

Sexually Transmitted Diseases Among American Youth: Incidence and Prevalence Estimates, 2000

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CONTEXT: In the United States, young people aged 15–24 represent 25% of the sexually experienced population. However, the incidence and prevalence of sexually transmitted diseases (STDs) among this age-group are unknown.

METHODS: Data from a variety of sources were used to estimate the incidence and prevalence of STDs among 15–24-year-olds in the United States in 2000. The quality and reliability of the estimates were categorized as good, fair or poor, depending on the quality of the data source.

RESULTS: Approximately 18.9 million new cases of STD occurred in 2000, of which 9.1 million (48%) were among persons aged 15–24. Three STDs (human papillomavirus, trichomoniasis and chlamydia) accounted for 88% of all new cases of STD among 15–24-year-olds.

CONCLUSIONS: These estimates emphasize the toll that STDs have on American youth. More representative data are needed to help monitor efforts at lowering the burden of these infections.

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Sexually transmitted diseases (STDs) are among the most common infections in the United States. According to national estimates for 1996, more than 15 million new STD cases occur each year.¹ However, the annual STD incidence among young Americans is not known, even though 15–24-year-olds represent 25% of the sexually experienced population aged 15–44.²

Accurately monitoring the incidence and prevalence of STDs among the population, and particularly among young people, is important in measuring the effects of disease control and prevention efforts. However, a major obstacle to the diagnosis, treatment and surveillance of STDs is that many of these infections—including chlamydia, genital herpes, trichomoniasis and human papillomavirus (HPV) infection—have few, if any, recognizable symptoms. If STDs are not detected because infected persons have no symptoms and therefore do not get tested, these infections cannot be reported and counted. Even when STDs are diagnosed, health care providers may not always report nationally notifiable ones, such as syphilis, gonorrhea and chlamydia. Furthermore, some STDs, such as genital herpes, trichomoniasis and HPV infection, are not nationally reportable; our knowledge about these infections is based on prevalence surveys conducted among various populations that may not be representative of the general population.

As a result of expanded screening programs and improved detection tests, the ability to monitor the occurrence of STDs, especially asymptomatic infections, has increased since 1996. In this article, we examine available evidence and provide estimates for the incidence and prevalence of STDs among 15–24-year-olds in the United States in 2000.

METHODS

We studied relevant data and estimates of STD incidence and prevalence in the available literature, focusing on the eight main STDs. For each STD, we adjusted the available information to estimate the incidence and prevalence among 15–24-year-olds in the United States for the year 2000. Sources were case reports of nationally notifiable diseases, national surveys, literature reviews and the World Health Organization (WHO).

Building on prior efforts,³ we categorized the quality and reliability of our estimates as good (level I), fair (level II) or poor (level III). Table 1 summarizes the criteria for these ratings. Our estimates were made using the available information with the highest-quality evidence.

RESULTS

Chlamydia

Chlamydia trachomatis infection is the most commonly reported notifiable disease in the United States. In 2000—the year in which all 50 states and the District of Columbia required that cases of chlamydia be reported—the Centers for Disease Control and Prevention (CDC) received 702,093 reports of chlamydial infection.⁴ Of reported cases that included the age of the infected individual, 74%—that is, 439,041 infections—occurred in persons aged 15–24. Nevertheless, because of the asymptomatic nature of this disease, incomplete screening coverage⁵ and underreporting, this figure most likely reflects a substantial underestimate of the true incidence of chlamydia among young people.

Using data from the Regional Infertility Chlamydia Prevalence Monitoring Project, Groseclose and colleagues estimated that three million new cases of genital chlamydia

occurred among 15–44-year-olds in 1996.⁶ In 2000, the same project included women of reproductive age attending almost 2,400 family planning clinics in all 50 states, the District of Columbia, the Virgin Islands and Puerto Rico.⁷ To estimate the incidence and prevalence of chlamydia, we adjusted the 2000 data for state, age, and race and ethnicity, and used a similar calculation method to that of Groseclose and colleagues (which assumes that the incidence of chlamydial infection is its prevalence divided by the duration of infection, that infection lasts 0.96 years among women and 0.40 years among men, and that the incidence among men equals that among women). From this procedure, we estimate that 2.8 million new cases of chlamydia occurred in 2000 and that the prevalence was 1.9 million. Furthermore, on the basis of data for women aged 15–24, the estimated annual incidence of chlamydia among all men and women in this age-group was 1.5 million infections (54% of the total), and the prevalence was 1.0 million infections. These estimates assume that approximately 50% of people aged 15–19 have never had sexual intercourse and that 15–24-year-olds make up 25% of the population aged 15–44 who have ever had intercourse.⁸ Because of the assumptions applied and because the Regional Infertility Chlamydia Prevalence Monitoring Project is not a population-based survey, we classified the quality of evidence and our estimates for chlamydia as level II.

Gonorrhea

Following a 74% decrease from 1975 through 1997, the rate of *Neisseria gonorrhoeae* infection increased in 1998 and remained essentially unchanged through 2000. In 2000, a total of 358,995 new cases of gonorrhea were reported to the CDC, of which 60% were among persons aged 15–24.⁹ Previous estimates of gonorrhea incidence have assumed a 50% underdiagnosis and underreporting rate.¹⁰ Applying this assumption to the available level II national surveillance data, we estimate that 718,000 new cases of gonorrhea occurred in 2000 and that 431,000 cases occurred among persons aged 15–24. Data were unavailable to allow the calculation of prevalence rates.

Syphilis

Syphilis rates decreased dramatically during the 1990s among both women and men. The greatest declines were among black Americans and persons living in the South, where rates historically have been the highest. In 2000, some 5,979 cases of primary and secondary syphilis (i.e., early stages of symptomatic *Treponema pallidum* infection) were reported to the CDC—the lowest yearly number ever recorded.¹¹ However, in the same year, the CDC also received 9,470 reports of early latent syphilis, in which infection was probably acquired in the preceding year. A further 15,597 reports were of late latent disease, in which infection probably occurred more than one year before diagnosis, making a total of 31,046 new cases of syphilis. Between 1997 and 2000, some 45–50% of all syphilis cases reported were late latent, indicating that a substantial proportion of syphilis

TABLE 1. Criteria used to rate estimates of incidence and prevalence of STDs

Rating level	Criteria
I (good)	Representative national surveys Complete national reporting
II (fair)	Consistent and widespread prevalence data from convenience samples
	Consistent and widespread, although incomplete, national reporting
	Extrapolations and assumptions based on representative national surveys
III (poor)	Inconsistent, nonrepresentative prevalence data Estimates based on rough extrapolations

Source: reference 1.

cases were not diagnosed within one year of infection.

Of the 15,449 cases that were reported in 2000 and acquired in the previous year (primary, secondary or early latent syphilis), 3,399 cases were among 15–24-year-olds.¹² If 50% of all reported syphilis cases are diagnosed and reported more than one year after infection and 20% of infections are never diagnosed or reported,¹³ then approximately 8,200 new syphilis infections occurred among persons aged 15–24 in 2000. Because of the incomplete national reporting of syphilis, this figure represents a level II estimate. Data were unavailable to allow the calculation of syphilis prevalence rates.

Genital Herpes

The incidence and prevalence of genital herpes—both symptomatic and asymptomatic—have increased dramatically during the past three decades.¹⁴ The number of clinically diagnosed cases of symptomatic genital herpes in the 1980s was 11 times that in the 1970s, and it has remained relatively constant ever since.¹⁵ Reports from a variety of clinical settings in the United States show that genital herpes accounts for a large majority of patient requests for treatment of symptomatic genital ulcers.¹⁶ Genital herpes accounts for the majority of symptomatic ulcers outside the United States as well.¹⁷

Symptomatic herpes infections are merely the tip of the iceberg. Surveys have shown that only a minority of infections with herpes simplex virus type 2 (HSV-2), the main virus that causes genital herpes, are recognized as symptomatic by those who are infected. In the early 1990s, an estimated 45 million Americans were infected with HSV-2, but only 9% of them reported a history of genital herpes.¹⁸ Using age-specific incidence curves and assuming that the rate of genital herpes in 2000 remained the same as the rate in 1985,¹⁹ we estimate that 1.6 million new HSV-2 infections occurred in the United States in 2000. Adjusting this figure for the age distribution of persons newly infected with HSV-2 to account for those aged 15–24—40% in models based on the National Health and Nutrition Examination Survey²⁰—we estimate that youth acquire 640,000 new HSV-2 infections each year.

TABLE 2. Estimated incidence and prevalence of selected STDs among 15–24-year-olds, and strength of evidence, United States, 2000

STD	Incidence	Prevalence	Strength of evidence*
Total	9.1 million	u	
Chlamydia	1.5 million	1.0 million	II
Gonorrhea	431,000	u	II
Syphilis	8,200	u	II
Genital herpes	640,000	4.2 million	II
HPV	4.6 million	9.2 million	III
Hepatitis B	7,500	u†	II
Trichomoniasis	1.9 million	u	III
HIV	15,000	u	II

*Rated according to criteria shown in Table 1. †Estimated prevalence of chronic hepatitis B virus infection is not available. Note: u=unavailable.

Assuming that the prevalence of HSV-2 infection remained stable between the early 1990s and 2000, at 45 million, we estimate that 4.2 million persons aged 15–24 (11% of the population aged 15–24) have been infected. It is important to note that although our estimates of incidence and prevalence of genital herpes among youth are derived from level I data on HSV-2, we classify them as level II because of the assumptions we made. In addition, our calculations ignore the sizable proportion of genital herpes infections caused by HSV-1; thus, our figures should be considered minimum estimates.

HPV

Comprehensive surveillance data are not available for genital HPV infection. If we suppose that age-specific incidence estimates for cervical HPV infection among women²¹ reflect the HPV incidence rates among men, then approximately 6.2 million new HPV infections occurred in 2000 among Americans aged 15–44; of these infections, 74% (4.6 million) occurred among 15–24-year-olds.

Using an estimated female HPV prevalence of 33% (derived from a survey of sexually active women attending a university health service²²), assuming an equal prevalence among sexually active men and applying these figures to the number of sexually active 15–24-year-olds in the population, we estimate that in 2000, some 9.2 million persons in this age-group were infected with HPV and hence were capable of spreading the virus. We classify the estimated incidence and prevalence of HPV as level III because of the limited evidence and crude extrapolations used.

Hepatitis B

Hepatitis B remains a prominent STD despite the availability of a preventive vaccine for more than two decades. By adjusting the reported number of cases to account for underreporting and asymptomatic infection,²³ the CDC has estimated that 81,000 new infections with the hepatitis B virus occurred in the United States in 2000, of which 15,000 occurred in persons aged 15–24.²⁴ Approximately half of these cases were among individuals who reported high-risk sexual activity.²⁵ Hence, the estimated incidence of sexually acquired hepatitis B among 15–24-year-olds is 7,500. Because of the assumptions and adjustments underlying

this estimate, we classified it as level II.

Young people bear an even larger proportion of the burden from chronic infection: Of the estimated 5,000 new chronic infections in the United States in 2000, some 1,200—nearly one-quarter—occurred among 15–24-year-olds. Individuals with chronic infection not only remain infectious for most or all of their lives, but also have an approximately 25% lifetime risk of developing cirrhosis or liver cancer.²⁶

Trichomoniasis

Vaginal infections caused by *Trichomonas vaginalis* are among the most common conditions transmitted sexually. Worldwide, more than 180 million cases of trichomoniasis are estimated to occur each year, accounting for nearly 20% of all cases of symptomatic vaginitis.²⁷ In the United States, depending on the type of clinical facility and the level of STD risk, between 5% and 60% of women and men screened for trichomonas will be infected with the parasite.²⁸ According to WHO, approximately 8.2 million new *T. vaginalis* infections occurred in the United States and Canada in 1999.²⁹ Assuming that 90% of these were in the United States and that the incidence remained the same in 2000, we estimate that 7.4 million new cases of trichomoniasis occurred in this country in 2000. If these infections were evenly distributed among sexually active persons of all age-groups,³⁰ 25% of them—1.9 million—occurred among persons aged 15–24. Because this figure is based on a rough extrapolation, we classify it as level III. Moreover, *T. vaginalis* infection may be underdiagnosed in the United States because of reliance on the relatively insensitive wet-mount procedure for diagnosis.³¹

HIV

The annual number of new HIV infections in the United States appears to have stabilized during the 1990s, although the introduction of highly active antiretroviral therapy has increased the prevalence of HIV by extending the life of HIV-infected people. The CDC has estimated that 800,000–900,000 persons in the United States are infected with HIV and approximately 40,000 new infections occur each year.³² In particular, the incidence of HIV and other STDs among men who have sex with men has remained high.³³

Assuming that 50% of HIV infections are contracted by persons younger than 25,³⁴ we expect that about 20,000 new HIV infections occur each year among youth. In 2000, according to the distribution of AIDS cases in the United States by the recorded route of infection, an estimated 75% of HIV infections were acquired through sexual intercourse. Thus, approximately 30,000 new infections were contracted through sexual intercourse in 2000, and 15,000 of these were contracted by persons aged 15–24. Being based on assumptions about HIV incidence in the United States, this estimate is level II.

Total STD Incidence

Despite decreases in the rates of some reportable STDs during the 1990s, we estimate that 18.9 million new cases of STD occurred in 2000, of which 9.1 million (48%) were

among young people aged 15–24 (Table 2). These estimates emphasize this age-group's particular vulnerability to STDs. Of the STDs examined, HPV was the most commonly acquired, followed by trichomoniasis and chlamydia. Together, these three STDs accounted for 88% of all new cases of STD among 15–24-year-olds in 2000; HPV and trichomoniasis accounted for 72% of new infections.

DISCUSSION

Estimates of the national incidence and prevalence of STDs are based on various sources of data, each with its own limitations. Information about infections that are reportable to state and local health departments are affected by the completeness of diagnosis and reporting. We assumed that only 50% and 80% of all gonorrhea and syphilis infections, respectively, are diagnosed and reported; however, few studies have been done to substantiate these assumptions, and those that have been conducted have small samples.³⁵ Because so many STDs, including HIV, are asymptomatic, infected individuals may not seek medical care. In particular, young, apparently healthy persons may not have routine contact with health care practitioners.

Estimates based on prevalence surveys, such as those for chlamydia and HPV, are subject to limitations of representativeness. For example, although women attending family planning clinics were surveyed for chlamydia in all 50 states and the District of Columbia, they may not have an STD prevalence that is generalizable to the entire population of sexually active women.³⁶ Additionally, our chlamydia estimates depended on assumptions about duration of infection among both men and women.³⁷ As the coverage of chlamydia screening increases over time, this duration may decrease; as a result, our estimated incidence of chlamydia would be an underestimation of the true incidence of this disease.

HPV infection and trichomoniasis accounted for 72% of all new cases of STD among the 15–24-year age-group in 2000; however, the quality of the evidence—level III—was poor. For all other STDs, we graded the evidence as level II. Thus, while information about STDs—particularly for chlamydia and HPV—has improved somewhat since incidence and prevalence estimates were last made, in 1996, the overall reliability of the supporting data remains weak.

Our estimate of 18.9 million new STDs in 2000 among the general population is somewhat higher than the 1996 estimate of 15 million infections. This increase may be attributable to our improved ability to screen and detect STDs; however, it may also reflect the imprecision of the estimates themselves. More representative data are needed, especially for those infections of highest incidence and greatest morbidity.

Nevertheless, given the available information about the burden of STDs among sexually active young people, our estimate of 9.1 million new infections in 2000 among 15–24-year-olds demonstrates the tremendous toll these infections continue to have on youth in America: Representing one-quarter of the ever-sexually active population aged 15–44,³⁸

young people acquire nearly one-half of all new STDs. This burden is reflected not only in morbidity among the individuals affected but also in economic and psychological costs. The estimates provided here are the best numbers to date on which to base policy decisions, outreach and educational efforts. We encourage other researchers to refine these estimates and thereby help monitor national efforts at lowering the burden of STDs, especially among young Americans.

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