HIV in the United States at the Turn of the Century: An Epidemic in Transition

ABSTRACT

Objectives. The current status of and changes in the HIV epidemic in the United States are described.

Methods. Surveillance data were used to evaluate time trends in AIDS diagnoses and deaths. Estimates of HIV incidence were derived from studies done during the 1990s; time trends in recent HIV incidence were inferred from HIV diagnoses and seroprevalence rates among young persons.

Results. Numbers of deaths and AIDS diagnoses decreased dramatically during 1996 and 1997 but stabilized or declined only slightly during 1998 and 1999. Proportional decreases were smallest among African American women, women in the South, and persons infected through heterosexual contact. HIV incidence has been roughly constant since 1992 in most populations with time trend data, remains highest among men who have sex with men and injection drug users, and typically is higher among African Americans than other racial/ethnic groups.

Conclusions. The epidemic increasingly affects women, minorities, persons infected through heterosexual contact, and the poor. Renewed interest and investment in HIV and AIDS surveillance and surveillance of behaviors associated with HIV transmission are essential to direct resources for prevention to populations with greatest need and to evaluate intervention programs. (*Am J Public Health.* 2001;91:1060–1068)

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Surveillance programs collect data on AIDS diagnoses throughout the United States and, in most states, on HIV diagnoses, as recommended by the Centers for Disease Control and Prevention (CDC).[1] Extensive HIV serologic surveys have been conducted in special populations,[2] and HIV incidence studies have been conducted in some populations. These surveillance data describe both the characteristics of infected persons and epidemic trends, including HIV incidence and prevalence, AIDS incidence and prevalence, and mortality in persons with AIDS. Surveillance data are also used in allocating resources for prevention and care and in evaluating public health programs.[1] However, interpreting these surveillance data became much more difficult after 1996, when therapeutic advances in treating HIV disease began to influence AIDS incidence and mortality at a population level. There has been no comprehensive overview of the descriptive epidemiology of HIV in the United States since these therapeutic effects became evident.

We synthesized the national surveillance data to provide such an overview for adults and adolescents, including trends in HIV incidence, HIV and AIDS diagnoses, and deaths. Epidemiologic data for children have been reviewed elsewhere.[3] Our synthesis documents continued HIV transmission in groups with high-risk sexual behaviors and in injection drug users (IDUs); increasing proportions of HIV infections and disease in communities of color, especially African Americans; unequal reductions in morbidity and mortality by race/ethnicity, sex, and socioeconomic status; and an increasing proportion of HIV transmission through heterosexual contact.

Methods

In all US states and territories, data on persons with AIDS must be reported to state or local health departments, which forward the data, without personal identifiers, to the CDC. Data (including sex, race/ethnicity, behavioral risk, and state and county of residence at time of diagnosis) are abstracted from medical records of persons who meet either the clinical (opportunistic illness) criteria or the immunologic AIDS-defining criteria added to the definition in 1993.[4] Among persons 13 years and older, behavioral risk is defined according to the following hierarchy: men who have sex with men (MSM), IDUs, MSM who inject drugs, persons with hemophilia or coagulation disorders, persons who have heterosexual contact with a partner with or at risk for HIV/AIDS, and recipients of contaminated blood or tissue.[5] Medical records, death certificates, and death registries are used to ascertain deaths.

As of February 1993, 25 states, most of which are in the Southeast, required the reporting of persons with a confidential positive test for HIV.[5] These states use the same data abstraction procedures and hierarchical risk classification used for AIDS cases, and most require the reporting of any laboratory test result diagnostic of HIV. We defined the date of HIV diagnosis in these states as the date of AIDS diagnosis for persons reported to have AIDS without a previous reported HIV diagnosis and otherwise as the date of the first HIV diagnosis. Because a uniform HIV/AIDS surveillance system was not implemented until January 1994, we restricted the analysis

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of HIV diagnoses to those made in these 25 states (the initial HIV reporting states) since that date.

We estimated numbers of HIV and AIDS diagnoses and of deaths among persons with an AIDS diagnosis (AIDS deaths) from data for adults and adolescents (aged ≥13 years) reported through September 2000, adjusted for reporting delays.[5,6] To produce corresponding estimates by behavioral risk, we allocated cases without a reported risk to each risk group, using the proportion of persons initially reported without a risk later found to have that risk.[5,6] We estimated prevalence as cumulative diagnoses minus cumulative deaths. We used 1998 population estimates from the US Bureau of the Census to compute death, diagnosis, and prevalence rates. Our estimates of AIDS diagnoses and deaths are for residents of the 50 states, the District of Columbia, and Puerto Rico. The 1567 AIDS cases from other areas (US territories) account for 0.2% of all adult and adolescent cases reported through September 2000.

To study the association between poverty and AIDS diagnosis and death rates, we used census data to define 4 groups of counties. We first sorted the counties by the percentage of the population living below the poverty level in 1990, listing first the county with the lowest percentage. We then defined the 4 groups by choosing 3 cutpoints, so that the total estimated population aged 15 to 59 years in 1998 in each group was approximately the same. Thus, the first and last groups contain the "wealthiest" and "poorest" counties, respectively.

HIV incidence cannot be measured directly in the population, because many newly infected persons do not seek or are not offered an HIV test and there is no easily measured biomarker for recent infection. Therefore, we synthesize information from a variety of sources. We summarize information on HIV incidence among adults and adolescents during the 1990s from 3 types of studies: longitudinal studies, record-based studies of repeat patient visits in clinics, and cross-sectional studies that used the serologic testing algorithm for determining recent HIV seroconversion among persons newly diagnosed with HIV.[7] We found these studies by searching electronic databases of the medical and epidemiologic literature (using keywords such as "HIV," "seroincidence," and "seroconversion") and by contacting persons who had conducted incidence studies in the past. We required that the period covered include 1993 or later, except for US Army reserves, for whom we used the most recent available results.

Because a substantial proportion of HIV infections occur before 22 years of age[8] and the time from HIV infection to AIDS diagnosis is long and variable,[9] we used trends in initial HIV diagnoses and seroprevalence rates among adolescents and young adults to infer likely trends in recent HIV incidence. We inferred trends from 3 data sources: (1) numbers of HIV diagnoses at ages 15 through 21 years during 1994 through 1999 in the 25 initial HIV reporting states, (2) HIV seroprevalence rates among Job Corps entrants aged 16 through 21 years during 1993 through 1997, and (3) HIV seroprevalence rates among military service applicants aged 18 through 21 years during 1993 through 1998. For Job Corps entrants and military applicants, we computed annual seroprevalence rates standardized to the characteristics of the corresponding 1993 population with respect to sex, race, age, region, and size of metropolitan area.[10]

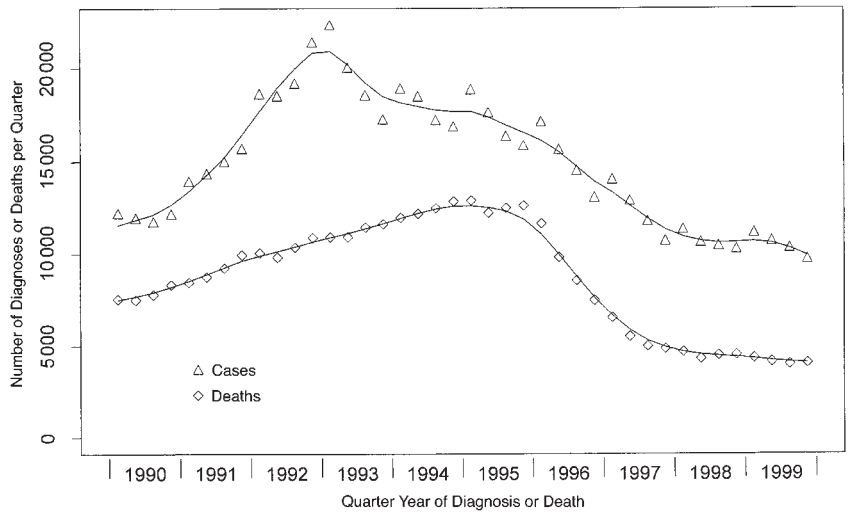


FIGURE 1—AIDS cases and deaths among adults and adolescents in the United States, by quarter year, 1990–1999.

Results

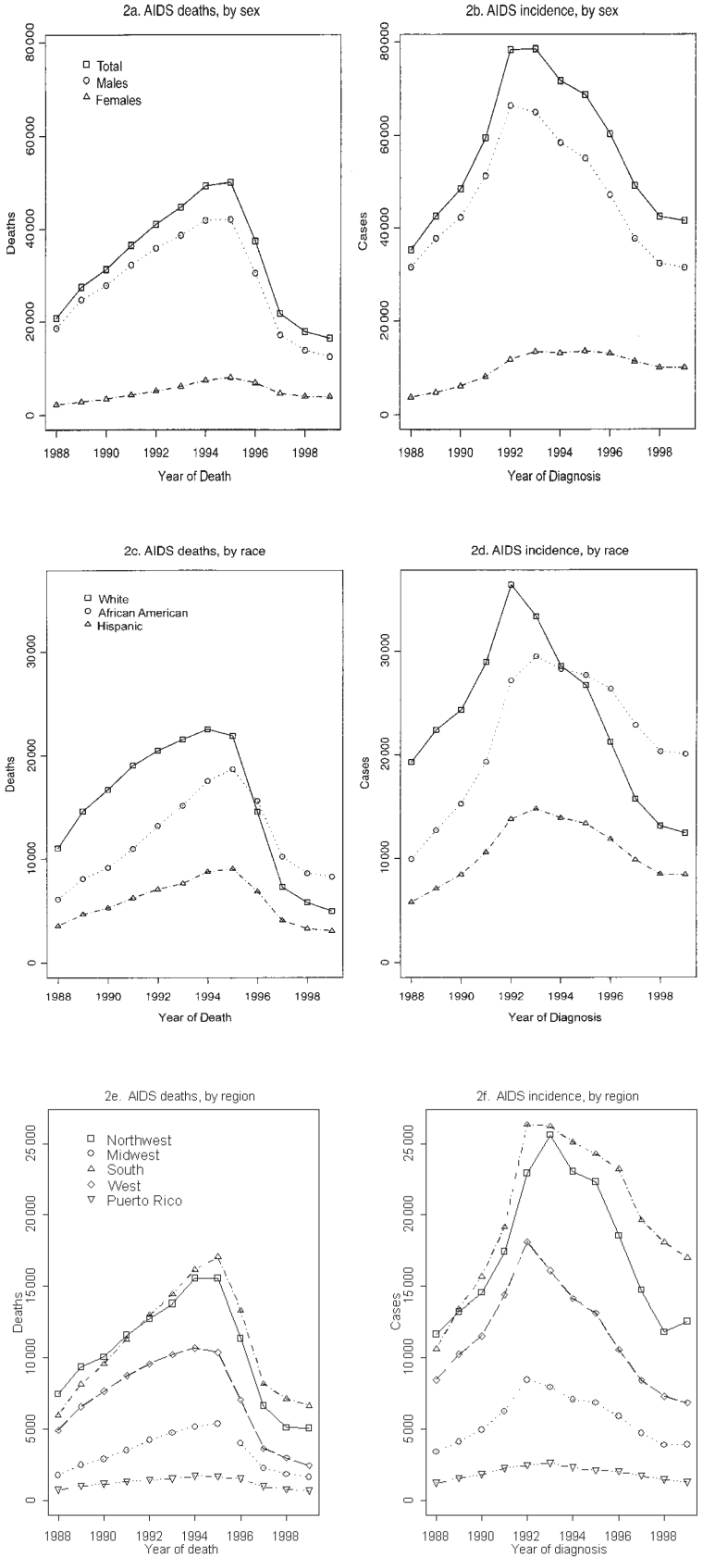
AIDS

Deaths. The annual number of deaths among persons with AIDS increased steadily until 1994 (Figure 1). The number of deaths per quarter was approximately constant during 1994 and 1995, declined markedly during 1996 and the first half of 1997, and was approximately constant during 1998 and 1999. The number of deaths during 1999 (16 400, or 7.4 deaths per 100 000 population) was 8% lower than the number of deaths during 1998 (17 800).

The mortality pattern was the same within each group defined by sex, by race/ethnicity, by region of residence, by county poverty level, and by sex and behavioral risk (Figure 2 a, c, e, g, i, k). Although there was little difference among these groups in the timing of maximal mortality, there was substantial variation in the subsequent declines. The percentage decrease in numbers of deaths was greater among men than among women, and, among both men and women, greater among Whites and residents of relatively wealthier counties (Table 1).

The percentage decrease in mortality was smallest among African American women and women from the South. For each year from 1988 through 1999, the greater the proportion of the population below the poverty level, the greater the death rate (Figure 2g: approximately one fourth of the population is in each of the poverty level groups). Death rates during 1999 were highest among African Americans (32.5 per 100 000, almost 11 times the rate among Whites).

Diagnoses. The number of new AIDS diagnoses increased from 1990 through 1992, followed by a decline from 1993 through 1999 (Figure 1). The AIDS surveillance definition was expanded in 1993 to include persons with a low CD4 count or percentage. Since the proportion of cases reported on the basis of CD4 criteria increased from 6% of diagnoses made in 1990 to 38% of diagnoses made in 1993, it is evident that most of the increase in AIDS diagnoses during 1990 through 1992 and the initial decline after 1993 were caused by this expanded definition and by the reporting (after



FIGURES 2a–f—AIDS deaths and AIDS incidence among adults and adolescents, by year: United States, 1988–1999.

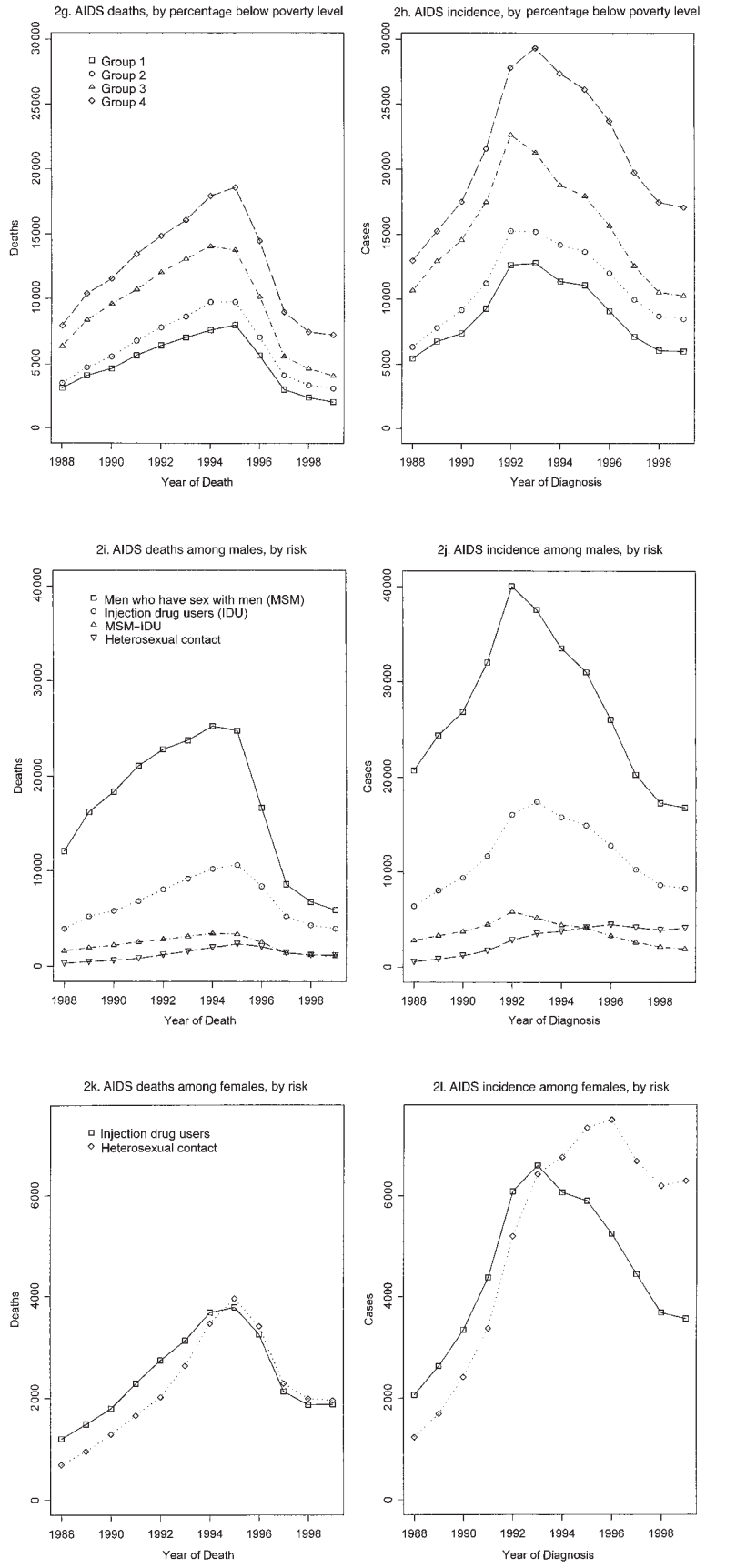
1992) of persons with a low CD4 count or percentage determined before 1993, most of whom would have been diagnosed later with an AIDS-defining opportunistic illness. The number of AIDS diagnoses per quarter was relatively constant during 1998 and 1999, after marked decreases during 1996 and 1997. The number of diagnoses made during 1999 (41 600, or 18.7 per 100 000) was 2% lower than the number of diagnoses made during 1998 (42 500).

In each group shown in Figure 2, the pattern of decline in AIDS diagnoses is similar to that for AIDS deaths, except that the decline in deaths began several years later. The decline in diagnoses began later among women than among men. The last groups to show a decline in diagnoses were men and women infected through heterosexual contact, among whom the decline did not begin until 1997. The percentage decrease in diagnoses from 1995 to 1999 was greater among men than among women (Table 1). For both men and women, the decrease was greater among Whites and among residents of wealthier counties. The percentage decrease in diagnoses was smallest among African American women, women from the South, and men and women infected through heterosexual contact.

Despite large declines in numbers of AIDS diagnoses in the past 5 years, most AIDS cases still occur in men, especially MSM and IDUs, and most are residents of the South or the Northeast. Since 1995, more new AIDS cases have occurred among African Americans than any other racial/ethnic group (Figure 2d); African Americans now account for nearly half of all new AIDS cases (Table 2). More than 40% of AIDS diagnoses during 1999 were among residents of the poorest counties, although these counties represented only one quarter of the 1998 population.

Compared with diagnoses made during 1990, the proportion of all diagnoses made during 1999 was substantially smaller for Whites, MSM, and female IDUs; the proportion was substantially larger for African Americans, residents of the South, and both men and women infected through heterosexual contact. Of the groups defined by demographic factors and behavioral risk shown in Table 2, the AIDS diagnosis rate during 1999 was highest among African Americans, for whom the rate was more than 10 times that of Whites. Of the groups shown in Table 2, diagnosis rates were greater in 1999 than in 1990 only among women and African Americans.

Prevalence. The prevalence of AIDS among adults and adolescents was 312 000 at the end of 1999 (140 per 100 000), compared with 76 000 at the end of 1990. Persons living with AIDS during 1999 were much more likely to be female, African American, or in-



FIGURES 2g–l—AIDS deaths and AIDS incidence among adults and adolescents, by year: United States, 1988–1999.

fected through heterosexual contact and much less likely to be White than were persons living with AIDS in 1990 (Table 2). At the end of 1999, the numbers of Whites and African Americans living with AIDS were similar (approximately 120 000 and 125 000, respectively), but the prevalence rate among African Americans was 6.7 times that among Whites.

HIV Infection

Diagnoses. Annual HIV diagnoses among adults and adolescents decreased from 20 800 in 1994 to 16 200 in 1999 in the 25 initial HIV reporting states. The number of people living with diagnosed HIV in these states (including those with AIDS) increased from 122 000 at the end of 1994 to 173 000 at the end of 1999. Among men, 51% of the 11 700 newly diagnosed with HIV in 1999 were African American; among women, 71% of the 4500 newly diagnosed were African American. HIV diagnosis rates per 100 000 during 1999 were 109.8, 57.7, and 13.0 among African American, Hispanic, and White men, respectively; the corresponding rates for women were 51.2, 16.3, and 2.5.

Seroprevalence. In general, HIV seroprevalence rates in 1997 remained much higher among persons with known behavioral risks than in other populations, and they were higher among African Americans.[2] Seroprevalence rates among African American MSM and African American women attending sexually transmitted disease clinics were at least 1.5 times the rates of Whites, except in the West, where rates were similar. Among IDUs who attended drug treatment centers, seroprevalence rates among African Americans were at least 1.5 times the rates of Whites, except in the South. In the Young Men's Survey (MSM aged 15 to 22 years who attended public venues frequented by MSM in 7 cities during 1994 through 1998), seroprevalence was 14.1 per 100 for African Americans, compared with 3.3 for Whites.[11]

Among persons tested who were not tested as a result of behavioral risk factors for HIV infection, HIV seroprevalence rates were also highest among African Americans, particularly in the South. In 1994, HIV prevalence among African American mothers was approximately 10 times higher than the rate among White women in the 13 states for which race/ethnicity was available from the Survey in Childbearing Women.[12] Among Jobs Corps entrants during the period 1993 through 1997, HIV seroprevalence rates were 3 to 10 times higher among African Americans than among youths of other races (Table 3). Rates were especially high among African American women from the South, for whom the average stan-

TABLE 1—Percentage Decline in AIDS Diagnoses and Deaths Among Adults And Adolescents, by Sex and Demographic Factors or Risk: United States, 1995–1999

	Diagnoses		Deaths	
	Males	Females	Males	Females
All	43	26	70	51
Race/ethnicity				
White	55	43	79	63
African American	32	16	59	44
Hispanic	38	34	69	56
Region of residence				
Northeast	46	36	71	57
Midwest	46	27	72	50
South	35	11	65	42
West	50	32	78	57
Puerto Rico	43	30	64	50
County poverty level[a]				
Group 1	49	36	76	64
Group 2	42	22	71	53
Group 3	46	27	73	49
Group 4	38	22	65	47
Risk				
MSM	46	. . .	76	. . .
MSM–IDU	54	. . .	68	. . .
IDU	45	40	63	50
Heterosexual contact	3	14	50	51

Note. MSM = men who have sex with men; IDU = injection drug user.
[a]Groups are defined by the percentage of the 1990 county population below the poverty level (see Methods). Groups 1 and 4 include counties with the smallest and largest percentages below the poverty level, respectively. Each group had approximately the same population in 1998.

dardized rate during these 5 years was 5.9 per 1000. Among young military applicants, rates were higher for African Americans and tended to be highest for African American women, especially those from the South, whose average standardized prevalence rate was 1.0 per 1000.

The CDC has used informal methods to estimate recent HIV incidence as approximately 40 000 infections per year and current prevalence as 800 000 to 900 000 persons living with HIV.[1] Since there were approximately 16 000 deaths among persons with AIDS during 1999, HIV prevalence may have increased by approximately 25 000 cases during that year. Such an increase is small compared with the large population involved and could not be detected with the available data sources.

Incidence. There are no national surveys providing HIV incidence estimates either for populations with behavioral risk or for the general population. Therefore, conclusions about HIV incidence can be drawn only by summarizing estimates from studies of persons with behavioral risk conducted in selected locations and from particular populations such as military applicants, Job Corps entrants, and blood donors.

HIV incidence rates are generally higher among MSM and IDUs than among other populations (Table 4). Recent HIV incidence among MSM has been approximately 2 per 100 person-years in most studies. Recent HIV incidence among IDUs varies geographically, but generally it is lower than that among MSM. In a study conducted in Philadelphia during the early 1990s, HIV incidence was much higher among IDUs who were not in drug treatment than among those who were (10.7 vs 3 per 100 person-years, respectively),[32] suggesting that most HIV infections occur in IDUs before they enter drug treatment programs.

HIV incidence rates are higher among African Americans than among other racial/ethnic groups. For example, incidence among first-time blood donors during 1993 through 1995 was more than 12 times higher among African Americans (51 per 100 000 per year) than among other racial/ethnic groups (<4 per 100 000 per year).[33] Incidence in the Young Men's Study was higher among African Americans (4.3 per 100 person-years) than among Whites (2.6 per 100 person-years).[21] Preliminary results from a similar study among 23- to 29-year-old MSM in 6 cities show that incidence among African Americans was much higher than among 15- to 22-year-old African American MSM and also much higher than among other 23- to 29-year-old MSM.[21] In 1999, the rates of HIV diagnoses for men and women aged 13 to 21 years in the initial 25 HIV reporting states were more than 11 times higher among African Americans than among Whites, both for men (rates per 100 000 of 25.4 and 2.2, respectively) and for women (rates of 29.2 and 1.7, respectively). Among Hispanics, the HIV diagnosis rates for men and women were 7.6 and 6.2 per 100 000, respectively.

Recent HIV incidence has been approximately constant in most populations for which time trends have been estimated. These include MSM and heterosexual patients not known to be IDUs at the San Francisco municipal sexually transmitted disease clinic (1990–1998[20]); US Army personnel on active duty (1988–1996[34]); men and women in the US Army Reserves (1986–1991[29,30]); and first-time blood donors (1993–1996[33]). However, HIV incidence declined during 1988 through 1997 among IDUs in Baltimore, Md.[23]

Trends in new HIV diagnoses and in seroprevalence rates also suggest that HIV incidence was approximately constant during 1993 through 1999 in most populations of adolescents and young adults for which data are available. During 1994 through 1999, there were 950 to 1050 new HIV diagnoses among persons aged 13 to 21 years (including AIDS diagnoses without a previous HIV diagnosis) each year in the initial 25 HIV reporting states. For both men and women in this age group, the numbers of diagnoses were approximately constant. Seroprevalence rates were approximately constant during 1993 through 1997 among young (18–21 years old) African American male applicants for military service and among African American and all other female Job Corps entrants (Table 3). However, rates declined among African American female applicants for military service and among African American male Job Corps entrants.

Discussion

The recent declines in AIDS diagnoses and in deaths among persons with AIDS are encouraging. However, highly active antiretroviral therapy (HAART), not behavioral change, was primarily responsible for these declines; the declines did not continue after 1997; and HIV continues to spread among MSM and IDUs and via heterosexual contact. From 1990 to 1999, the number of living persons diagnosed with AIDS increased 4-fold, to 312 000 persons. Increasing proportions of persons with AIDS are women, African Americans or Hispanics, IDUs, heterosexuals, and residents of the South, reflecting earlier trends in HIV transmission, differences in testing behaviors, and differential effects of HAART. Our synthesis of surveillance data also shows that the poor are disproportionately affected and that HIV incidence rates are especially

TABLE 2—Distribution of AIDS Diagnoses and Prevalence Among Adults and Adolescents, by Demographic Factors and Risk, and Rates per 100 000 Population: United States, 1990 and 1999

	Diagnoses				Year-End Prevalence			
	1990		1999		1990		1999	
	%	Rate	%	Rate	%	Rate	%	Rate
Sex								
Male	87	42.9	76	29.3	89	68.3	80	230.8
Female	13	5.8	24	8.8	11	8.2	20	55.1
Race/ethnicity								
White	50	15.6	30	7.6	55	26.7	39	74.0
African American	32	68.1	48	79.2	28	96.2	40	494.8
Hispanic	17	43.5	20	33.6	16	61.8	20	244.8
Region of residence								
Northeast	30	34.6	30	29.6	30	53.5	30	221.1
Midwest	10	10.2	9	7.6	10	16.5	10	59.2
South	32	22.5	41	21.9	32	34.8	37	149.3
West	24	27.4	16	14.2	25	44.9	20	129.1
Puerto Rico	4	66.4	3	42.1	3	86.6	3	304.7
County poverty level[a]								
Group 1	15	14.9	14	10.9	16	24.5	16	90.2
Group 2	19	18.1	20	15.2	18	27.8	20	112.0
Group 3	30	27.7	24	18.1	31	44.8	26	146.0
Group 4	36	33.2	41	30.4	35	50.1	38	210.3
Risk, males								
MSM	63		53		66		58	
MSM–IDU	9		6		10		8	
IDU	22		26		19		25	
Heterosexual contact	3		13		2		8	
Risk, females								
IDU	54		35		57		41	
Heterosexual contact	39		62		36		56	

Note. MSM = men who have sex with men; IDU = injection drug user.
[a]Groups are defined by the percentage of the 1990 county population below the poverty level (see Methods). Groups 1 and 4 include counties with the smallest and largest percentages below the poverty level, respectively. Each group had approximately the same population in 1998.

TABLE 3—Seroprevalence per 1000 Among Military Applicants and Job Corps Entrants, by Race, Sex, and Year of Test: United States, 1993–1998

	African American				Other Race/Ethnicity			
	Military		Job Corps		Military		Job Corps	
Year	Male	Female	Male	Female	Male	Female	Male	Female
1993	0.6	1.1	3.4	4.4	0.1	0.1	1.1	0.3
1994	0.7	1.4	2.7	2.9	0.0	0.0	0.7	0.5
1995	0.7	0.9	2.6	5.2	0.1	0.1	0.5	0.5
1996	1.0	0.8	2.1	3.3	0.1	0.1	0.6	0.5
1997	0.6	0.3	2.1	5.2	0.0	0.1	0.4	0.5
1998	0.8	0.8	NA	NA	0.0	0.1	NA	NA

Note. NA = data not available.

high among African Americans with high-risk behavior, and it suggests that HIV incidence has not declined since the early 1990s.

The declines in AIDS incidence and in deaths among persons with AIDS since 1995 were caused primarily by the slower progression of HIV-associated immune deficiency among persons who used HAART.[35–38] Thus, current trends in AIDS incidence and mortality primarily indicate the success of the secondary prevention of severe disease and death in persons living with HIV.[35,39] The substantial declines in AIDS deaths from 1995 to 1999 in all demographic and risk groups and the declines in AIDS diagnoses reflect the widespread use of HAART in all of these groups. The declines varied among groups because of differences in HIV incidence during the late 1980s and 1990s,[40] HIV testing patterns (with African Americans and Hispanics more likely to be tested late in the course of disease),[41] access to and use of effective therapy (with African Americans and Hispanics, women, the uninsured, and the poor less likely to have effective therapy),[42–44] and adherence to therapy.[45] Further studies are needed to evaluate the relative importance of these factors.

In marked contrast to the declines during 1996 and 1997, AIDS diagnoses and deaths were relatively constant during each quarter year in 1998 and 1999. Further declines in AIDS diagnoses and deaths during the next several years will require better access to therapy (especially among the poor), simpler drug regimens (to facilitate adherence), and the continued development of effective drugs. In the 25 original HIV reporting states, approximately 25% of those with new AIDS diagnoses each year during 1994 through 1998 had no earlier reported HIV diagnosis.[46] Therefore, increased HIV testing is also essential.

The disproportionate effect of the HIV epidemic on lower-income populations has been demonstrated before at the local level[47,48] but not at the national level. Because ours is an ecological analysis, based on county of residence at the time of AIDS diagnosis, the results may be confounded by other factors associated with AIDS incidence, such as geography and race/ethnicity, which reflect causal factors such as behavioral risk, past HIV inci-

TABLE 4—HIV Incidence Estimates: United States, 1985–1998

Population	Dates	Type of Study	Incidence per 100 Person-Years (95% CI)	Reference
		Men who have sex with men		
New York City	1994–1995	Longitudinal study (STD clinic)	3.3 (1.2, 7.2)	13
New York City	1993–1995	Cohort	2.9 (1.7, 4.9)	14
3 Cities	1993–1995	Cohort	2.3 (1.7, 2.9)	15
8 Cities	1994–1995	Cohort	1.5 (1.2, 1.9)	16
Seattle, Wash	1995–1996	Cohort	1.3 (0.4, 3.0)	17
7 Cities	1991–1996	RB (STD clinics)	2.1 (1.6, 2.8)	18
San Francisco, Calif	1996–1998	STARHS (anonymous test sites)	2.1 (1.3, 3.3)	19
San Francisco, Calif	1989–1998	STARHS (STD clinic)	6.6	20
6 Cities, young men	1994–1998	STARHS (venues)	2.8	21
6 Cities	1991–1997	STARHS (STD clinics)	7.2 (4.8, 10.5)	CDC, unpublished
		Injection drug users		
New York City	1991–1997	6 cohorts, 4 other programs	0.7 (0.5, 0.9)	22
Baltimore, Md	1988–1997	Cohort	3.1 (2.8, 3.5)	23
Baltimore, Md	1994–1997	Cohort, needle exchange	3.2	24
Philadelphia, Pa	Early 1990s	Cohort, women	3.5 (1.0, 9.0)	25
Los Angeles, Calif	1989–1994	Treatment program	0.7	26
4 Cities	1994–1997	RB (treatment programs):		27
		New York City	0.9 (0.5, 1.5)	
		Newark, NJ	0.9 (0.4, 1.8)	
		Seattle, Wash	0.2 (0.1, 0.6)	
		Los Angeles, Calif	0.0 (0.0, 0.3)	
7 Cities	1991–1996	RB (STD clinics)	0.9 (0.6, 1.2)	18
San Francisco, Calif	1989–1998	STARHS (STD clinics)	1.5 (0.6, 3.1)	20
6 Cities	1991–1997	STARHS (STD clinics)	1.8 (0.8, 4.0)	CDC, unpublished
		Persons presumed to have been infected through heterosexual contact		
New York City	1994–1995	Longitudinal study (STD clinic):		13
		Men	0.9 (0.4, 1.9)	
		Women	0.8 (0.2, 2.3)	
8 Cities	1994–1995	Cohort, women	1.1 (0.6, 2.3)	16
7 Cities	1991–1996	RB (STD clinics)	0.4 (0.4, 0.5)	18
San Francisco, Calif	1989–1998	STARHS (STD clinic)	0.4 (0.2, 0.5)	20
6 Cities	1991–1997	STARHS (STD clinics)	0.5 (0.4, 0.7)	CDC, unpublished
		General populations		
US Army active duty	1989–1993	Repeat testing	0.2	28
US Army reserves	1985–1991	Men, repeat testing	0.3	29
		Women, repeat testing	0.1	30
First-time blood donors	1993–1996	32 American Red Cross centers (STARHS)	0.010 (0.006, 0.015)	7
Whole blood donors	1991–1994	5 cities	0.004 (0.003, 0.005)	31
Apheresis donors	1991–1994	5 cities	0.001 (0.000, 0.007)	31

Note. CI = confidence interval; RB = record-based estimate (review of records for patients who made repeated visits); STD = sexually transmitted disease; STARHS = serologic testing algorithm for determining recent HIV seroconversion[7]; CDC = Centers for Disease Control and Prevention.

dence, testing behavior, and treatment. The CDC now collects socioeconomic data on persons with HIV and AIDS in selected states[49] and plans to do so in additional areas. Because income level has important implications for both primary and secondary HIV prevention, we will carry out detailed analyses to obtain more information about the association between income and other indicators of socioeconomic status and AIDS incidence.

Since early in the HIV epidemic, AIDS surveillance data have been used to identify modes of HIV transmission, populations into which the epidemic was spreading, populations at increased risk for infection, populations most severely affected, and populations with the greatest need for primary prevention, secondary prevention, and health care services.[46] These surveillance data have also been used to allocate federal resources for prevention and treatment. Modes of transmission are known. The other uses of HIV and AIDS surveillance continue to be important. We must modify surveillance to obtain data relevant to ensuring that primary and secondary prevention resources are allocated appropriately and to evaluating these interventions.

Our results have policy implications for the nature and future of HIV, AIDS, and behavioral surveillance in the United States. We need estimates of HIV incidence to guide primary prevention, so that we will know where, in which populations, and through which behaviors HIV is currently being transmitted. HIV incidence can be estimated directly both among persons tested repeatedly in high-risk populations (such as clients of sexually transmitted disease clinics) and among persons tested once (using a procedure to determine whether a person who tests positive was infected recently). Until more information on HIV incidence is available, we must continue to infer trends in HIV incidence from trends in rates of new HIV diagnoses and in prevalence rates among adolescents and young adults.

We need data to provide an early warning of a resurgence of HIV infection or the spread of infection into a new population. For

example, there are indications of recent increases in rectal gonorrhea and risky sexual behavioral among MSM.[50,51] We need enhanced behavioral surveillance among groups with high behavioral risk, as well as more behavioral data from interviewing representative samples of infected persons.

The populations in which the HIV epidemic is becoming concentrated—racial and ethnic minorities, women, and the poor—need increased access to prevention programs and health care services, but these are populations that had less access to health care services in the past. To be sure that resources are allocated appropriately for health care in these populations, we need estimates of the number of people living with diagnosed HIV and AIDS at the national, state, and local levels, which will require HIV reporting in all states.

During the last 10 years, groups with less access to medical care have been affected more and more by the HIV epidemic. This change makes it harder to employ effective primary and secondary prevention programs. Monitoring the status of the epidemic and targeting and evaluating the effectiveness of prevention programs will be an important public health challenge. An expanded HIV and AIDS surveillance program will be essential in meeting this challenge. □

Contributors

All authors contributed to the conception and design of this project, the interpretation of the data, and the editing of the manuscript. J. Karon did the data analyses and was the primary author of the text.

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