculture. Beginning in 1992, regional laboratories were requested to retest and confirm all ceftriaxone MICs >0.25 μg/mL and ciprofloxacin MICs >0.06 μg/mL.

Test-of-cure cultures for gonorrhea should not be encouraged as a routine, because currently recommended therapies are highly effective. However, STD program staff are encouraged to conduct thorough epidemiologic investigations of patients who appear not to respond to therapy with recommended treatment regimens, in order to determine whether failure may be due to a resistant strain and to identify possible sources of reinfection. Isolates from these patients and their sex partners should be preserved and referred to the state laboratory and CDC for confirmation by standardized antimicrobial susceptibility test procedures.

Many states, concerned that the GISP system cannot provide adequate information for local therapy decisions, have considered establishing state surveillance systems to monitor antimicrobial susceptibility. Ideally, state laboratories should work toward providing antimicrobial susceptibility testing, using NCCLS-approved methods, for antimicrobials used locally to treat gonorrhea. However, the resources and labor required to establish and maintain a surveillance system similar to GISP are considerable; many states may lack an infrastructure that could support collection and analysis of these data. STD program staff should consider these factors before allocating program resources to such an endeavor.

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State and Territorial Epidemiologists and Laboratory Directors

State and Territorial Epidemiologists and Laboratory Directors are gratefully acknowledged for their contributions to this report. The epidemiologists listed below were in the positions shown as of June 24, 1993, and the laboratory directors listed below were in the positions shown as of April 1993.

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