

# Update on Infectious Diseases

## January 1989

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Maryland Institute for Emergency Medical Services Systems

*Although the scientific information on AIDS remains basically the same as that discussed in the August 1987 "AIDS: A Guide for EMS," we are providing an "update" in response to your questions. This "update" offers further information on the spread and control of infectious diseases, focusing on hepatitis B as well as AIDS. In addition, we have included more detail on disinfectants and cleaning procedures as they should be applied to the prehospital environment.*

*While the basic information remains unchanged, concerns will understandably continue. Incorporation of infectious disease information into new and continuing education on an ongoing*

*basis should serve to keep all providers reminded of risks as well as safety measures. For further information about infectious disease training programs, contact your MIEMSS regional administrators (Region I, Dave Ramsey, 895-5934; Region II, Dick Mettetal, 791-2366; Region III, John Donohue, 328-3997; Region IV, Marc Bramble, 822-1799; Region V, Marie Warner-Crosson, 474-1485). The Maryland EMS AIDS Hotline (1-800-323-2437, Monday - Friday, 10 am to 4 pm) will continue to be available as a resource for questions.*

— Ameen Ramzy, MD  
State EMS Director

## Infectious Disease Educational Program Offered

The educational program "Infectious Disease Information for Prehospital Care Providers" is being incorporated into the training and recertification programs for first responders, EMTs, CRTs, and EMT-Ps. (The substance of that program is provided in this special "update," which is not intended to stand alone as a training program.) The educational program is also available from the regional administrators in slide/tape and videotape formats for viewing by EMS provider organizations. Students who successfully complete the learning module under the direction of a trained instructor will receive two hours of continuing education credits; those who successfully complete the program without an instructor will receive one hour of credit. (For further information regarding program materials and scheduling, contact your regional administrator.) It is anticipated that more than 13,000 EMS personnel will view this program within the coming year through the training and recertification processes.

The learning objectives established for the educational program are listed below:

1. Given a list of the six events in the chain of infection, the prehospital care provider (PHCP) will be able to define them. Five of six must be correct.
2. Given the circumstances of a particular medical call where blood has been splashed on the rescuer, the PHCP will be able to distinguish between a percutaneous and a mucocutaneous exposure. The distinction must be correct.

3. Given the modes of transmission (percutaneous/mucocutaneous), the PHCP will be able to name examples of each that could occur in the field. Three examples of each must be given.

4. Given the status of a certain accident scene, the PHCP will be able to list steps that can be taken to minimize susceptibility to HIV and HBV. Four steps must be given.

5. Given a list of similarities and differences between AIDS and hepatitis B, the PHCP will be able to identify each for its particular virus. All must be correct.

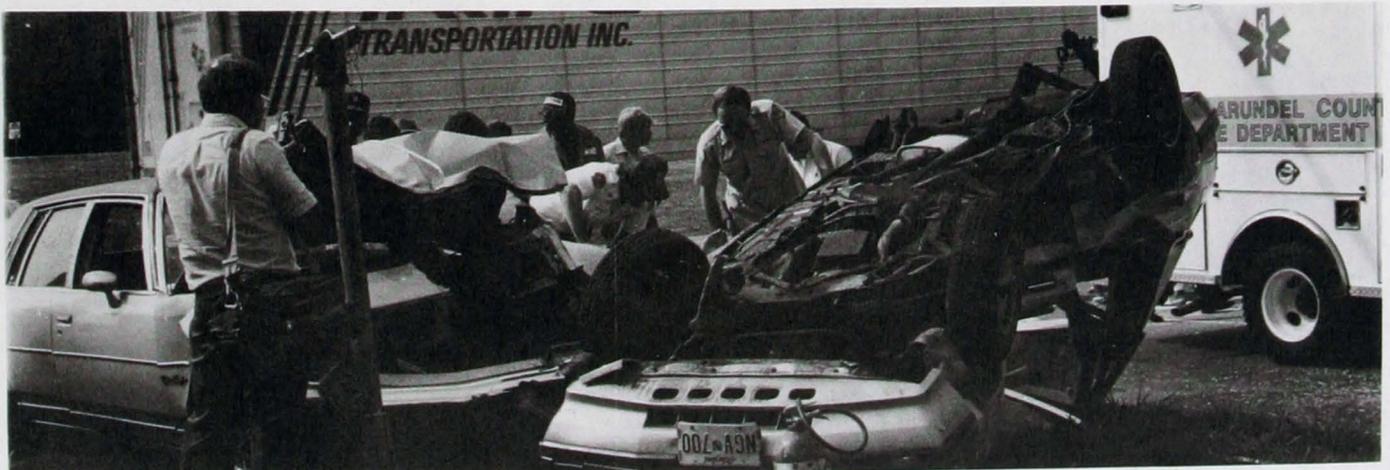
6. Given a situation in which a percutaneous exposure could occur, the PHCP will be able to apply the proper procedure for treating this exposure. All four steps must be given.

7. Given a situation in which a mucocutaneous event could occur, the PHCP will be able to repeat the proper procedure for treating this exposure. Both steps must be given.

8. Given a condition in which an exposure to an infectious virus has occurred, the PHCP will state the follow-up procedure. Three steps must be given.

9. Given the three types of cleaning procedures, the PHCP will be able to define each. All three must be correct.

10. Given the three categories of medical equipment (under CDC recommendations), the PHCP will be able to state the proper cleaning procedure for each. All three must be correct.



# Text of 'Infectious Disease Information For Prehospital Care Providers'

**Editor's note:** The following text is taken from the script used in the instructional program entitled "Infectious Disease Information for Prehospital Care Providers," which was produced by MIEMSS staff in 1988. Slight modifications have been made to adapt this information to a printed format. All aspects of infection control that constitute the learning module are covered in this publication.

Some of the duties of prehospital care providers present risks of exposure to infectious diseases. These risks can be minimized if you understand how infectious diseases are spread and take the appropriate precautions to limit your exposure to them.

The purpose of this article is to give prehospital care providers an understanding of basic infection control principles and to present guidelines for the use of protective equipment as well as cleaning and decontamination techniques. Two blood-borne diseases—hepatitis B and AIDS—are of primary interest.

All of the recommendations made in this publication are in accordance with guidelines established by the Centers for Disease Control.

## Chain of Infection

Infectious diseases are spread through a series of steps in which an infectious agent passes from a source to a susceptible host. The host (or infected person) may then become another source from which the agent can spread and may develop a disease resulting from the infection.

Infection is the entry of organisms into the body and their multiplication, which results in disease or damage to cells or tissues. Obvious signs of disease may or may not be present. A person with *active disease* exhibits signs of the disease resulting from the infection. A person in a *carrier state*, on the other hand, displays no outward signs of disease yet is infected with a disease-carrying organism. Both conditions pose risks to prehospital care providers.

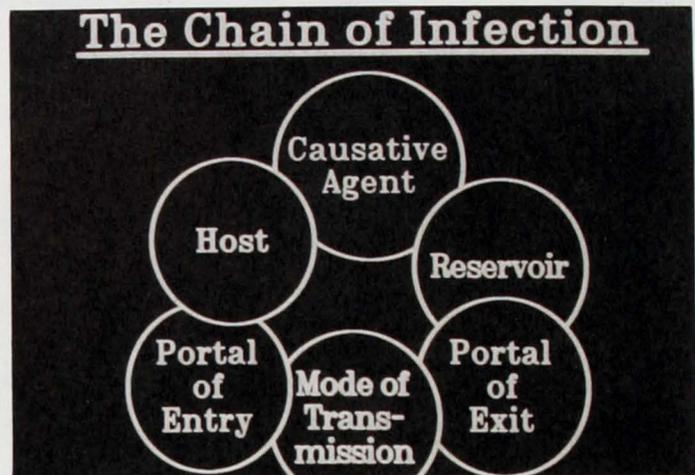
To understand how to control infection, you should understand the chain of infection—the sequence of events that need to occur for infection to spread from one person to another. By knowing this process, you also know how to break the chain and thus minimize or eliminate the possibility of being exposed to an infectious agent.

The chain of infection is composed of the following points:

1. The infectious agent, which is the organism that is responsible for the disease
2. A reservoir, which is a place where organisms can survive and possibly multiply
3. A means of exit—a way for organisms to escape the reservoir
4. A mode of transmission—the way the organisms are spread from one person or reservoir to another
5. A means of entry, which is the way the organisms are able to enter the body
6. The susceptible host—the person who is at risk of acquiring the infection and developing the disease

The infectious agent in the spread of hepatitis B is the hepatitis B virus (HBV). The human immunodeficiency virus (HIV) causes the acquired immune deficiency syndrome (AIDS).

A reservoir for these two viruses is the human body. For viruses to grow and reproduce, they need to be inside a human cell. Therefore, they can live in blood and other body fluids. But when



*In the spread of infection, a causative agent passes from a reservoir (such as an infected person) to a susceptible host. The host may then become another reservoir from which the agent can spread.*

those reservoirs are dried or decontaminated, the viruses die.

Patient care equipment that is inserted into the body can also be a reservoir for viruses if it has not been cleaned properly. Examples are IV lines and esophageal airways.

A means of exit is a pathway for the virus out of the reservoir. A means of entry is a way for viruses to enter a host. There are three primary pathways for HBV and HIV:

1. **Blood.** When a person infected with HBV or HIV bleeds (means of exit), contact with another person's broken skin (means of entry) may result in the transmission of viral particles. This transmission can occur, for example, if contaminated blood is injected into an uninfected person by needlestick injury. It can also happen if infected blood contacts a cut, insect bite, or hangnail on a prehospital care provider's hand.

Among IV drug abusers, the sharing of needles and syringes contaminated with infected blood can lead to the transmission of the viruses, because the contaminated blood is injected along with the drug.

2. **Sexual activity.** Viruses can exit the body through the genitourinary tracts of men and women. The small tears that are created by anal and vaginal intercourse provide an avenue for viruses in an infected person's semen or vaginal fluid into an uninfected person's body.

3. **Mother to child.** HBV and HIV can be passed from a mother to her unborn child through transplacental transmission. The viruses can also be transmitted to a child from an infected mother during the birth process, and HIV can be transmitted through breast milk.

For transmission of HBV or HIV to occur, the virus must be introduced directly into the body. In the prehospital environment, this transmission can occur in two ways: percutaneously or mucocutaneously.

A percutaneous event occurs when blood or body fluid is introduced through the skin. Examples are being stuck with a bloody needle; receiving a cut from a sharp object such as glass that is contaminated with blood; or having blood contaminate an open cut, insect bite, or hangnail on the prehospital provider's

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hand.

A mucocutaneous event occurs when blood or body fluid contacts the prehospital care provider's mucous membrane by splashing into the nose, mouth, and possibly the eye.

The major factor in determining who will and who will not get infected is the susceptibility of the host. In regard to HBV and HIV, prehospital care providers can decrease their susceptibility by covering any broken skin before reporting for work, wearing protective attire, preventing injury, and washing hands thoroughly after patient care procedures are finished.

Vaccinations against particular diseases decrease a person's risk of being infected by a virus that causes that disease. Vaccinations are available to protect you from the hepatitis B virus. Unfortunately, immunizations against HIV do not exist.

The primary goal in controlling infection is to protect both patients and health care personnel against infectious diseases. The chain of infection must be broken. There are several ways to do this: use appropriate protective gear, eliminate the infectious organisms, remove reservoirs, eliminate the mode of transmission, and immunize personnel against as many infections as possible.

The easiest way to break the chain is to eliminate a mode of transmission. This is best accomplished by hand washing and using protective gear such as gloves, masks, and eye protection when you are performing procedures in which you are likely to be splashed with a patient's blood or body fluids. To protect patients from the spread of infection, equipment and patient transport vehicles must be cleaned properly.

### Blood-Borne Diseases of Special Concern in the Prehospital Environment

Two diseases of special concern to prehospital care providers are hepatitis B and the acquired immune deficiency syndrome (AIDS). Although these diseases are similar in their modes of transmission, they are different in many other ways (see accompanying table).

#### Hepatitis B

The hepatitis B virus attacks liver cells. The disease has a long incubation period—ranging from 6 weeks to 6 months. Signs and symptoms of hepatitis B are nausea, vomiting, fatigue, abdominal pain, jaundice, and low-grade fever. In the United States, between one and ten people per thousand (or 0.1 to 1%) may be carriers of the disease (and not have active disease).

Hepatitis B infection can have a number of different outcomes. Ninety percent of people who have diseases will recover completely. The outcome for the other 10% is not as good. Some will be chronic carriers of the virus and can infect others. A small percentage of people with hepatitis B develop very serious disease and die in a short time. Another group develops chronic liver disease. There seems to be a link between HBV infection and later development of liver cancer.

HBV is transmitted percutaneously and mucocutaneously. It is transmitted by needlestick with a contaminated needle, through IV drug abuse, by sexual intercourse with an infected person, and from a mother to her unborn child or newborn. The major body fluids that can help the spread of HBV are blood, semen, vaginal fluid, and possibly saliva.

HBV may be transmitted to people with breaks in the mucosal lining of their mouths by kissing; it can also be contracted by sharing a household with a chronic carrier. The virus can be transmitted from patients to health care personnel and, less commonly, from health care providers to patients.

Vaccines have been developed to protect people from this disease. Active immunization (with hepatitis B vaccine) offers long-term, perhaps even lifelong, protection against the virus. Two forms of this vaccine are available: plasma-derived and yeast-derived. Both have been studied extensively to ensure their safety and effectiveness. Passive immunization (administration of hepatitis B immune globulin) provides short-term protection against hepatitis B after exposure to contaminated blood such as through a needlestick injury. Consult your personal physician for information about these immunizations.

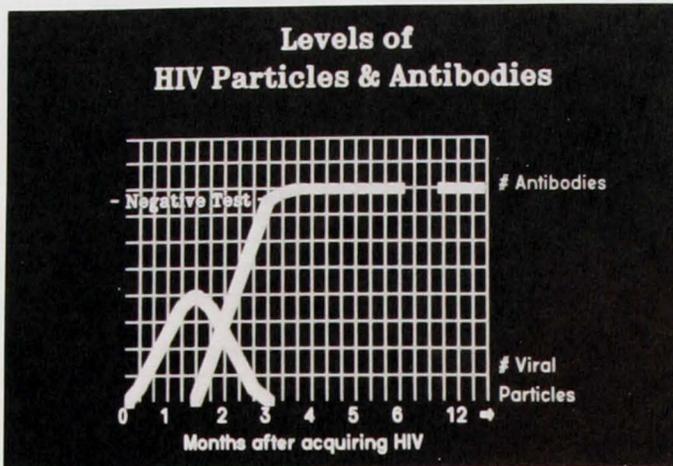
### HEPATITIS B AND AIDS: SIMILARITIES AND DIFFERENCES

	<u>Hepatitis B</u>	<u>Acquired Immune Deficiency Syndrome (AIDS)</u>
	Hepatitis B virus (HBV)	Human immunodeficiency virus (HIV)
Cause		
Mode of transmission*		
Blood	Yes	Yes
Semen	Yes	Yes
Vaginal fluid	Yes	Yes
Saliva	Possibly	Found in < 1% of carriers
Tears	No	No
Target cells	Liver cells	White blood cells (immune system)
No. of viral particles per ml of blood+	1,000,000,000 (one billion)	1000 (one thousand)
Risk of infection	6-30% of exposures to infected blood	1% of exposures to infected blood
Protective vaccine available?	Yes	No
No. of health care worker deaths/yr	200	None reported to date

\*Both viruses can be transmitted percutaneously (through a break in the skin) and mucocutaneously (through mucous membranes such as in the nose, mouth, or eyes).

+Blood from a person with hepatitis B is 1,000,000 times more infectious than blood from a person with AIDS.

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A **key concept** in the understanding of HIV infection is that newly infected people have not had time to make antibodies to the virus and therefore will have negative results to HIV antibody tests. Although these people test negative, the viral particles in their blood can cause infection in others (curve on left). The test will be positive (curve on right) only after the body has had time to make antibodies.

### AIDS (Continued from page 3)

The acquired immune deficiency syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). Because the virus attacks the white blood cells (part of the immune system), the infected person's ability to fight off other infectious diseases is severely hampered. In addition, people with AIDS are susceptible to various kinds of cancer and to diseases of the central nervous system.

Like HBV, HIV is transmitted percutaneously and mucocutaneously. HIV is carried in blood. It can be transmitted to a health care provider who sustains an unintentional injury from a needle or broken glass contaminated with blood from an infected person. It can be passed from one person to another when IV drug abusers share a contaminated needle. Unprotected sexual involvement with an infected person can be another means of transmission. HIV can be passed from a woman with the virus to her unborn child (across the placenta) or to her newly born child (through breast milk).

The virus has been spread through blood transfusions, but with increased effectiveness in screening donated blood for the virus, this mode of transmission has been controlled. Screening of blood products for HIV began in 1985, so now the chance of being infused with contaminated blood is about 1 in 50,000 units.

AIDS can be transmitted by sexual contact just as other sexually transmitted diseases are spread. The major pathway has been through male homosexual practices, primarily anal sex. Another risky behavior is having unprotected sex (homosexual or heterosexual) with an IV drug abuser, who may be infected with the virus. The Surgeon General of the United States Public Health Service has stated that, other than abstinence from sexual activity, the use of condoms appears to be one of the best methods of controlling the spread of this disease.

Although HIV has been found in many body fluids, the ones considered infectious are blood, semen, and vaginal fluid; in a few cases, the virus has been identified in breast milk. Tears, sweat, and urine have not been demonstrated to be infectious fluids. HIV has been detected in the saliva of less than 1% of carriers; however, transmission of the virus by contact with saliva has never been documented.

There is no evidence that casual contact with an infected person can result in transmission of the disease. The infection has not been passed to people who share households with people who are infected with the virus, even when they shared food, towels, cups, and razors and kissed each other. Getting blood on intact skin or on clothing or equipment is not considered to be an exposure to HIV. You are *not* considered to be exposed to HIV if you are in the same room with someone who has AIDS, touch the person, or talk with an HIV-infected person.

The virus that causes AIDS is very fragile. It dies very quickly once it is outside the body. When the fluid carrying the virus is dried or decontaminated, the virus is dead. No cases of environmental spread of AIDS have been documented.

There is no test that can be routinely performed to identify HIV. The only available tests detect an antibody to the virus, not the virus itself. When the virus invades the body, the body's protective response is to create antibodies. This process takes different amounts of time (usually between 6 weeks and 3 months) in different people under various circumstances. Newly infected people, who have a very high number of infectious particles in their blood, have not had enough time to produce antibodies; therefore, they will test negative for the presence of antibodies, but their body fluids are infectious.

Because the tests for HIV antibodies might not identify everyone who is actually infected and because you can't identify people with AIDS just from their appearance, prehospital care providers are advised to treat *all* patients' blood as if it is infected.

There is no protective vaccine against AIDS and no means of curing someone with the disease. The Maryland Health Department provides counseling and testing for exposure to HIV at no cost to prehospital care providers. Call that agency for more information, or consult your personal physician or EMS department.

It is impossible to identify all patients who carry one of these viruses. Infection with HBV or HIV is often not the reason that someone needs emergency medical care, so health care workers may not be looking for the presence of infection. For example, the victim of a heart attack, an automobile crash, or a shooting incident would be treated for those specific illnesses or injuries, not for hidden infections or a carrier state for either virus. Screening for HIV may not be helpful, since newly infected persons, who can be infectious to others, may not have yet made the detectable antibody and therefore would test negative for its presence.

### Treating and Reporting an Exposure

The following procedures are to be used to treat and report an exposure to contaminated blood or body fluid.

If you are exposed percutaneously:

1. Wipe off blood or fluid and apply alcohol.
2. After arriving at the hospital, and as soon as patient care allows, wash your hands and the wound.
3. If the wound is a small laceration that might need stitches, seek prompt medical attention.
4. If you have received a puncture wound, seek medical attention to evaluate your tetanus immunization status. These inoculations should be renewed every 10 years.

If you are exposed mucocutaneously:

1. Flush your eye or rinse your mouth with saline or water.
2. After arriving at the hospital, and as soon as patient care allows, wash your face.

**Follow-up Procedure.** When the treatment steps have been completed, the incident must be reported.

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*Goggles should be worn during responses in which blood or body fluids might be splashed in the rescuer's eyes.*

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1. Follow the report of injury guidelines established by your department.
2. If guidelines have not been established for exposure to HIV, use the following procedure:
  - a. Report to your supervisor and document the event.
  - b. Contact the Maryland Health Department (945-AIDS in metropolitan Baltimore or 1-800-638-6252 statewide) for information about counseling and testing at your nearest regional center (offered at no cost to prehospital care providers), or consult your personal physician.
3. People who have not received the hepatitis B vaccine should be evaluated for HBV exposure as soon as possible after the incident.

## Protective Measures

The best way to avoid exposures to these viruses is to use protective procedures on all responses in which you might be exposed to a patient's blood or body fluid. Examples are calls involving open injuries (such as gunshots and stabbings), vehicular crashes, delivering babies, and giving CPR (because IV lines may need to be started). Many calls will not involve these kinds of situations, so protective attire may not be necessary. However, it is better to enter a situation with protective gear in place than to delay treatment while you put on protective clothing.

### Guidelines for Use of Protective Gear

**Gloves.** Three types of gloves must be available to prehospital personnel:

1. Heavy duty or leather gloves should be worn while performing extrication procedures. These heavy gloves protect the worker's hands from cuts and scratches that could become contaminated with a patient's blood or body fluid.
2. Mid-weight rubber, vinyl, or plastic gloves should be worn for non-patient care duties that involve handling of equipment or evidence items contaminated with blood or secretions. They should also be worn when cleaning equipment and the interior of transport vehicles. Disposable and non-disposable brands are available. Household rubber gloves are one example.
3. Medical-grade gloves should be worn for all patient care procedures that require dexterity and sensitivity but may involve contamination of the hands with blood or body fluids. These procedures include IV insertions, dressing and splinting open injuries, and establishing airways. Examples of this glove weight are

sterile surgical gloves and disposable non-sterile latex or vinyl gloves.

**Masks.** Masks are not necessary in most situations. However, if you think that blood or body fluids might be splashed in your face, a medical-grade face mask should be worn.

**Eye Protection.** Eye protection should be worn in situations in which blood or body fluids could be splashed into your eyes. This protection can be plain or prescription glasses, goggles, or helmet visors. If goggles are used, a style that allows clear vision and does not obstruct peripheral vision should be chosen. Helmet visors should be maintained to allow clear vision.

**Gowns.** Gowns offer little protection because they become soaked just like any other clothing. Since they can be penetrated by sharp objects, are hot and cumbersome, and may even be dangerous in some situations, the use of gowns in the prehospital environment is not recommended. The best protective action is to change soiled clothing as soon as possible and to shower or wash skin that may be contaminated with blood. Remember that getting blood on clothing or intact skin is not considered an exposure to HBV or HIV.

### Protection of Broken Skin

Before reporting for duty, you should cover any cuts, abrasions, or insect bites with a small dressing or Band-Aid. This will reduce the risk of having contaminated blood or fluid contact your broken skin.

### Airway Management

Respiratory assist devices (such as pocket masks and bag-valve masks) should be used whenever possible. This protection should prevent the transmission of hepatitis B. The risk of contracting AIDS during mouth-to-mouth resuscitation is very small: there have been no documented cases of HIV infection following this emergency procedure.

### Handling Sharp Objects

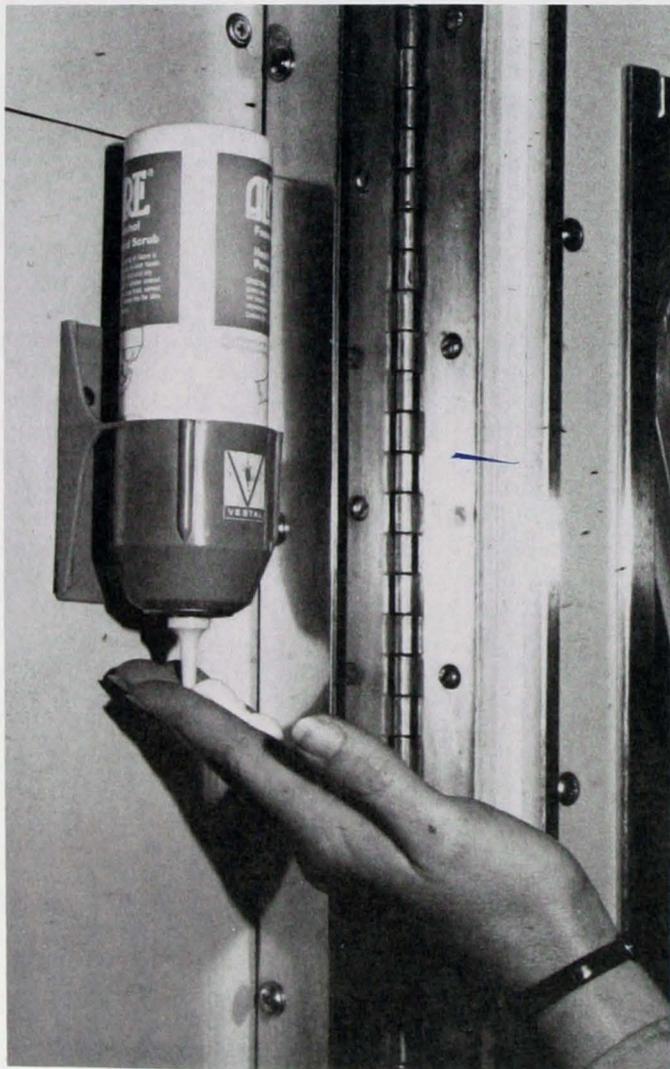
Take special care when handling sharp instruments, needles, objects, and glass. Needles should not be recapped, bent, or broken. Needles and other sharp objects should be disposed of properly in metal or heavy plastic containers that cannot be punctured.

Think of the safety of others when you discard sharp objects. Throwing needles or broken glass into an unmarked trashcan could cause injury to the person who handles the trash. Leaving a used needle inside a transport vehicle creates hazards for others using the vehicle.

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Receptacles that cannot be punctured should be used for disposal of needles and other sharp objects.



If you do not have access to soap and water after patient care procedures are complete, use a waterless hand cleaner to minimize the spread of infection. As soon as the proper facilities are available, wash your hands thoroughly, even if you have worn gloves while caring for the patient.

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### Handwashing

Handwashing helps to protect you and your patients from infection. Wash your hands thoroughly after each patient transport and as soon as patient care allows. In the field, when soap and water are not readily available, waterless hand cleaners should be used to wash blood or body secretions from your skin. However, this is not an adequate substitute for handwashing; you should wash your hands thoroughly as soon as the necessary facilities are available.

### Cleaning Procedures

You can control the spread of infection in your work environment by using the proper procedures to clean your equipment and the interior of your vehicle. Three terms are commonly used to describe these procedures:

*Decontamination* (cleaning) is removing disease-producing organisms and making the environment or an object safe.

*Disinfection* is a process of physically or chemically killing an infectious agent outside the body.

*Sterilization* is the complete removal or destruction of all forms of microbial life, which is accomplished by steam, gas, or liquid agents.

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### CLEANING BASED ON CATEGORIES OF MEDICAL EQUIPMENT

- **Non-critical items**  
Clean with detergent disinfectants and hot water
- **Semi-critical items**  
Require high-level disinfection
- **Critical items**  
Require sterilization



Items classified as critical by the CDC are used in invasive procedures and require sterilization after use. For prehospital care, these items come in sterile packages and are disposable, so prehospital personnel do not need access to sterilization equipment.



A washing machine can be used to clean MAS trousers. Removal of air bladders is not necessary, but the air valves must be closed.

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The Centers for Disease Control has established criteria for the cleaning of medical equipment. The three categories in the CDC's recommendations (non-critical, semi-critical, and critical) are based on how the equipment is used.

Most items used in the field are classified as non-critical and require thorough cleaning with detergent disinfectants and hot water. These items do not touch mucous membranes and are not inserted into the body. Examples are MAS trousers and spinal immobilization devices.

Items classified as semi-critical are those that touch mucous membranes. These items require high-level disinfection. Examples are esophageal obturator, nasopharyngeal, and oropharyngeal airways.

Critical items are inserted into the body. These items require sterilization. Examples are IV catheters, syringes, and surgical instruments. Critical items used in the field are packaged in sterile containers and are disposable, so prehospital care providers will not be involved in sterilization procedures.

Always wear gloves when cleaning and disinfecting prehospital equipment. The use of disinfectant chemicals is described in another article in this publication.

### Cleaning MAS Trousers

To clean MAS trousers, wipe off blood with hot soapy water or a detergent disinfectant solution while wearing gloves.

The outer fabric of MAS trousers is nylon pack cloth treated with Scotchguard, which will withstand cleaning with laundry detergents, hydrogen peroxide, a 1:10 dilution of bleach, and temperatures up to 200°F (the temperature of clothes dryers).

MAS trousers can be washed in a standard washing machine using the hot water setting and detergent. It is not necessary to remove the air bladders. Before placing MAS trousers in the washing machine, **be certain that the air valves are closed.**

If a washing machine is not available, manual cleaning is acceptable.

After washing, the fabric may be air dried or placed in a dryer.

Ultrasonic cleaning is not advised, since soil may be only loosened and not removed.

### Cleaning the Interior of Transport Vehicles

For the interior of transport vehicles, routine cleaning procedures with detergent disinfectants and hot water provide adequate decontamination. Always wear gloves during cleaning operations. The use of bleach is not recommended because repeated applica-



MAS trousers can be cleaned manually if a washing machine is not available.

tions corrode metal and therefore may damage some medical equipment. (See article "Disinfectants for HBV and HIV" for additional information.)

### Care of Clothing

Routine laundry practices are adequate to decontaminate clothing that is soiled with the blood or body fluids of people with hepatitis B or AIDS. The use of hot water (160°F) and detergent will kill the virus. If water temperature less than 160°F is used, a detergent disinfectant is recommended. It is not necessary to use bleach; if you do use it, do not exceed 1 cup of bleach per washtub of water. Standard dry cleaning chemicals also provide adequate cleaning.

### Ineffective Procedures

Some cleaning procedures are ineffective and can even be dangerous.

All disinfectants require a clean surface before they can work. Use of a disinfectant on a soiled surface is very ineffective and therefore wastes time and money.

Hospital environment disinfectants may contain up to 99% "inert" ingredients. Their composition is unknown to the user. They may damage metal, crack plastic, or etch glass. They may also be harmful to those who use them.

The spraying of disinfectants is not recommended. Sprays are applied unevenly, so you cannot be sure that the amount sprayed will disinfect the area adequately.

Spray disinfectants can cause equipment to malfunction. Electrical connections and electronic instruments can short-circuit from ionic residues that almost all spray disinfectants leave behind.

Although some sources have recommended that bleach should be used for environmental cleaning and disinfection, the recommendation from the Centers for Disease Control is to use a detergent disinfectant for cleaning up blood and body fluids from people infected with HBV or HIV.

### Summary

Prehospital care providers should treat all patients' blood as a potential source of the viruses that cause hepatitis B and AIDS. These viruses are spread by blood from an infected person entering another person's body, by unprotected sexual intercourse with an infected person, and from an infected mother to her unborn or newly born child.

With proper protection, the prehospital care provider can minimize the risk of exposure to these viruses.

## Disinfectants for HBV and HIV

There have been no reported cases of environmental spread of HBV and HIV. Two reasons account for this: (1) neither virus can reproduce itself outside the human body and (2) the viruses cannot cause infection unless they can get inside the human body, i.e., through the skin or mucous membrane. Although HBV can survive longer than HIV in the environment, both viruses can be easily removed by cleaning procedures and can be killed by chemical disinfection. Scientific studies have shown that hepatitis B virus can be eliminated from smooth environmental surfaces by water and mechanical cleaning or by detergent and that chemical disinfectants such as bleach solutions (500 to 5000 ppm), 70% isopropyl alcohol, and 2% glutaraldehyde are effective disinfectants. Human immunodeficiency virus has also been proven to be eliminated by a wide variety of chemical disinfectants (see below).

It is important to note that each disinfectant reacts differently with the material it contacts. Some can corrode metal, short-circuit electronics, etch glass, stiffen plastic, dissolve adhesives, or decolorize fabrics. In addition, the use of many of these products can be harmful to the persons who use them if the directions and warnings on the labels are not followed correctly. If you have questions concerning product safety, write to the manufacturer and ask for a "Material Safety Data Sheet." The manufacturer must supply this information to any consumer since these products are registered by the Environmental Protection Agency (EPA). This is true for all disinfectants, including those sold in grocery stores.



The spraying of disinfectants is **not** recommended because application is uneven and uncontrolled. Contact of the solution with electrical connections and electronic instruments can cause short circuits.

### Selection and Use of Disinfectants

1. The type of cleaning or disinfecting procedure should be determined according to the CDC category for the equipment, i.e., non-critical, semi-critical, or critical.
2. Check with the manufacturer of the equipment to be cleaned to determine which disinfectant can be used without damaging the equipment.
3. Always use disinfectants according to label instructions.
4. **Always wear gloves** when performing cleaning and disinfection procedures.
5. Disinfectants must be applied to **clean** surfaces. The greater the amount of blood and dirt, the less effective the disinfectant.
6. Do not spray disinfectants. This is an uneven and uncontrolled application. Disinfectant spraying of the interior of vehicles can short-circuit electrical connections and electronic equipment.

### Types of Disinfectants and Antiseptics

#### Bleach

##### Uses

- As a powerful antimicrobial (germ-killing) agent, bleach is recommended for cleaning up fresh (undried) blood spills on surfaces that cannot be cleaned easily.
- Good disinfectant for plastic materials

##### Concentration

- 1:10 dilution (5000 ppm) = 1 cup of bleach to 9 cups of water (slightly more than 1/2 gallon)

##### Contact time

- 30 minutes

##### Precautions

- Highly corrosive to metal even at low concentrations (100 ppm, which is 1/4 cup of bleach to 1 gallon of water)
- Can hamper the function of electrical connections and electronic equipment
- Can decolorize fabrics
- Undiluted bleach and 1:10 dilutions can cause eye, skin, and respiratory irritations.

#### Alcohol, 70% Isopropyl

##### Uses

- Can be used around electrical connections and electronic equipment because it leaves no ionic residue and does not corrode metal
- It is a good skin antiseptic and is the primary antimicrobial ingredient of most waterless handwashing products.

##### Contact time

- 5-30 minutes for high-level disinfection

##### Precautions

- Equipment must be immersed for disinfection; alcohol is not recommended for disinfection of surfaces that cannot be immersed, since it evaporates quickly.
- Flammable; inactivated by the presence of blood and dirt; can stiffen and crack plastic
- May dry and irritate the skin

#### Glutaraldehyde, 2%

##### Uses

- Powerful disinfectant: can kill bacteria, fungi, viruses, and the mycobacteria that cause tuberculosis

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- Most commonly used for disinfection of respiratory equipment
- Can work in the presence of blood and dirt
- Acid glutaraldehydes do not corrode metal, and most brands will not affect plastic or rubber.

**Contact time**

- 10-30 minutes for high-level disinfection

**Precautions**

- Alkalinized glutaraldehydes will corrode and stain high-carbon metals such as stainless steel and leave residue on metals.
- These are unstable, expensive products that must be mixed freshly with each use to maximize effectiveness. Although the labels state that the product is stable for 14 to 28 days after preparation, effectiveness cannot be guaranteed after one single use. The effectiveness decreases every time the solution is used in the 14- to 28-day period.
- Must never be used to disinfect environmental surfaces
- Can cause chemical burns on human skin and mucous membranes and are eye and respiratory irritants

**Hydrogen Peroxide**

**Uses**

- Good for dissolving dried blood and body fluids from the surfaces of equipment
- Can be used as a skin and oral antiseptic

**Concentration**

- 3%

**Contact time**

- Reacts immediately upon contact

**Precautions**

- A 3% solution is not considered a disinfectant, so cleaning and decontamination are still required.

**Iodophors**

**Uses**

- Excellent skin antiseptics (see Precautions)

**Concentration**

- Varies with product

**Contact time**

- Must dry in air for maximum effectiveness

**Precautions**

- Although iodophors have very good antimicrobial activity, they are not recommended for disinfection of equipment.
- Can corrode metal, dissolve rubber, crack plastics, and stain many metals
- Can irritate fresh open wounds or burns

**Phenolics and Quaternary Ammonium Compounds**

**Uses**

- Common classes of hospital environmental disinfectants; more than 1000 products of this type are commercially available

**Concentration**

- See manufacturer's recommendation.

**Contact time**

- See manufacturer's recommendation.

**Precautions**

- Should **not** be used to disinfect equipment; leave ionic residues; if used consistently for routine cleaning, these compounds must be stripped from all surfaces periodically
- Must be used with caution inside transport vehicles because they can affect the function of electrical and electronic equipment
- Must be used exactly in accordance with label instructions

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## Glossary

**AIDS:** Acquired immune deficiency syndrome, a disease that attacks the immune system and causes a person to be susceptible to diseases that could normally be resisted

**Chain of infection:** The sequence of events that need to occur for infections to spread

**Infectious agent:** An organism (such as HBV or HIV) responsible for a disease

**Reservoir:** A place where organisms can survive and possibly multiply

**Means of exit:** A way for organisms to escape the reservoir

**Mode of transmission:** The way organisms are spread

**Means of entry:** A way for organisms to enter the body

**Susceptible host:** A person at risk of acquiring infection and developing a disease

**Cleaning procedures:**

**Decontamination:** Removing disease-producing organisms and making the environment or an object safe

**Disinfection:** Physically or chemically killing an infectious agent outside the body

**Sterilization:** Complete removal or destruction of all forms of microbial life, which is accomplished by steam, gas, or liquid agents

**Detergent disinfectant:** A product that contains soap and a chemical disinfecting agent and that is labeled "detergent disinfectant"

**Exposure:** An event that allows an infectious agent to enter the body.

**HIV:** Human immunodeficiency virus (the virus that causes AIDS)

**Hepatitis B:** A disease that attacks liver cells

**HBV:** Hepatitis B virus (the virus that causes hepatitis B)

**Modes of transmission of HBV and HIV:**

**Percutaneously:** Through the skin (such as a needlestick injury or by getting infected blood on broken skin)

**Mucocutaneously:** Through a mucous membrane (nose, mouth, or eye)

## Disinfectants for HBV and HIV

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- Each product varies in its ability to react with the material being cleaned as well as the toxic effects associated with use.
- Material Safety Data Sheets should be obtained for any of these products.

### Detergent Disinfectants

#### Uses

- Primary uses of these solutions of detergents and disinfectant chemicals are for cleaning and decontaminating environmental surfaces and some types of non-critical equipment and for laundering.

- Available in grocery stores; a wide variety of products are sold commercially
- The words "detergent" and "disinfectant" are clearly visible on the label.
- Registered with the Environmental Protection Agency because they are labeled as disinfectants

#### Concentration

- See label instructions.

#### Contact time

- See label instructions.

#### Precautions

- See label instructions.

## Sources of Additional Information

### Agencies

AIDS Administration, Division of AIDS Surveillance, Maryland Department of Health and Mental Hygiene, 201 West Preston Street, Baltimore, MD 21201, 945-AIDS (metropolitan Baltimore), 1-800-638-6252 (statewide).

Health Education Resource Organization (HERO), 101 West Read Street, Suite 812, Baltimore, MD 21201, 301-685-1180.

Maryland EMS AIDS Hotline: 1-800-323-2437 (Maryland EMS-related questions only) (Monday through Friday, 10 am to 4 pm).

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## Maryland Law Regarding Notification Of Firefighters, EMTs, Rescue Squad Personnel, Law Enforcement Officers

The current Maryland law regarding notification of firefighters, emergency medical technicians, rescue squad personnel, and law enforcement officers is printed in its entirety in this special "update" on infectious diseases. A common question, which arises in training programs involving prehospital care providers, involves HIV testing for patients who are transported by prehospital care providers. The current law states that if individuals specified in the law (for example, firefighters, EMTs, rescue squad men, or law enforcement officers) come into contact with a patient who is subsequently diagnosed as having a specified disease or virus, as a result of information obtained in conjunction with the services provided during the visit to the facility, the attending physician or a designee at a medical facility shall notify the specified individuals.

Some prehospital care providers have presumed that this means that all patients are tested for HIV or other viruses by all hospitals. This is not, indeed, the case. The law specifies that, if a patient is found to be positive, the prehospital care providers are to be notified within 48 hours of diagnosis (not admission). The law, however, does not specify which patients are to be tested. In most situations, testing of the patient depends upon individual hospital policies. Therefore, if no information is provided to a prehospital care provider regarding a specific patient transport, this may mean that the patient was negative, or it may simply mean that the patient was not tested. The important point is that the safest and wisest policy is to manage all patients as being potentially infected and to follow established guidelines, which are reinforced in this update.

**Companion bills SB215 and HB16 were passed during the 1988 session of the Maryland General Assembly. The final law appears as follows.**

### §18-213 Notification of firefighters, emergency medical technicians, rescue squadmen, and law enforcement officers of exposure to contagious disease or virus.

(a) *Definitions.* — (1) In this section the following words have the meanings indicated.

- (2) "Contagious disease or virus" means:
- (i) Human immunodeficiency virus (HIV);
  - (ii) Hepatitis B;

- (iii) Meningococcal meningitis;
- (iv) Tuberculosis;
- (v) Malaria;
- (vi) Rabies; or
- (vii) Mononucleosis.

(3) "Law enforcement officer" means any person who, in an official capacity, is authorized by law to make arrests and who is a member of one of the following law enforcement agencies:

- (i) The Maryland State Police;
- (ii) The Baltimore City Police Department;
- (iii) The police department, bureau, or force of any county;

(iv) The police department, bureau, or force of any incorporated city or town;

(v) The office of the sheriff of any county;

(vi) The police department, bureau, or force of any bicounty agency or the University of Maryland, Morgan State University, St. Mary's College, or of any institution under the jurisdiction of the Board of Trustees of State Universities and Colleges;

(vii) The State Aviation Administration police force of the Department of Transportation, the Mass Transit Administration police force of the Department of Transportation, the Maryland Toll Facilities police force of the Maryland Transportation Authority, and the Maryland Port Administration police force of the Department of Transportation;

(viii) The law enforcement officers of the Department of Natural Resources; or

(ix) The Maryland Alcohol and Tobacco Tax Enforcement Unit.

(b) *Fire fighter, emergency medical technician, or rescue squadman.* — While treating or transporting an ill or injured patient to a medical care facility or while acting in the performance of duty, if a paid or volunteer fire fighter, emergency medical technician, or rescue squadman comes into contact with a patient who is subsequently diagnosed as having a contagious disease or virus, as a result of information obtained in conjunction with the services provided during the visit to the facility, the attending physician or a designee of the medical care facility who receives the

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# Maryland Law Regarding Notification Of Firefighters, EMTs, Rescue Squad Personnel, Law Enforcement Officers

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patient shall notify the fire fighter, emergency medical technician, or rescue squadman, and the employer or employer's designee, of the individual's possible exposure to the contagious disease or virus.

(c) *Law enforcement officer.* — If, while treating or transporting an ill or injured patient to a medical care facility or while acting in the performance of duty, a law enforcement officer comes into contact with a patient who is subsequently diagnosed, as a result of information obtained in conjunction with the services provided during the visit to the facility, as having a contagious disease or virus, the attending physician or a designee of the medical care facility who receives the patient shall notify the law enforcement officer and the officer's employer or employer's designee of the officer's possible exposure to the contagious disease or virus.

(d) *When notice made; written confirmation; confidentiality.* — The notification required under subsection (b) or (c) of this section shall:

- (1) Be made within 48 hours, or sooner, of confirmation of the patient's diagnosis;
- (2) Include subsequent written confirmation of possible exposure to the contagious disease or virus;
- (3) Be conducted in a manner that will protect the confidentiality of the patient; and
- (4) To the extent possible, be conducted in a manner that will protect the confidentiality of the fire fighter, emergency medical technician, rescue squadman, or law enforcement officer.

(e) *Compliance with section.* — The written confirmation

required under subsection (d) (2) of this section shall constitute compliance with this section.

(f) *Written procedures for implementation of section.* — Each medical care facility shall develop written procedures for the implementation of this section, and, upon request, make copies available to the local fire authority, the local fire authority's designee, the local law enforcement authority, or the local law enforcement authority's designee having jurisdiction.

(g) *Liability of medical care facility or physician — Breach of patient confidentiality.* — A medical care facility or physician acting in good faith to provide notification in accordance with this section may not be liable in any cause of action related to the breach of patient confidentiality.

(h) *Same — Failure to provide notice.* — A medical care facility or physician acting in good faith to provide notification in accordance with this section may not be liable in any cause of action for:

(1) The failure to give the required notice, if the fire fighter, emergency medical technician, rescue squadman, or law enforcement officer fails to properly initiate the notification procedures developed by the health care facility under subsection (f) of this section; or

(2) The failure of the employer or employer's designee to subsequently notify the fire fighter, emergency medical technician, rescue squadman, or law enforcement officer of the possible exposure to a contagious disease or virus. (1986, ch. 763; 1987, ch. 11, subsection 1; ch. 697; 1988, ch. 6, subsection 1; chs. 275, 276.)