Epidemiology of HIV

This is a PDF version of the following document:
Module 1: Screening and Diagnosis
Lesson 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 with HIV. This estimate includes persons with diagnosed HIV plus the estimated number with undiagnosed HIV. Because the number of persons with undiagnosed HIV is an estimate, the overall HIV prevalence is an estimate. The CDC uses prevalence data to better understand the overall current status of the HIV epidemic 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 with HIV per 100,000 population.

- **Persons with Diagnosed HIV**: The number of persons 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 with HIV who remain undiagnosed. These data help the CDC designate which areas and populations have the greatest need for HIV care and treatment services.

- **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. Thus, the number of persons with diagnosed HIV is not the same as the number of persons with new HIV infections (HIV incidence). Determining the number of HIV diagnoses in a 1-year period helps the CDC to understand trends in the burden of HIV disease in the United States.

- **HIV Incidence**: The HIV incidence represents the CDC's estimate of the number of persons who newly acquired HIV during a fixed time period, typically a 1-year time period. Because many persons with HIV are diagnosed years after their initial infection, the HIV incidence data is based on calculations performed by the CDC, with HIV diagnoses data playing an important role. The incidence estimates are used by the CDC to monitor trends in HIV transmission, including overall trends in key populations. The incidence estimates also help to inform the CDC on the effectiveness of ongoing prevention strategies.

- **HIV Incidence Rate**: The HIV incidence rate represents the number of persons who newly acquired HIV during a fixed time period (typically 1 year) per 100,000 population.
**Estimated HIV Prevalence**

The estimated prevalence for the total number of persons with HIV in the United States takes into account the number with diagnosed HIV and the estimated number of persons living with undiagnosed HIV.\[1,2\] For year-end 2018, the CDC estimated that 1,173,900 persons 13 years of age and older were living with HIV in the United States, including 1,012,100 persons with diagnosed HIV and 161,800 with HIV had not yet been diagnosed (undiagnosed HIV).\[2\] The number of persons living with HIV (estimated HIV prevalence) in the United States increased each year from 2014 to 2018 (Figure 1), which corresponds with the number of new HIV infections outpacing the number of deaths of persons with HIV during that time period.\[2\]

**HIV Prevalence by Sex and Transmission Category**

At year-end 2018, the CDC estimates that among persons with diagnosed or undiagnosed HIV in the United States, 77.7% are male and 22.3% are female.\[2\] Overall, among persons with diagnosed or undiagnosed HIV infection in the United States at year-end 2018, an estimated 58% acquired HIV through male-to-male sexual contact, 26% via heterosexual contact, 11% 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 reported for men and women, but do not include data for transgender persons (Figure 2).\[2\] Among males living with diagnosed or undiagnosed HIV, 74.5% acquired HIV through male-to-male sexual contact, 10.5% through heterosexual contact, 8.1% through injection drug use, 6.6% 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 with diagnosed or undiagnosed HIV, 79.6% acquired HIV through heterosexual contact, 19.9% via injection drug use, and less than 1% through other routes (perinatal, transfusion, or no reported risk factor).\[2\] The HIV prevalence rate for persons 13 years of age and older in the United States was 427.5 per 100,000 persons, which means approximately 0.4% of the United States population aged 13 years and older is living with HIV.\[2\]

**HIV Prevalence by Race/Ethnicity**

Among persons with diagnosed or undiagnosed HIV in the United States at year-end 2018, approximately 41.2% were identified as Black/African American, 29.0% White, 23.4% Hispanic/Latino, and 6.4% 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 persons who are Black/African American comprise approximately 13% of the United States population, they account for more than 40% of persons with HIV. At year-end 2018, the HIV prevalence rate is by far the highest among persons who are Black/African American (1,434 per 100,000 population), a rate approximately 2.4 times higher than in individuals who are Hispanic/Latino, and 7.2 times higher than in persons who are White (Figure 4).\[2\] These statistics clearly illustrate how the HIV epidemic is disproportionately impacting persons who are Black/African American and Hispanic/Latino.

**HIV Prevalence by Age Group**

In the United States at year-end 2018, the age group with the highest HIV prevalence (persons with diagnosed or undiagnosed HIV) was in persons 55 years of age and older and next highest was in persons 45-54 years of age (Figure 5); these two age groups also had the highest HIV prevalence rate (persons with diagnosed or undiagnosed HIV per 100,000 population).\[2\] Overall, 58.3% of persons with HIV (diagnosed or undiagnosed) at year-end 2018 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 with diagnosed or undiagnosed HIV at year-end 2018, more
persons with HIV resided in the South (539,600) than any other region (Figure 7). Overall, at year-end 2018, 46% of persons with diagnosed or undiagnosed HIV resided in the South, 22% in the Northeast, 20% in the West, and 12% in the Midwest (Figure 8). The HIV prevalence rate (persons with diagnosed or undiagnosed HIV per 100,000 population) by region was highest 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 in the United States.\[3\] 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 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 Diagnoses in United States

In the United States, for the year 2018, an estimated 37,515 persons were newly diagnosed with HIV (any stage of HIV disease). From 2014 through 2018 there was an overall decline in new HIV diagnoses of about 7% (Figure 9).\[3\]. The overall rate of new HIV diagnosis in 2018 was 11.5 per 100,000 population and the rate among adolescents and adults was 13.6.\[3\]

New HIV Diagnoses by Sex and Transmission Category

Persons newly diagnosed with HIV in the United States in 2018 had the following gender breakdown: 79.4% cisgender males, 18.9% cisgender females, 1.5% in transgender women, 0.13% in transgender men, and 0.03% additional gender identity.\[3\] The proportion of infections involving cisgender males and cisgender females has been relatively consistent during the years 2014 through 2018.\[3\] Among persons newly diagnosed with HIV in 2018, an estimated 65.8% were attributed to male-to-male sexual contact, 25.6% to heterosexual contact, 6.6% to injection drug use, 3.6% to both male-to-male sexual contact and injection drug use, and less than 1% to other transmission categories (Figure 10).\[3\] The proportion of persons with newly diagnosed HIV who had male-to-male sexual contact as their acquisition risk increased from 55% in 2008 to 66% in 2018.\[3,4\] 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 in 2018 in the United States, 43% were among persons who are Black/African American, 26% White, 26% Hispanic/Latino, 2% Asian, 3% persons of multiple races, and less than 1% each for persons who are American Indian/Alaska Native and Native Hawaiian/other Pacific Islander.\[3\] The number of new HIV diagnoses in 2018 was highest in persons who are Black/African American, then in those who are White, or Hispanic/Latino. The rate of new diagnosis (new HIV diagnosis per 100,000 population) in 2018 was by far highest in individuals who are Black/African American and second highest in persons who are Hispanic/Latino; the new diagnosis rate for individuals who are Black/African American (39.2) was approximately 2.4 times higher than among persons who are Hispanic/Latino (16.4), and 8.2 times higher than persons who are White (4.8) (Figure 11).\[3\]

New HIV Diagnoses by Age

Comparing number of new HIV diagnoses by age categories, the highest number of new HIV diagnoses in 2018 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 2018 in the United States, 16.6% occurred in persons 50 years of age or older (Figure 13).\[3\]

New HIV Diagnoses by Region
The overall rate of new HIV diagnosis in the United States in adults and adolescents in 2018 was 13.6 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 (15.6), followed by the Northeast (9.9), then the West (9.7), with the lowest rates in the Midwest (7.2). Overall, approximately 52% of new HIV diagnoses in 2018 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 2018 were Georgia (28.6), Louisiana (25.2), Florida (25.0), Nevada (19.8), and Maryland (19.6); the District of Columbia (Washington, D.C) had an extremely high HIV diagnosis rate (45.7).[3]
### Undiagnosed HIV

#### Undiagnosed HIV in the United States

Using back-calculation methods, the CDC estimated at the end of 2018, 13.8% of persons with HIV were not aware of their HIV diagnosis.[2] From 2003 to 2018 the percentage of persons with undiagnosed HIV in the United States declined from approximately 25% to 14%; since 2014 the undiagnosed fraction of persons with HIV has continued to 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 HIV and are more likely to transmit HIV to others if they are not receiving antiretroviral therapy.[8]

#### Undiagnosed HIV by Age, Race, and TRANSMISSION CATEGORY

In general, the younger the age group, the higher the percentage of undiagnosed HIV; in 2018, among persons aged 18 to 24 years with HIV in the United States an estimated 44.9% had undiagnosed HIV (Figure 16).[2] The percentage of persons with undiagnosed HIV varies among different racial/ethnic groups, from a high of 20.5% in persons who are Native Hawaiian/Pacific Islander to a low of 11.3% in persons who are White (Figure 17).[2] Among different transmission categories, heterosexual males (17.1%) and men who have sex with men (15.9%) had the highest undiagnosed fraction in 2018, with the lowest undiagnosed fraction in persons who inject drugs (6.9% in males and 5.9% in females).[2]

#### Undiagnosed HIV and Risk of Transmission

Studies have shown that a large proportion of HIV transmissions occur from persons with HIV who are not yet aware of their HIV status.[8,9,10,11] 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 infections decreases among persons who become aware their HIV diagnosis.[12,13,14,15] Persons who become aware of their HIV engage in care, and take antiretroviral therapy will dramatically lower their risk of transmitting HIV to others.[8,16,17]

#### Late Diagnosis of HIV

Unfortunately, despite improvement in HIV screening and knowledge of status, 21% of persons newly diagnosed with HIV in 2016 had stage 3 HIV disease (AIDS) at the time of the HIV diagnosis.[18] For these individuals, late diagnosis represents missed opportunities to obtain medical care that would improve health outcomes and lower the risk of HIV transmission to others. The rates of AIDS at diagnosis increases with age, but does not differ significantly by racial/ethnic groups.[18] 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 with HIV in the United States.[19,20] 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.[8,11,20,21]
HIV Incidence Estimates

Definition of HIV Incidence

The HIV incidence in the United States represents new HIV infections during a specific time period and data for incidence are typically reported as the number of new HIV infections in a 1-year period. 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 new 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 recently acquired HIV.

CDC Method for Estimating HIV Incidence

The CDC estimates HIV incidence in the United States primarily based on the approach of the Serological Testing Algorithm for Recent HIV Seroconversion (STARHS), a laboratory process that can identify persons with recent HIV infection.[4] The STARHS is a two-step serologic process (Figure 18).[4]

- **Step 1**: The first step consists of a conventional HIV enzyme-linked immunoassay (EIA). This test typically becomes reactive approximately 1 month after HIV acquisition.
- **Step 2**: In the second step, samples reactive with the conventional EIA are then tested with the BED HIV-1 Capture Immunoassay. The BED capture assay uses peptides as antigens in the assay that are derived from the immunodominant region of HIV gp41. The name BED refers to HIV-1 subtypes B, E, and D. The BED assay determines the ratio of HIV-specific IgG antibodies to overall IgG antibodies in the sample (HIV IgG:Total IgG). The BED capture assay typically becomes positive approximately 6 months after HIV acquisition and approximately 5 months after the conventional HIV EIA becomes positive.

Samples from persons with chronic HIV will be reactive with both the conventional EIA and the BED capture assay. If the sample is reactive with the conventional EIA, but nonreactive with the BED capture assay, then it can be assumed the HIV infection occurred recently, likely within the prior 6 months; this situation is categorized as recent infection and also referred to as “STARHS reactive”. The CDC analyzes STARHS testing data combined with epidemiology data using complex statistical models to generate HIV incidence estimates for the entire United States.[4]

Estimates of HIV Incidence in the United States

The CDC estimated the number of new HIV infections in the United States decreased slightly from 38,000 in 2014 to 36,400 in 2018 (Figure 19).[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 1980s, (2) a peak in the mid-1980s, (3) a marked decline in the late 1980s, (4) stabilization and leveling off in the 1990s, and (5) a gradual decline in new infections from 2007 to 2018.[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 2018, an estimated 81.6% occurred in males and 18.4% 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 2018, an estimated 67% were attributed to male-to-male sexual contact, 22.6% to heterosexual contact,
6.5% to injection drug use, and 3.8% to both male-to-male sexual contact and injection drug use (Figure 20). [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 2018.[2,4]

**HIV Incidence by Race/Ethnicity**

Of the persons 13 years of age and older in the United States with newly acquired HIV infection in 2018, an estimated 42% were Black/African American, 28.3% Hispanic/Latino, 24.7% White, 1.7% Asian, 2.5% persons of multiple races, and less than 1% each in American Indian/Alaska Native and Native Hawaiian/other Pacific Islander populations.[2] The number of new HIV infections in 2018 was highest in Black/African American individuals, followed next by Hispanic/Latino persons, then White individuals (Figure 21).[2] The HIV incidence rate (new HIV infections per 100,000 population) was by far highest in Black/African American persons and second highest in Hispanic/Latino persons; the new incidence rates for Black/African American individuals (45.4), which was 2 times higher than persons who are Hispanic/Latino (22.4), and 8.7 times higher than persons who are Whites (5.2).[2]

**HIV Incidence by Age**

In 2018, 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 22).[2] The new diagnosis rate (new HIV diagnosis per 100,000 population) was also highest in persons aged 25-34 (31.5 per 100,000 persons) then 35-44 (16.9 per 100,000 persons). Among new HIV infections in 2018, 20.3% 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 2018 was by far highest in the South (Figure 23).[2] Overall, approximately 52% of new HIV infections in 2018 occurred in persons with residence in the South at the time of HIV diagnosis.[2] The highest incidence rate (new HIV infections per 100,000 population) was also highest in the South (18.4), followed by the West (11.6), the Northeast (10.5), and with the lowest rates in the Midwest (8.1).[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 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, 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

Deaths of Persons Diagnosed with HIV 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 2014 to 2018 the annual number of deaths of persons diagnosed with HIV has remained stable at approximately 16,000 deaths per year (Figure 24).[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 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 2018, among the 15,484 deaths in persons with diagnosed HIV, 72.2% occurred in persons 50 years of age or older (Figure 25).[3] The total number of deaths and death rates in 2018 were highest among Black/African American individuals—they accounted for 43% of all deaths in persons with diagnosed HIV (Figure 26).[3]

Causes of Death

For persons diagnosed with HIV 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 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 during 1996 through 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 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 27]).[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, or clades, are responsible for 71% of all HIV-1 infections globally: subtype A (common in West Africa, Central Africa, and Russia), subtype B (common in Europe, the Americas, Australia, and Japan), and subtype C (common in South Africa, East 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 Subtypes and Impact on HIV Outcomes

There may be differences in disease progression among the different subtypes, or clades, 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 2019, an estimated 38.0 million people were living with HIV globally, including 36.2 million adults and 1.8 million children who were younger than 15 years of age ([Figure 28]).[40] More than 25 million (approximately 67% of the total) live in sub-Saharan Africa, including 20.7 million in Eastern and Southern Africa and 4.9 million in Western and Central Africa.[40] In Eastern Europe and Central Asia, the number of people with HIV sharply increased from 2010 to 2019 (970,000 to 1.7 million), fueled by a significant injection drug use epidemic.[40,41,42] In the Asia and Pacific regions, the HIV prevalence increased from 4.7 to 5.8 million between 2010 and 2019.[40,41]

HIV Global Incidence

Based on the UNAIDS data, an estimated 1.7 million new HIV infections occurred globally in 2019 ([Figure 29]), which represented a 26% decline from the 2.3 million new infections in 2012.[40,41,43] Sub-Saharan Africa led the way with a 39% decline in new infections from 2012 to 2019 (1.6 million to 970,000).[40,43,44] Although most regions have seen a decline in new annual HIV infections since 2012, increases have occurred in Latin America (86,000 to 120,000). The number of new infections has remained level in Eastern Europe and Central Asia.[40,41]

Global AIDS-Related Deaths
In 2019, there were an estimated 690,000 AIDS-related deaths globally, including 440,000 in sub-Saharan Africa and 160,000 in the Asia and Pacific region (Figure 30). There has been a steady decline in AIDS-related deaths in the past decade. Overall, AIDS-related deaths have fallen by approximately 64% since the peak of 1.9 million deaths in 2004. Globally, tuberculosis remains the most common cause of death in persons with HIV, accounting for approximately one-third of all global AIDS-related deaths. 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.

**Global Antiretroviral Therapy Coverage**

During 2019, an estimated 25.4 million persons with HIV globally were taking antiretroviral therapy, which is approximately 67% of all people with HIV globally; this represents a substantial ramp up from the 7.8 million persons receiving antiretroviral therapy in 2010 and a dramatic increase from the 2.0 million receiving antiretroviral therapy in 2005 (Figure 31).
HIV-2

HIV-2 on a Global Scale

Of the 36.9 million individuals with HIV worldwide, approximately 1-2 million have HIV-2.[44,47] 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%.[48] 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, other risk groups include sexual or needle-sharing partners of persons known to have HIV-2, persons who received a blood transfusion or a nonsterile injection in a country where HIV-2 is endemic, and children born to women with HIV-2.[49]

HIV-2 in United States

Fewer than 1% of persons diagnosed with HIV in the United States are diagnosed with HIV-2.[50,51] 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.[50] A follow-up study reported that from 2010 through 2017 there were 198 reported diagnoses of HIV-2 in the United States, of which 102 were HIV-2 monoinfection, 11 were dual HIV-1 and HIV-2 infections, and 85 probable (unconfirmed) HIV-2 infection.[51] The 198 diagnoses of HIV-2 corresponded to only 0.6% of all new diagnoses of HIV in the United States during this time period.[51] Among those diagnosed with HIV, 45% had a birth country listed that is known to be endemic for HIV-2.[51] Among persons with a new diagnosis of HIV-2 reported to the CDC from 2010 through 2017, approximately 55% resided in the Northeast and 31% in the South.[51]
**Summary Points**

- In the United States at year-end of 2018, approximately 1.2 million people were living with HIV in the United States, including 1,012,100 with diagnosed HIV and 161,800 with undiagnosed HIV.
- The number of people 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 2018 HIV prevalence data in the United States include 58% of persons with HIV had male-to-male sex as their transmission category, blacks/African Americans accounted for approximately 41% of all people with HIV, and 58% of persons with HIV were 45 years of age or older.
- Among the 37,515 persons diagnosed with HIV in 2018 in the United States, 66% acquired HIV via male-to-male sex, 43% were black/African American, and 46% resided in the South at the time of the diagnosis.
- The HIV incidence (estimated new HIV infections) in the United States has declined slightly between 2014 and 2018, with an estimated 36,400 new infections in 2018.
- The proportion of persons with HIV in the United States who are unaware of their HIV status decreased from 25% in 2003 to 13.8% in 2018; however, among persons aged 13 to 24 years with HIV, 45% 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 remained relatively steady between 2014 and 2018. Most of these deaths are due to non-AIDS causes, particularly liver disease, cardiovascular disease, and non-AIDS malignancies.
- Among persons with diagnosed HIV who died in 2018 in the United States, blacks/African Americans had the highest number of deaths and highest death rate.
- 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 38 million people are living with HIV and 25.6 million (67%) reside in sub-Saharan Africa. Globally, in 2019, an estimated 1.7 million new HIV infections occurred and an estimated 690,000 persons with HIV died.
- In 2019, an estimated 25.4 million persons with HIV globally were receiving antiretroviral therapy.
- Globally, an estimated 1 to 2 million persons are living with HIV-2, with the highest prevalence rates in West Africa. In the United States, HIV-2 accounts for fewer than 1% of all person with HIV globally.
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**Figures**

**Figure 1 Persons with Diagnosed or Undiagnosed HIV in the United States in United States, 2014-2018**

This graph shows CDC estimates for persons ≥13 years old with diagnosed or undiagnosed HIV in the United States during the years 2014 through 2018. These numbers estimate the HIV prevalence.


*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection*
These data show transmission categories for HIV acquisition for persons ≥13 years old with diagnosed or undiagnosed HIV in the United States in 2018.


*Other = perinatal, hemophilia, blood transfusion, and risk factor not reported or identified.

*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection
Figure 2 (Image Series) - Persons with Diagnosed and Undiagnosed HIV in the United States, HIV Transmission Categories, 2018
Image 2B: Transmission Category: Males

This pie chart shows transmission categories for HIV acquisition for males ≥13 years old with diagnosed or undiagnosed HIV in the United States in 2018.


*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection
This pie chart shows transmission categories for HIV acquisition for females ≥13 years old with diagnosed or undiagnosed HIV in the United States in 2018.


*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection
Figure 3 HIV Prevalence, by Race/Ethnicity, United States, 2018

This table shows the HIV prevalence and percent based on race/ethnicity in the United States in 2018.


<table>
<thead>
<tr>
<th>Racial/Ethnic Group</th>
<th>Estimated HIV Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>3,900</td>
</tr>
<tr>
<td>Asian</td>
<td>17,600</td>
</tr>
<tr>
<td>Black/African American</td>
<td>482,900</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>274,100</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islander</td>
<td>1,100</td>
</tr>
<tr>
<td>White</td>
<td>340,700</td>
</tr>
<tr>
<td>Multiple Races</td>
<td>52,900</td>
</tr>
<tr>
<td>Total</td>
<td>1,173,200</td>
</tr>
</tbody>
</table>
Figure 4 HIV Prevalence Rates, by Race/Ethnicity, United States, 2018

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


*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection
**Figure 5 Persons with Diagnosed or Undiagnosed HIV, by Age Categories, United States 2018**

This bar graph shows the breakdown by age categories (in years) for persons ≥13 years old with diagnosed or undiagnosed HIV in the United States in 2018.

Figure 6 Persons with Diagnosed or Undiagnosed HIV, Percentage 45 and Older, United States, 2018

This bar graph shows that approximately 58% of persons ≥13 years old with diagnosed or undiagnosed HIV in the United States in 2018 were 45 years of age or older.


*Estimate for persons ≥13 years of age living with diagnosed or undiagnosed HIV infection
Figure 7 Persons with Diagnosed or Undiagnosed HIV, United States, year end 2018—by Region of Residence

This graph shows that at year-end 2018, more persons with diagnosed or undiagnosed HIV resided in the South than any other region of the United States.

Figure 8 Persons with Diagnosed or Undiagnosed HIV, United States, year end 2018—by Region of Residence (Percent)

This pie chart shows the geographic region of residence for persons with diagnosed or undiagnosed HIV at year-end 2018. Persons residing in the South accounted for 46% of all people with diagnosed and undiagnosed HIV in the United States.

Figure 9 HIV Diagnoses, United States, 2014-2018

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2018, by Transmission Category

Image 10A: New HIV Diagnoses 2018 Males and Females

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2018, by Transmission Category
Image 10B: Males with New HIV Diagnosed in 2018

Figure 10 (Image Series) - New HIV Diagnoses in the United States in 2018, by Transmission Category
Image 10C: Females with New HIV Diagnosed in 2018

Figure 11 New HIV Diagnoses (Rate) in the United States in 2018, by Race/Ethnicity

Figure 12 New HIV Diagnoses in the United States in 2018, by Age Group

As shown in this graphic the highest number of persons newly diagnosed with HIV in 2018 were between 20 and 35 years of age.

Figure 13 New HIV Diagnoses in the United States in 2018, Percentage 50 Years of Age and Older

As shown in this graphic 16.6% of persons newly diagnosed with HIV in 2018 were 50 years of age or older.

Figure 14 New HIV Diagnosis in the United States in 2018, by Region of Residence

Figure 15 Proportion of Persons with Undiagnosed HIV in United States, 2014-2018

Figure 16 Proportion of Persons with Undiagnosed HIV in United States in 2018, by Age Group

Figure 17 Proportion of Persons with Undiagnosed HIV in United States in 2018, by Race/Ethnicity

**Figure 18 Serological Testing Algorithm for Recent HIV Seroconversion (STARHS)**

This algorithm uses both a conventional HIV enzyme immunoassay (EIA) and HIV BED immunoassay. The BED assay is based on the ratio of HIV Ig antibodies to total Ig antibodies.

**Figure 19 Estimated HIV Incidence in United States, 2014-2018**

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 20 Estimated HIV Incidence in Persons Aged ≥13 Years, in United States, by Transmission Category, 2018

Figure 21 Estimated HIV Incidence in Persons Aged ≥13 Years, in United States, by Race/Ethnicity, 2018

Figure 22 Estimated HIV Incidence in United States, by Age Group, 2018

Figure 23 Estimated HIV Incidence in United States, by Region, 2018

Figure 24 Annual Deaths in Persons with Diagnosed HIV, by Year—United States, 2014-2018

Figure 25 Deaths in Persons with Diagnosed HIV, by Age Group, United States, 2018

This graphic shows that more than 70% of deaths in persons with HIV in 2018 were in persons 50 years of age or older.

### Deaths in Persons with Diagnosed HIV Infection in U.S., 2018

<table>
<thead>
<tr>
<th>Racial/Ethnic Group</th>
<th>Deaths (Diagnosed with HIV)</th>
<th>Rate/100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian/Alaska Native</td>
<td>43</td>
<td>1.8</td>
</tr>
<tr>
<td>Asian</td>
<td>79</td>
<td>0.4</td>
</tr>
<tr>
<td>Black/African American</td>
<td>6,679</td>
<td>16.3</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>2,712</td>
<td>4.5</td>
</tr>
<tr>
<td>Native Hawaiian/Other Pacific Islander</td>
<td>12</td>
<td>2.0</td>
</tr>
<tr>
<td>White</td>
<td>4,309</td>
<td>2.5</td>
</tr>
<tr>
<td>Person of Multiple Races</td>
<td>1,050</td>
<td>14.8</td>
</tr>
</tbody>
</table>
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. The M group comprises at least 9 distinct HIV subtypes.

**Figure 28 Global HIV Prevalence by Region, 2019**

Source: UNAIDS. Data 2020.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Total</strong></td>
<td><strong>38,000,000</strong></td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>20,700,000</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>4,900,000</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>240,000</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>5,800,000</td>
</tr>
<tr>
<td>Latin America</td>
<td>2,100,000</td>
</tr>
<tr>
<td>Caribbean</td>
<td>330,000</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>1,700,000</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>2,200,000</td>
</tr>
</tbody>
</table>
### HIV Incidence by Region, 2019

<table>
<thead>
<tr>
<th>Region</th>
<th>Newly Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Total</strong></td>
<td><strong>1,700,000</strong></td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>730,000</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>240,000</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>20,000</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>300,000</td>
</tr>
<tr>
<td>Latin America</td>
<td>120,000</td>
</tr>
<tr>
<td>Caribbean</td>
<td>13,000</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>170,000</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>65,000</td>
</tr>
</tbody>
</table>

Source: UNAIDS. Data 2018.
Figure 30 Global Deaths Due to AIDS During 2019

Source: UNAIDS. Data 2020.

<table>
<thead>
<tr>
<th>Region</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Total</td>
<td>690,000</td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>300,000</td>
</tr>
<tr>
<td>Western and Central Africa</td>
<td>140,000</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>8,000</td>
</tr>
<tr>
<td>Asia and the Pacific</td>
<td>160,000</td>
</tr>
<tr>
<td>Latin America</td>
<td>37,000</td>
</tr>
<tr>
<td>Caribbean</td>
<td>6,900</td>
</tr>
<tr>
<td>Eastern Europe and Central Asia</td>
<td>35,000</td>
</tr>
<tr>
<td>Western and Central Europe and North America</td>
<td>12,000</td>
</tr>
</tbody>
</table>
Figure 31 Persons with HIV on Antiretroviral Therapy—Global, 2000-2019