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AIDS and Human Immunodeficiency Virus Infection in the United States: 1988 Update

INTRODUCTION

National surveillance of life-threatening diseases associated with human immunodeficiency virus (HIV) infection, including acquired immunodeficiency syndrome (AIDS), remains an essential indicator of the course of the HIV epidemic. Diagnosed cases of AIDS are, however, the clinical endpoint of the continuum of infection with HIV; they do not necessarily reflect current HIV infection patterns, since the media interval between infection with HIV and onset of AIDS is nearly 10 years.

To complement AIDS surveillance and more effectively monitor the levels and trends of HIV infection in the United States, CDC, in collaboration with other federal agencies, state and local health departments, blood-collection agencies, and medical research institutions, has undertaken a multifaceted "family" of complementary HIV surveys. Individually and in combination with other ongoing surveillance activities, these studies will provide local and national public health officials with information on HIV seroprevalence (the prevalence of HIV infection as measured by the presence of HIV antibodies in the blood) so that interventions can be targeted to control the spread of HIV infection in specific settings.

An extensive review of the information available on HIV infection in the United States was published by CDC in December 1987 (1), before the full implementation of the family of surveys. New information has become available in the year since that review, both from the CDC surveys and from other sources. This report provides an overview of patterns and trends in national surveillance for AIDS and summarizes the current data on HIV seroprevalence in the United States. STATUS AND TRENDS: AIDS SURVEILLANCE

Before HIV was identified as the causative agent for AIDS, the surveillance definition of AIDS included diseases that were indicative of a defect in cell-mediated immunity, occurring in a person with no known cause for diminished resistance to disease. Such indicator diseases included Pneumocystis carinii pneumonia, Kaposi's sarcoma, and other serious opportunistic infections. With the identification of HIV as the causative agent for AIDS and the availability of laboratory tests to detect HIV antibody, the case definition was revised in 1985 and again in 1987 to include additional diseases in persons with laboratory evidence for HIV infection. These diseases included disseminated histoplasmosis, chronic isosporiasis, and certain non-Hodgkin's lymphomas (1985 revision), and extrapulmonary tuberculosis, HIV encephalopathy, HIV wasting syndrome, and presumptively diagnosed indicator diseases (1987 revision). Patterns and Trends in AIDS Surveillance

As of December 31, 1988, 82,764 cases of AIDS in the United States and its territories had been

reported to CDC. Of these cases, more than 46,000 have been fatal. Although the number of cases reported each year continues to rise (Figure 1), the rate of increase has declined yearly, except in 1987, when the revised case definition resulted in an unusual increase in the number of reported cases.

Geographic distribution. AIDS cases have been reported from all 50 states, the District of Columbia, and four U.S. territories, but the geographic distribution of AIDS cases remains uneven. Between January 1 and December 31, 1988, annual incidence rates by geographic area varied from 0.6 cases per 100,000 persons in North Dakota to 38.9 cases in New York (Figure 2); the rate in the District of Columbia was 81.2 cases per 100,000 persons.

The geographic distribution of cases has shifted over time. Before 1983, the mid-Atlantic region of the United States (New York, New Jersey, and Pennsylvania) reported 63% (541 of 856) of all AIDS cases in the United States (Figure 3). This proportion gradually decreased to 32% (00,279 of 32,311) in 1988, mainly because of a slower rate of increase in the proportion of AIDS patients with a history of male homosexual activity without intravenous (IV)-drug use reported from this region compared with other regions of the country. For example, before 1983, 58% (318 of 544) of the AIDS patients in this transmission category were reported from the mid-Atlantic region; reported cases rose more slowly in the mid-Atlantic region, and thus this figure had decreased to 21% (3,859 of 17,993) by 1988 (Figure 4). This slower rate of increase in cases in the mid-Atlantic region also occurred among heterosexual patients with a history of IV-drug use. Before 1983, 91% (130 of 143) of all such cases were reported from this region; however, this percentage had decreased to 59% (4,423 of 7,531) by 1988 (Figure 5).

Age and sex distribution. Of the 82,764 AIDS cases reported through December 31, 1988, 81,083 (98%) were in adults, 335 (less than 1%) were in adolescents (13-19 years of age), and 1,346 (2%) were in children (less than 13 years of age). Since 1982, 91% of the adult cases reported have been in men. The proportion of adult cases in women increased from 7% before 1984 to 10% in 1988. In 82% of the cases in adolescents and 55% of the cases in children, the patients were male; these proportions have remained relatively stable since 1982.

Modes of transmission. HIV has three main modes of transmission: sexual contact with an infected person, exposure to infected blood or blood products (mainly through needle-sharing among IV-drug users), and perinatal transmission from an infected woman to her fetus or infant.

Recent investigations have shown no evidence of new modes of HIV transmission, and, with only a few exceptions, the distribution of cases by transmission category has remained relatively stable (Table 1). Although homosexual and bisexual men still account for the majority of AIDS cases, case surveillance has documented an increasing role of IV-drug use in the transmission of HIV. The proportion of cases in adult/adolescent males with a history of homosexual/bisexual activity as the only risk factor for AIDS decreased from 70% in 1987 to 63% in 1988, whereas the proportion of cases in adult/adolescent males with a history of IV-drug use as the only risk factor increased from 14% in 1987 to 20% in 1988. In adult/adolescent female cases, the proportion of women with a history of IV-drug use decreased from a high of 60% in 1984 to 49% in 1987 and increased again in 1988 to 53%. The proportion of cases in children whose mothers had a history of sex with a person at risk for HIV infection (including IV-drug users) rose from 11% before 1985 to 21% in 1988.

By the end of 1988, 3,589 heterosexually acquired AIDS cases had been reported to CDC. Of these cases, 2,340 (65%) were in persons who reported sexual contact with a person with or at increased risk for HIV infection, and 1,249 (35%) were in persons born in countries with high rates of heterosexually acquired HIV infection (98% of whom were Haitians). Although the proportion of heterosexually acquired AIDS cases has remained relatively stable, ranging from 5.2% of all adults cases reported in 1983 to 4.8% in 1988, the composition of the group has changed. U.S. residents born in Haiti or Africa

accounted for 79% of the 107 heterosexually acquired cases reported in 1983, but only 25% of the 1,543 cases reported in 1988. The proportion of heterosexual men with AIDS (excluding U.S. residents born in Haiti or Africa) whose infection was acquired through heterosexual transmission increased from 0.5% in 1983 to 3.9% in 1988; the proportion of females with heterosexually acquired AIDS increased from 14.8% to 25.6% over the same period. Most heterosexually acquired cases, excluding U.S. residents born in Haiti or Africa, continue to be in women (75%), blacks or Hispanics (70%), and partners of IV-drug users (71%). Thus, heterosexually acquired AIDS in the United States has been focused in demographically discrete population groups.

Investigations have been completed for 1,971 adult cases reported to CDC with an undetermined risk for HIV infection. Risk factors were identified for 1,632 (83%) of these persons. The 339 persons with no risk factors identified after investigation were similar to persons with heterosexually acquired AIDS and to IV-drug users with AIDS in that the majority (65%) were black or Hispanic. The sex distribution was also similar to IV-drug users with AIDS (78% male; 22% female). Of these persons, 22% reported illicit, non-IV-drug use. One-third reported a history of a sexually transmitted disease, and 32% of the interviewed men reported sexual contact with a prostitute. These investigations have not suggested the existence of new modes of HIV transmission.

Race/ethnicity. Blacks and Hispanics have suffered a disproportionately large share of the burden of AIDS in the United States (Table 2). Excluding U.S. territories, the cumulative incidence of AIDS per 100,000 persons was highest in these groups (83.8 and 73.0 in blacks and Hispanics, respectively) followed by whites (26.3), Asian/Pacific Islanders (13.9), and American Indians/Alaskan Natives (6.1). The racial distribution of cases has remained stable over time, with only a few exceptions. The proportion of cases in adult white males decreased in 1988, and the proportion in blacks and Hispanics increased, reflecting at least in part the impact of the change in the AIDS case definition. In both adults and children, this racial/ethnic disproportion is directly or indirectly related to IV-drug use (Table 3).

Mortality. Fifty-six percent of all AIDS patients (56% of adults and adolescents and 55% of children) and 85% of those diagnosed before 1986 are reported to have died. The actual case-fatality ratio approaches 100% within 5 years after diagnosis of AIDS; incomplete reporting of deaths to CDC results in an underestimate of the case-fatality ratio.

AIDS exerts a substantial impact on young adult mortality; in 1987, AIDS deaths accounted for 11% of all deaths in men 25-34 years of age and 9% of all deaths in men 35-44 years of age. For women, these proportions were 3% and 1%, respectively. To obtain more complete information on the survival status of reported AIDS cases, CDC will conduct survival analyses in late 1989 for specific geographic locations using the National Death Index. Impact of the Revised Case Definition

Because of changing diagnostic practices and the availability of laboratory tests to detect antibody to HIV, CDC revised the case definition for AIDS in 1985 and again in 1987. The reported incidence of AIDS increased only 3%-4% as a result of the 1985 revision, but the 1987 revision has greatly increased the number of reported cases. Of all cases reported between September 1987 and December 1988, 29% met only the revised definition. A higher proportion of patients meeting only the 1987 case definition compared with those meeting the 1985 case definition were female, black or Hispanic, and/or had a history of IV-drug use. Possible explanations for these differences include a higher frequency of tuberculosis and fewer complete diagnostic workups in these groups, leading to more frequent presumptive diagnoses of AIDS.

Analyses of trends in AIDS cases must take into account the large number of cases meeting only the revised case definition and the varying use of the definition in different populations. Completeness of reporting and reporting delays must also be considered. Completeness of AIDS Case Reporting

Many states have assessed the completeness of reporting of diagnosed cases by comparing lists of reported AIDS cases with lists of potential cases obtained from alternative information sources (e.g., tumor registries, death certificates, and tuberculosis registries) or by implementing intensive case-finding activities to search for unreported cases. However, because their methodologies vary, these evaluations require critical review and cannot be used to estimate the completeness of reporting throughout the United States.

Most evaluations have been in high-prevalence areas that have maintained strong, federally supported AIDS surveillance programs for several years. Evaluations conducted in these areas have shown 80%-100% completeness of reporting of diagnosed cases. Fewer evaluations have been performed in lower prevalence areas, which only recently have received federal funding and technical assistance to support surveillance activities. In Oregon and South Carolina, completeness of reporting of diagnosed cases was determined to be 63% and 61%, respectively, before surveillance activities were strengthened. A follow-up evaluation in Oregon suggests that the completeness of reporting in this state has improved to 97% since state surveillance activities have been enhanced.

Diagnosed AIDS cases do not represent all cases of severe morbidity associated with HIV infection. Many HIV-infected persons suffer from illnesses that are not reportable as AIDS even under the current case definition (e.g., pneumonia in seropositive IV-drug users), and some infected persons may not have access to adequate medical or diagnostic care. Thus, the number of persons with severe HIV-related morbidity exceeds the number of diagnosed AIDS cases; reported AIDS cases may represent fewer than 80% of all cases of recognized or unrecognized severe morbidity associated with HIV infection.

As of May 1988, all 50 states and the District of Columbia were receiving federal assistance to strengthen AIDS surveillance activities. A standardized evaluation of the completeness of AIDS reporting, using alternative data bases (e.g., statewide hospital discharge summaries and Medicaid documentation), will be supported by a fiscal year 1990 initiative in 15-20 sites. Comparably collected data from these sites will provide a clearer understanding of the completeness of reporting nationally.
Reporting Delays

The timeliness in which an AIDS case report is received at CDC depends on several factors. These factors include the volume of cases reported from a state and the availability of staff to complete case report forms. In many instances, initial case reports are incomplete and require additional follow-up by local health department staff, including reviews of other record systems and contacts with health-care providers. In some cases, local health officials may become aware of a previously diagnosed case only through retrospective reviews of death certificates, tumor registries, tuberculosis registries, or laboratory reports.

Table 4 shows the estimated percentage of cases diagnosed in selected calendar quarters that were reported to CDC within 0, 1, 2, 3, 6, and 12 months after the month of diagnosis. Of cases diagnosed by the end of March 1987, 32% were reported within 1 month and 48% were reported within 2 months after the date of diagnosis; for cases diagnosed during the second half of 1987, the corresponding percentages are about 20% and 41%. Current estimates show that the percentage of cases reported within 1 month of diagnosis have again reached the 30% level during the second quarter of 1988. The increase in reporting delays during the second half of 1987 is thought to be associated with the increased time required by local surveillance staff to review and process a backlog of case reports and of newly reportable cases meeting only the revised case definition. Projections of AIDS Cases and Deaths Through 1992

Projections of the number of AIDS cases that will be diagnosed and reported to CDC in the future are

made through the use of mathematical models. Using an extrapolation model, the Public Health Service (PHS) projected in May 1986 that 270,000 AIDS cases diagnosed by the end of 1991 would be reported to CDC. Trends were extrapolated from historical incidence data after adjusting for estimated delays in case reporting (2). Figure 6 shows the 1986 projections, by quarter of diagnosis. Current data indicate that more cases were actually diagnosed in 1986 and 1987 than were predicted. As of December 31, 1988, actual diagnosed and reported cases for these years numbered 17,175 and 24,108, respectively. After adjustment was made for estimated reporting delays, these figures increased to 17,900 and 25,200, respectively, for cases that are compatible with the pre-1987 case definition, or 10%-13% higher than the corresponding predictions. The total numbers of cases expected to be diagnosed and reported are 18,600 for 1986 and 27,700 for 1987, or about 20% more than the predictions.

Projections made in May 1988 estimate that 365,000 AIDS cases will have been diagnosed in the United States by the end of 1992. The number of cases is expected to increase by about 10,000 per year, from 39,000 cases in 1988 to 80,000 in 1992 (Table 5). The new projections correspond closely with those made in 1986, after the earlier projections are inflated by 10% to account for cases diagnosed but not reported to CDC. With the use of an average 12-month estimate of survival after a diagnosis of AIDS (as was used in 1986), 263,000 of these projected 365,000 AIDS patients are predicted to die by the end of 1992. The actual number of deaths may be lower because these figures do not reflect the effect of new therapies, such as AZT. The data required for estimating the long-term effect of these therapies on survival are not yet available.

Figure 7 depicts the incidence of reported AIDS cases by quarter (after adjustment for reporting delays) through 1987 as well as the 1988 projected incidence for reported cases diagnosed in 1988-1992 that will be reported to CDC. The wide prediction intervals (particularly after 1989) reflect different possible patterns of incidence -- from decreasing incidence to an acceleration in quarterly incidence. It is unlikely, however, that incidence will drop sharply in the next 4 years; if at least 1 million Americans are now infected with HIV, as PHS estimates, the long interval between infection and a diagnosis of AIDS makes unlikely a marked decrease in incidence, such as that suggested by the lower prediction limit in Figure 7.

The prediction intervals for the 1988 projections are wider than those for the 1986 projections because of a change in the statistical procedure being used. The current method incorporates more completely the actual uncertainty in the projection model.

Estimates of future trends in AIDS cases were also made in 1988 by using the back-calculation method (3,4). This approach makes use of current AIDS incidence data (adjusted for reporting delays) and estimates of the latency-period distribution, the time from HIV infection to AIDS diagnosis, to predict future trends in AIDS incidence. With the use of this method, the projection is that the cumulative case count will reach 330,000 by the end of 1992 (5), which, after the addition of 10% to reflect diagnosed cases never reported to CDC, is virtually identical to the prediction from the extrapolation method. The agreement in forecasts from these two very different methods suggests that the projections are reasonable estimates of the cumulative AIDS case count for the next 4 years.

Projections indicate that a total of 172,000 AIDS patients will require medical care in 1992, at a cost expected to range from $5 billion to $13 billion. These figures are still underestimates of the true magnitude of HIV morbidity, since many clinical manifestations of HIV infection are not reportable even under the current AIDS case definition. STATUS AND TRENDS: HIV INFECTION

Information on levels and spread of HIV infection in the population is essential for targeting and evaluating prevention and control efforts and for predicting future health-care needs. Because HIV

infections are not readily or routinely ascertained and many early infections do not come to medical attention, comprehensive survey methods and sentinel surveillance approaches must be used to determine seroprevalence rates and patterns. Some surveys must be anonymous and unlinkable to identifiable persons to avoid the self-selection bias inherent in voluntary surveys that could lead to either significant underestimates or occasional overestimates of HIV prevalence (6). Other surveys must include interviews of volunteer participants to evaluate risk factors for HIV infection. Both types of surveys must continue over time to assess trends in infection.

CDC's comprehensive family of HIV surveys focuses on four types of populations: groups at recognized risk of infection, women of reproductive age, persons in special settings such as prisons and colleges, and large sentinel groups observed over time. In the year since the 1987 review of data on HIV infection in the United States (1), more information has become available, both from the family of HIV surveys and from other sources, on levels of infection in reproductive-age women and in regular heterosexual partners of HIV-infected persons. Much more information is available on HIV infection in prisoners, and preliminary data are available on HIV infection in college students and migrant farm workers. Data from an additional year have now been analyzed for the following large sentinel groups observed over time: blood donors, military applicants, Job Corps entrants, and patients at sentinel hospitals. Impact of Self-Selection of Survey Participants

A study from New Mexico has implications for the interpretation of data from all types of HIV surveys. An HIV survey was conducted in a sexually transmitted disease (STD) clinic in Albuquerque, New Mexico, using voluntary nonblinded and blinded anonymous components (7). Of 949 male clients, 782 (82%) accepted HIV testing and 167 (18%) declined. Among the acceptors, the overall seroprevalence was 1.0%; the seroprevalence in homosexual men was 7.0%. However, more than half of the total number of seropositive patients were among the 18% who declined HIV testing, and the seroprevalence in those who declined testing was more than five times that of the acceptors. Therefore, the net seroprevalence for the entire group was actually 1.8% rather than the 1.0% observed and was 14.3% for homosexual men rather than the 7.0% observed. Thus, with the nonblinded survey approach, the HIV prevalence in this STD clinic population was substantially underestimated, even though a relatively high participation rate of more than 80% was achieved. Similarly, a recent study of childbearing women in New York City found that voluntary testing failed to detect 86% of those infected with HIV, as determined by a simultaneous blinded survey (8).

These studies show the need for blinded surveys (unlinked surveys based on blood specimens already collected for other purposes) to accurately assess HIV prevalence. Nonblinded (linked) surveys remain important for risk assessment but should not be relied upon as the principal indicator of HIV prevalence. These findings also underscore the need for careful pilot studies to evaluate the potential effects of self- selection bias in the proposed national household-based HIV seroprevalence survey. HIV Infection in Groups at Recognized Risk

Homosexual and bisexual men. Results from recent surveys of homosexual and bisexual men at STD clinics and in recruited cohorts show seroprevalence values of 24% in Milwaukee (9), 14% in Albuquerque, New Mexico (7), and 50% in male prostitutes in New York City (10). These findings are consistent with previous data from these and other cities reviewed in 1987 (1).

Intravenous-drug users. Table 6 summarizes recent and updated data for persons abusing IV drugs. Data from the New York City surveys are consistent with other available information from that area (1), but newer data from Detroit and Milwaukee suggest possible increases in seroprevalence. Seroprevalence in the western cities appears to be remaining at the low levels previously seen. The first data available from Washington, D.C.--28% seroprevalence in hospitalized IV-drug users without AIDS-like conditions--are similar in magnitude to earlier data from nearby Baltimore. Cohort data

from New York City showed an annual rate of new HIV infection of 7% in previously uninfected persons through 1987 (11).

The preliminary evidence of increased HIV prevalence in some large midwestern cities and the cohort evidence of ongoing new infection in New York City suggest that HIV transmission associated with IV-drug use continues actively, although it is not possible to be certain because of the different study designs used. CDC is collaborating with health departments in 39 cities and the corresponding states to conduct standardized surveys in IV-drug users in 80 treatment centers. These surveys will be repeated annually to indicate trends as well as levels of infection. Preliminary data from these surveys in five cities are consistent with other recent data.

Heterosexual partners of persons at risk. New and updated studies in the United States (and other countries) of HIV transmission from infected persons to their steady heterosexual partners without other risks continue to show varied but appreciable levels of transmission risk. In 13 newer (Table 7) and 13 previous studies (1) that include at least 20 couples each, the prevalence of infection in heterosexual partners ranges from 0-58%, with a median of 24%. Studies available from Italy (Table 7) indicate relatively lower risk in occasional partners of infected persons, with prevalence values of 0-1% compared with 15%-38% for steady partners.

The relative efficiency of male-to-female versus female-to-male transmission may be an important determinant in rates of heterosexual transmission. Although sufficient data are not yet available for fully evaluating differences, in several of the larger studies in the United States and Europe, female partners of HIV-infected men appeared to have higher prevalence rates than did male partners of HIV-infected women in the same study populations (1, Table 7). HIV Infection in Women of Reproductive Age

Data on HIV infection in women of reproductive age in selected clinical settings increased considerably in 1988. Preliminary statewide data are also available on childbearing women in nine states from the anonymous, unlinked testing of blood specimens routinely collected from newborn infants (6).

Women in clinical settings. Results of 13 new or updated surveys and studies from clinical settings in eight areas became available in 1988 (Table 8). Similar to data reported before 1988 (1), the observed seroprevalence ranged from less than 1% to approximately 4.3% in female clients who were screened without knowledge of risk status. Most of the rates above 1% were from inner-city hospitals in the Northeast, the region and the areas with the country's highest incidence of AIDS in women. The highest figure for a group of women who were tested without regard to individual risk, 4.3%, was found among women delivering at a hospital that serves an inner-city, high-risk population in Newark, New Jersey.

Surveys of childbearing women. The prevalence of HIV infection in childbearing women can be determined by anonymously testing blood that is routinely collected from their newborn infants (for diagnosis of hereditary metabolic disorders in the infants). This method measures the seroprevalence in childbearing women because sample selection is relatively unbiased and blood specimens are available for over 90% of births. No behavioral information is available for assessing risk for HIV infection (although risk can be assessed in surveys of voluntary participants in women's health clinics). However, on the basis of risks known to be associated with AIDS in women and on the geographic correlation of highest HIV prevalence in women in New York City in areas where IV-drug use is highest, IV-drug use in women and in their male sex partners appears to play the major role in HIV transmission in previous studies (L Novick and R Stricof, New York State Department of Health, personal communication).

Of more than 40 states presently implementing or anticipating surveys of childbearing women, preliminary statewide data are available from nine (Table 9). Prevalence rates range from under 0.1% in California, Colorado, Michigan, New Mexico, and Texas to 0.2% in Massachusetts, 0.5% in Florida and New Jersey, and 0.7% in New York. In these states, prevalence is lowest in rural areas and highest in inner-city areas. HIV Infection in Special Settings

Prisoners. Many state correctional systems have instituted either mass screening programs or large-scale, blinded serologic surveys for HIV infection. The Federal Bureau of Prisons tests a 10% sample of federal prisoners. Other jurisdictions conduct screening or testing programs for selected groups of prisoners, such as known IV-drug users and others thought to be at particularly high risk (12). Most routine screening programs have yielded seroprevalence rates higher than those estimated for the general population but much lower than those seen in groups composed of persons at increased risk (Table 10). Two states have found appreciably high seroprevalence rates in incoming prisoners: Maryland, with 7% (13), and New York, with 15% (14). These rates reflect the large numbers of IV-drug users in the inmate populations and the high prevalence of HIV infection in IV-drug users in these states.

College students. As part of the comprehensive family of HIV surveys and studies (6), CDC is collaborating with the American College Health Association in an assessment of HIV infection in college students. Tests are conducted anonymously on blood specimens drawn for other purposes at student clinics; 1,000 students are scheduled to be tested at each of 19 universities. For the first 12,000 specimens tested, comprising various numbers of specimens from 17 of the participating campuses, the crude overall seroprevalence is 0.2%. Although the data are preliminary, the majority of seropositive specimens have come from male students.

Migrant and seasonal farmworkers. To estimate the prevalence of HIV infection in migrant and seasonal farmworkers, researchers conducted a study at a health clinic serving approximately 4,500 such workers in North Carolina. Between August 27 and October 27, 1987, all blood specimens routinely collected at the clinic for other purposes were tested anonymously for HIV antibody. Of 426 samples, 11 (2.6%) were positive for HIV antibody (15). The highest age-specific prevalence (6.7%) was in the 30- to 39-year age group; HIV-antibody prevalence was more than twice as high for males (3.5%) as for females (1.5%). Seroprevalence values were 4.1% (11 of 263) for black patients, zero (none of 125) for Hispanics, and zero (none of 38) for whites. No risk information was available for the participants in the survey. HIV Infection in Large Population Surveys

The national HIV surveillance program also includes larger population surveys of blood donors, civilian applicants for military service, Job Corps entrants, and non-AIDS patients at sentinel hospitals. These samples are from broad segments of the U.S. population but are biased according to the degree to which persons at high risk are restricted from or exclude themselves from these groups and as a result of the sociodemographic and geographic composition of the groups.

Blood donors. In the highly self-selected population of voluntary blood donors, the prevalence of HIV infection is low--0.018% for 15 million American Red Cross blood donations between April 1985 and May 1988. (These represent about half of all voluntary donations in the United States.) The overall level has declined from 0.035% in mid-1985 to 0.010% in the second quarter of 1988, primarily because of the permanent deferral of previously identified seropositive persons. Donors tested for the first time probably provide the best estimate of HIV seroprevalence in the segment of the population from which donors are drawn. The overall seroprevalence among persons donating for the first time in 1985-1988 was 0.042% (provisional data provided by R Dodd, American Red Cross). (See section titled "Trends in HIV Infection over Time.")

Although these rates cannot yet be adjusted by age, sex, or race, they are higher for men than for women (0.067% for males and 0.014% for females among first-time donors) and higher for blacks and Hispanics than for whites. Despite the selected nature of blood donors with regard to HIV risk factors (persons with a history of male homosexual or bisexual contact, IV-drug use, or sexual contact with persons at high risk are asked not to donate), 80%-90% of seropositive donors interviewed acknowledge one or more of these risk factors for infection (16-17 and CDC unpublished data, 1988). This population will continue to be monitored as part of overall HIV surveillance activities.

Civilian applicants for military service. The crude overall prevalence of HIV infection is 0.14% in 1,798,600 applicants for military service screened between October 1985 and September 1988. The overall rate is 0.15% in males and 0.07% in females. (See section titled "Trends in HIV Infection over Time.") The Walter Reed Army Institute of Research, Department of Defense, in collaboration with CDC and state and local health departments, is undertaking a systematic evaluation of risk factors in seropositive military applicants to monitor trends in modes of HIV transmission in the population from which recruits are drawn.

Job Corps entrants. Since March 1987, HIV-antibody screening has been required as part of the medical evaluation of new participants in residential training programs of the Job Corps (Department of Labor). Of the first 84,089 residential Job Corps entrants tested, 0.41% were positive for HIV antibody (provisional data provided by C Hayman, Job Corps, Department of Labor). Entrants are disadvantaged youths 16-21 years of age who are drawn heavily from racial and ethnic minorities and include both the inner-city and the rural poor. The Job Corps has no entrance restrictions on the basis of sexual orientation or hemophilia, but active IV-drug users are not accepted.

Sentinel hospital patients. To monitor changes in HIV-antibody prevalence over time in a population that is not self-selected, CDC initiated collaborative surveys in a network of sentinel hospitals in September 1986. By the end of 1988, the network had grown to 40 hospitals nationwide. The surveys are anonymous and unlinked to identifiable persons, and they include patients of all ages who are being treated for conditions not known to be related to HIV. For the first six hospitals for which there are at least 6 months of data (26,275 specimens tested), the range of seroprevalence rates is from 0.12% to 0.80%, with a median of 0.24%. Hospital-specific seroprevalence rates for males range from 0.19% to 1.04%, with a median of 0.50%, and for females range from 0 to 0.57%, with a median of 0.05%.

Because the participating hospitals may serve specialized segments of the community, these data are not representative of the communities sampled. In addition, the sample does not represent the highest-risk patients in the hospitals, e.g., those on infectious disease and cancer services or those being treated for gunshot or knife wounds. In a recent study of critically ill patients at a Baltimore, Maryland, emergency room (18), 4.0% of 2,275 patients had HIV infection that was unrecognized on admission. HIV-infection status was partially associated with penetrating trauma, which includes knife and gunshot wounds (18). Patterns of HIV Infection by Race and Ethnicity

The cumulative incidence of AIDS cases is disproportionately higher in blacks and Hispanics than in whites (Table 11). The ratio of AIDS case incidence is 3.2 to 1 for blacks and 2.8 to 1 for Hispanics compared with whites. This racial/ethnic disproportion is also observed in HIV-seropositive blood donors, applicants for military service, and sentinel hospital patients (Table 11). Even among homosexual and bisexual men and among IV-drug users, where race/ethnicity-specific data are available, blacks appear to have higher seroprevalence rates than whites. In a large multicenter study of female prostitutes (19), black and Hispanic prostitutes had a higher HIV-antibody prevalence (15.4%) than did white and other prostitutes (6.7%), with a ratio of 2.3:1. The disproportion existed both for prostitutes who used IV drugs (2.5:1) and for those who did not acknowledge IV-drug use (3.3:1). Blacks also had higher seroprevalence rates in studies of migrant farmworkers (15) and in Belle Glade,

Florida (20). The higher rate of IV-drug use among black and Hispanic groups, with consequently greater risk of HIV exposure, is clearly a contributing factor to this racial disproportion. However, because disproportionate rates of HIV-antibody prevalence appear more frequently even among black and Hispanic IV-drug users compared with white users, it may not be the only factor. Evaluation of the Estimate of Total HIV Infections

see ref. (1)

Several different approaches have been used to estimate the total number of HIV infections (1). These estimates can be evaluated by examining their compatibility with available prevalence data. CDC's working estimate of 1.0 million-1.5 million infections (1) corresponds to a 0.4%-0.6% infection rate in the U.S. population of 245 million (Table 12). Data from the six pilot sentinel hospitals, which are located in cities that in the aggregate have an HIV prevalence in applicants for military service of approximately the national average (21 and CDC unpublished data, 1988), show a median prevalence of 0.24% and a range from 0.12% to 0.80%. These preliminary findings fall below the "expected" prevalence but are in the vicinity.

Most HIV-infected persons are between 17 and 55 years of age, an age span that constitutes about 55% of the population. With a male-to-female predominance in prevalence typically of at least 4 to 1, the prevalence rate might be expected to range from 1.2% to 1.8% for men and from 0.3% to 0.4% for women (Table 12). As noted already, data from childbearing women range from under 0.1% in California, Colorado, Michigan, New Mexico, and Texas to 0.2% in Massachusetts, 0.5% in Florida and New Jersey, and 0.7% in New York. For predominantly male prisoners in 15 state correctional systems, who should overrepresent HIV prevalence because of more frequent IV-drug use, data range from 0 to 15.0%, with a median of 0.9% (1, Table 10). Thus, while variable, the observed HIV antibody prevalence data are compatible with CDC's 1.0 million-1.5 million working estimate, particularly with the lower end of the range. Trends in HIV Infection over Time

The risk of new infection in persons with hemophilia and in persons receiving blood transfusions has declined dramatically because of the screening of donated blood and the heat treatment of clotting factor concentrates. Evidence also indicates an appreciable decline in the incidence of new infections in homosexual men. Eight cohorts of homosexual men observed over time showed sharp drops in incidence (1), and the most recent data available from the large San Francisco cohort showed no new infections in 1987 (22). In addition, considerable evidence reflects reduced high-risk sexual behavior in homosexual men (23) and sharp declines in rates of other sexually transmitted diseases, at least in white homosexual men (24 and CDC unpublished data, 1988).

The risk of new infection, however, appears to remain high in IV-drug users and in their heterosexual partners. Indeed, in several areas, the prevalence of HIV infection in IV-drug users has been increasing (1), and the annual rate of new infection was documented to be as high as 19% in one group in New York City between 1985 and 1986 (25) and as high as 7% as recently as 1987 (11).

Since 1985, prevalence has declined in first-time Red Cross blood donors, more so in men than in women (Figure 8; 1; and R Dodd, American Red Cross, personal communication). Prevalence has also decreased in male applicants for military service, primarily because of a decline in prevalence rates for white males (Figures 9 and 10, 26). However, both blood donors and applicants for military service are self-selected. Moreover, blood-collection agencies have actively tried to reduce the number of donations by persons at risk. Therefore, an increase in the rate of self-deferral by persons at risk could have influenced the observed prevalence patterns in both blood donors and military recruit applicants.

Data on trends over time are limited for groups not subject to self-selection. In the first 24 months of anonymous testing of non-AIDS patients at the four pilot sentinel hospitals, the prevalence has been stable (Figure 11; 21; and CDC unpublished data, 1988). Childbearing women in Massachussetts had a

net seroprevalence of 0.21% in 1987; data from 1988 indicate a slight increase in net seroprevalence to 0.25% (R Hoff and GF Grady, Massachusetts Department of Health, personal communication).

Stable seroprevalence over time does not imply an absence of new infection; rather, a stable net prevalence is consistent with ongoing new infection. For example, 19-year-old applicants for military service in 1988 have a higher prevalence than 18-year-old applicants in 1987, consistent with infection having occurred in the population throughout the year. Direct evidence shows that new infections continue to occur in donors giving blood more than once (0.03 per 1,000 per year) and in active-duty military personnel (0.8 per 1,000 per year) (1). The prevalence patterns in such large groups are the sum total of different patterns in their component subgroups; declining rates in one subgroup may balance increasing rates in another. As infected persons become ill and are less likely to be sampled, they cause a decline in observed prevalence that may obscure increases due to new infection. Although the relatively stable preliminary prevalence trends suggest that new HIV infection is not spreading rapidly throughout the entire population, reported AIDS cases are expected to continue to increase, reflecting the lengthy interval between infection and onset of AIDS in the estimated 1.0 million-1.5 million persons already infected with HIV in the United States. STATUS OF HIV SEROSURVEILLANCE ACTIVITIES

Since November 30, 1987, the implementation of the clinic-based, sentinel, and childbearing-women surveys in the comprehensive family of HIV surveys has proceeded rapidly. Table 13 summarizes the current status of these surveys.

The National Household Seroprevalence Survey (NHSS), a nationwide household- based survey to determine the number of HIV-infected persons in the United States, is being conducted in two phases. The first phase consists of pilot and pretest studies to examine factors affecting study validity, such as participation rates, response bias, and procedural and logistical approaches. The second phase--the 50,000-household nationwide survey--will be planned after phase one is completed, on the basis of the outcome of the pilot study and pretest. The pilot study of approximately 300 households was conducted in Allegheny County, Pennsylvania, in January and February 1989. Analysis of results is now being completed. Data collection for the pretest involving at least 1,700 households is scheduled for late spring 1989.

The results of surveys such as the proposed NHSS must be interpreted with caution; a difference in the participation rate between persons at high risk and those at low risk of infection may markedly influence the validity of the results (7). Because of this difference, even a high participation rate (e.g., 95%) can result in inaccurate results if a large proportion of the population at high risk is part of the 5% that chooses not to participate.

References

1.CDC. Human immunodeficiency virus infection in the United States: a review of current knowledge. MMWR 1987;36(suppl S-6):1-48. 2.Morgan WM, Curran JW. Acquired immunodeficiency syndrome: current and future trends. Public Health Rep 1986;101:459-65. 3.Brookmeyer R, Gail MH. Minimum size of the acquired immunodeficiency syndrome (AIDS) epidemic in the United States. Lancet 1986;6:1320-2. 4.Brookmeyer R, Gail MH. Methods for projecting course of acquired immunodeficiency syndrome epidemic. J Natl Cancer Inst 1988;80:900-11. 5.Brookmeyer R, Damiano A. Statistical methods for short-term projections of AIDS incidence. Statistics in Medicine (in press). 6.Dondero TJ Jr, Pappaioanou M, Curran JW. Monitoring the levels and trends of HIV infection: the Public Health Service's HIV surveillance program. Public Health Rep 1988;103:213-20. 7.Hull HF, Bettinger CJ, Gallaher MM, Keller NM, Wilson J, Mertz GJ. Comparison of HIV-antibody prevalence in patients consenting to and declining HIV-antibody testing in an STD clinic. JAMA 1988;260:935-8.

8.Krasinski K, Borkowsky W, Bebenroth D, Moore T. Failure of voluntary testing for human immunodeficiency virus to identify infected parturient women in a high-risk population. N Engl J Med 1988;318:185. 9. Wisconsin Department of Health and Social Services. Wisconsin AIDS

update. October 1988:24. 10. Chiasson MA, Lifson AR, Stoneburner RL, Ewing W, Hildebrandt D,

Jaffe HW. HIV-1 seroprevalence in male and female prostitutes in New York City (Abstract). In: Abstracts from the IV International Conference on AIDS, 12-16 June 1988, Stockholm;1988:4116.

11.DesJarlais DC, Sotheran J, Stoneburner R, et al. HIV-1 is associated with fatal infections other than AIDS among intravenous drug users (Abstract). In: Abstracts from the IV International Conference on AIDS, 12-16 June 1988, Stockholm;1988:4219. 12.Hammett T. AIDS in correctional facilities: issues and options. Third edition. Washington, D.C.: U.S. Department of Justice, National Institute of Justice, 1988. 13. Vlahov D, Brewer TF, Munoz A, et al. Trends of HIV-1 seroprevalence among inmates entering Maryland prisons (USA) 1985-1987 (Abstract). In: Abstracts from the IV International Conference on AIDS, 12-16 June, Stockholm;1988:4211. 14. Truman BI, Morse D, Mikl J, et al. HIV seroprevalence and risk factors among prison inmates entering New York State prisons

(Abstract). In: Abstracts from the IV International Conference on AIDS, 12-16 June 1988, Stockholm;1988:4207. 15. CDC. HIV seroprevalence in migrant and seasonal farmworkers

- North

Carolina, 1987. MMWR 1988;37:517-9. 16. Schorr JB, Berkowitz A, Cumming PD, Katz AJ, Sandler SC. Prevalence

of HTLV-III antibody in American blood donors. N Engl J Med 1985;313:384-5. 17. Cleary PD, Singer E, Rogers TF, et al. Sociodemographic and

behavorial characteristics of HIV antibody in positive blood donors.

Am J Public Health 1988;78:953-7. 18. Kelen GD, Fritz S, Qaqish B, et al. Unrecognized human

immunodeficiency virus infection in emergency department patients. N

Engl J Med 1988;318:1645-50. 19. CDC. Antibody to human immunodeficiency virus in female prostitutes.

MMWR 1987;36:157-61. 20. Castro KG, Lieb S, Jaffe HW, et al. Transmission of HIV in Belle

Glade, Florida: lessons for other communities in the United States.

Science 1988;239:193-7. 21. Dondero TJ, Rauch K, Storch GA, et al. U.S. sentinel hospital

surveillance network: results of the first 20 months (Abstract). In: Abstracts from the IV International Conference on AIDS, 12-16 June 1988, Stockholm;1988:6015. 22. Hessol NA, O'Malley PM, Rutherford GW, et al. Seroconversion to HIV among homosexual and bisexual men who participated in hepatitis B vaccine trials (Abstract). In: Abstracts of the IV International Conference on AIDS, 12-16 June 1988, Stockholm;1988:6015. 23. Fineberg HV. Education to prevent AIDS: prospects and obstacles. Science 1988;239:592-6. 24. CDC. Increases in primary and secondary syphilis -- United States. MMWR 1987;36:393-7. 25.Schoenbaum EE, Selwin PA, Hartel D, Klein RS, Davenny K, Friedland GH. HIV seroconversion in intravenous drug abusers: rate and risk factors (Abstract). In:

Abstracts of the III International Conference on AIDS, 1-5 June 1987, Washington, D.C.;1987:117.
26.CDC. Trends in HIV infection among civilian applicants for military service -- United States, October 1985-March 1988. MMWR 1988;37:677-9.