
CLINICAL INFECTIOUS DISEASES

A Practical Approach

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New York Oxford
OXFORD UNIVERSITY PRESS
1999

Epidemiology and Prevention

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The first cases of AIDS (acquired immunodeficiency syndrome) were recognized in 1981, prior to the identification of the etiologic agent. Thus the initial case definition of this new syndrome was based on available clinical and laboratory data.

For purposes of surveillance, the initial AIDS case definition by the Centers for Disease Control (CDC) required CD4 cell depletion accompanied by one or more specific opportunistic infections and/or tumors that became known as "AIDS-defining conditions." The CDC surveillance case definition was modified in 1985 and 1987 as more information became available about the spectrum of illnesses associated with HIV (human immunodeficiency virus) infection and as specific HIV antibody tests were developed.

Patients with HIV infection were categorized as having AIDS, AIDS-related complex (ARC), or asymptomatic disease. However, as more information has been gathered regarding the natural history of HIV infection, these terms have become outdated. It is now recognized that infection with HIV results in a progressive loss of immune system function, with individual cases progressing along a continuum from asymptomatic to increasingly severe clinical manifestations resulting from opportunistic infections and malignancies known as AIDS.

Definition of AIDS

Several studies have shown the value of the absolute CD4 cell count as an important indicator of HIV disease. In January 1993 the CDC further expanded the definition of AIDS to include HIV-infected adolescents and adults with a CD4 count under $200/\mu\text{L}$ irrespective of clinical manifestations, as well as HIV-infected persons with pulmonary tuberculosis, recurrent pneumonia, and invasive cervical cancer (Table 97.1).

The epidemiologic definition of AIDS used in European countries is presented in Table 97.2. The major difference between authorities in the United States (CDC) and Europe is the omission of asymptomatic HIV-infected subjects with CD4 count below 200 cells in the European definition.

It should be remembered that this classification system has been designed primarily as an epidemiologic tool, rather than a clinical staging system. Other staging systems that have been designed for clinical purposes are described in subsequent chapters.

Laboratory Diagnosis of HIV Infection

The most commonly used laboratory diagnostic assays for HIV infection are based on the detection of antibodies formed against HIV viral antigens. Antibody assays have been primarily de-

signed for detection of antibodies in human serum, although some of the tests have been able to detect HIV antibodies on whole blood or saliva. Antibody testing is used not only to support the individual diagnosis of HIV infection but also for public health purposes, such as blood bank screening and surveillance of the epidemic, as well as research. More than 100 HIV antibody tests, some of them already outdated, have been developed since 1985 by more than 40 different companies. Techniques for detecting HIV have evolved rapidly, to reduce the costs, achieve earlier diagnosis, eliminate uninterpretable results, and simplify the lab procedure.

Serologic diagnosis

Serologic tests are divided in two broad categories: *screening tests*, with the highest sensitivity, and *confirmatory tests*, with the highest specificity.

Screening tests

Enzyme-linked immunosorbent assays

These tests, commonly called ELISAs, are the most frequently used immunoassays for the detection of antibodies formed against HIV. They are called first-, second-, or third-generation tests, depending on the type of antigen—viral lysate, recombinant proteins, or synthetic peptides—and the type of conjugate used, with corresponding increases in specificity.

The advantages of ELISA include the high sensitivity and specificity, with differences in quality between various commercial brands, as well as the ease of performance for large numbers of samples. Among the disadvantages are the need for trained personnel, the cost and maintenance of equipment, and the duration of the procedure compared with rapid enzyme immunoassay (EIA) tests.

Rapid EIA tests

Based on the use of recombinant proteins or synthetic peptides fixed on a membranous support, rapid EIA tests have been designed for certain testing situations such as emergency wards, blood banks, or autopsy rooms, as well as field testing. Among the advantages are the quick performance—in general, under 30 minutes—and minimal equipment, as well as the ability for some of them to directly test blood rather than serum. Some of these tests are stable for up to 12 months, even at room temperature. Rapid tests are considered rather expensive, although costs vary widely (US <\$1–\$4), and they are not fit for processing large batches of samples. Sensitivity and specificity do not differ significantly from ELISA.

Table 97.1 Revised classification system of HIV disease

CD4 T-cell category (count/ μ L)	Clinical category		
	A	B	C
≥ 500	A1	B1	C1
200–499	A2	B2	C2
<200	A3	B3	C3

CATEGORY A

Asymptomatic HIV infection
 Persistent generalized lymphadenopathy
 Acute retroviral syndrome

CATEGORY B (FORMERLY ARC)

Bacillary angiomatosis	Hairy leukoplakia, oral
Candidiasis	<i>Herpes zoster</i>
Oral	Idiopathic thrombocytopenic purpura
Recurrent vaginal	Listeriosis
Cervical dysplasia	Pelvic inflammatory disease
Constitutional symptoms (e.g., fever or diarrhea >1 month)	Peripheral neuropathy

CATEGORY C (AIDS-DEFINING CONDITIONS)

CD4 count less than 200 cells/mm ³	Histoplasmosis
Candidiasis	Isosporiasis
Pulmonary	Kaposi's sarcoma
Esophageal	Lymphoma
Cervical cancer	<i>Mycobacterium avium</i>
Coccidioidomycosis	<i>Mycobacterium kansasii</i>
Cryptococcosis extrapulmonary	<i>Mycobacteria tuberculosis</i>
Cryptosporidiosis	<i>Pneumocystis carinii</i>
Cytomegalovirus	Pneumonia, recurrent
Encephalopathy, HIV	Progressive multifocal leukemia
Herpes simplex	<i>Salmonellosis</i>
Chronic (>1 mo)	Toxoplasmosis of brain
Esophageal	Wasting syndrome

Source: Centers for Disease Control. 1993 Revised Classification System for HIV Infection and Expanded Surveillance Case Definition for Aids among Adolescents and Adults.

The high sensitivity of screening tests does not overcome the problem of the "window" period, which is the time between exposure to HIV and the production of antibodies. However, with the newer tests this period has been reduced to a matter of days for most patients. Nevertheless, a period of up to 6 months is still considered necessary before an individual suspected of HIV infection is declared HIV-negative.

Confirmatory tests

Confirmatory tests are used for their high specificity.

Western blot test

The Western blot is currently the most commonly used method to confirm specific antibody responses to HIV viral proteins. It

Table 97.2 Expanded European AIDS Surveillance Case Definition (1993)

Candidiasis	Encephalopathy, HIV	Lymphoma
Pulmonary	Herpes simplex	<i>Mycobacterium avium</i>
Esophageal	Chronic (>1 mo)	<i>Mycobacterium kansasii</i>
Cervical cancer	Esophageal	<i>Mycobacteria tuberculosis</i>
Coccidioidomycosis	Histoplasmosis	<i>Pneumocystis carinii</i>
Cryptococcosis extrapulmonary	Isosporiasis	Pneumonia, recurrent
Cryptosporidiosis	Kaposi's sarcoma	Progressive multifocal leukemia
Cytomegalovirus		<i>Salmonellosis</i>
		Toxoplasmosis of brain
		Wasting syndrome

is based on the detection of antibodies directed at nine specific viral proteins produced by the three major HIV structural genes, ENV, GAG, and POL. It has demonstrated greater than 99% sensitivity and specificity.

The Western blot is considered the "gold standard"—that is, the most widely accepted serologic confirmatory tests—because of the specific detection of antibodies against multiple HIV viral antigens. Aside from the basic positivity or negativity of samples, a qualitative evaluation of the recognized viral antigens can be performed. However, the limitations of the Western blot technique are numerous. The procedure is time-consuming, labor-intensive, and subjective. Its high sensitivity and specificity depend critically on the standardization of the technique, therefore requiring a high level of staff training and laboratory organization. Even commercial Western blots have shown a lack of consistency between batches, because of the varying antigen preparation, therefore making interpretation of results difficult. The World Health Organization (WHO) has made efforts to standardize the interpretation criteria for the Western blot. The cost of commercialized Western blots remains very high, approaching US\$20 per test.

The Western blot's use is especially important in populations with a low prevalence of infection, since the risk of false-positive results with screening tests is high. In some high-risk populations, the predictive value of a positive enzyme immunoassay is greater than 99%, but the Western blot is still used as the confirmatory test.

Line immunoassay

The line immunoassay is a second-generation assay, having the potential to replace the Western blot. Recombinant proteins and/or synthetic peptides are applied in band patterns on nylon support strips and tested in a way similar to the Western blot. The line immunoassay has the advantage of being more easily standardized than the Western blot. It is also a less expensive alternative for confirmation and differentiation of viral strains because protein bands representing more than one virus can be applied to the strip. This may be an important consideration when both HIV-1 and HIV-2 are present or suspected.

Other tests

Other serologic techniques include the immunofluorescence (IF) and the radioimmunoassay (RIPA). These techniques are confined to research settings.

HIV testing strategies

Since no single test is 100% sensitive and specific, serologic tests need to be combined, depending on the purpose of HIV detection and the prevalence of infection in the population targeted. The conventional testing strategy—used for diagnosis of HIV infection in individual patients—recommends the use of an ELISA, possibly followed by a repeat ELISA on reactive samples in order to discard laboratory errors, and then a Western blot. The use of a differently formatted ELISA as the repeat test helps reduce the risk of producing false-positive results and limits the costs of Western blot controls.

Because of the limits of the Western blot, WHO has recommended alternative testing strategies for resource-poor settings in the developing world. However, these new approaches are still being widely debated.

Virus detection techniques

Although the detection of HIV antibodies is the most conventional technique for HIV diagnosis, direct demonstration of virus, viral antigen, or viral DNA may be useful for clinical research situations.

Laboratory techniques have been developed for the detection of HIV p24 antigen in serum samples. It has been shown that viral antigenemia can be detected in HIV-1-infected individuals early in infection and in the late stages of the disease. Viral antigen detection is commercially available, and convenient, but it is not very sensitive. Its highest sensitivity is in acute HIV seroconversion.

Virus isolation is used for the direct demonstration of the virus-infected status. Detection of viral replication in peripheral blood mononuclear cell cultures relies on several techniques, such as measurement of released p24 viral antigen in the culture supernatant, measurement of reverse transcriptase activity, or HIV DNA detected by polymerase chain reaction (PCR) in cultured cells.

Polymerase chain reaction for HIV-1 DNA or RNA has a very high sensitivity and specificity, but it is still a complex and expensive procedure. Virus isolation and PCR are used for specific research questions. They are employed to detect HIV-1 in the interval between exposure and seroconversion, or for confirming indeterminate Western blot test results. They have proven useful in providing relevant information in perinatal transmission studies of HIV, where the presence of passive antibodies of the mother precludes the serodiagnosis of active infection of the exposed infant. Besides specific diagnostic situations, these techniques have also proved useful in monitoring the success of AIDS therapies.

Status of HIV/AIDS Worldwide

Global HIV/AIDS estimates

UNAIDS and WHO estimate that over 30 million people were living with HIV infection at the end of 1997 (see Fig. 97.1). That is one in every 100 adults in the sexually active ages of 15 to 49 worldwide. Included in the 30 million figure are 1.1 million children under the age of 15. The overwhelming majority of HIV-infected people—more than 90%—live in the developing world, and most of these do not know that they are infected.

These latest estimates also point up the continuing rapid spread of HIV. Altogether, 5.8 million people are believed to have acquired HIV infection in 1997, 590,000 of them children. Overall, that is equivalent to nearly 16,000 new infections every day of the year, including those in children infected at birth or through breastfeeding. Assuming that currently unbroken trends in many parts of the world will continue, it is estimated that more than 40 million people will be living with HIV in the year 2000.

An estimated 2.3 million people died of AIDS in 1997. These deaths represent a fifth of the total 11.7 million AIDS deaths since the beginning of the epidemic in the late 1970s. Of the people who died of AIDS this year, 46% were women and 460,000 were children.

The regional epidemics

The regional distribution of global HIV/AIDS cases in adults and children is shown in Figure 97.2. North America, Europe, and Australasia are estimated to have a total of more than 1.5 mil-

People newly infected with HIV in 1997	Total	5.8 million
	Adults	5.2 million
	Women	2.1 million
	Children <15 years	590 000
No. of people living with HIV/AIDS	Total	30.6 million
	Adults	29.5 million
	Women	12.1 million
	Children <15 years	1.1 million
AIDS deaths in 1997	Total	2.3 million
	Adults	1.8 million
	Women	820 000
	Children <15 years	460 000
Total no. of AIDS deaths since the beginning of the epidemic	Total	11.7 million
	Adults	9.0 million
	Women	4.0 million
	Children <15 years	2.7 million
Total no. of AIDS orphans ^a since the beginning of the epidemic		8.2 million

^a Defined as HIV-negative children who lost their mother or both parents to AIDS when they were under the age of 15

Fig. 97.1 Global summary of the HIV/AIDS epidemic, December 1997.

lion infections. The spread of HIV infection among homosexual men appears to have decreased markedly, although increases in infection have been demonstrated in the United States because of older gay men returning to risk behavior or new gay generations engaging in unsafe sex. Transmission through injecting drug use and heterosexual intercourse increased during the latter half of the 1980s and the early 1990s.

The magnitude of the HIV/AIDS problem in eastern Europe and central Asia remains poorly defined. As of late 1997, an estimated 150,000 adults and children are infected with HIV in this region, and drug injection accounts for the majority of the new infections.

Two-thirds of all cumulative HIV infections have occurred in sub-Saharan Africa, with about half of these 20.8 million infected adults being women. About 1 million African children are estimated to have been infected as a result of mother-to-child transmission. Although central and eastern Africa remain the hardest hit by the epidemic, there is increasing spread in West Africa, southern Africa, and parts of North Africa. In some urban populations in central and eastern Africa, it is estimated that up to one in three adults is now infected. In eastern and central Africa HIV prevalences among female prostitutes may reach 80%, while it is common to find infection rates greater than 50% among sexually transmitted disease (STD) clinic patients. (See HIV/AIDS surveillance database from the U.S. Bureau of Census, Center for International Research, for a complete inventory of seroprevalence data on African populations.)

By contrast with sub-Saharan Africa, limited data are available on North Africa and the Middle East. As of late 1997, HIV was estimated at more than 210,000 for the region, mainly among homosexual and bisexual communities.

South and southeast Asia are currently experiencing a rapidly expanding HIV epidemic. Whereas in early 1991 WHO estimated that there were around 500,000 HIV infections in the region, as

of late 1997 it was conservatively estimated that more than 6 million adults had been infected. At this pace, Asia will soon surpass Africa in the annual number of new infections.

Significant levels of HIV infection have recently been detected among injecting drug users (IDUs) in countries like Vietnam, Malaysia, Thailand, and China. Sexual transmission of HIV has been expanding at the same time, leading to significant levels of infection in female sex workers in various countries. In Thailand, HIV infection is now spreading to the general population, as demonstrated by surveys in young military recruits or antenatal clinic attenders.

As of late 1997, HIV prevalence in adults was estimated at 1.3 million in Latin America and the Caribbean. Brazil already has more AIDS cases than any developing country outside Africa. This region illustrates the diversity of epidemiologic patterns across the continent, with a combination of heterosexual, homosexual, bisexual, and drug-injection behaviors. Throughout this region, the proportion of AIDS cases among women is increasing, reflecting the importance of heterosexual transmission.

All these prevalence figures reveal little about the actual spread of HIV, except that it continues to increase at a staggering rate. In 1997 alone, it is estimated that 5.8 million people became infected. The majority of the new infections have occurred in sub-Saharan Africa, India, and Southeast Asia. Although there is still much uncertainty about the future spread of HIV and about the ultimate global dimensions of the epidemic, since it has not yet reached its equilibrium, a conservative estimate is that by the year 2000 there will be a minimal cumulative total of 40 million cases of HIV infection, with 10 million adult AIDS cases. Since approximately 90% of infections will have occurred in developing countries, it is becoming clear that the epidemic is turning into a mainly heterosexually transmitted disease of the developing world, and of marginalized populations within the industrialized world.

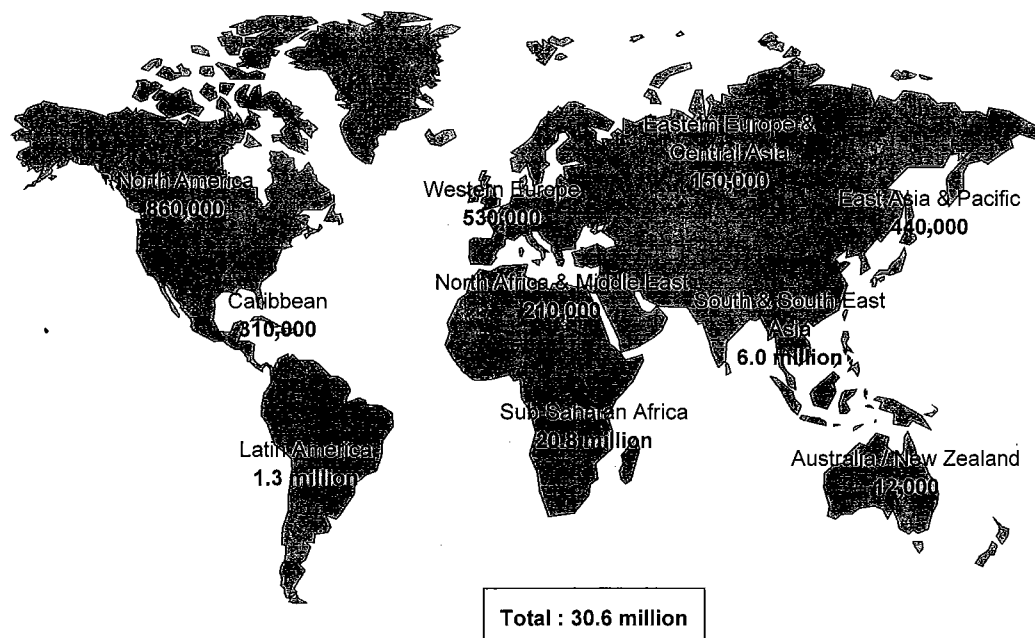


Fig. 97.2 Adults and children estimated to be living with HIV/AIDS as of end 1997

Modes of Transmission

The modes of transmission have not changed beyond those described or predicted early in the epidemic, and they are identical throughout the world. The vast majority of cases of HIV infection and AIDS throughout the world can be attributed to sexual contact, bloodborne transmission, or perinatal transmission.

Bloodborne transmission includes needle-sharing by drug users; receipt of infected blood, blood products, or organs and tissues; and percutaneous or mucosal occupational exposure.

Sexual transmission

In a global sense HIV infection is primarily a sexually transmitted disease, since 75% of cases worldwide are estimated by WHO to be acquired by sexual contact. Receptive anal intercourse appears to be the most efficient mode of sexual transmission of HIV, explaining the prevalence of HIV infection among homosexual and bisexual male communities. Homosexual transmission still accounts for the majority of sexually transmitted AIDS cases in North America and most of Europe and Oceania, although heterosexual transmission is growing in importance.

Vaginal heterosexual intercourse is a fairly inefficient mode of transmission of HIV, particularly from woman to man. For Western countries, estimated per-contact probabilities of HIV infection range from 0.001 to 0.002. These figures contrast sharply with recent figures from Thailand reporting probabilities of 0.03 to 0.05. It is now known that the efficiency of heterosexual transmission can be greatly enhanced in the presence of well-defined risk factors, including a more advanced immunodeficiency of the infecting partner; anal intercourse; sex during menses; and the presence of ulcerative or nonulcerative STDs in either partner. The combination of such amplifying factors, in addition to high-risk sexual behavior patterns, may explain the widespread heterosexual epidemic in the Third World.

Bloodborne transmission

Some 10%–15% of HIV infections are estimated to be acquired by bloodborne (or parenteral) transmission worldwide. This mode of transmission includes needle-sharing by drug users; receipt of infected blood, blood products, or organs and tissues; and percutaneous or mucosal occupational exposure.

Transmission of HIV through sharing of injection equipment among IDUs accounted for 5%–10% of HIV infections worldwide in 1993, but for 25% in developed countries. It is the main cause of bloodborne transmission in Asia, Latin America, and the Caribbean. In the United States, more than 20% of AIDS cases are attributed to injecting drug use. In Europe, Italy, Spain, France, and Switzerland report the highest percentages of drug-use-associated AIDS cases. The use of noninjecting drugs, such as crack cocaine, has also been associated with increased rates of HIV infection through the exchange of sex for money or drugs.

Transmission via contaminated blood or blood products is a very efficient form of transmission, approaching 100%. Fortunately, bloodborne routes of acquisition now account for only about 5% of HIV infections in the world. The proportion of AIDS cases attributable to blood transfusion has been steadily declining in the Western world thanks to rigorous screening techniques for blood donors. However, the risk of HIV infection by contaminated blood remains high in the developing world, as a result of the failing health care system. Although HIV infection has also been transmitted through donated organs and tissues, most cases occurred before 1985, when organ donors started to be routinely screened for HIV.

The risk of occupational HIV transmission in the health care setting is small. Occupational HIV transmission usually refers to health care worker exposure to patient or laboratory specimens through percutaneous injury.

The CDC have been collecting documented reports on occupational HIV transmission in a limited number of health care

workers. Overall, the risk of infection from a needle stick appears to be around 0.3% of such exposures.

Perinatal or "vertical" transmission

Transmission of HIV from mother to child during or after pregnancy accounts to 5%–10% of acquired HIV infections worldwide. It is by far the major source of infection in children. It has become a major public health problem in much of Africa, where around 1 million children had been infected as of late 1993. Transmission occurs before birth, during delivery, and through breastfeeding, with rates ranging from about 14% to 40%, the highest figures being observed in African studies. The differences in rates may be explained by the stage of infection of the mother, the risk of transmission being greater in early or advanced stages of infection, and by breastfeeding practices. In this case the risk is particularly great when the mother becomes infected during late pregnancy or while breastfeeding. Recently zidovudine (AZT) administered during pregnancy, at delivery, and in the first 6 weeks of life to the infant has reduced transmission by over two-thirds (from 25% to 8%).

There is no evidence so far that HIV is spread through casual contact. Studies of household contacts of HIV-infected persons have revealed only a single instance of transmission among persons who were not sex or needle-sharing partners of the index case. In that situation there appeared to be repeated blood contact from the index case with an active dermatitis in the recipient. There is no evidence that HIV can be transmitted by food, inanimate objects, skin contact such as handshaking, animals, or water. Although HIV has been isolated from saliva, suggesting the theoretical risk that HIV could be transmitted by deep kissing, biting, or other direct contact of infected saliva with nonintact skin or a mucous membrane, transmission by such route seems rare or nonexistent. Finally, HIV transmission by insects has been the subject of much speculation, yet it has not been corroborated by any evidence, even in developing countries where malaria and HIV are both endemic.

Determinants of HIV Spread

The spread of HIV infection in a population can be characterized by four types of variables: behavioral, biologic, demographic, and socioeconomic/political.

Behavioral variables

Sexual behavior is the most important determinant for the spread of HIV, its heterogeneity significantly influencing the dynamics of HIV infection among and between populations in the world. In particular, high rates of sexual partner change and contacts with highly infected core groups such as sex workers play a key role in the spread of HIV into the general population. The rate of sexual transmission of HIV is also affected by the rate of sexual practices such as anal intercourse, or by the rate of condom use.

Biologic variables

It has been demonstrated that the risk of sexual transmission of HIV is greatly enhanced in the presence of ulcerative as well as nonulcerative STDs, since they increase both the infectiousness

of the infected individual and the susceptibility of the noninfected sex partner. The efficiency of sexual transmission of HIV also increases with higher viral load, as in longer infected individuals, particularly those with overt AIDS.

Demographic variables

Since HIV is primarily a sexually transmitted disease, young and sexually more active age groups are more affected by the epidemic.

Family separation and disintegration of social norms, which occur with large concentrations of migrant labor, as in mining areas or industrial plantations, create an imbalance between supply and demand of sexual contact between men and women. This in turn favors prostitution and its consequent contact with HIV-infected commercial sex workers.

Socioeconomic/political factors

As in other epidemics, poverty is one of the major driving forces behind AIDS, generating family separation, prostitution, and drug addiction. In the developing world, crises in many health care systems have led to reduced access to health services, poor STD case management, and few resources for preventive activities. In addition, war and civil conflicts have generated large refugee flows and economic disarray, thus placing populations at higher risk of STDs or HIV infection.

Women's lack of personal power also correlates with the rapid spread of HIV infection, since women in this situation do not have the means to minimize the risks of heterosexual transmission of HIV.

Epidemiology of HIV-2

Human immunodeficiency virus 2 is distinct from HIV-1 but also belongs to the family of retroviruses. Epidemiologic features characteristic of HIV-2 are briefly reviewed here. Further information can be found in Kanki and De Cock's review on epidemiology and natural history of HIV-2 (see References).

Although HIV-2 infection has been documented in Africa, Europe, the Americas, and Asia, its spread has remained very limited. It occurs predominantly in West Africa, and to some extent in Angola and Mozambique, and in Portugal. Guinea-Bissau is the major focus of HIV-2, with prevalence rates as high as 13.4% in the male general population. In most other countries of the region, HIV-2 seroprevalence rates of around 2.5% have been documented, with significant variations between countries and population groups.

The epidemiology, risk groups, and routes of transmission of HIV-2 are similar to those of HIV-1. There are, however, several distinctive features of HIV-2 epidemiology that differ from HIV-1. The age of acquisition of HIV-2 appears to be higher than for HIV-1, the prevalence of HIV-2 increases much more slowly than that of HIV-1, and infection in infants and young children is unusual. This supports the hypothesis that the risk of transmission and virulence of HIV-2 is much lower than of HIV-1. Many areas of West Africa are facing double epidemics of HIV, with both HIV-1 and HIV-2 cocirculating in the population. Patients coinfecting with both viruses do occur. In countries with dual infections, it appears that the rate of HIV-1 spread is greater than that of HIV-2.

Prevention of HIV Infection

No single intervention offers the "magic bullet" that will reduce the spread of HIV-1. However, multiple coordinated approaches can be effective. They include educational programs to encourage behavior change, condom promotion, and STD case management. In addition, risk reduction among injecting drug users (e.g., by needle exchange programs), as well as blood donor referral and HIV testing of blood donations, are essential components of a prevention package. Undeniably AIDS prevention interventions have produced long-term risk-behavior reduction in some populations. However, resources need to be sufficient to foster widespread behavior changes, and continued risk reduction depends on sustainable behavior-change programs.

It is essential that preventive interventions be integrated in national AIDS programs, which in turn provide technical support and coordination for all those who work in the field. Interventions are briefly reviewed next. Further information on prevention of HIV infection is noted in the References at the end of the chapter.

Education

Education refers to interventions aimed at preventing people from engaging in risk behavior by improving their knowledge of the transmission of HIV infection. It must not be aimed only at individuals whose risk of infection is particularly high because they have multiple sex partners, but at all sexually active men and women, and at adolescents before they become sexually active. Educational issues include the reduction of the number of sex partners and/or high-risk practices, the use of barrier methods in high-risk sexual encounters, and women's responsibility to refuse sexual activity that places them at risk of infection. Among the educational channels or techniques are the use of mass media, peer educators, and face-to-face education through testing and counseling.

Mass media include newspapers, magazines, radio or TV programs, and telephone hot lines, aimed at various segments of the general population. Mass media campaigns in Switzerland, using mail and other supports to promote condom use, nonexchange of syringes, and monogamy, demonstrated that both sales and use of condoms increased significantly. In Thailand, "100% condom use" programs were implemented nationwide among sex workers and their clients. Within a short period, condom use among sex workers was shown to increase markedly, while at the same time reported STDs among the same group decreased dramatically (Fig. 97.3).

Peer educators are people of the same background and social standing as their target audiences, who speak the same language and share the same values. Peer education is essential for groups that are stigmatized by mainstream society, like gay men or sex workers, and are therefore suspicious of initiatives from outside. In several American cities peer educators were trained to deliver AIDS risk-reduction messages to fellow gay men. As a result, behavioral change could be demonstrated, at least for the short term.

Another example of peer education is provided by the community-based intervention program of Ciudad Juárez, Mexico. As a result of the program, involving sex workers as peer educators, significant changes in knowledge and practices related to STDs and HIV/AIDS were achieved. Peer educators are also used in community-based programs aimed at reaching at-risk groups like schoolchildren or out-of-school children. Limited experience

among high school students in the United States shows that peer-led sex education can help teenagers to postpone the onset of sexual life.

The combination of testing for HIV and counseling both before and after the test aims at changing risk behavior. In their extensive review of counseling and testing, Higgins and coworkers (1991) concluded that this method was fairly effective in reducing high-risk behavior in the gay population, as well as in drug treatment centers, regarding sharing of injecting equipment and sexual behavior among drug users. More recently, counseling and testing were also demonstrated to be effective among discordant couples in the United States. However, limited studies in the United States have indicated only modest impact with STD patients. While short-term impact on condom use could be demonstrated in one study, marked increase in STD incidence was observed in other studies among STD patients counseled about a negative HIV test.

Promotion of condom use and other barrier methods

However important it is to give people the full range of options for preventing sexual transmission, including abstinence, mutual

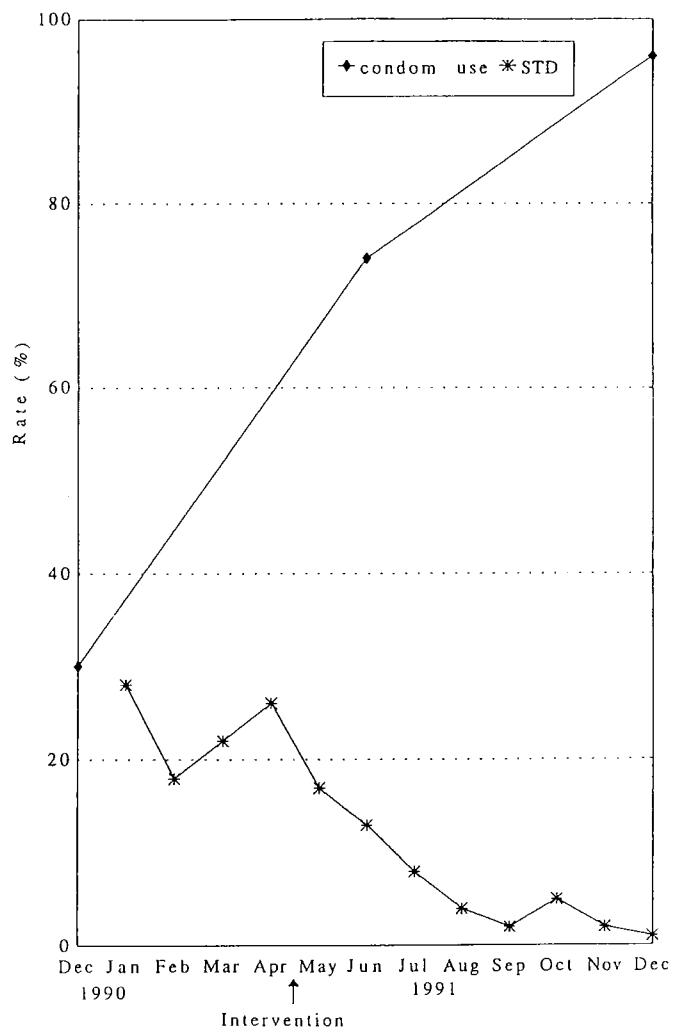


Fig. 97.3 Increase in condom use and decrease in sexually transmitted diseases (STDs) among sex workers following introduction of 100% condom use, Pitsanuloke, Thailand.

fidelity, and nonpenetrative sex, it is essential to promote condom use and to make it available and inexpensive. In many developing countries, condoms have been distributed effectively through social marketing techniques. The experience of Zaire illustrates the successes of a vigorous condom social marketing program; between 1987 and 1991, condom sales soared from less than half a million to more than 18 million. Similar social marketing programs in several African countries also demonstrate marked increases in condom sales. Overall, condom use has increased in special-risk groups (gays, sex workers, IDUs) wherever preventive interventions have been conducted.

Efforts are still under way to develop barrier methods that can be used by women when they are unable to get their partner to use a condom, or when they otherwise wish to control the prevention process. One of the methods is the "female condom"—essentially a pouch that women can insert into the vagina before intercourse—which is now on the market in several countries, including Switzerland, Great Britain, and the United States. It offers effective protection, but it is expensive. There is an intensive research effort to develop chemical methods that can be applied by a woman without her partner's knowledge, and that can inactivate HIV locally and reduce the risk of acquisition of infection.

Control of sexually transmitted diseases

Since conventional STDs are recognized risk factors of HIV transmission, STD diagnosis and treatment are key issues in the prevention of sexual transmission of HIV. The efficacy of STD control in preventing HIV was clearly shown in a community-based intervention trial in Mwanza, Tanzania. In those communities where STD control was strengthened HIV incidence was reduced by 42% compared to the control communities. Even outside the context of AIDS, the high burden of mortality and morbidity associated with classic STDs in the developing world and the relatively low cost of treatment justify STD control as a public health priority measure. Last but not least, since the target audiences are identical, STD clinical services offer unique opportunities of conveying credible educational messages regarding both STDs and HIV at the individual level.

Reduction of vertical transmission

Results from a multicenter randomized double-blind clinical trial in the United States and France in 1995 showed that treatment of HIV-positive mothers and their infants with AZT may reduce by two-thirds the risk for perinatal HIV transmission. In this trial HIV-positive women took AZT during pregnancy, labor, and delivery; their newborns were given 6 weeks of treatment. The full treatment was demanding: 100 mg AZT 5 times/day during pregnancy; intravenous administration of 2 mg/kg followed by 1 mg/kg/hr during labor and delivery; 2 mg/kg every 6 hours in newborns for 6 weeks. No major side effects were observed, but long-term effects are still being assessed. This regimen is now recommended by the U.S. Public Health Service. Unfortunately, because of its cost and complexity, this approach may be of limited accessibility in the developing world, where most cases of mother-to-infant transmission occur.

When safe alternatives to breastfeeding are available, HIV-infected mothers should be advised not to breastfeed, in order to keep their infants uninfected. Yet in developing countries, where no safe alternative exists, WHO and the United Nations Children's Fund (UNICEF) recommend that the risk of HIV in-

fection through breastfeeding be weighed against the benefits of breastfeeding in reducing the infant's risk of dying from infectious diseases or malnutrition.

Prevention of HIV transmission through blood transfusions

Securing safety of blood supplies is of paramount importance, as the risk of infection through administration of a single contaminated blood transfusion exceeds 90%. In the United States and most Western countries blood safety was effectively accomplished by mid-1985. As part of the safety strategy, reduction of blood utilization in clinical therapeutics and the practice of autotransfusion have been encouraged. However, as reported above, in many developing countries systematic blood testing, as well as recruiting regular voluntary blood donors, has been of limited success.

Reduction of transmission among injecting drug users

While the main prevention goal should be effective treatment of addiction, harm reduction programs including the distribution of clean needles and syringes have been demonstrated to reduce the HIV threat. These programs have been successful in several countries, including the United States, Australia, New Zealand, Sweden, the Netherlands, and the United Kingdom, in spite of strong political opposition at the beginning, on the grounds that these programs encouraged drug use and undermined the "war on drugs." In addition to providing safe equipment, these programs are effective entry points to other services for previously marginalized people. No evidence of increased drug use has emerged.

Prevention of HIV transmission in the health care setting

Human immunodeficiency virus as well as other bloodborne pathogens can be transmitted within the health care setting from patient to patient, from patient to health care worker, and, rarely, from health care worker to patient. Transmission by these three routes can be minimized, although not eliminated, through the application of effective infection control practices based on the concept of "universal precautions." This concept assumes that all blood and body fluids are potentially infectious, regardless of whether they are from a patient or health care worker, and regardless of the laboratory test result. This concept is applied through numerous guidelines which include handwashing, careful handling of needles and other sharp objects, use of gloves and other protective barriers as indicated by the nature of the procedure, and sterilization or disposal of instruments as appropriate. Detailed recommendations can be found in Chapter 8.

Accidental occupational exposure to HIV cannot, however, be totally eliminated. Postexposure care includes immediate post-exposure interventions, such as decontamination of the exposure site and consideration of chemoprophylaxis with AZT. Follow-up care for exposed persons includes education and counseling until infection is diagnosed or excluded with certainty and careful evaluation of the case. Detailed recommendations on the management of occupational exposure to HIV were published by the Public Health Service.

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