

Transmission of human immunodeficiency virus (HIV) in health-care settings worldwide

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Based on the information available, transmission of human immunodeficiency virus (HIV) can and does occur in health-care settings. No cases of such transmission have been reported from an infected health-care worker to a patient. Transmission of HIV from an infected patient to a health-care worker has been documented after parenteral or mucous-membrane exposure to blood. However, this risk is <1%, is limited to exposure to blood, and can be further minimized through adherence to routine infection control measures. Patient-to-patient transmission through invasive equipment or through HIV-infected blood, blood products, organs, tissues, or semen also occurs but can be prevented by proper sterilization of instruments and through donor-deferral, donor screening, and heat treatment of Factors VIII or IX to inactivate the HIV. In health-care settings, prevention of HIV transmission requires education of all health-care workers and ancillary staff, provision of necessary equipment, and strict adherence to general infection control practices.

Transmission of human immunodeficiency virus (HIV) in health-care settings can occur via instruments or equipment from the health worker to patient, from the patient to health worker, and from patient to patient. In September 1988, the Global Programme on AIDS of the World Health Organization initiated a project to bring together the available data from various countries on HIV transmission in each of these situations. Summarized below are the findings gathered from the WHO Collaborating Centres on AIDS.

Worker-to-patient transmission

Persons with HIV infection include health workers, many of whom continue to work in health-care settings. In the United Kingdom, a trainee surgeon who possibly contracted HIV infection occupationally in Africa, and who worked in urology, vascular surgery and general surgery, died of AIDS in 1988. Three hundred and thirty-six patients who had been operated upon by this surgeon were offered counsel-

ling and testing for HIV. Seventy-six (22%) chose to be tested and all were negative for HIV; 63 of these were tested over 90 days following exposure (Dr J. Porter, Public Health Laboratory Service, Communicable Disease Surveillance Centre, London, England; personal communication, 1989).

In an ongoing investigation in the USA, as of May 1989 none of an HIV-infected surgeon's 615 patients who were tested was positive for HIV antibody (Dr B. Mishu, Tennessee Department of Health and Environment, Nashville, USA; personal communication).

There are two retrospective published studies from the USA (1, 2). The first looked for cases of AIDS among patients who had been treated by a surgeon with AIDS; no instances of HIV infection were identified. In the second report, HIV antibody testing was offered to patients who had been operated on by an HIV-infected surgeon. Of the 75 patients tested none was positive for HIV antibody.

No individual case reports of HIV transmission from an infected health-care worker to a patient have been published or reported.

Patient-to-worker transmission

Numerous studies of HIV transmission from patients to health workers are underway throughout the world (Table 1). Data are available from prospective studies in Canada, Italy, Spain, Sweden, United Kingdom and USA (3-21). For example in the USA, in a study by the Centers for Disease Control, of 1201 health workers with documented needlestick injuries, cuts with sharp objects, and contamination of open

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Table 1: Prospective studies of health-care workers exposed to HIV-infected patients^a

Author and reference	No. of exposures	No. of workers	Number infected	Infection rate (per 100)
Marcus (10)	1201	1201	3	0.25
Gerberding (15)	625	212	1	0.47
Henderson (11)	482	359	1	0.27
Elmslie (16)	281	281	0	0.00
Pizzocolo (20)	195	195	0	0.00
Gill ^b	110	110	0	0.00
Hernandez (18)	58	58	0	0.00
Joline (4)	52	48	0	0.00
Ramsey (19)	44	44	1	2.27
Jorbeck (21)	41	41	0	0.00
Leach (17)	—	31	0	0.00

^a Although these prospective studies are similar in following up health-care workers exposed to HIV-infected patients, their data may not be comparable because different eligibility criteria and definitions of exposure were used.

^b Personal communication, 1989.

wounds or mucous membranes with the blood of HIV-infected patients, 4 were tested positive for HIV antibody. One of these workers was first tested positive 10 months after a needlestick injury, but non-occupational exposure to HIV infection could not be excluded. The other three persons had received needlestick injuries and were tested negative for HIV antibody at the time of the exposure, but experienced acute retroviral syndromes and then seroconverted to HIV. Two of these three needlesticks were caused by coworkers during resuscitation procedures. At the Clinical Center, National Institutes of Health, USA, 359 health-care workers with 482 parenteral or mucous-membrane exposures to the blood or other body fluids of HIV-infected patients were tested for HIV antibody; one, who was cut with a sharp object, experienced an acute retroviral syndrome and seroconverted (11). Also in the USA, at San Francisco General Hospital, 212 workers with 625 parenteral or mucous-membrane exposures to HIV-infected blood or body fluids were tested for HIV antibody; one of these with a needlestick injury experienced an acute retroviral syndrome and seroconverted to HIV (15). Of 44 health-care workers at the University of Texas Medical Branch, Galveston, Texas, USA, with percutaneous and non-percutaneous exposures to HIV-infected secretions, one with a needlestick injury seroconverted (19).

The other prospective studies have failed to document occupational transmission. In Canada, of 281 workers with parenteral or mucous-membrane exposure to HIV-infected patients enrolled in a national surveillance programme, none has seroconverted (K.D. Elmslie, Acting Director, Bureau of Epidemiology and Surveillance, Federal Centre for AIDS, Ottawa, Canada; personal communication,

1989). Of 110 health workers in the United Kingdom exposed to HIV infected blood via percutaneous injury, bite or contact with broken skin, or a splash, none has seroconverted (Dr N. Gill, UK Public Health Laboratory Service, Communicable Disease Surveillance Centre, London, England; personal communication, 1989). In Brescia, Italy, of 195 health-care workers with needlestick exposures to HIV-infected blood, none has seroconverted (20). In Sweden, surveillance of 41 health workers exposed to HIV-infected blood found no seroconversions (21). Other countries are conducting surveillance of health workers who are occupied with HIV-infected or AIDS patients at either a national or local level (e.g., France, Switzerland, Hungary, Greece). Data from these projects have not been systematically analysed. The combined data consistently demonstrate that the risk to health-care workers of occupationally acquiring HIV infection is less than 1% per needlestick exposure to HIV-infected blood.

Cross-sectional studies in Africa have shown that the prevalence of HIV-1 infection in health workers was not related to the degree of patient, blood, or needle contact and was considered to reflect the background rate of infection in the community (22, 23). In Kinshasa, Zaire, in 1984, 6.4% of 2384 health-care workers were tested positive for HIV antibody (22); the seropositivity rate increased to 8.7% in 1986 (23). In Dakar, Senegal, of 780 hospital workers, 1 (0.1%) was seropositive for HIV-1 and 4 (0.5%) were seropositive for HIV-2. The authors concluded that "hospital workers do not represent a risk group for HIV infection when compared with the healthy control population in Senegal" (24).

Additional studies have been conducted for

specific occupations, such as dentistry (25, 26) or for certain procedures, such as mouth-to-mouth resuscitation (27). Of 255 dental personnel with an estimated 110 potential contacts to probably infectious material, none was positive for HIV antibody (25). Klein and colleagues, in the USA, identified one seropositive dentist with no other identifiable risks for HIV infection among 1309 dental professionals tested for HIV antibodies (26). The HIV-infected dentist sustained numerous needlestick injuries and practised in an area of the USA with a high prevalence of AIDS cases. Four nurses attempted resuscitation of a patient with AIDS who committed suicide. The nurses were exposed to large amounts of the patient's blood by giving mouth-to-mouth resuscitation as the patient bled from the mouth and nose; 18 months after the incident the nurses remained negative for HIV antibody (27). In addition to these studies, individual cases of occupational transmission of HIV have been reported. The definition of occupational transmission of HIV varies with the reports and no standard definition has been published. The best documented reports of HIV transmission which can be attributed to occupational exposure are those in which the worker is tested and found negative for HIV antibody shortly after the exposure (preferably within 30 days), experiences an acute retroviral syndrome temporally associated with the exposure, and subsequently seroconverts, which generally occurs within 6 months after the exposure. The number of reports is small considering the number of health professionals who have cared for HIV-infected patients, regardless of whether the patient's HIV infection status was known. These case reports can be divided into cases for whom seroconversion was documented after a specific exposure (Table 2), and those presumptive or possible cases for whom serology or exposure data are lacking (Table 3). In this report, documented occupationally-related seroconversions are those that involved a specific exposure to HIV-infected blood, a baseline negative HIV antibody test in the worker followed by a positive test, regardless of the time interval between the two samples. In either documented or possible cases the health-care worker denies any other risk for HIV infection except occupational exposure.

Among the documented seroconversions, 13 reports were from the USA, two from France, and one each from the United Kingdom, Martinique, and Italy (7, 10, 15, 28-38) (Table 2). Of these 18 reports, 13 involved parenteral exposure (i.e., needlestick injury or cut with a sharp object) to blood or blood-containing body fluids, five were caused by blood contamination of mucous membranes or non-intact skin, and one was the result of parenteral exposure to concentrated HIV-1. An acute retroviral syndrome

Table 2: Data from 18 documented seroconversions in health workers

Author and reference	Country	Type of exposure	ARS*
1. Editorial (28)	United Kingdom	Needlestick	yes
2. Stricof (29)	USA	Needlestick	yes
3. Oksenhendler (30)	France	Needlestick	yes
4. Neisson-Vernant (31)	Martinique	Needlestick	yes
5. CDC ^b (7)	USA	Non-intact skin	yes
6. CDC (7)	USA	Mucous membrane	no
7. CDC (7)	USA	Non-intact skin	yes
8. Gioannini (32)	Italy	Mucous membrane	yes
9. Michelet (33)	France	Needlestick	yes
10. Wallace (34)	USA	Needlestick	yes
11. Barnes (35)	USA	Sharp object	yes
12. Ramsey (19)	USA	Needlestick	no
13. CDC (9)	USA	Needlestick	yes/AIDS
14. Marcus (10)	USA	Needlestick	yes
15. Marcus (10)	USA	Two needlesticks	yes
16. Gerberding (15)	USA	Needlestick	yes
17. Weiss (37), CDC (38)	USA	Sharp object	NR ^c
18. CDC (36)	USA	Cutaneous	NR

* ARS = acute retroviral syndrome.

^b CDC = Centers for Disease Control, USA.

^c NR = not reported.

was reported in 14 of the 18 cases; in two cases details on an acute febrile illness are not proved. Six of these cases (10, 15, 19, 29, 35) were identified in various prospective studies discussed above.

The cases that cannot be considered conversions, and may or may not represent occupational transmission, because of insufficient information, include six from the USA and one from the United Kingdom, Denmark, France, Mexico, Germany and Italy (5, 6, 26, 37-46) (Table 3). With one exception (5, 6), HIV antibody detection or the diagnosis of AIDS preceded identification of a potential occupational exposure to HIV.

Anecdotal reports of HIV infection in health-care workers, with or without documented seroconversion, emphasize the difficulty of determining whether infection was occupationally acquired. If substantial numbers of health-care workers were infected with HIV this would probably be reflected in national AIDS case reporting.

Although most countries do not report demographic or occupational information for AIDS cases, these data are available from the AIDS case surveillance dataset in the USA. While 5.4% of the AIDS cases reported working in a health-care setting since 1978, this is comparable to the proportion of

Table 3: Data on 12 possible cases of occupational transmission of HIV

Author and reference	Country	Type of exposure
1. Bygbjerg (39)	Denmark	Surgical practice in Zaire
2. Belani (40)	USA	Palm prick from hospital waste
3. Anonymous (41)	France	Worked in intensive care unit
4. Grint (42)	United Kingdom	Home-health provider, non-intact skin
5. Weiss (5), McCray (6)	USA	Colonic biopsy Needlestick
6. Weiss (5), CDC (43)	USA	Two needlesticks
7. Weiss (5), CDC (43)	USA	Two exposures/unknown source
8. Weiss (37), CDC (38)	USA	Concentrated virus on skin
9. Klein (26)	USA	Multiple needlesticks
10. Ponce de Leon (44)	Mexico	Needlestick, puncture wound
11. Schmidt (45)	Federal Republic of Germany	Needlestick
12. Lima (46)	Italy	Needlestick

the total US population working in the health services (5.7%) (47); most (95%) of this group of AIDS patients have recognized non-occupational risk factors for HIV infection. The remaining cases with an unidentified risk are demographically more similar to other AIDS cases in the USA than they are to health-care workers (i.e., more likely to be male, nonwhite, and service rather than clinical workers) (48-50).

Patient-to-patient transmission

Transmission of HIV via contaminated needles and syringes or reused equipment in health-care settings has been reported from several countries. Syringes contaminated with blood aspirated during the course of intravenous injections were identified as the probable source of nosocomial HIV infection among 41 children hospitalized in the USSR (51). Medical injections were found to be a risk factor for HIV seropositivity among children under the age of 24 months in Kinshasa, Zaire, and among hospital workers (52, 22). However, other researchers in Rwanda did not find an association between the number of medical injections received and HIV seropositivity (53). These authors concluded that medical injections were given less frequently in Kigali, Rwanda, than in Kinshasa. Additional cases of transmission of HIV to blood or plasma donors in Spain and Mexico (54-58), to haemodialysis patients in Argentina (59), and after acupuncture in France (60) have also been reported. These cases emphasize the need for proper sterilization and disinfection of reusable equipment and increased use of disposable equipment when available.

HIV transmission through blood and blood products was documented early in the AIDS epidemic. Cases of HIV infection have also resulted from transplantation of infected organs, tissues, bone, and

through semen used for artificial insemination (61-63). Donor self-deferral (persons excluding themselves from donating) and routine HIV-screening of donors of blood, blood products, organs, tissues, and semen have significantly reduced the risk of transmission from these sources. However, some areas of the world where routine HIV-screening is not yet available continue to have a serious problem with HIV transmission through blood and blood products.

Résumé

Transmission du virus de l'immunodéficience humaine dans les établissements de soins de santé

Des cas de transmission du virus de l'immunodéficience humaine (HIV) se sont effectivement produits dans des établissements de soins de santé, mais on ne connaît aucun cas où le virus ait été transmis à un patient par un agent de santé infecté. Des agents de santé ont été contaminés par le sang de patients infectés, soit à la suite de piqûres, soit par contact du sang avec les muqueuses. Toutefois, ce risque est inférieur à 1%, il n'existe que s'il y a contact avec le sang des malades, et il peut être encore réduit si les mesures habituelles de protection contre les infections sont rigoureusement respectées. La transmission de patient à patient par les instruments chirurgicaux ou par le sang, ses dérivés, les organes, les tissus ou le sperme infectés est possible, mais peut être évitée par diverses méthodes: stérilisation soignée des instruments, délais d'attente et mesures de dépistage imposés aux donneurs, traitement par la chaleur des facteurs VIII et IX pour inactiver le virus. La

prévention de la transmission du VIH dans les établissements de soins passe par l'éducation de tous les professionnels de la santé et du personnel auxiliaire, la mise en place de l'équipement nécessaire et le respect rigoureux des mesures générales de prévention des infections.

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