**Objectives**

1. Review the most recent data on the global effect of the human immunodeficiency virus (HIV)/AIDS pandemic.
2. Summarize theories about the origin of HIV.
3. Review the modes of HIV transmission.
4. Identify risk behaviors that facilitate HIV transmission.
5. Analyze societal factors that are contributing to the expanding pandemic.
6. Analyze HIV’s effects on the future of people living in regions with a high HIV disease burden.

**Key Points**

1. HIV is a preventable infection.
2. The incidence of new HIV infections has leveled off but is not in rapid decline.
3. Approximately 90% of all HIV-positive people in the world live in developing countries.
4. Many societal factors are driving the spread of the epidemic, including people on the move, complex emergencies, cultural factors (e.g., the status of women), poverty, stigma, and denial.
5. HIV is most commonly transmitted during high-risk events such as unprotected sex with an infected person; blood-to-blood contact with an infected person; and pregnancy, childbirth, and breastfeeding by HIV-positive women.

**Overview**

Epidemiology is the study of the determinants and distribution of disease. In a world characterized by the rapid movement of people, goods, and information, human immunodeficiency virus (HIV)/AIDS has rapidly touched nearly every nation on this planet. This chapter considers the epidemiology of one of the most devastating and complex infectious diseases of the late 20th and early 21st centuries.

**Global HIV/AIDS Statistics**

According to UNAIDS, at the end of 2007, 33.2 million people worldwide were estimated to be living with HIV or AIDS. Most of them reside in the developing world; about 68% live in sub-Saharan Africa. The number of incident (new) HIV infections is believed to have peaked in the late 1990s at more than 3 million new infections per year and was at 2.5 million new infections in 2007. Among the new infections, 420,000 were among children younger than 15 years. This means that in 2007 there were nearly 6,850 new HIV infections globally per day, along with approximately 2.1 million AIDS-related deaths. The estimated 1.7 million new HIV infections in sub-Saharan Africa in 2007 mean that as many as 22.5 million Africans may now be living with the virus. Most are unaware that they are infected.

Between 2006 and 2007, UNAIDS downwardly revised its estimates of HIV infection globally. In 2006, the estimated number of people living with HIV/AIDS globally was 39.5 million; in 2007, the number was 33.2 million. UNAIDS has emphasized that although there are some localized reductions in HIV prevalence, the most important reason for this downward revision is several changes to how UNAIDS calculates its estimates. In other words, there has not been a major shift in patterns of HIV transmission or a true reduction in HIV prevalence. The estimates were previously inflated, and because of improved and more precise methods, the estimates have been revised to more accurately reflect reality.

Every country in the world was, at some point, a low-prevalence country. HIV prevalence among pregnant women attending antenatal clinics in South Africa was less than 1% in 1990, and today it is around 29%. To understand this pandemic, we must examine the origins of the disease as well as the many biological and socioeconomic factors that foment its growth.
Where Did HIV Come From?

AIDS did not come to wide public attention until mid-1981, after clusters of deaths from pneumocystis jirovecii (formerly known as PCP [pneumocystis carinii pneumonia]) and Kaposi sarcoma were reported among young, previously healthy homosexual men in New York City, Los Angeles, and San Francisco. Previously, PCP had been diagnosed only in people who were immunocompromised. The aggressive form of Kaposi sarcoma ravaging young men in the United States had previously been observed among older men of European or Mediterranean descent.

*Morbidity and Mortality Weekly Report* published a summary of these early cases in 1982. This article elicited similar reports from France, the Caribbean, and Central America. In the United States, the disease was first called “gay cancer” and then labeled “gay-related immune deficiency” because homosexual men first exhibited characteristic symptoms. In some areas in Africa, the disease was called “slim” or “slim disease” because of the profound wasting and the association of death with progressive weight loss and diarrhea. About the same time, pediatric immunologists noted more infants with unexplained immune problems.

It is widely believed that HIV is the result of an animal-to-human (zoonotic) transfer of a simian immunodeficiency virus. HIV type 2 (HIV-2), which is prevalent in West Africa and has spread to Europe and India, is almost indistinguishable from a simian immunodeficiency virus that infects sooty mangabey monkeys. An animal source for a new human infection is not unique to HIV. The bubonic plague in Europe was transmitted from rodents. Influenza reached humans via pigs. Variant Creutzfeldt-Jakob disease in the United Kingdom was transmitted to humans through consumption of infected “mad cows.” Like these other infections, once HIV was established in humans, it began to follow human habits and movements.

Modes of Transmission

The following fluids from an infected person contain HIV:
- Blood
- Semen
- Vaginal fluid
- Breast milk

HIV is usually transmitted via the following:
- Sex with an infected person
- Exposure to the blood of an infected person through contaminated needles and syringes, tainted transfusions, the sharing of unsterilized razors during cutting practices, or other mechanisms
- Pregnancy, birth, or breast-feeding from infected mother to child

Although HIV antibodies may be present in saliva, tears, and urine, there is no epidemiologic evidence that contact with these fluids has resulted in HIV infection. HIV is not transmitted by the respiratory route or by casual contact in any setting, whether household, social, work, school, or prison. HIV is not transmitted by food, water, toilets, swimming pools, shared eating and drinking utensils, or other objects such as second-hand clothing or telephones. Insects such as mosquitoes do not transmit HIV. When a
mosquito bites, it sucks a small amount of blood from the person; the mosquito does not deposit any blood into the person.

HIV is not transmitted through casual contact. All people need to be aware of how HIV is and is not transmitted to reduce high-risk behaviors and to avoid unnecessary fears and stigmatization of HIV-infected people.

**Behavioral Risk and Vulnerable Groups**

Certain behaviors place people at greater risk of HIV infection, including unprotected sex with an infected person, blood-to-blood contact with an infected person, and injection drug use. Groups of people who engage in these high-risk behaviors (or who are involved in high-risk events such as childbirth and breast-feeding) are considered vulnerable to infection. The following section provides more information about high-risk events and behaviors as well as vulnerable groups.

**Exposure Through Sexual Contact**

Sexual intercourse is the major route of transmission of HIV throughout the world. The precise risk of HIV transmission from one act of sexual intercourse with an infected person is not known. Although some people have had multiple sexual contacts with an infected person without acquiring HIV, others have become infected from one sexual encounter. The probability that a person has acquired a sexually transmitted disease is, in general, proportional to the number of sexual partners that person has had in recent years. A study in Rwanda of behavioral risk factors for HIV infection found that infection rates were higher among women who were single and reported having more than one lifetime sexual partner. Rates of infection were lower among married women and women in monogamous partnerships. However, even among low-risk women, HIV prevalence was about 20%. For some women, a steady male partner who has sexual contact outside the primary relationship is the only source of HIV exposure. HIV is not just a disease of prostitutes and sexually promiscuous individuals.

There is now evidence from three randomized, controlled clinical trials conducted in Kenya, Uganda, and South Africa that male circumcision reduces the risk of heterosexually acquired HIV infection in men by approximately 60%. These results support long-term observations of a lower prevalence of HIV infection in countries where male circumcision is most commonly practiced. The evidence for a reduction of HIV acquisition risk in the context of male circumcision led the World Health Organization to formally announce recommendations on male circumcision for HIV prevention. The World Health Organization has stated that male circumcision should be a part of a comprehensive HIV prevention package. Of course, male circumcision services should be offered with full adherence to principles of basic human rights, including informed consent, confidentiality, and absence of coercion. Male circumcision is an important aspect to a comprehensive and integrated HIV/sexually transmitted illness prevention campaign.

**Exposure Through Blood or Blood Products**

Direct exposure to HIV-infected blood—whether through a tainted blood transfusion, the use of nonsterile razor blades for ritual scarring or traditional healing, or needle-stick accidents suffered by health care workers—is an efficient way to transmit HIV.

Compared with industrialized nations, countries in sub-Saharan Africa experience more transfusion-associated HIV transmission because of a higher prevalence of HIV infection in donor populations, a lack of HIV antibody screening in some areas, and a higher residual risk of contamination in blood supplies, despite antibody screening.

**Exposure through Pregnancy, Birth, or Breast-Feeding**

Transmission of HIV from mother to infant can occur at any point during pregnancy, labor, and delivery, or through breast milk after the baby is born. Without antiviral treatment, the rate of transmission of HIV from mothers to babies varies, depending on the region, from about 15% to 30% (in non-breast-feeding populations). Although HIV can be transmitted early in pregnancy, a particularly risky time for HIV transmission is the time of delivery, when the infant is directly exposed to maternal blood and secretions. Epidemiologic data indicate that breast-feeding approximately doubles the risk of HIV transmission. Prevention of perinatal HIV infection is one of the most powerful methods available to reduce the global effect of the virus. Please see the chapter on prevention of mother-to-child transmission of HIV for more information on this topic.
What Drives the Epidemic?

Epidemics are the result of complex interactions between biology and the environment. This section summarizes some of the principal societal factors driving the spread of this disease.

People and Goods on the Move
We are living in a global economy, with more people traveling than ever before. The most common reason for people to leave their homes and families is to seek work. HIV/AIDS has followed the routes of trade and commerce and the movement of labor, goods, and services. These are routes of legitimate commerce as well as illegal activities, such as trafficking in humans and illicit drugs. Migrant labor plays a particularly important role in southern Africa, where a thriving mining industry attracts workers from all over the region. Most miners live in single-sex dormitories, often hundreds of miles from their families. Many of these miners engage in sex with prostitutes, contract HIV, and transport the infection back home to their wives, who may in turn transmit the virus to infants during pregnancy.

People in Conflict and Complex Emergencies
War and instability are conducive to the spread of AIDS. The military can have a powerful effect on the general population’s exposure to HIV, whether through commercial sex, casual and consensual sex with other soldiers or civilians, or rape in times of conflict. Moreover, war and conflict often weaken or destroy public health systems, legitimate commerce, safe food supplies, and stable social arrangements. Sometimes war has stopped the spread of HIV (for example, Sierra Leone). This effect probably occurred because the conflict restricted movement within the country, and cross-border migration and trade became extremely difficult. In these situations, AIDS prevention efforts are a critical part of the reconstruction and normalization process.

Cultural Norms and the Status of Women
Cultural barriers often prevent women from taking necessary precautions to protect themselves and their babies from HIV. Domestic violence reduces women’s control over their exposure to HIV. In settings where supremacy and violence are regarded as a man’s right, women can seldom question their husbands about extramarital encounters, negotiate condom use, or refuse sex. In a recent study from Soweto, South Africa, 1,366 women who presented for antenatal care were interviewed privately about their experiences of partner violence and their perceived power in sexual relationships. Their HIV status was also determined. Researchers found that women who reported having been physically or sexually assaulted by an intimate male partner were more likely to be HIV infected. A high degree of male control in relationships was also associated with increased risk of HIV infection among women.

People in Poverty
AIDS tends to disproportionately affect the politically and economically disenfranchised. All over the world, HIV has settled into communities where people are poorly educated and living in poverty. Sadly, it is often poor, uneducated, and unempowered women and children who are most susceptible to this disease. Millions of people are vulnerable to HIV because they do not know the basic facts or because poverty constrains their life choices. Poverty can force women into situations where prostitution or transactional sex (sex exchanged for gifts and favors) becomes their only source of income.

Stigma and Denial
In many regions, denial and silence regarding HIV have been the norm for years. People are reluctant to admit that a fatal disease spread by behavior branded as immoral is rampaging through their community or their country. People who purport to explain the transmission of HIV among different populations but limit their analysis to such factors as sexual promiscuity and drug use tend to stigmatize or blame certain groups while failing to explain or understand larger issues involved in disease transmission. As mentioned earlier, it is not necessary to have multiple partners to acquire HIV, nor is everyone who has multiple partners HIV infected.

Ignorance fuels stigma and fear. Failure to provide accurate information about HIV leaves an information vacuum that is often filled by malevolent rumors and misinformation regarding disease spread, prevention, and treatment.

Denial about HIV can stigmatize HIV/AIDS and create an environment conducive to the continued spread of the virus. People living in such circumstances are less likely to want to know their HIV status, even if counseling and testing are offered. For example, people may be less likely to raise the issue of condom use before sex because they fear that their partner might interpret doing so as an
indication of possible HIV infection. Fear of revealing her HIV status to friends and family may prevent an infected woman from giving her baby replacement feeding as a way to avoid transmitting the virus through breast milk. An atmosphere of persecution, denial, and misinformation severely undermines prevention efforts.

**Prevention and Control**

Although there is hope that an effective anti-HIV treatment will be made available on a wide scale in the future, a cure or vaccine for AIDS is unlikely within the next several years. Therefore, prevention and treatment remain the most realistic strategies for dealing with the HIV epidemic.

Success in prevention requires consistent and persistent intervention over time, a clear understanding of the realities of target populations, and empowered participation by those affected by the interventions. Several barriers to successful prevention efforts have been identified around the world, including the following:

- Regional and national political instability
- A combination of growing populations and shrinking resources
- The presence of other endemic health problems (including childhood diseases, malaria, and tuberculosis)
- Poor governance, including inefficiency and corruption
- Apathy and silence at the international, national, and local organizational and governmental levels
- Lack of domestic spending on health care

HIV is clearly a preventable disease. If everyone who is currently infected did not transmit the virus to anyone else, the disease would eventually burn out and disappear. Stopping transmission through behavior change is a complicated challenge, but data indicate that HIV prevention and counseling efforts can be effective. A longitudinal study in Zambia of about 12,000 heterosexual couples evaluated the effect of prevention education and counseling on disease transmission. At baseline, 57% of the couples were concordant (both partners) HIV negative, 23% were concordant HIV positive, and 20% were serodiscordant (one partner was HIV negative; the other, HIV positive). All couples were counseled about HIV prevention and provided with condoms. Long-term follow-up showed reduced HIV acquisition rates among concordant negative couples, from approximately 3% to approximately 0.5% per year, and among serodiscordant couples, from about 23% to less than 10% per year.

Uganda, which has a strong prevention and control campaign, has reduced rates of HIV transmission, in part because of the ABC (Abstain, Be faithful, and use Condoms) campaign.

**Treatment and Its Influence on the Epidemic**

Fortunately, antiretroviral therapy is becoming increasingly available to people in developing countries. Some health professionals believe that treatment itself can help eliminate stigma. When treatment is available and AIDS is no longer considered a death sentence, more people may be motivated to seek counseling and testing. Knowing one’s status is more acceptable when treatment can improve and prolong life. We have seen evidence of this across the Baylor International Pediatric AIDS Initiative’s Children’s Clinical Centers of Excellence Network. Prior to the establishment of this network, some members of the community were concerned that the Centers of Excellence would be labeled as “AIDS clinics” and that families would be reluctant to bring their children for treatment for fear of being recognized and stigmatized. After several years of operation in countries across Africa, the network is providing comprehensive health services to more than 27,000 HIV-infected children and families (at the time of this printing), and the number is growing daily. In this case, access to treatment overshadowed concerns about stigma. As more treatment centers can offer highly active antiretroviral therapy, this phenomenon may be repeated throughout the developing world.

**Discussion**

Although the incidence of HIV may have plateaued, the HIV pandemic is not in rapid decline. More people are becoming infected with the virus than are dying from it. The numbers of incident infections and deaths remain unnecessarily high. Education, prevention, and treatment are currently the most promising strategies to slow the spread of the disease. Achieving greater levels of education, prevention, and treatment globally and curbing the growth of the HIV/AIDS pandemic may well be one of the greatest challenges of our time, and it is one
that we must embrace with a sense of total commitment and immediacy.

REFERENCES

5. WHO AIDS Series 6. Prevention of sexual transmission of human immunodeficiency virus. Geneva, Switzerland, 1990. This is an old WHO pamphlet, and I could not locate the entire content online, although the abstract can be found at URL = Available at http://www.popline.org/docs/0898/063912.html. [Accessed October 29, 2008.]