Epidemiology of HIV

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Section 1: Screening and Diagnosis
Topic 1: Epidemiology of HIV

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Definitions for HIV Epidemiology Data

The Centers for Disease Control and Prevention (CDC) generates extensive HIV surveillance data. The following explains the types of information that are routinely provided in the CDC's United States HIV surveillance reports and how the CDC utilizes these data.

- **HIV Prevalence**: The HIV prevalence is the estimated number of persons living with HIV. This estimate includes persons living with diagnosed or undiagnosed HIV. Because the number of persons living with undiagnosed HIV is an estimate, the overall HIV prevalence is an estimate. The CDC uses prevalence data to better understand the overall impact of HIV in the United States and to estimate the total number of people who need access to HIV treatment.

- **HIV Prevalence Rate**: The HIV prevalence rate is the number of persons living with HIV per 100,000 population.

- **Persons Living with Diagnosed HIV**: The number of persons living with diagnosed HIV include all persons who have been diagnosed with HIV and are still living, regardless of when the diagnosis of HIV was made. These numbers will be smaller than the estimated HIV prevalence since it does not include persons living with HIV who remain undiagnosed.

- **Diagnoses of HIV**: The diagnoses of HIV are persons who have been diagnosed with HIV during a fixed time period, typically 1 year. These individuals are newly diagnosed, but they may have acquired HIV long before the diagnosis of HIV is made. The number of persons with diagnosed HIV is not the same as new HIV infections (HIV incidence). Determining the number of HIV diagnoses helps the CDC to understand trends in the burden of HIV disease in the United States. These data help the CDC designate which areas and populations have the greatest need for HIV care and treatment services.

- **HIV Incidence**: The HIV incidence represents the CDC's estimate of the number of new infections that occurred during a fixed time period. Because many persons living with HIV are diagnosed years after their initial infection, the HIV incidence data is based on calculations performed by the CDC. The incidence data is used by the CDC to monitor trends in HIV transmission, including overall trends and trends in key populations. The incidence data also helps to inform the CDC on the effectiveness of ongoing prevention strategies.

- **HIV Incidence Rate**: The HIV incidence rate represents the number of new infections that occurred during a fixed time period (typically 1 year) per 100,000 population.
HIV Prevalence

Estimated HIV Prevalence

The estimated prevalence for the total number of persons living with HIV in the United States takes into account the number living with diagnosed HIV infection and the estimated number of persons living with undiagnosed HIV.\[1,2\] For year-end 2016, the CDC estimated that 1,140,400 persons 13 years of age and older were living with HIV infection in the United States, including 977,900 persons with diagnosed HIV and 162,500 whose infection had not yet been diagnosed (undiagnosed HIV).\[2\] The number of persons living with diagnosed or undiagnosed HIV (estimated HIV prevalence) in the United States increased each year from 2010 to 2016 (Figure 1), which corresponds with the number of new HIV infections outpacing the number of deaths of persons with HIV during that time period.\[1,2\]

HIV Prevalence by Sex and Transmission Category

At year-end 2016, the CDC estimates that among persons living with diagnosed or undiagnosed HIV in the United States 77% are male and 23% are female.\[2\] Overall, among persons living with diagnosed or undiagnosed HIV infection in the United States at year-end 2016, an estimated 57% acquired HIV through male-to-male sexual contact, 26% via heterosexual contact, 12% by injection drug use, and 5% had combined risk factors for male-to-male sexual contact and injection drug use; these HIV transmission category prevalence data have also been broken out for men and women, but do not include data for transgender persons (Figure 2).\[2\] Among males living with diagnosed or undiagnosed HIV, 73% acquired HIV through male-to-male sexual contact, 11% through heterosexual contact, 9% through injection drug use, 7% had risk factors for both male-to-male sexual contact and injection drug use, and less than 1% acquired HIV via other routes (perinatal, hemophilia, transfusion, or no reported risk factor).\[2\] Among females living with diagnosed or undiagnosed HIV infection, 79% acquired HIV through heterosexual contact, 20% via injection drug use, and 1% through other routes (perinatal, transfusion, or no reported risk factor).\[2\]

HIV Prevalence by Race/Ethnicity

Among persons living with diagnosed or undiagnosed HIV in the United States at year-end 2016, approximately 42% are black/African American, 30% white, 22% Hispanic/Latino, and 6% are of other races, including American Indian/Alaska Native, Asian, Native Hawaiian/other Pacific Islander, and multiple races (Figure 3).\[2\] It is striking to note that although blacks/African Americans comprise approximately 12% of the United States population, they account for 42% of persons living with HIV. At year-end 2016, the HIV prevalence rate is by far the highest among blacks/African Americans (1,441 per 100,000 population), a rate approximately 2.5 times higher than in Hispanic/Latinos, and 7.3 times higher than in whites (Figure 4).\[2\] These statistics clearly illustrate how the HIV epidemic has disproportionately affected blacks/African Americans and Hispanics/Latinos.

HIV Prevalence by Age

In the United States at year-end 2016, the two age groups that accounted for the largest number of persons living with diagnosed or undiagnosed HIV are (in order) persons 45-54 and 55 years of age and older (Figure 5); these age groups also had the highest HIV prevalence rate.\[2\] Overall, 61% of persons living with HIV at year-end 2016 were 45 years of age or older (Figure 6).\[2\]

HIV Prevalence by Region of Residence

In the United States, based on data for persons living with diagnosed or undiagnosed HIV at year-end 2016, more persons with HIV infection resided in the South (518,700) than any other region (Figure 7).
Overall, at year-end 2016, 45% of persons with diagnosed or undiagnosed HIV resided in the South, 23% in the Northeast, 20% in the West, and 12% in the Midwest (Figure 8). The highest HIV prevalence rate (persons living with diagnosed or undiagnosed HIV per 100,000 population) was in the Northeast and second highest in the South.
New HIV Diagnoses

Reporting of New HIV Diagnoses

The CDC annually provides updated information on new diagnoses of HIV infection in the United States. Note that new HIV diagnoses are not the same as new HIV infections (HIV incidence), since a significant proportion of persons newly diagnosed with HIV infection may have acquired HIV years prior to their HIV diagnosis. The rates of new HIV diagnosis are given as rates per 100,000 population. The United States data for new HIV infections typically includes all 50 states, the District of Columbia, and 6 United States dependent areas (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, the Republic of Palau, and the U.S. Virgin Islands).

New HIV Diagnosis in United States

In the United States, for the year 2017, an estimated 38,281 persons were newly diagnosed with HIV infection (any stage of HIV disease).[3] From 2010-2017 there was an overall decline in new HIV diagnoses of about 13% (Figure 9).[3] The rate of new HIV diagnosis in 2017 was 11.8 per 100,000 population.[3]

New HIV Diagnosis by Sex and Transmission Category

Among the new HIV infections diagnosed in the United States in 2017, an estimated 81% occurred in males and 19% in females.[3] The proportion of infections in males and females has been relatively consistent in the past 6 years. Among the newly diagnosed HIV infections in 2017, an estimated 67% were attributed to male-to-male sexual contact, 24% to heterosexual contact, 6% to injection-drug use, 3% to both male-to-male sexual contact and injection drug use, and less than 1% to other transmission categories, such as maternal-to-child transmission, occupational exposure, or receipt of contaminated blood products; these transmission category data have also been reported separately for men and women, but not for transgender persons (Figure 10).[3] The proportion of newly diagnosed HIV infections involving male-to-male sexual contact has increased in recent years from 55% in 2008 to 67% in 2017.[3,4] This statistic is particularly startling given that men who have sex with men account for about 2% of the United States population.[5]

New HIV Diagnosis by Race/Ethnicity

Of the persons diagnosed with HIV infection in 2017, 45% were black/African American, 26% white, 25% Hispanic/Latino, 2% Asian, 2% persons of multiple races, and less than 1% each American Indian/Alaska Native and Native Hawaiian/other Pacific Islander.[3] The number of new HIV diagnoses in 2017 was highest in blacks/African Americans, then whites, then Hispanics/Latinos. The rate of new diagnosis (new HIV diagnosis per 100,000 population) was by far highest in blacks/African Americans and second highest in Hispanics/Latinos; the new diagnosis rate for blacks/African Americans (41.1) was approximately 2.6 times higher than Hispanics/Latinos (16.1), and 8 times higher than in whites (5.3) (Figure 11).[3]

New HIV Diagnosis by Age

Comparing number of new HIV diagnoses by age categories, the highest number of new HIV diagnoses in 2017 occurred among persons aged 25-29 years followed by those 20-24 years old and then 30-34 years old (Figure 12).[3] The new diagnosis rate (new HIV diagnosis per 100,000 population) was highest in persons aged 25 to 29 (33.4 per 100,000 population).[3] Among new HIV diagnoses in 2017, 17% occurred in persons 50 years of age or older (Figure 13).[3]

New HIV Diagnosis by Region
The overall rate of new HIV diagnosis in the United States in adults and adolescents in 2017 was 14.0 per 100,000 population, but the rate of new HIV diagnoses in different geographic regions varied significantly.[3] The highest rates were in the South (16.1), followed by Northeast (10.6), then West (9.4), with the lowest rates in the Midwest (7.4). Overall, approximately 52% of new HIV diagnoses in 2017 occurred in persons with residence in the South at the time of HIV diagnosis (Figure 14).[3] The five states with the highest rates of new HIV diagnoses (for adults and adolescents per 100,000 population) in 2017 were Georgia (30.0), Louisiana (26.6), Florida (26.6), Maryland (20.2), and Nevada (19.7). The District of Columbia (Washington, D.C) had an extremely high HIV diagnosis rate (53.6).[3]
Undiagnosed HIV Infection

Undiagnosed HIV in the United States

Using back-calculation methods, the CDC estimated at the end of 2016, 14.2% of persons living with HIV infection were not aware of their HIV infection.[2] From 2003 to 2016 the percentage of persons with undiagnosed HIV infection in the United States declined from approximately 25% to 14%; since 2010 the undiagnosed fraction of persons living with HIV has continued to further decline, although only slightly in recent years (Figure 15).[1,2,6,7] Persons unaware of their HIV status are unable to benefit from treatment of their HIV infection and are more likely to transmit HIV to others.[8]

Undiagnosed HIV by Age, Race, and Risk Factor

In general, the younger the age group, the higher the percentage of undiagnosed HIV infection; in 2016, among persons aged 18 to 24 living with HIV in the United States an estimated 44% had undiagnosed HIV infection (Figure 16).[2,9] The percentage of persons with undiagnosed HIV infection varies some among different racial/ethnic groups, from a high of 19.1% in Asians to a low of 11.5% in whites (Figure 17).[2] Among different transmission categories, heterosexual males (18.4%) and men who have sex with men (16.4%) had the highest undiagnosed fraction in 2016, with the lowest undiagnosed fraction in persons who inject drugs (6.5% in males and 5.3% in females).[2]

Undiagnosed HIV and Risk of Transmission

Studies have shown that persons with HIV infection who are not aware of their HIV status are responsible for a disproportionate number of new HIV infections.[8,10,11,12] Data from 2016 showed an estimated 37% of new HIV infections were attributed to the 14% of individuals who were unaware of their infection at that time.[8] Several studies have also shown that high-risk sexual behaviors and the prevalence of sexually transmitted diseases decreases among persons who become aware they have HIV infection.[13,14,15,16] Persons who become aware of their HIV infection, engage in care, and take antiretroviral therapy will dramatically lower their risk of transmitting HIV to others.[8,17,18]

Late Diagnosis of HIV

Unfortunately, despite improvement in HIV screening and knowledge of status, among persons newly diagnosed with HIV infection in 2016, 21% had stage 3 HIV disease (AIDS) at the time of diagnosis.[19] For these individuals, late diagnosis represents missed opportunities to obtain medical care, improve health outcomes, and to prevent transmission of HIV to others. The rates of AIDS at diagnosis increases with age, but does not differ significantly by racial/ethnic groups.[19] Even among individuals who do not meet criteria for late diagnosis of HIV, there is still a need for overall earlier diagnosis.

Awareness of HIV Status and HIV Care Cascade

Increasing awareness of HIV status represents the first step in improving the HIV care cascade, also called the HIV care continuum, which is a model for identifying issues and opportunities related to the delivery of HIV services to people living with HIV in the United States.[9,20] Early HIV diagnosis and prompt linkage to care, retention in care, and receipt of effective antiretroviral therapy are all essential in reducing morbidity and mortality, minimizing disparities in care and treatment, and lowering the risk of HIV transmission to others.[8,12,20,21]
HIV Incidence Estimates

Definition of HIV Incidence

The HIV incidence in the United States represents new infections during a specific time period—typically 1 year. The HIV incidence rate is the number of new cases per 100,000 population per year. Note that the yearly CDC surveillance statistics reporting of HIV diagnoses is not the same as HIV incidence estimates. Persons who are newly diagnosed with HIV could have acquired HIV a long time ago and may not represent true new infections. In contrast, the HIV incidence for a specific year is meant to truly estimate the number of persons who acquired HIV infection during that year. The CDC estimates HIV incidence in the United States using a complex system that incorporates surveillance data, the Serological Testing Algorithm for Recent HIV Seroconversion (STARHS), the CD4-depletion model, and an extended back-calculation method.[4]

Estimates of HIV Incidence in the United States

The CDC estimated the number of new HIV infections in the United States decreased from 41,100 in 2010 to 38,700 in 2016 (Figure 18).[2] In a separate analysis, CDC investigators estimated HIV incidence from 2008-2013 using a biomarker for recency of infection (stratified extrapolation approach) and 2 back-calculation models (CD4 and Bayesian hierarchical models).[22] With this approach, estimated new HIV infections per year decreased approximately 4% per year from a high of 48,309 in 2008 to a low of 39,270 in 2013.[22] Overall, five major trends in HIV incidence have occurred in the United States since the onset of the HIV epidemic: (1) a dramatic rise in the early 1980's, (2) a peak in the mid-1980's, (3) a marked decline in the late 1980's, (4) stabilization and leveling off in the 1990's, and (5) a gradual decline in new infections from 2007 to 2016.[2,22,23,24,25,26]

HIV Incidence by Sex and Transmission Category

Among the estimated new HIV infections in persons aged 13 years and older in the United States in 2016, an estimated 82% occurred in males and 18% in females. The proportion of new HIV infections in males and females in the United States has been relatively consistent in the past 7 years.[2] Among new HIV infections in 2016, an estimated 68% were attributed to male-to-male sexual contact, 24% to heterosexual contact, 5% to injection drug use, and 3% to both male-to-male sexual contact and injection drug use; these transmission category data have also been reported separately for males and females, but not for transgender persons (Figure 19).[2] The proportion of newly diagnosed HIV infections involving male-to-male sexual contact has increased in recent years from 63% in 2010 to 67% in 2016.[2,4]

HIV Incidence by Race/Ethnicity

Of the persons 13 years of age and older with new HIV infections in the United States in 2016, 42% were black/African American, 27% Hispanic/Latino, 25% white, 2% Asian, 3% persons of multiple races, and less than 1% each American Indian/Alaska Native and Native Hawaiian/other Pacific Islander.[2] The number of new HIV infections in 2016 was highest in blacks/African Americans, then Hispanics/Latinos, then whites (Figure 20).[2] The HIV incidence rate (new HIV infections per 1000,000 population) was by far highest in blacks/African Americans and second highest in Hispanics/Latinos; the new incidence rates for blacks/African Americans (49.6) was approximately 2 times higher than Hispanics/Latinos (23.7), and 9 times higher than in whites (5.6).[2]

HIV Incidence by Age

In 2016, the number of new HIV infections among persons 13 years of age and older in the United States was highest in the age group 25-34 years, followed by those 13-24 years old and then 35-44
years old (Figure 21).[2] The new diagnosis rate (new HIV diagnosis per 100,000 population) was highest in persons aged 25-34 (33.6 per 100,000 persons) then 35-44 (17.9 per 100,000 persons). Among new HIV infections in 2016, 21% occurred in persons 45 years of age or older.[2]

**HIV Incidence by Region**

The number of new HIV infections in the United States among persons 13 years of age and older in 2016 was by far highest in the South (Figure 22).[2] Overall, approximately 51% of new HIV infections in 2016 occurred in persons with residence in the South at the time of HIV diagnosis.[2] The highest incidence rates (new HIV infections per 100,000 population) were also in the South (19.3), followed by Northeast (12.8), and West (12.8), with the lowest rates in the Midwest (8.2).[2]
Social Determinants of Health and HIV

Role of Social Determinants of Health in the HIV Epidemic

Social determinants of health play an important role in driving the HIV epidemic in the United States. The term "social determinants of health" refers to the overlapping social, cultural, environmental, and economic factors that are responsible for most health inequities; in the case of HIV, examining such factors can help to explain the disproportionate burden of HIV in certain populations, such as in African Americans.[27] Some examples of social determinants of health are safe housing, access to health care services, transportation options, quality of education, literacy, culture, and access to job opportunities. Importantly, many socioeconomic variables, such as income, education, and occupation, will indirectly impact health and therefore serve as proxies for other determinants of health, which may not always be exactly clear.[28,29] Analyzing data for key social determinants of health in populations living with HIV could inform strategies related to HIV testing, treatment, and prevention.

CDC Report on Social Determinants of Health and HIV

The CDC has identified significant gaps in knowledge regarding the relationship between social determinants of health and HIV, and to this end, the CDC released a report based on data collected from 2009 to 2013 that summarizes numbers and rates of HIV diagnoses among adults according to five social determinants of health: federal poverty level, education level, median household income, employment status, and health insurance coverage status.[27] Although the intersection of social determinants of health and individual-level factors, such as race/ethnicity and behavioral HIV risk factors, is complex, the CDC report suggests the rate of HIV diagnosis increases as the rate of poverty, unemployment, and lack of health insurance increases, and is highest in areas with lower median household income and lower educational attainment.[27] Notably, for both men and women, the HIV diagnosis rates decreased as the median household income increased.[27] Such indicators underscore that HIV risk is informed by a confluence of factors that go beyond individual-level attributes and have population-level consequences.
Deaths in Persons with HIV Infection

Deaths of Persons Diagnosed with HIV Infection or AIDS

With the availability of potent combination antiretroviral therapy in the mid-1990s, the annual number of HIV-related deaths in the United States dramatically decreased.\[23,30,31\] Subsequently, from 2000 to 2011 the number of annual deaths of persons ever diagnosed with AIDS continued to decline.\[32,33\] More recently, CDC surveillance data revealed that during 2012 to 2016 the annual number of deaths of persons diagnosed with HIV infection decreased from 16,183 to 15,428 and deaths of persons with HIV infection ever classified as stage 3 (AIDS) deaths decreased from 13,181 to 12,287 (Figure 23).\[3\] Note, however, that deaths of persons with HIV (with or without AIDS), as reported, may be due to any cause and may be unrelated to HIV infection or AIDS. Recent analysis suggests that persons with HIV infection who take antiretroviral therapy have a life expectancy of 71 years.\[34\]

Deaths in Persons with HIV by Categories

In 2016, among the 15,428 deaths in persons with diagnosed HIV, 69% occurred in persons 50 years of age or older (Figure 24).\[3\] Among persons with diagnosed HIV, the total number of deaths and death rates in 2016 were highest in blacks/African Americans (Figure 25).\[3\] Among all deaths in persons with diagnosed HIV in 2016, 44% were in blacks/African Americans.\[3\]

Causes of Death

For persons diagnosed with HIV infection who take effective antiretroviral therapy, more than 50% of deaths are now due to non-AIDS causes.\[35,36,37\] The cause and frequency of death was analyzed in the Data Collection on Adverse Events of Anti-HIV Drugs (D:A:D) study, a collaborative, observational study that prospectively followed 23,441 persons with HIV infection for 5 years in Europe, the United States, and Australia; all patients enrolled had access to combination antiretroviral therapy.\[38\] In this study, liver disease was the most frequent non-AIDS-related cause (14.5%); other causes of death included cardiovascular disease (11%) and non-AIDS malignancies (9.4%). More recent data from the Antiretroviral Therapy Cohort Collaboration (ART-CC) found that among persons with HIV in North America and Europe who started combination antiretroviral therapy between 1996-1999 and survived for more than 10 years, the leading causes of non-AIDS-related deaths were malignancy, cardiovascular disease, and liver-related causes.\[37\]
Global HIV-1 Epidemiology

HIV-1 Groups and Subtypes (Clades)

Strains of HIV-1 can be classified into four groups: the "major" group M, the "outlier" group O, and two additional groups, N and P (Figure 26).[39] Group M is responsible for most of the global HIV pandemic, and has at least 9 distinct subtypes of genetically-related HIV, which are often referred to as clades. Group N has been found in a small number of individuals in Cameroon. Group O is responsible for tens of thousands of infections in West and Central Africa. Group P is a new group identified in two individuals in Cameroon. Viral subtypes can mix genetic material and create a hybrid virus and, if the recombinant virus is capable of transmission, it is designated as a "circulating recombinant form". As an example, the circulating recombinant form created from subtypes B and F has been designated circulating recombinant form B/F, which is commonly found in Latin America.

Global Distribution of HIV-1 Subtypes

Three HIV-1 subtypes are responsible for 71% of all HIV-1 infections globally: subtype A (common in West and Central Africa, and Russia), subtype B (common in Europe, the Americas, Australia, and Japan), and subtype C (common in Southern and Eastern Africa, India, and Nepal). Presently, subtype B accounts for 12% and subtype C accounts for about 48% of infections globally, though infections with non-subtype B clades have been increasing in Western Europe and North America due to immigration from sub-Saharan Africa, Asia, and Eastern Europe.

HIV-1 Clades and Impact on HIV Outcomes

There may be differences in disease progression among the different subtypes, though studies on this question have been limited by confounders such as access to medical therapy, nutritional status, host genetic factors, and mode of viral transmission.[39] There do not seem to be major differences in response to antiretroviral therapy based on subtype, but subtype-specific pathways to resistance may exist and are being studied. Similarly, the diversity of HIV subtypes may have implications for future antiretroviral therapy and for vaccine development.

HIV Global Prevalence

At the end of 2017, an estimated 36.9 million people were living with HIV infection globally, including 35.1 million adults and 1.8 million children younger than age 15 (Figure 27).[40] More than 25 million (approximately 70% of the total) live in sub-Saharan Africa, including 19.6 million in Eastern and Southern Africa and 6.1 million in Western and Central Africa.[40] In sub-Saharan Africa, the HIV prevalence increased from 23.5 million in 2010 to 25.5 million in 2015 and then stabilized at 25.7 million in 2017.[41] The HIV prevalence rates are highest in sub-Saharan Africa, with an HIV prevalence rate of 6.8% in Eastern and Southern Africa and 1.9% in Western and Central Africa.[40] In Eastern Europe and Central Asia, the number of people living with HIV infection sharply increased from 2010 to 2015 (970,000 to 1.5 million), fueled by a significant injection drug use epidemic, but the HIV prevalence has since slightly declined to 1.4 million in 2017.[40,41,42] In the Asia and Pacific regions, the HIV prevalence increased from 4.7 to 5.1 million between 2010 and 2015 and then stabilized at 5.2 million in 2017.[40,41] In this region, the countries with the highest HIV prevalence are India (2.1 million), China (850,000), Indonesia (630,000), and Thailand (444,000).[40]

HIV Global Incidence

Based on the UNAIDS data, an estimated 1.8 million new HIV infections occurred globally in 2017 (Figure 28), which represented a 14% decline from the 2.1 million new infections in 2015 and a 22% decline from the 2.3 million new infections in 2012.[40,41,43] Sub-Saharan Africa led the way with a 25% decline in new infections from 2012 to 2017 (1.6 million to 1.2 million).[40,43] Although most
regions have seen a decline in new annual HIV infections since 2012, increases have occurred in Latin America (86,000 to 100,000) and the Caribbean 12,000 to 15,000). The number of new infections has remained level in Eastern Europe and Central Asia.\textsuperscript{40,41}

**Global AIDS-Related Deaths**

In 2017, there were an estimated 940,000 AIDS-related deaths globally, including 660,000 in sub-Saharan Africa and 170,000 in the Asia and Pacific region (Figure 29).\textsuperscript{40} The 940,000 AIDS-related deaths in 2017 represent a 34% decline from 2010.\textsuperscript{40} Overall, AIDS-related deaths have fallen by about 51% since the peak of 1.9 million deaths in 2004.\textsuperscript{40} Globally, tuberculosis remains the most common cause of death in persons with HIV infection, accounting for approximately one-third of all global AIDS-related deaths.\textsuperscript{44} The global decline in AIDS-related deaths has been attributed to the expanded availability and use of antiretroviral therapy in many regions of the world.\textsuperscript{40,41}

**Global Antiretroviral Therapy Coverage**

During 2017, an estimated 21.7 million persons living with HIV infection globally were taking antiretroviral therapy, representing approximately 59% of all people living with HIV globally; this represents a substantial ramp up from the 8.0 million persons receiving antiretroviral therapy in 2010 and a dramatic increase from the 2.1 million receiving antiretroviral therapy in 2005 (Figure 30).\textsuperscript{40,41,45} The UNAIDS Programme Coordinating Board has advocated an aggressive global scale-up of antiretroviral therapy and the initial antiretroviral therapy roll out exceeded expectations.\textsuperscript{41,44}
HIV-2

HIV-2 on a Global Scale

Of the 36.9 million individuals living with HIV worldwide, approximately 1-2 million are infected with HIV-2. Most persons with HIV-2 reside in West Africa, or in countries, particularly France, Spain, and Portugal, after migrating from West Africa. In addition, HIV-2 has been reported in several former Portuguese colonies, including Angola, Mozambique, and the Indian states of Goa and Maharashtra. Since 1996, HIV-2 prevalence has declined in several West African countries. For example, Guinea-Bissau, which has the highest prevalence of HIV-2 globally, has seen a drop in HIV-2 prevalence from 7.4% in 1996 to 4.4% in 2006, but during this same time period the prevalence of HIV-1 increased from 2.3% to 4.6%. Several reports have documented small cohorts of HIV-2 in North America, West and Central Europe, the Middle East, North Africa, Southern Africa, Asia, and Oceania. Although current or past residence in a country where HIV-2 is endemic is the strongest risk factor for acquiring HIV-2 infection, other risk groups include sexual or needle-sharing partners of persons known to be infected with HIV-2, persons who received a blood transfusion or a non-sterile injection in a country where HIV-2 is endemic, and children born to women with HIV-2 infection.

HIV-2 in United States

Fewer than 1% of HIV infections in the United States are caused by HIV-2. The number of persons with HIV-2 reported to the CDC between 1988 and June 2010 was 242, though only 166 met the CDC’s strict working case definition. The reported number of HIV-2 infections may significantly underestimate the actual number of cases, due to unrecognized infections, unreported infections, limited access to diagnostic tests, and the strict working definition for the diagnosis of HIV-2. Regardless, HIV-2 remains uncommon in the United States and primarily is seen in persons who emigrated from an HIV-2 endemic region, or with exposure to a person from an HIV-2 endemic region. Among cases of HIV-2 reported to the CDC, approximately two-thirds were concentrated in the Northeast, including 46% in New York City alone. Overall, 81% of the HIV-2 cases occurred in persons from West Africa, with Ivory Coast as the most common country of origin.
Summary Points

- In the United States at year-end of 2016, an estimated 1,140,400 people were living with HIV infection, including 977,900 with diagnosed HIV infection and 162,500 with undiagnosed HIV infection.
- The number of people living with HIV (diagnosed or undiagnosed) in the United States has steadily increased as the number of new infections per year has outpaced the number of people dying with HIV.
- Key HIV prevalence data in the United States include 57% of persons infected had male-to-male sex as their transmission category, blacks/African Americans account for approximately 42% of all people living with HIV, and 61% of persons living with HIV are 45 years of age or older.
- Among the 38,281 persons diagnosed with HIV infection in 2017 in the United States, 67% were infected by male-to-male sex, 45% were black/African American, and 52% resided in the South at the time of the diagnosis.
- The HIV incidence (estimated new HIV infections) in the United States has declined 6% between 2010 and 2016, from 41,100 to 38,700.
- The proportion of persons living with HIV infection in the United States who are unaware of their HIV status decreased from 25% in 2003 to 14.2% in 2016; however, among persons aged 13 to 24 years living with HIV infection, 44% are undiagnosed. Persons who are aware of their HIV status can benefit from HIV treatment and are less likely to transmit the virus to others.
- The annual number of deaths for persons diagnosed with HIV infection declined nearly 5% between 2010 and 2016, from 16,183 to 15,428. Most deaths that occur in persons with HIV infection who took antiretroviral therapy are due to non-AIDS causes, particularly liver disease, cardiovascular disease, and non-AIDS malignancies.
- Among persons with diagnosed HIV who died in 2016 in the United States, blacks/African American had the highest number of deaths and highest death rate among persons with diagnosed HIV who died in 2016.
- Strains of HIV can be classified into four groups: of these, group M is responsible for the bulk of the global HIV pandemic.
- Globally, an estimated 36.9 million people are living with HIV infection and 25.7 million (70%) reside in sub-Saharan Africa. Globally, in 2017, an estimated 1.8 million new HIV infections occurred and an estimated 940,000 persons with HIV infection died.
- In 2017, an estimated 21.7 million persons were receiving antiretroviral therapy.
- An estimated 1 to 2 million persons are living with HIV-2 infection globally, with the highest prevalence rates in West Africa.


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Figures

Figure 1 Persons Living with Diagnosed or Undiagnosed HIV in the United States in United States, 2010-2016

This graph shows CDC estimates for persons ≥13 years old living with diagnosed or undiagnosed HIV infection in the United States during the years 2010-2016. These numbers estimate the HIV prevalence.

These data show transmission categories for HIV acquisition for persons ≥13 years old living with diagnosed or undiagnosed HIV in the United States in 2016.


*Other = hemophilia, blood transfusion, and risk factor not reported or identified.
This pie chart shows transmission categories for HIV acquisition for males ≥13 years old living with diagnosed or undiagnosed HIV in the United States in 2016.

Figure 2 (Image Series) - Persons Living with Diagnosed and Undiagnosed HIV in the United States, HIV Transmission Categories, 2016
Image 2C: Transmission Category: Females

This pie chart shows transmission categories for HIV acquisition for females ≥13 years old living with diagnosed or undiagnosed HIV in the United States in 2016.


- Heterosexual Contact: 79%
- Injection Drug Use: 20%
- Other: 1%

Total for Females = 258,000
**Figure 3 HIV Prevalence, by Race/Ethnicity, United States, 2016**

This table shows the HIV prevalence and the percent based on race/ethnicity in the United States in 2016.


<table>
<thead>
<tr>
<th>Racial/Ethnic Group</th>
<th>Estimated HIV Prevalence</th>
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<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>3,600</td>
</tr>
<tr>
<td>Asian</td>
<td>16,600</td>
</tr>
<tr>
<td>Black/African American</td>
<td>476,100</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>254,600</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islander</td>
<td>1,000</td>
</tr>
<tr>
<td>White</td>
<td>339,400</td>
</tr>
<tr>
<td>Multiple Races</td>
<td>48,200</td>
</tr>
<tr>
<td>Total</td>
<td>1,139,500</td>
</tr>
</tbody>
</table>
Figure 4 HIV Prevalence Rates, by Race/Ethnicity, United States, 2016

This bar graph shows HIV prevalence rates based on race/ethnicity for persons ≥13 years old living with diagnosed or undiagnosed HIV in the United States. Blacks/African-Americans have by far the highest prevalence rate (persons living with HIV per 100,000 population).

Figure 5 Persons Living with Diagnosed or Undiagnosed HIV, by Age Categories, United States 2016

This bar graph shows the breakdown by age categories (in years) for persons ≥13 years old living with diagnosed or undiagnosed HIV in the United States in 2016.

Figure 6 Persons Living with Diagnosed or Undiagnosed HIV, Percentage 45 and Older, United States, 2016

This bar graph shows that approximately 61% of persons ≥13 years old living with diagnosed or undiagnosed HIV in the United States in 2016 were 45 years of age or older.

Figure 7 Persons Living with Diagnosed or Undiagnosed HIV, United States, year end 2016—by Region of Residence

This graph shows that at year-end 2016, more persons living with diagnosed or undiagnosed HIV infection resided in the South than any other region of the United States.

Figure 8 Persons Living with Diagnosed or Undiagnosed HIV, United States, year end 2016—by Region of Residence (Percent)

This pie chart shows the geographic region of residence for persons living with diagnosed or undiagnosed HIV infection. Persons living in the South account for 45% of all people living with diagnosed and undiagnosed HIV in the United States.

Figure 9 HIV Diagnoses, United States, 2010-2017

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2017, by Transmission Category

Image 10A: Transmission Category, Males and Females

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2017, by Transmission Category
Image 10B: Males

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2017, by Transmission Category
Image 10C: Females


Total for Females = 7,312

- Heterosexual Contact: 85.6%
- Injection Drug Use: 13.8%
- Other: 0.4%
Figure 11 New HIV Diagnoses (Rate) in the United States in 2017, by Race/Ethnicity

Figure 12 New HIV Diagnoses in the United States in 2017, by Age Group

Figure 13 New HIV Diagnoses in the United States in 2017, Percent 50 Years of Age and Older

Figure 14 New HIV Diagnosis in the United States in 2017, by Region of Residence

Figure 15 Proportion of Persons with Undiagnosed HIV Infection in United States in 2010-2016

Figure 16 Proportion of Persons with Undiagnosed HIV Infection in United States in 2016, by Age Group

Figure 17 Proportion of Persons with Undiagnosed HIV Infection in United States in 2016, by Race/Ethnicity

Figure 18 Estimated HIV Incidence in United States, 2010-2016

Investigators from the Centers for Disease Control and Prevention incorporated data from the HIV case surveillance system and CD4 cell count test results to estimate the HIV incidence in the United States.

Figure 19 Estimated HIV Incidence in Persons Aged ≥13 Years, in United States, by Transmission Category, 2016

Figure 20 Estimated HIV Incidence in Persons Aged ≥13 Years, in United States, by Race/Ethnicity, 2016

Figure 21 Estimated HIV Incidence in United States, by Age Group, 2016

Figure 22 Estimated HIV Incidence in United States, by Region, 2016

Figure 23 Deaths in Persons Diagnosed with HIV Infection, with or without AIDS, by Year—United States, 2012-2016

Figure 24 Deaths in Persons Diagnosed with HIV Infection, by Age Group—United States, 2016

Figure 25 Deaths in Persons Diagnosed with HIV Infection, by Race/Ethnicity—United States, 2016


<table>
<thead>
<tr>
<th>Racial/Ethnic Group</th>
<th>Deaths (Diagnosed with HIV)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Rate/100,000</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>46</td>
<td>1.9</td>
</tr>
<tr>
<td>Asian</td>
<td>95</td>
<td>0.5</td>
</tr>
<tr>
<td>Black/African American</td>
<td>6,795</td>
<td>16.9</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>2,497</td>
<td>4.3</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islander</td>
<td>12</td>
<td>2.1</td>
</tr>
<tr>
<td>White</td>
<td>5,038</td>
<td>2.5</td>
</tr>
<tr>
<td>Person of Multiple Races</td>
<td>944</td>
<td>14.0</td>
</tr>
<tr>
<td>Total / Average Rate</td>
<td>15,427</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Figure 26 HIV-1-Groups


*CRFs = Circulating Recombinant Forms
Figure 27 Global HIV Prevalence by Region, 2017

Source: UNAIDS. Data 2018.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Number</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Total</td>
<td>36.9 million</td>
<td>0.8</td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>19.6 million</td>
<td>6.8</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>6.1 million</td>
<td>1.9</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>220,000</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>5.2 million</td>
<td>0.2</td>
</tr>
<tr>
<td>Latin America</td>
<td>1.8 million</td>
<td>0.5</td>
</tr>
<tr>
<td>Caribbean</td>
<td>310,000</td>
<td>1.2</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>1.4 million</td>
<td>0.8</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>2.2 million</td>
<td>0.3</td>
</tr>
</tbody>
</table>
### Figure 28 Global HIV Incidence by Region, 2017

Source: UNAIDS. Data 2018.

<table>
<thead>
<tr>
<th>Region</th>
<th>Newly Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Total</td>
<td>1.8 million</td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>800,000</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>370,000</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>18,000</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>280,000</td>
</tr>
<tr>
<td>Latin America</td>
<td>100,000</td>
</tr>
<tr>
<td>Caribbean</td>
<td>15,000</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>130,000</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>70,000</td>
</tr>
</tbody>
</table>
### Figure 29 Global Deaths Due to AIDS During 2017

Source: UNAIDS. Data 2018.

<table>
<thead>
<tr>
<th>Region</th>
<th>Newly Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Total</strong></td>
<td>940,000</td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>380,000</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>280,000</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>9,800</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>170,000</td>
</tr>
<tr>
<td>Latin America</td>
<td>37,000</td>
</tr>
<tr>
<td>Caribbean</td>
<td>10,000</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>34,000</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>13,000</td>
</tr>
</tbody>
</table>
Figure 30 Persons Living with HIV on Antiretroviral Therapy—Global, 2010-2017