CHAPTER 21

Transmission of HIV in Health Care Settings

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preview CHAPTER 21

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INTRODUCTION

Transmission of HIV infection in health care settings is not a major mode of transmission, and contributes little to the spread of HIV in the general population. As a result, prevention of infection here will have a very limited impact on HIV spread in the general population. This is one reason for the low priority accorded health care settings in resource-constrained settings. But prevention of such transmission should be considered part of good quality health care; the subject deserves more attention than it has received so far.

This chapter examines the risks and prevention of HIV transmission in health care settings, except through blood transfusion. Similar to other blood-borne pathogens, HIV is more likely to be transmitted from patients to health care workers (HCWs) than from HCWs to patients. The effects of HCWs' anxiety on attitudes towards HIV-infected patients have been documented in several studies. Measures to prevent occupational HIV infection will not only prevent morbidity and mortality in a small number of HCWs, but can also improve patient care.

THE MAGNITUDE OF THE PROBLEM

Occupational Infections

Although HIV transmission from patient to HCW is infrequent in industrialized countries, the situation is different in countries with limited resources. While there are no direct measures of the magnitude of the problem there, the few estimates available give reason for concern. The prevalence of infection in the patient population, the nature and frequency of blood exposure and the likelihood of acquiring infection after a single blood exposure from an infected patient will determine the risk of occupational transmission of HIV.

OTHER HEALTH CARE-ASSOCIATED INFECTIONS

HIV transmission from patient to patient has been reported in hospitals, nursing homes and outpatient health care settings in the United States and other countries. Most transmissions have been associated with improper infection control practices. Since the onset of the AIDS epidemic, only two episodes of HIV transmission from an infected HCW to patients have been reported.

Procedures in the informal health sector that may be associated with transmission of HIV infection include: injections by drug peddlers and quacks, scarifications by traditional healers, circumcision of boys or men and female genital mutilation (FGM).

PREVENTION OF HIV INFECTION IN HEALTH CARE SETTINGS: EXPERIENCE FROM INDUSTRIALIZED COUNTRIES

Prevention of transmission of HIV in health care settings requires two levels of action:

- Prevention of blood exposures. Studies in the United States have shown that implementation of "Universal Precautions," as recommended by the Centers for Disease Control (CDC) in 1987 and later replaced by "Standard Precautions," has reduced the frequency of blood exposures among HCWs. This infection control strategy treats all blood as infectious, and uses various work practices and barrier materials appropriate to the patient interaction to avoid blood exposure.
- Postexposure prophylaxis. Based on current information about primary HIV infection, the use of antiretroviral agents for postexposure prophylaxis (PEP) is biologically plausible. The US Public Health Service recommends PEP after some occupational exposures to HIV, based on indirect evidence from animal and human studies.

PREVENTION OF HEALTH CARE-ASSOCIATED HIV INFECTIONS: EXPERIENCE FROM COUNTRIES WITH LIMITED RESOURCES

In countries with limited resources, preventing transmission of HIV infection in health care settings is generally not a high priority: often, basic measures to protect HCWs and patients are not taken. But standard precautions can reduce the incidence of blood exposures even in resource-constrained settings—and should be taken.

LESSONS LEARNED

The few data available suggest that the risk of occupational HIV infection in many resource-constrained settings is far from negligible. Health care workers must be involved in the planning of realistic interventions, and must receive continual training and supervision.

table of contents CHAPTER 21

INTRODUCTION

Transmission of HIV in health care settings occurs from patient to patient, from patient to health care worker (HCW) and from HCW to patient. Before blood screening for HIV, transmission of HIV to patients in health care settings was mainly associated with blood transfusion. This is now an extremely rare occurrence in industrialized countries—but in some resource-constrained settings, the risk for patients receiving a transfusion with HIV-infected blood may still be considerable.

Even so, these infections account for only a small proportion of the national toll. A study in Tanzania, for example, estimated that less than 0.4 percent of the total annual incidence of HIV infection was attributed to medical infections.[1] Prevention of transmission in health care settings will have a very limited impact on the rate of HIV spread in the general population. But there are other good reasons for allocating resources to prevention of patient-to-patient transmission and occupational infections. Avoidance of transmission from one patient to another is an integral part of quality curative care.

Ensuring the safety of health staff is also the responsibility of health services managers. The effect of HCWs' anxiety on attitudes towards HIV-infected patients has been documented in several studies. Measures to reduce occupational infection will not only prevent morbidity and mortality in a small number of HCWs, but will also improve patient care.

This chapter examines the risks and prevention of HIV transmission in health care settings, other than through blood transfusion. (Ensuring the safety of blood and blood products is addressed in Chapter 20.) Similar to other blood-borne pathogens, HIV is more likely to be transmitted from patients to HCWs than from HCWs to patients. Transmission between HCWs and patients most often is the result of a percutaneous injury (PI) to a HCW, whereas the majority of patient-to-patient transmissions have involved breaches in recommended infection control practices.

THE MAGNITUDE OF THE PROBLEM

Occupational Infections

Determinants of the risk of HIV transmission after occupational exposure

Prevalence of infection in the patient population, the nature and frequency of blood exposure and the likelihood of acquiring infection after a single blood exposure from an infected patient determine the risk of occupational transmission of HIV.

Prospective studies from several countries have estimated that the risk after occupational percutaneous exposure to HIV-infected blood is approximately 0.32 percent (95 percent confidence interval [CI]= 0.18 percent-0.46 percent),[2-4] and after a mucous membrane exposure, 0.09 percent.[5] The risk of transmission after skin exposure has not been precisely quantified, but is believed to be even smaller: No cases of HIV transmission after exposure to intact skin have been documented.[6] The risk after exposure to fluids or tissues other than HIV-infected blood is also unknown.

Epidemiologic and laboratory studies suggest that a variety of factors may affect risk following an occupational exposure. A laboratory study demonstrated that less blood is transferred across membranes by a needle that passes through gloves, is of smaller gauge or is solid rather than hollow bore.[7] A retrospective case-control study of HCWs who have had percutaneous exposure to HIV found that risk increased with exposure to a greater quantity of blood from the source patient (as indicated by a device visibly contaminated with the patient's blood), a procedure that involved a needle placed directly in a vein or artery or a deep injury.[8] The risk was also greater for exposure to blood from patients with terminal illness—possibly reflecting the higher titer of HIV in blood late in the course of AIDS—or other factors, such as the presence of syncytia-inducing strains of HIV.

Occupational infections in industrialized countries

Since transmission of HIV in health care settings is infrequent and involves unusual routes of transmission, most cases in countries with a well-organized surveillance system are detected by studying HIV-infected persons who have no identified risk for infection. Several countries have a surveillance system for occupationally acquired HIV infections.

As of December 1999, CDC had received reports of 56 United States HCWs with documented HIV seroconversion temporally associated with an occupational exposure. CDC has also received reports of 136 HCWs with possible occupationally acquired HIV infections; each of these workers reported the infection was occupationally acquired and no other risk was identified. But transmission of infection after a specific exposure was not documented. Of the 56 documented episodes, 51 involved infected blood; one, visibly bloody body fluid; one, an unspecified fluid; and three, concentrated virus in a laboratory. Forty-nine exposures were percutaneous; five were mucocutaneous; and one was both percutaneous and mucocutaneous; the route of one exposure (to concentrated virus) is uncertain.[9] The 49 percutaneous exposures involved hollow-bore needles (44), broken glass vials (two), scalpels (two) or an unknown sharp object (one).[10]

Table 1

Documented and Possible Cases of Occupationally Acquired HIV Infection[11]

	Documented	Possible
United States	56	136
France	11	27
United Kingdom	4	9
Mexico		9
Italy	5	
Australia	4	
Spain	5	
South Africa	3	1
Germany	3	3
Belgium	2	1
Canada	1	2
Holland		2
Switzerland	2	
Denmark		1
Israel		1
Argentina	1	
Zambia	1	

Another 42 documented cases and 56 possible cases of occupationally acquired HIV infection were reported from other countries, including a few resource-constrained settings, as of September 1997 (Table 1). Forty of these 42 occurred after a percutaneous injury (PI); two after massive mucous membrane exposures.[11]

Since HCWs do not usually report occupational exposures, these numbers are certainly low—only 10 percent to 60 percent of percutaneous exposures are probably reported in the United States.[12]

Occupational infections in countries with limited resources

There are no extensive data on HCWs infected through occupational exposure in countries with limited resources (Table 1), but some studies have attempted to estimate the incidence of these infections.

A study in nine hospitals in Mwanza Region, Tanzania, found an average of five PIs per HCW per year.[13] Estimating a 20 percent HIV prevalence among patients and a transmission probability of 0.25 percent, the incidence of HIV infection through occupational exposure would be 0.27 percent per year. When this study was conducted, the incidence of HIV infection in the general adult population was 0.95 percent in the rural areas and 1.2 percent in Mwanza town. Compared to these latter incidence rates, the incidence of occupationally acquired HIV infection among HCWs was far from negligible. A study in a Zambian hospital determined the risk to surgeons was 1.5 percent over five years. Yet surgeons at Katete Hospital had a parenteral exposure incidence of 0.7 percent per procedure—substantially lower than that found in industrialized countries (1.7 percent-5.6 percent).[14] Table 2 summarizes two studies, one from Tanzania, the other from the United States, which used a similar methodology to estimate the annual risk of occupationally acquired HIV infection.[14,15]

Although there are no direct measures of the magnitude of the problem in countries with limited resources, the few estimates available (such as those cited above) give reason for concern. HIV prevalence in many countries with limited resources is far greater than in industrialized countries. Rates among hospitalized patients of more than 20 percent are not at all exceptional. In addition to the study in Tanzania, research conducted in other countries (including Taiwan and Brazil) also shows a disturbingly high incidence of PIs, often due to insufficient staff training and equipment, such as inadequate containers for waste disposal.[13, 16]

As in the United States, most exposures to blood are not reported in these countries. A survey of 10,469 HCWs in 16 teaching hospitals in Taiwan found only 18 percent of sharp object injuries were reported.[13]

Table 2

	Tanzania	United States
Setting	9 hospitals in Mwanza Region	6 hospital emergency departments
Estimated HIV prevalence in patient population	20%	high: 4.1% – 8.9% low: 0.2% – 0.7%
Incidence of percutaneous injury per person per year	5	0.37
Annual risk of occupational HIV infection	0.27%	high: 0.026% low: 0.002%

Other Health Care-Associated Infections

Patient-to-patient transmission

HIV transmission from patient to patient has been reported in hospitals, nursing homes and outpatient health care settings in the United States and other countries. These are usually associated with improper infection control practices.

The most dramatic reports have come from Eastern Europe. In the 1980s, between 8,000 and 10,000 Romanian children were infected with HIV through transfusion of unscreened blood or the use of contaminated hypodermic needles.[17] Similar needles were also associated with the transmission of HIV to 41 hospitalized children in the Soviet Union.[18] Three patients (two in the United States and one in the Netherlands) acquired HIV infection after being inadvertently injected with blood from an infected patient during nuclear medicine procedures.[19]

Hemodialysis centers have been implicated in several reported transmission incidents. Nine patients became infected in a dialysis center in Colombia between January 1992 and December 1993. Dialysers were reprocessed separately with five percent formaldehyde and labeled for use on the same patient. Access needles, however, were reprocessed by soaking in a common container with a low-level disinfectant, with the potential for cross-contamination or use on another patient. Improperly reprocessed patient-care equipment (most probably the access needles) was the likely mechanism of transmission.[20] This outbreak was only discovered by accident; similar situations could have occurred elsewhere. Transmission during hemodialysis has been reported in at least three instances in Argentina with 11 to 30 infected patients in each episode; most of the episodes were not investigated.[21, 22] Lack of infection control measures during hemodialysis also caused HIV transmission in Egypt.[23]

The only report of HIV transmission from patient to patient during a surgical procedure came from Australia, where five patients whose minor outpatient procedures were performed on the same day by an HIV-negative surgeon. These patients were subsequently found to be HIV-positive.[24] Four had no identifiable source of infection; the fifth patient had known risk factors for HIV, was subsequently found to be HIV-positive and is the probable source of infection. Although the mechanism of transmission was not identified, contamination of multidose medication vials was considered a possible vehicle for transmission in this outbreak.

In most cases, these transmissions could have been avoided through adherence to standard infection control practices, including aseptic technique, cleaning and disinfecting or sterilizing equipment between patients, safe injection practices and appropriate handling of single-use or single-patient-use devices and equipment.

HCW-to-patient transmission

Since the onset of the AIDS epidemic, only two episodes of HIV transmission from an infected HCW to patients have been reported, one in the United States (1990) and the other in France (1997).[25, 26] The United States case involved six patients whose infections were linked epidemiologically and genetically to a dentist with AIDS.[25] Although the investigation indicated that HIV transmission occurred during office visits for dental care—and was most likely from dentist to patient rather than from patient to patient—the precise event resulting in transmission could not be determined.

The French incident involved an orthopedic surgeon whose HIV transmission to one patient was confirmed through genotypic analysis. Although the precise mechanism of transmission is unknown, the duration of the procedure (10 hours), procedure-related opportunities for PI to the HCW and possible high viral titer in the surgeon are hypothesized as contributing factors. No breaches in infection control were identified.[26]

Retrospective investigations to assess the risk for HCW-to-patient transmission did not detect any transmission among 22,759 patients treated by 53 infected HCWs. Despite the limitations of retrospective studies, these data are consistent with other studies that show the risk from infected HCWs to patients is exceedingly low.[27]

Transmission of HIV infection in the informal health sector

Procedures in the informal health sector that may be associated with transmission of HIV infection include:

- Injections by drug peddlers and quacks
- Scarifications by traditional healers
- Circumcision of boys or men
- Female genital mutilation (FGM)

A history of scarifications has been linked to increased risk in some studies, but not in others.[28, 29] There are no hard data on the transmission risk of circumcision and FGM.

Nor has any increased risk due to occupational exposure been documented in traditional birth attendants (TBAs) in studies in Rwanda, Zambia and Uganda.[30, 31] TBAs usually do not give injections and the risk of percutaneous injury should be minimal, but they do have frequent skin-blood contacts.

PREVENTION OF HIV INFECTION IN HEALTH CARE SETTINGS: EXPERIENCE FROM INDUSTRIALIZED COUNTRIES

Prevention of transmission of HIV in health care settings requires two levels of action:

- The first level (primary prevention) involves reducing PIs and other exposures to blood using a variety of strategies, including development of improved engineering controls (such as safer medical devices), work practices (such as technique changes to reduce handling of sharps) and personal protective equipment (such as gloves).
- The second level consists of prophylaxis of infection after an exposure, including treatment with one or more antiviral drugs.

Prevention of Blood Exposures

Studies in the United States have shown that implementation of the CDC's "Universal Precautions" and more recent "Standard Precautions" has reduced the frequency of blood exposures among HCWs.[32-34] These precautions treat all blood as infectious, and employ various work practices (like not recapping needles) and barrier materials (gloves, gowns, face protection, etc.) appropriate to the patient interaction to avoid blood exposure.

Although several studies have reported fewer PIs when needles are not recapped and sharps disposal boxes are installed, a reduction in overall injury rates

has not been consistently observed.[35, 36] Injuries associated with disposal of the sharp are still frequent in all countries; location of sharps disposal containers, frequency of container replacement and education must be considered. In the United States, a continuing incidence of PIs despite implementation of these strategies suggests that additional preventive measures are needed—such as the use of devices with safety features. Studies have demonstrated the efficacy of some safety devices; however, they should not constitute the only prevention option.[12] Prevention of PIs among HCWs will also prevent transmission of HIV from infected HCWs to patients.

To prevent patient-to-patient transmission of HIV, the following are recommended:

- Standard infection control practices, including aseptic techniques
- Cleaning and disinfecting or sterilizing equipment between patients
- Safe injection practices
- Appropriate handling of single-use or single-patient-use devices and equipment

Post-Exposure Prophylaxis

Based on current information about primary HIV infection, post-exposure prophylaxis (PEP) with antiviral agents is considered biologically plausible. The US Public Health Service (PHS) recommends PEP after some occupational exposures to HIV, based on indirect evidence of PEP efficacy that includes data from animal and human studies.[37, 38] But assessing the efficacy of PEP through a prospective, placebo-controlled trial may not be possible because of the low rate of conversion. Data on perinatal transmission have shown that the protective effect of zidovudine (ZDV) is only partly explained by reduction of the HIV titer in maternal blood; ZDV may also have a direct protective effect on the fetus and/or the infant after exposure.[39,40] In a case-control study among HCWs, PEP was associated with a decrease of approximately 81 percent in the risk of HIV seroconversion after percutaneous exposure to HIV-infected blood.[8] Failure of ZDV PEP to prevent HIV infection after an occupational exposure has been reported in at least 21 instances worldwide.[41, 42]

Table 3

Basic and Expanded Post-Exposure Prophylaxis Regimens[33]

Regimen category	Application	Drug regimen
Basic	Occupational HIV exposures for which there is a recognized transmission risk	Four weeks (28 days) of both zidovudine (ZDV) 600 mg qd in two or three divided doses and lamivudine (3TC) 150 mg BID
Expanded	Occupational HIV exposures where the nature of the exposure suggests an elevated risk for transmission (e.g., meets criteria for highest or increased transmission risk)	Basic regimen plus either indinavir 800 mg q8h (to be taken on an empty stomach and with increased fluid consumption, i.e., 48 oz/day) or nelfinavir 750 mg TID (with meals)

Based on the PHS recommendations, most occupational HIV exposures will warrant only a two-drug regimen, using two nucleoside analogue reverse transcriptase inhibitors, usually ZDV and lamivudine (3TC). The addition of a third drug, usually a protease inhibitor (such as indinavir or nelfinavir), should be considered for exposures that pose an increased risk for transmission or when resistance to the other drugs is unknown or suspected (Table 3).[37] Although PEP with the above drugs has not been associated with serious adverse events, in several studies over 70 percent of HCWs experienced side effects such as nausea, headache or fatigue; approximately 50 percent of them stopped taking the drugs because of side effects. [43, 44]

If PEP is prescribed, it should be started as soon as possible (within hours of exposure). Although the optimum duration of PEP is unknown, four weeks appears protective in HCWs, and medication should probably be administered for that length of time. Exposed HCWs who choose to take PEP should be advised of the importance of completing the prescribed regimen. They should know the side effects of the drugs, what can be done to minimize these effects and how they will be clinically monitored for toxicity during the follow-up period.[37]

Exposed HCWs should receive follow-up counseling, postexposure testing and medical evaluation, regardless of whether they receive PEP. HIV-antibody testing should be performed for at least six months (at six weeks, 12 weeks, and six months after exposure). Psychological prevention counseling of the worker and, in some cases, the worker's family is frequently beneficial.

PREVENTION OF HEALTH CARE-ASSOCIATED HIV INFECTIONS: EXPERIENCE FROM COUNTRIES WITH LIMITED RESOURCES

In countries with limited resources, preventing transmission of HIV in health care settings is generally not a high priority; even basic precautions to protect HCWs and patients may not be taken. There is a consensus for standard precautions; however, there is little documented experience showing how these precautions can best be taken in settings with limited resources and low staff motivation.

A survey conducted in nine hospitals in Mwanza, Tanzania, revealed lack of equipment and personal barrier commodities. The shortage of gloves was widespread and many procedures in labor rooms were conducted without them; reused gloves were the main source of protection in some areas.[15] Only 37 percent of rooms in general wards and 89 percent of labor rooms had containers for sharps disposal.

The survey also revealed that exposures to blood were frequent. Approximately nine percent of 623 nurses and one percent of 118 physicians recalled having a needlestick during the week preceding the interview; 22 percent of nurses working in labor wards and 25 percent of those working in operating rooms had sustained a needlestick in the previous month; 50 percent had sustained a mucous membrane exposure in that period.

To prevent blood exposures, a comprehensive plan should be developed based on surveillance data from the institution (where, how and when exposures occur); measures should focus on the prevention of blood exposures associated with higher risks of transmission. This plan should include modification of procedures and work practices, elimination of unnecessary needles, use of devices with safety features, HCW education and safety promotion in the work environment. Any prevention program should include the implementation of barrier precautions (proper use of gloves, eye protection, etc.) and proper disposal of sharps. Several countries have adapted these recommendations to their circumstances, considering the limited resources available. Involvement of HCWs is fundamental to the success of a prevention plan.

But these personnel must have training and supervision. In a Ribeirao Preto, Brazil health care facility, HCWs were trained not to recap needles and sharps disposal containers were installed. Nevertheless, 64 percent of the needles in these containers were found to be recapped, showing the importance of continuing education to maintain safe work practices.[45]

The Groupe d'Etude sur le Risque d'Exposition des Soignants in France (GERES) is working with a network of hospitals in Mali, Senegal and Côte d'Ivoire to reduce the risk of exposure to blood among HCWs.[46] The collaborative program will be implemented in several steps:

- Assessment of the risk of exposures to blood, including the incidence of PI and the circumstances in which PI occurs.
- Meetings with several groups (administrative staff, doctors, nurses, laboratory personnel) to discuss findings of the assessment and set priorities for intervention. A risk-reduction strategy will be defined that is adapted to the local needs and resources available.
- Implementation of the strategy, which will always include a training component.
- Setting up a surveillance system for exposures to blood that will allow evaluation of the program.

Despite the lack of financial resources or wide availability of antiretroviral drugs, several countries with limited resources have considered the use of PEP after occupational exposures to HIV. Although such a plan should not be the primary means to prevent occupationally acquired HIV infection, it has increased awareness of the problem and the need for preventive strategies. In countries with a high incidence of PIs and high prevalence of HIV, PEP use may become very difficult because of high costs and toxicity.

PEP should not be accepted as the only strategy for preventing occupationally acquired HIV infections in any institution. A program for postexposure management will fail if preventive strategies for blood exposures are not a priority. In a study conducted in Brazil, the direct costs associated with occupational exposures (such as follow-up testing and PEP drugs) was very high (US$1,413.10).[47] These resources could be used to reduce exposures—the best way to prevent occupationally acquired HIV infections.

HCWs with occupational exposure to HIV should receive follow-up counseling, post exposure testing and medical evaluation, regardless of whether they receive PEP; measures to ensure absolute confidentiality must be in place. HIV testing should be available and free for HCWs and source patients. In addition, if an HCW is found to be HIV-infected at baseline, his/her rights (professional and other) should be protected.

Prevention of HIV transmission from patient to patient is a major challenge for countries with limited resources. Little has been done to evaluate approaches to be considered in these settings. Strategies to prevent transmission from patient to patient include:

- Promotion of basic infection control measures, such as cleaning and disinfection or sterilization of equipment.
- Safe injection practices, including avoidance of injectable drugs if alternative drugs are available that can be given per os.
- Appropriate reuse of devices/equipment.
- Appropriate handling of multidose vials.

Reuse of disposable syringes is not cost-effective and should be avoided; they are not manufactured for reuse and sterilizing methods may be inadequate. Reusable syringes and needles should be sterilized or boiled for at least 20 minutes. Chemical disinfection by soaking in high-level disinfectants must not be used for syringes and needles.

Training programs for TBAs include infection control. TBAs are usually taught how to boil their instruments (mainly scissors). Alternatively, the umbilical cord can be cut with a razor blade that is discarded after use. For instance, the Reproductive Health Kit for Emergency Situations provided by UNFPA contains single-edge razor blades to avoid accidental percutaneous injuries in birth attendants. It is also recommended that TBAs use gloves to conduct deliveries. Other traditional practitioners may also be trained in the prevention of HIV transmission in their practice.

Community awareness about the risks of traditional practices can be raised. Researchers of the Tanzania Netherlands Support Program on AIDS, for example, asked villagers in Mwanza Region, Tanzania to draw maps of their villages and indicate the places where HIV transmission was likely to occur. In some cases, the house of the traditional healer was highlighted and a rule was imposed on the traditional healer of one-patient one-razor blade.[48]

More studies, preferably linked to action, must be undertaken to better understand the circumstances and possible preventive measures against HIV infection in health care settings in resource-constrained areas.

SUMMARY

Transmission of HIV infection in health care settings is not a major mode of transmission and contributes little to the spread of HIV in the general population. As a result, prevention of infection here will have limited impact on the rate of spread of HIV in the general population. This is one reason for the low priority accorded it in resource-constrained settings. But prevention here deserves more attention than it has received so far: It is part of good quality health care.

LESSONS LEARNED

- Prevention of HIV in health care settings in resource-constrained countries has so far received too little attention.
- The few data available suggest that the risk of occupational HIV infection in many resource-constrained settings is far from negligible.
- Addressing the problem of occupational risk may boost staff morale and improve the quality of patient care.
- The first priority should be prevention of exposure to infected body fluids.
- Involvement of health care workers in the planning of realistic interventions and continuous training and supervision is vital to the success of any prevention program.

RELEVANT CHAPTER

Chapter 20 *Ensuring the Safety of Blood and Blood Products*

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