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Risk of infection with the AIDS virus through exposures to blood

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Introduction

It is now well known that human immunodeficiency virus (HIV)—the AIDS virus—is spread in three ways: through homosexual and heterosexual activity; infected mother to fetus or infant; and through blood-to-blood exposure such as occurs in needle sharing by intravenous drug abusers, in blood transfusions, and in provision of blood products to hemophiliacs.

In recent months, health-care workers, police officers, and members of other occupational groups have become concerned that infection may be possible through more superficial surface contact with contaminated blood. While these fears may be understandable, they greatly exaggerate the risks present when appropriate protective or basic hygienic measures are taken. This AIDS Bulletin summarizes what is known about the risks associated with the types of exposures to blood which might be experienced by personnel in law enforcement and criminal justice agencies as they perform their duties. It also summarizes the standard precautionary measures which should be taken to minimize the risk of infection with HIV.

Needlesticks and punctures with sharp instruments

Accidental needlesticks and punctures with sharp instruments pose greater risks for actual blood-to-blood contact than open-wound exposures. Needlesticks and punctures involving instruments contaminated with HIV-infected blood bear some similarity to needle sharing among IV drug abusers. However, there are critical differences which make the risk associated with these accidental injuries much lower than the risk involved in purposeful needle-sharing activity.

From the Director

Acquired Immunodeficiency Syndrome—AIDS—has been called the most serious public health problem in the United States and worldwide today. Since it first appeared in 1981, there has been an enormous amount of uncertainty and fear about this fatal disease. Because they may be in contact with intravenous drug users and others at high risk for the disease, criminal justice professionals understandably are concerned about becoming infected with the AIDS virus while carrying out their duties.

Until a vaccine or cure for AIDS is found, education is the cornerstone of society's response to this deadly disease. Accurate information can help calm unwarranted fears about the disease and its transmission, thus enabling criminal justice personnel to continue to perform their duties in a safe and professional manner.

Since 1985, the National Institute of Justice has worked with the Centers for Disease Control and other public health officials to provide important authoritative medical information about AIDS to criminal justice professionals.

Two special reports on AIDS—as it relates to corrections and law enforcement agency procedures--have been published and widely disseminated. This AIDS bulletin is part of a new series designed to inform criminal justice professionals about the disease and its implications for criminal justice agencies. Future bulletins will summarize agency policies relating to AIDS, education programs, and legal and labor relations issues.

President Reagan has said that the AIDS crisis "calls for urgency, not panic... compassion, not blame... understanding, not ignorance." The National Institute of Justice is working to ensure that criminal justice professionals have the accurate information they need to understand and deal with the risks created by AIDS. Until medical science can bring this deadly disease under control, our best defense is a well-informed citizenry.

James K. Stewart
Director

When intravenous drug abusers share needles, a small amount of the user's blood is often drawn into the syringe where it can mix with the remnants of blood of previous users similarly drawn. This blood, together with the drug, is then injected directly into the user's bloodstream.

In an accidental needlestick or puncture, by contrast, the risk is limited to the possibility that any contaminated blood which is present on the needle or instrument may come into contact with the blood of the person suffering the wound. In addition, addicted IV drug users who share needles are likely to experience multiple exposures which greatly increases their risk of infection over those who experience one isolated exposure.

As a result of these differences, the rate of HIV transmission is much higher in needle sharing by IV drug users than in accidental needlesticks. Researchers at the Centers for Disease Control (CDC) and elsewhere have been gathering data on needlestick exposures to the AIDS virus for several years. Data from at least three U.S. studies suggest that the risk of HIV infection due to accidental needlestick or puncture wounds is extremely small. First, in a CDC surveillance project as of June 30, 1987, only four (0.6 percent) of 649 tested health-care workers, who had been stuck with needles or cut with sharp instruments known to have been used previously on HIV-infected patients, themselves became infected.[1] Second, in a study at the National Institutes of Health (NIH), none of 103 workers with similar needlesticks or puncture wounds became infected.[2] Third, a California study identified no seroconversions among 60 health-care workers who sustained needlestick exposures to HIV-infected blood.[3] Overall, researchers estimate that the probability of infection from a single needlestick is less than 1 percent.

Despite the low risk associated with needlestick or puncture wounds, it is important for law enforcement and other criminal justice personnel to minimize the chance of becoming infected with HIV by exercising caution in conducting searches of suspects, motor vehicles, and any places hidden from direct view. Whenever possible and practical, suspects should be directed to empty their own pockets. Personnel conducting searches should wear gloves—which may provide some protection, although they cannot protect against direct punctures by sharp instruments—and move their hands very slowly and delicately around the area. Whenever possible, mirrors should be used to search hidden areas. Any needles or other sharp instruments found in the course of searches should be handled with great care and stored in puncture-proof containers. Personnel who sustain a needlestick or puncture wound should immediately "milk" it to induce bleeding (as with a snakebite), wash it thoroughly with soap and water, and seek medical attention. For further guidance, readers should consult NIJ's recent publication on AIDS and the Law Enforcement Officer.[4]

Open wound and mucous-membrane exposures

The evidence cited above suggests that the risk of HIV transmission from the most serious of the types of exposures under discussion here—needlesticks and puncture wounds—is extremely low. Not surprisingly, then, the risk associated with open wound and mucous-membrane (e.g. eyes, nose, mouth) exposures is even lower. In the CDC surveillance study referred to above, 172 health-care workers had open wounds or mucous membranes exposed to the blood of HIV-infected patients, but none of these workers became infected.[5] In the NIH study, no infections occurred among 229 health-care workers with similar mucous-membrane exposures. Finally, in a study at the University of California, 34 health-care workers with open wound or mucous-membrane exposures were tested and none were positive for HIV antibodies.[6] In other words, at least 435 health-care workers with nonneedlestick exposures to HIV-infected blood have been followed in prospective studies and none have become infected. Nevertheless, CDC has always believed that infection through such exposures was possible, although the risk is still considered extremely low.

Recent reports of five HIV infections apparently associated with nonneedlestick exposures have increased concern among many occupational groups, including personnel in some criminal justice agencies. Two persons providing nursing care to AIDS patients became infected following extensive blood contact in which both failed to follow CDC-recommended infection control procedures. However, the reports causing the most concern involved three health-care workers reported by CDC in late May 1987 to have been infected following nonneedlestick exposure to HIV-infected blood.[7]

In the first of the three recently reported cases, an ungloved health-care worker with chapped hands was in direct contact for about 20 minutes with the blood of a patient later found to be infected with HIV. In the second case, a medical technologist, using a device for separation of blood components, spilled HIV-contaminated blood over most of her hands and forearms. Again, the worker was not wearing gloves and may have touched a patch of dermatitis on her ear, which may have resulted in blood contact with broken skin. In the third case, a health-care worker, filling a tube with the blood of an HIV-positive patient, was splattered with blood on her face and in her mouth. This worker was not wearing a mask or face shield and apparently was exposed by blood-to-mucous-membrane contact.[8]

Although CDC was unable to rule out all other possible risk factors in these three cases, the infections could very likely have been prevented if CDC-recommended procedures had been followed to prevent contact between HIV-infected blood and broken skin or mucous membranes. In Case 1, the health-care worker had chapped hands and was not wearing gloves; in Case 2, the technologist was not wearing gloves and also touched a patch of dermatitis in her ear with contaminated hands; in Case 3, the worker was not wearing a mask or eye protection while working directly with blood.[9] While unbroken skin is an effective barrier against all micro-organisms, the proper use of gloves will provide the

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wearer with valuable protection should chafing, nicks, or other inapparent breaks be present on the hands.

Finally, concern may arise from the recent report of a laboratory worker infected with HIV.[10] This case involved a researcher who had had regular and prolonged contact in the laboratory with preparations of HIV much more highly concentrated than are found in normal samples of blood or body fluids. Investigators believe that the infection resulted from an incident or incidents similar to those experienced by the three health-care workers just discussed. It should be emphasized that the National Institutes of Health have tested hundreds of laboratory staff who have worked with HIV and this is the only known case of infection. Also, it is important to note that working with concentrated viruses in the laboratory is many orders of magnitude more hazardous than in any clinical situation. Therefore, this incident of infection is not an accurate reflection of infectious hazards in any area of law enforcement.

Criminal justice agency personnel may find themselves in situations similar to those faced by the health-care workers described above. Agencies should ensure that policies are established and implemented to guide their personnel's actions in such situations. CDC's conclusion for health-care workers is also extremely important for all criminal justice policymakers and line personnel: "these cases emphasize again the need to implement and strictly enforce previously published recommendations for minimizing the risk of exposure to blood and body fluids of all patients in order to prevent transmission of HIV in the workplace . . ."[11] The key words here are "all patients." These precautions and procedures should be consistently applied—they need not and should not depend upon prior knowledge of who is and is not infected with the AIDS virus.

The persistence of HIV in dried blood

Recently, crime laboratory personnel, evidence technicians, and other criminal justice personnel have expressed concern about a report that HIV could survive for several days in dried blood. In particular, it has been suggested that, when personnel scrape dried blood samples from surfaces at crime scenes so that they can be sent for laboratory analysis, small particles may fly in all directions. These particles may come into contact with the skin or mucous membranes of personnel working at the scene. Moreover, concern has been raised that samples of dried blood may pose risks to laboratory technicians who are called upon to perform serologic analysis. Autoclaving will kill the virus but also renders the evidence useless for serologic analysis.[12] Other technologies, such as gamma radiation, inactivate the virus but maintain the evidence in a state suitable for serologic analysis. However, this is an expensive process which some researchers believe to be unnecessary given the actual level of risk involved.

The concerns about HIV in dried blood may be understandable, but they appear to be overreactions. A laboratory study found that "under . . . experimental conditions . . . a highly concentrated preparation [of HIV] . . . dried and held at room temperature . . . retains infectivity for more than three days."[13] However, several facts about this study should be understood. First, and most important, it was a laboratory study and was not intended to show what would happen in real life. The objective was to assess the adequacy of infection control procedures. In fact, these procedures were found to be more than adequate. Second, the HIV preparation employed in the study was five orders of magnitude (or 100,000 times) more concentrated than would normally occur in blood samples. Other studies have shown that the virus is rapidly inactivated during the drying process.[14] Moreover, in these laboratory studies, the temperature and environment were much more controlled than would be the case at a real crime or accident scene. Environmental factors at a scene may further hasten the inactivation of the virus. Notably, no cases of infection have been traced to exposure to dried blood, but the fact that the virus is fragile does not lessen the importance of consistently using the recommended safety procedures.

Despite the very low risk of infection resulting from the exposures discussed in this Bulletin, gloves, masks, and protective eyewear should be used if there is likelihood of exposure to blood or other body fluids. Since blood, blood particles, or other body fluids may adhere to the shoes of personnel working at a crime or accident scene, disposable protective shoe coverings of paper or plastic should also be considered, if considerable blood contamination is encountered. While HIV infection has proved to be exceedingly difficult to acquire through the types of exposures that may be experienced by criminal justice personnel, adherence to appropriate precautionary measures and common-sense principles of hygiene can minimize the small risk that does exist. Moreover, such precautionary measures will protect personnel not only against HIV infection but also against hepatitis-B and other infections that may be transmitted through blood and other body fluids.

Notes

1. E. McCray, "The Cooperative Needlestick Surveillance Group: Occupational Risk of AIDS Among Health-Care Workers," *New England Journal of Medicine* 314; 1986: 1127–1132; R.L. Stricof and D.L. Morse, "HTLV-III/LAV Seroconversion Following Deep Intramuscular Needlestick Injury" (Letter), *New England Journal of Medicine* 314; 1986: 1115; Centers for Disease Control (CDC), "Recommendations for the Prevention of HIV Transmission in Health-Care Settings," *Morbidity and Mortality Weekly Report* 36; August 21, 1987: 3S–18S; Ruthann Marcus, Hospital Infection Program, Center for Infectious Diseases, CDC, Personal Communication, September 1987.

2. D.K. Henderson, A.J. Saah, B.J. Zak et al., "Risk of Nosocomial Infection with HTLV-III/LAV in a Large Cohort of Intensively Exposed Health-Care Workers," *Annuals of Internal Medicine* 104; 1986: 644–647; CDC, "Prevention of HIV Transmission in Health-Care Settings."

3. J.L. Gerberding et al., "Risk of Transmitting HIV, Hepatitis-B Virus and Cytomegalovirus to Health-Care Workers Exposed to Patients with AIDS and AIDS-Related Conditions," *Journal of Infectious Diseases* 156; July 1987: 1–8.

4. T.M. Hammett, *AIDS and the Law Enforcement Officer: Concerns and Policy Responses* (Washington, National Institute of Justice, U.S. Department of Justice, 1987).

5. McCray, "Cooperative Needlestick Surveillance Group"; CDC, "Prevention of HIV Transmission in Health-Care Settings"; Ruthann Marcus, CDC, Personal Communication, September 1987.

6. Henderson et al. "Risk of Nosocomial Infection"; Gerberding et al., "Risk of Transmitting HIV."

7. CDC, "Prevention of HIV Transmission in Health-Care Settings"; CDC, "Update: HIV Infections in Health-Care Workers Exposed to Blood of Infected Patients," *Morbidity and Mortality Weekly Report* 36; May 22, 1987: 285–288.

8. CDC, "Update: HIV Infections in Health-Care Workers."

9. For guidelines, see CDC, "Prevention of HIV Transmission in Health-Care Settings."

10. National Institutes of Health, unpublished data.

11. CDC, "Update: HIV Infections in Health-Care Workers."

12. D. Bigbee, "The Collection and Handling of Evidence Infected with Human Disease Causing Organisms," *FBI Law Enforcement Bulletin*, July 1987.

13. L. Resnick et al., "Stability and Inactivation of HTLV-III/LAV Under Clinical and Laboratory Environments," *Journal of the American Medical Association* 255; April 11, 1986: 1887–1891.

14. CDC, "Prevention of HIV Transmission in Health-Care Settings."

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