Management of Bloodborne Infections in Sport

A Practical Guide for Sports Health Care Providers and Coaches

Terry Zeigler

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Preface

Because bleeding injuries are a common occurrence in athletic events of all types, it is important that people involved in athletics become familiar with bloodborne pathogens and know the procedures that can be performed to reduce the risk of transmittal. Recent research, however, shows that athletic personnel have been slow to respond to the threat of human immunodeficiency virus (HIV) and other bloodborne pathogens. A significant number of sports medicine personnel also are not adhering to precautionary measures that would protect them from the possible transmission of HIV and other bloodborne pathogens.

The key in athletics is to educate those working with athletes about the potential risk for HIV and hepatitis B virus transmission. *All athletic personnel* who come into contact with athletes must be responsible for themselves in their knowledge of Universal Precautions when dealing with injured athletes of all ages and with bloodborne pathogens.

The Occupational Safety and Health Administration (OSHA) guidelines were established to provide employers the information they need to make their work environment safe for employees who may come into contact with infectious materials. Some institutions have gone even further than the OSHA guidelines and have developed even stricter policies regarding the management of bloodborne infections. Employers should inform you of their own policies regarding bloodborne infections.

The purpose of this manual is to provide a foundational education regarding the transmission and treatment of bloodborne pathogens for all those who come into contact with athletes. This educational foundation will provide a basis and rationale for the Universal Precautions and procedures to be discussed throughout the manual. With the knowledge gained through this manual, all individuals working with athletes, young and old, will be better prepared to deal with blood in the athletic setting and to reduce the risk of transmission of bloodborne pathogens.

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CHAPTER

Bloodborne Pathogens

Bloodborne pathogens are microorganisms present in human blood that cause disease in humans. These pathogens include, but are not limited to, human immunodeficiency virus (HIV) and hepatitis B virus (HBV). The prevalence of HIV and HBV infections has increased steadily over the past decade throughout the world. Human immunodeficiency virus and HBV infections can be fatal. Not only are these viruses capable of killing the host; they can also be transmitted through blood and body fluids to unsuspecting individuals. It is imperative that all individuals gain an understanding of the pathogenesis and transmission of these viruses so that the risk of spread of these infections can be reduced.

Hepatitis is a disorder involving inflammation of the liver. Common symptoms include loss of appetite, dark urine, fatigue, and sometimes fever. Hepatitis can be caused by infections and by toxins, including drugs; this discussion is limited to infectious causes. Progressive signs of infection are associated with severe fatigue, anorexia, nausea, vomiting, and jaundice. Fulminant hepatitis may result in hepatocellular destruction, encephalopathy, coma, and death (Buxton et al. 1994, 108).

Five different types of hepatitis virus have been identified. Hepatitis A virus is the most common cause of viral hepatitis. This virus is usually transmitted by food and water contaminated by human waste. It rarely causes serious complications. Hepatitis C virus (HCV) is mostly seen in people who have had a blood transfusion. However, with the introduction of blood screening, transfusion-associated HCV has been nearly eradicated in developed countries. Now the main route of transmission for HCV is parenteral (i.e., piercing mucous membranes or the skin barrier), and thus the precautions outlined in this book should be used to prevent transmission. Hepatitis delta virus, a peculiar virus that occurs only in association with hepatitis B, is common in the Mediterranean region. Hepatitis E is endemic in India and South America

("Hepatitis" 1996). Hepatitis B poses the most serious threat to athletic personnel, and along with HIV will be the focus of this book.

The risk of acquiring HBV infection is much greater than for HIV. Approximately 1,200 new cases per year are reported among health care workers, and 5% to 10% of those become chronic or fatal. Despite the fact that HBV is more contagious, public awareness is much greater for HIV. "Hepatitis B is as prevalent, if not more prevalent, and more infectious than AIDS," said Thelma King Thiel, president of the American Liver Foundation. "The public needs to know this" (Kong 1991, 1).

In 1992, HIV infected 40,000 Americans, bringing the number of HIV-infected people in the country to about one million, with a yearly death toll that exceeded 31,000. By comparison, each year more than 500,000 Americans become infected with some form of hepatitis virus, and approximately 16,000 die from complications of the virus each year (Stein 1993, 65).

Hepatitis B virus and HIV are transmitted in virtually the same ways, but with some distinct differences. While only approximately 8% of HIV infections in the United States are transmitted through heterosexual intercourse, 41% of HBV infections are spread through heterosexual intercourse. Although a majority of HIV infections can be traced to some type of risky behavior (i.e., intravenous drug use or unprotected sex), 26% of HBV cases have no known source.

Hepatitis B virus is more contagious than HIV because it is a hardier virus. Hepatitis B virus can remain infectious outside the body (for example, in dried blood) for a week or longer, whereas HIV is extremely fragile outside of the body.

Another underlying cause for the higher rate of transmission of HBV over HIV is that the virus tends to be more concentrated in the blood (100 times greater than for HIV). Because the concentration of HBV is so much greater, transmission may occur with smaller amounts of blood exposure (Stein 1993, 66). Hepatitis B virus can be transmitted through very small amounts of blood and through contact with saliva or other body fluids. Human immunodeficiency virus is not known to have been transmitted through body fluids other than blood.

Although HBV and HIV are not the only bloodborne pathogens, they pose the most serious risk to athletic personnel. The discussion that follows provides greater detail about HBV and HIV.

Hepatitis B

Hepatitis B virus is a contagious disease spread by blood products or by body fluids. It can culminate in liver failure, although only 5% of those infected suffer chronic liver damage ("Hepatitis" 1996). Type B infections have also been linked with a form of liver cancer called hepatocellular carcinoma, particularly in Asia and Africa (Sparks 1996).

Hepatitis B virus continues to be the single most important cause of viral hepatitis throughout the world. Hepatitis B virus is especially a problem when it infects a person together with HCV. Simultaneous infection with these two viruses is an important cause of chronic liver disease and hepatocellular carcinoma (liver cancer).

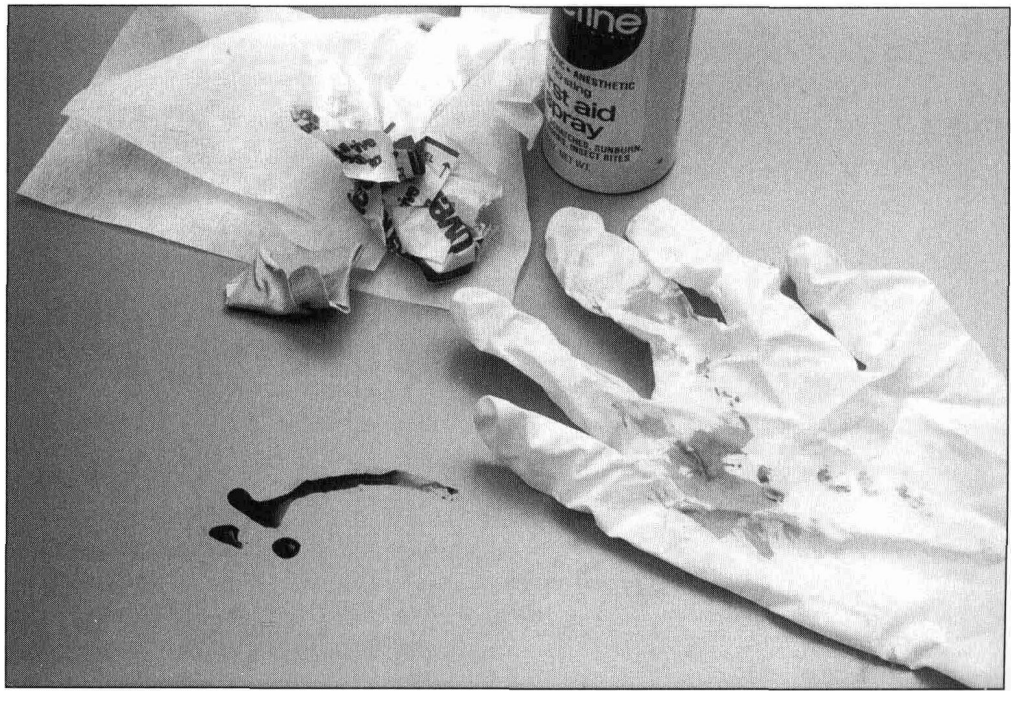
About one-half of the 300,000 people infected with HBV each year become acutely ill. The other 50% show no symptoms (or show minor symptoms similar to those of a cold) and usually never know that they are infected. The majority of newly infected people (90-94%) have immune systems that defeat the virus. However, 6% to 10% of adults (and 25-90% of infected children under five) cannot beat the virus and become chronic HBV carriers (Stein 1993, 66).

Chronic HBV carriers can transmit the virus to other individuals. Of chronic HBV carriers, approximately one-third will develop "chronic active hepatitis" which leads to cirrhosis, liver failure, and/or cancer. However, it should be noted that the chronic carrier can also be in an asymptomatic carrier state for years.

Transmission of Hepatitis B Virus

Hepatitis B virus has been isolated in a variety of bodily fluids including saliva, semen, vaginal secretions, cerebral spinal fluid, pleural fluid, breast milk, synovial fluid, gastric juice, urine, and feces. The most common mode of HBV transmission is percutaneous (through the skin) or via exposure to mucous membrane.

A large percentage (41%) of HBV infections are acquired through heterosexual intercourse. Transmission can also occur from mother to infant at birth, through the sharing of intravenous drug needles, and through blood transfusions. However, 26% of individuals infected with HBV have no known source of infection.



Hepatitis B virus can be transmitted through very small amounts of blood and can remain infectious for a week or longer, even in dried blood.

Hepatitis B Virus Prevention and Immunization

Prevention of the transmission of HBV can be achieved in the athletic setting by minimizing the risk of bloodborne pathogen exposure and adhering to Universal Precautions. It is of primary importance that all athletic training personnel (staff and students) be immunized for HBV.

The HBV vaccine was licensed in 1981 by the Federal Drug Administration. The vaccine is intended for preexposure prophylaxis. Two vaccines are currently licensed in the United States. The vaccines are administered in a three-dose series, with the first two doses given one month apart and the third dose given five months after the second. A postvaccination antibody test is available and should be given three to five weeks after the last vaccination to determine serologic response.

In late 1991, routine HBV vaccination of all infants was recommended in the United States. Internationally, more than 75 countries have included HBV vaccine in their immunization programs. Although only a small proportion of HBV infections occur among young children, they account for a substantial proportion of chronic infection and costs. Thus infant immunization appears to be an essential strategy for combating the virus (Francis 1995, 1242).

In 1991, the Occupational Safety and Health Administration issued regulations requiring employers to offer HBV vaccinations to employees with an occupational exposure to blood at no cost to the employees. Also in 1991 the Immunization Practices Advisory Committee strongly recommended immunization for all adults at increased risk of occupational exposure to HBV. Because of the occupational exposure to blood and bodily fluids in the athletic

Who Should Be Vaccinated for HBV?

The following is a list of individuals who are at risk for HBV and who would benefit from the HBV vaccine:

- All health care personnel having potential contact with infectious material
- Selected patients (i.e., individuals who receive blood transfusions) and their contacts
- Infants born to mothers with positive hepatitis B surface antigen or individuals who have had household or sexual contacts with chronic carriers
- Public safety personnel
- Users of illicit injectable drugs
- Prisoners
- Morticians
- Ethnic groups with high incidence of HBV infection (including Eskimos and Asian or Haitian refugees)
- Persons at risk due to sexual practices (i.e., sex with multiple partners, homosexual sex among males)
- Military personnel or travelers to locations where HBV is endemic, especially if staying more than six months

setting, all athletic training staff and students should be immunized before working with the athletes (Buxton et al. 1994, 108).

Some side effects may occur after an HBV vaccination and may last for one to two days. The most common side effect is soreness of the arm in which injection was given. Other infrequent side effects include flu-like symptoms with a fever over 100 degrees Fahrenheit, symptoms mimicking stomach flu that may be accompanied by abnormal liver tests, and sore throat or upper respiratory infection.

Hepatitis B Epidemiology

The World Health Organization listed hepatitis B as the ninth leading cause of death worldwide in 1994 (Perillo 1994, 34S). The threat of HBV infection is more widespread than for HIV. Hepatitis B is a disease of global distribution. It is estimated that there are approximately 300 million persistent carriers of HBV in the world, including more than 200 million in Asia (Umenai et al. 1994, 520). Of 35 countries in Eastern Asia and the South Pacific, 25 countries have an HBV carrier rate of more than 5%, with 17 of these countries having a carrier rate of more than 10%. In China, the carrier rate in the general population is 10%. In most of the island countries of the South Pacific, the HBV carrier rate is 10% to 20% or more.

Surveys suggest that there are more than one million HBV carriers in the United States (Perillo 1994, 34S). Cases per year in the United States along with deaths per year for all types of hepatitis and HIV are presented in table 1.1.

■ Table 1.1 Comparison of Cases per Year and Deaths per Year Between the Types of Hepatitis and HIV (Stein 1993, 68)

Type of hepatitis	Cases/Year	Deaths/Year
Hepatitis A	70,000	100
Hepatitis B	300,000	5,000
Hepatitis C	150,000	10,000
Hepatitis D	70,000	1,000
Hepatitis E	no test	0
HIV	40,000	31,000

■ Human Immunodeficiency Virus

Human immunodeficiency virus infects T lymphocytes in the human immune system. Because this cell is central to every phase of the immune response, its disruption cripples the immune system and leaves the body vulnerable to a variety of infections (Booher and Thibodeau 1994, 154; Calabrese and LaPerriere 1993, 7). Over time, the HIV-infected individual becomes increasingly susceptible to a variety of dangerous infections and malignancies. It is these secondary diseases that are the major cause of death for the HIV-infected individual (Calabrese and LaPerriere 1993, 7).

As seen under scanning electron microscopy, the HIV virus is shaped like a 20-sided soccer ball. The shell is made of protein, and the genes are contained inside the shell. Overlying the shell is a lipid membrane that is acquired by the virus after it infects the human host cell. Contained within the outer shell is another protein capsule. This cone-shaped capsule (the core) is made up of many protein molecules. All of the protective packaging protects the important and vital core: the genes and proteins that will help carry out the virus' reproductive mission.

The viral genes provide the instructions for making more viruses. However, the actual manufacturing of the genes and proteins needed to reproduce the virus is achieved by the chemicals found within the host cell. Like other viruses, HIV causes the host cell to devote its entire time to reproduction of the virus and renders it ineffective for its normal purpose and function (Hoffman 1994, 171). Human immunodeficiency virus is an RNA retrovirus because it has a dense cylindrical core that encases two molecules of viral RNA genetic material. It is a retrovirus because it possesses a special enzyme, called reverse transcriptase, that is able to make a DNA copy of the viral RNA. That enables the virus to reverse the normal flow of genetic information and to incorporate its viral genes into the genetic material of its host.

Human Immunodeficiency Virus Transmission

In order for HIV to be transmitted from one person to another, the uninfected individual must have an exposed portal of entry. The skin serves as a protective barrier for the body, so an open wound in the skin would create an entry portal for the virus. This wound could result either from an injury (such as a laceration) or through a needle-stick (purposeful, as in drug use, or accidental). The most common portals of entry for the virus are the vagina, anus, and blood vessels.

The virus thrives inside host cells. So one mode of infection involves passing an infected cell from one individual to another. Human immunodeficiency virus particles are also found circulating freely in body fluids of an infected

Who Should Be Tested for HIV?

The Presidential Commission on the HIV Epidemic recommended an HIV test for the following individuals (Rhode Island Department of Health 1989, 3):

- Any person who received blood or blood products between 1977 and 1985
- Any person using intravenous drugs, including people who used intravenous drugs since 1977 but no longer use them
- Any man who has sexual relations with other men
- Any person who has engaged in sex with more than one partner since 1977
- Anyone who has had sexual intercourse with a partner in any of the preceding categories, or with a person who is known to be HIV infected
- Pregnant women who may be at risk

The Three Stages of HIV

The course of this disease has been divided into three stages. The majority of people who are infected with HIV appear healthy and are unaware that they are infected (Seltzer 1993, 111). At stage I of the infection, the virus can be detected only by serological testing. Individuals with stage I infections carry the virus and can be infectious to others. Stage I can last from six months to 10 years or more (Calabrese and LaPerriere 1993, 7).

Stage II is referred to as AIDS-related complex or ARC. Symptoms may include (a) fatigue, (b) fever, (c) loss of appetite, (d) loss of weight, (e) diarrhea, (f) night sweats, and (g) swollen glands (Booher and Thibodeau 1994, 165). These symptoms may be persistent or intermittent. At this point, the individual is more prone to infection or malignancy. The level of HIV in the bloodstream rises and overwhelms the immune system.

Severe T-cell depletion in the presence of a major infection or malignancy marks the third and final stage of the disease. Most authorities believe that all patients who are infected with HIV will eventually develop AIDS and that HIV is ultimately 100% fatal (Seltzer 1993, 111).

individual, so another mode of transmission involves the exchange of body fluids from an infected person to an uninfected person, especially when the body fluid contains blood.

Although HIV is present in a variety of fluids, it is primarily transmitted through blood, semen, and vaginal secretions. Blood is the most concentrated source of HIV (Calabrese and LaPerriere 1993, 10). High concentrations of free virus are also found in cerebrospinal fluid and semen (Hoffman 1994, 172). Activities involving the exchange of these fluids between individuals also carry the potential for spreading HIV. Transmission occurs through the following methods: (a) sexual contact with an infected partner, (b) blood transfusion from an infected person, (c) sharing of contaminated intravenous needles, or (d) passage from mother to fetus through the placenta (Booher and Thibodeau 1994, 65). At least 97% of United States AIDS cases have been passed on through these four modes of transmission.

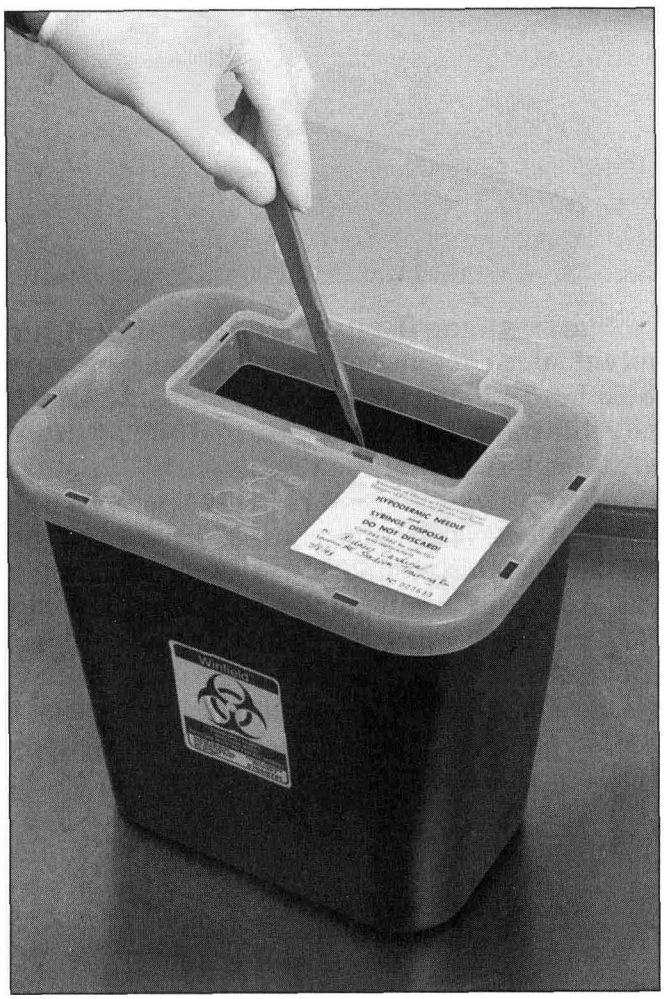
People who received blood transfusions or blood products between 1977 and 1985 (hemophiliacs and surgery patients) may have received HIV-infected blood. Most of the blood used for medical purposes during these years was safe, but people who received transfusions during the time have a low risk of acquiring the infection.

Transmission requires intimate contact between individuals. The virus cannot withstand exposure to air for very long because its membrane dries out quickly and deteriorates. For this reason, HIV cannot be passed along by the touching of a surface that has been touched by an infected person (Hoffman 1994, 175).

No scientific evidence supports transmission of HIV through ordinary nonsexual contact. Although HIV has been isolated in saliva, tears, sweat, urine, respiratory droplets, breast milk, cerebrospinal fluid, and amniotic fluid, there has been no evidence of transmission through these fluids (CASM 1993, 63; WHO 1992; Knight 1995).

There is also no evidence that HIV can be transmitted through swimming, pool water, communal bath water, toilets, food, drinking water, casual contact, mosquitoes, other insects, wrestling mats, taping tables, sinks or other surfaces, or through the air (CASM 1993, 63; NCAA 1991, 24).

There have been no documented cases of HIV transmission during athletic competition (Calabrese and LaPerriere 1993, 10; AAP 1991, 640; Mitten 1994, 63). In the athletic setting, only blood poses a degree of risk (AMSSM and AASM 1995, 510). However, athletes involved in anabolic steroid use could be at risk if they share needles (Seltzer 1993, 112). There have been two reports in athletes of HIV transmission secondary to injectable anabolic steroid use and sharing of needles (Sklarek et al. 1984).



The risk of HIV transmission in the health care setting can be greatly reduced by careful handling of sharps. Dispose of contaminated blades, needles, and other sharp objects in a puncture-resistant sharps container.

The risk of infection is increased by having multiple sexual partners, by homosexual activities among males, and by sharing of needles among intravenous drug users. Heterosexual transmission in the United States accounts

for about 8% of cases, but the percentage is rising. It is a significant mode of transmission in Africa and Asia. About 25% of AIDS cases occur in intravenous drug users exposed to HIV-infected blood through shared needles.

Transmission in the health care setting has occurred primarily through accidental HIV-infected needle-sticks of health care workers through hollow-bore needles. It has been documented that transmission of HIV occurs in approximately 1 of 300 needle-stick injuries involving infected blood (AMSSM and AASM 1995, 511). In a study of 2,042 percutaneous injuries involving HIV-infected blood, six health care workers were found to be infected. Of these six cases, five were related to injuries with sharp objects or needles. Only one was related to blood exposed in an open wound. All cases involved a large quantity of HIV-infected blood (Henderson et al. 1990).

Dr. David Rogers, a professor of medicine at Cornell who is vice chairman of the National Commission on AIDS, stated:

> In the health care cases, the infection in virtually every instance was caused by the transmission of large amounts of blood through hollow-bore needles. With cuts or scratches, the risk is as close to zero as possible. When two people bleed, they bleed out, not in. It's hard to imagine an exchange of enough blood to cause infection. (Kirshenbaum 1992, 13)

Human Immunodeficiency Virus Treatment and Prevention

Although a cure has not been found for HIV, new treatments are continually being researched and developed. The current primary treatment for HIV is a combination of drugs given sequentially to slow down the ability of the HIV virus to reproduce. However, further research needs to be done in the area of HIV physiology. Once the physiology of the virus is better understood, researchers will have a better understanding of how to design drugs to fight the virus.

Preventing HIV Infection

If an individual is currently not infected and abstains from sex and drug abuse, there is virtually no risk of acquiring HIV. If a person is sexually active, the risk of HIV infection can be reduced by following these guidelines (Rhode Island Department of Health 1989, 4):

- Use latex condoms for all types of sexual intercourse.
- Use a water-soluble lubricant with condoms to reduce the risk of tearing the condom. A lubricant also reduces injury to the membrane lining of genital areas.
- Use a spermicide containing Nonoxynol-9 together with a condom. This kind of spermicide kills the virus.
- Avoid anal sex.
- Do not have sex with prostitutes, with multiple partners, or with any partner who may be at risk for HIV infection.

Human Immunodeficiency Virus Epidemiology

It is estimated that one million people are infected with HIV in the United States (Davis 1992). This translates into 1 infection in every 250 Americans (AMSSM and AASM 1995, 510). Experts estimate that 1 in 100 adult males between the ages of 20 and 49 is seropositive (i.e., there is presence of antibodies [proteins to bind HIV] in the serum indicating exposure to HIV) (Seltzer 1993, 111).

Research indicates an overall seroprevalence of approximately 0.2% for the average college population (Hunt and Pujol 1994, 104). On the basis of this statistic, as many as 600 of the 320,000 athletes competing nationwide in varsity sports at four-year colleges could be infected with the virus (Bartimole 1995, 4). The age group of 20- to 29-year-olds is the fastest growing demographic group in the United States with a diagnosis of AIDS (Hunt and Pujol 1994, 102).

In the United States, 58% of AIDS cases are accounted for by homosexuals or bisexual males. Intravenous drug abusers represent 23% of United States AIDS patients. About 25% of all regular intravenous drug abusers are thought to be HIV seropositive (Seltzer 1993, 111). Only 6% of AIDS transmission is thought to be through heterosexual transmission in the United States; however, the World Health Organization reported that heterosexual transmission is responsible for almost 75% of AIDS cases worldwide (Seltzer 1993, 111).

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