

AIDS Crisis in Africa: Health Care Transmissions

Bill Number: Oversight

Hearing Date: March 27, 2003

Witness:

Maria Wawer, MD, MH, Sc

Testimony:

Mr. Chairman, Members of the Committee, thank you for this opportunity to testify regarding the very important topic of HIV/AIDS prevention in Africa. Given the AIDS crisis on the African continent, every effort must be made to determine optimal approaches to prevention.

Credentials and experience:

I am Maria Wawer, Professor of Clinical Public Health, Mailman School of Public Health, Columbia University, and Adjunct Professor of Public Health, Johns Hopkins Bloomberg School of Public Health. I am also a Principal Investigator on the Rakai Project, one of the largest HIV/AIDS research collaborations in Sub-Saharan Africa. I received my MD degree in 1977, from McMaster University, Hamilton, Ontario, Canada; an MHS in 1980, from the University of Toronto, Toronto, Canada; and have been a Fellow, of the Royal College of Physicians and Surgeons of Canada [FRCP(C)] since 1984. The latter is equivalent to Board Certification in preventive medicine in the US.

Since 1988, I have worked in the area of HIV/AIDS epidemiological, behavioral and preventive research in international settings. During this period, I have been the Principal Investigator on 11 HIV scientific studies, and a senior co-investigator on more than 10 other HIV-related studies. Most of this research has been supported by the National Institutes of Health. I have authored and co-authored over 60 peer reviewed papers and 6 book chapters on HIV/AIDS, and have delivered or contributed to over 120 presentations at international HIV/AIDS/STD meetings.

My primary HIV-related research for the past 15 years has been conducted in Rakai District, Uganda. With my colleagues at Makerere University, the Uganda Virus Research Institute/Uganda Ministry of Health, Columbia University and Johns Hopkins, we have conducted detailed examinations of risk factors for HIV acquisition and transmission, in order to develop and test HIV prevention and care strategies. We have also worked closely and exchanged data with other HIV/AIDS researchers in Uganda and throughout Africa, as members of international research networks and collaborations, and through international meetings and consultancies.

What do the data tell us about HIV transmission in Africa?

1. The HIV epidemic represents a crisis in the Sub-Saharan region of Africa.

WHO estimates that there are 29.4 million HIV infected persons living in Africa, and that approximately 3.5 million new infections occurred in 2002 (WHO, 2002) This represents a severe humanitarian, social and economic burden.

Although the epidemic has stabilized and abated somewhat in Uganda, we still observe HIV rates of over 10% among adults in towns and cities. Among the 300 Ugandan researchers and health staff who work with me in Rakai, every one has lost family members to the epidemic. We thus urge that every effort be made to curb the spread of HIV.

2. What are the major routes of HIV spread in Africa?

HIV can be spread via unsafe injection practices and blood transfusion. Efforts to reduce such transmission by provision of single use syringes and needles, appropriate sterilization equipment, facilities for the disposal of contaminated injection materials, and high quality HIV screening of potential blood donors, are all highly desirable.

However, data from Africa do not support the hypothesis that unsafe injections represent a common route of HIV transmission in the Sub-Saharan region. Available evidence from a broad range of sources points to heterosexual transmission, followed by mother-to-child transmission, as the major routes of HIV spread on the continent.

Evidence regarding routes of HIV transmission in Africa.

To assess the main routes of HIV transmission, we must first examine the epidemiological patterns of infection by age, gender and reported behaviors, and assess which modes of transmission (unsafe injections, heterosexual and/or mother-to-child) are most plausible.

Age and gender patterns of HIV infection

Table 1 (attached) summarizes data from a number of African countries, showing the proportions of persons infected with HIV by age group and gender. The countries are illustrative of general patterns observed in the region. The data can be summarized as follows:

- Rates of HIV infection are low (below 1%) in children aged 5-14, and age at which mother-to child transmission does not occur and when sexual exposure is unlikely (Table 1).

- Rates of HIV infection increase, often dramatically, during adolescence and young adulthood, reflecting the onset of sexual activity (Table 1). The increase is usually more rapid among females. Our data and those of others show that girls in many African settings become sexually active at younger ages than boys, and sexual debut frequently occurs with men who are some years older: this places adolescent girls at higher risk than adolescent boys. We reviewed our most recent data on HIV acquisition in Rakai, and again found these patterns: only 1% of new infections occurred among persons aged 15-16, while over 90% occurred in persons aged 17-49, the age range of peak sexual exposure. In women in particular, the rate of new infections dropped to very low levels above age 50.

- In the great majority of HIV risk studies, rates of infection are closely associated with reported sexual activity, including numbers of partners. Similar patterns are observed with other STDs, such as HSV-2 (genital herpes).

- The age and gender distribution of HIV in Africa does not follow the pattern of receipt of injections (for vaccination and treatment in young children; for treatment in older persons).

HIV acquisition in infants and young children

- Although most infants and young children are exposed to multiple injections (for example, for immunization) the great majority of HIV-positive children in Africa acquire HIV from their infected mothers. In the absence of preventive therapy, approximately 15-20% of HIV-infected mothers transmit the virus to the infant in utero or at time of birth, and 10-15% transmit through breast milk.

Early in the recognized epidemic in Kinshasa, Zaire (currently Congo), Mann et al. reported that over a third of early childhood HIV infection was associated with blood

transfusion and injections. However, it should be noted that infant testing was still under development in the mid 1980s, and such high rates of non-vertical transmission have not been reported by other researchers or in more recent years. In a study in Kampala, Uganda, 98% of HIV-infected children had an HIV-positive mother (Muller and Moser, 1992). The probable causes of infection in the 2% of HIV+ children who had uninfected mother were transfusion and injections. In a separate study in rural Masaka, Uganda, over 2,500 children aged 5-12 were tested for HIV and only 10 (0.4%) were found to be infected: one of these 10 infections was attributed to transfusion and one to unsafe injections (Kengeya-Kayondo et al). When 3,941 initially HIV-negative children aged 0-12 were followed in the same district, only one child became HIV-infected over the subsequent year, probably through breast milk (the mother was HIV-positive). The authors concluded that, in this setting, no infections had arisen as a result of injections (Mulder et al).

Biological evidence for modes of transmission

Studies have shown that transmission from an HIV-infected person to a sexual partner is strongly associated with the infected person's HIV viral load (the amount of HIV in the blood). (Gray et al, Wawer et al, 2003), and with the presence of genital ulcer .

Comparison of HIV rates with rates of hepatitis C, an infection which is readily spread by injections, shows no common patterns throughout Africa. For example, South Africa has very high HIV rates but relatively low hepatitis C seroprevalence, whereas the opposite situation occurs in Tanzania (Madhava et al, WHO). However, HIV rates generally mirror those of HSV-2 (genital herpes) which is transmitted sexually, but not through unsafe injections (Wawer et al, 2001) .

Unsafe injections

There can be no doubt that unsafe injections represent a public health problem. For example, they have been implicated as major routes of transmission for hepatitis B and hepatitis C (Simonsen et al).; Also, many injections given world wide are unnecessary.

Hollow gauge needles, especially those used for intravenous injections or sample collection, can retain blood. HIV has been recovered from such needles for up to up to several weeks (Abdala et al). It is less clear whether syringes used for non-intravenous injection (i.e., subcutaneous or intramuscular injections, the types generally administered for immunization and therapy) pose a severe risk of HIV transmission. When syringes used to provide subcutaneous or intramuscular injections to HIV-infected clinic patients were subsequently tested for HIV content using highly sensitive HIV tests, only a small number (<4%) revealed the presence of potentially infectious material (Rich et al.). There is thus likely to be variability in the risk posed by unclean needles, depending on their type, use, and whether blood is left in the needle or syringe.

Although in some studies persons with established HIV infection report receiving more injections and uninfected persons, this may reflect receipt of injections for treatment of HIV-related illness. We recently re-examined our Rakai data and found no association between reported injections and the acquisition of new HIV infection: persons who did not acquire HIV actually reported slightly more injections from all sources (government clinics, medicine shops, traditional healers) than persons who acquired HIV during follow up.

The World Health Organization estimates that approximately 1.4-2.9% (or about 50,000-100,000) cases of HIV are spread annually in Africa through unsafe injections (WHO 2002). However, the risk may be spread unevenly between countries and regions, depending on background HIV rates and injection practices. Clearly, improving injection safety and reducing the number of unnecessary injections would be of public health benefit.

3. Conclusions

The data indicate that sexual transmission, and in infants, mother-to-child transmission, represent the most common routes of HIV infection in Africa.

However, there are also data that transmission via unsafe injections does occur in Africa, although it is not a main cause of the infection. Given the diversity of the African continent, great differences in medical resources and practices, and in the background rate of HIV infection, it is not possible to arrive at a meaningful summary estimate of the proportion of infections contributed by unsafe injections. The data, however, suggest that it is low and probably below 3% in the great majority of settings.

This should not be a reason for complacency. HIV researchers should reassess existing data to provide greater precision regarding the extent of potential injection-associated transmission, and of the circumstances under which it occurs. Wherever possible, HIV studies should include questions on injection and transfusion practices. Efforts to provide an adequate and long term supply of clean injection equipment, coupled with educational programs to promote needle safety and reduce unnecessary injections, would be of public health benefit.

From the viewpoint of HIV prevention, however, the data argue for continued concerted efforts to reduce risks of HIV transmission associated with unsafe sex and to improve prevention of mother-to-child HIV transmission.

Table 1.

Prevalence (% of persons with infection) of HIV infection by age and gender in a number of African countries.

Males Females Both sexes combined

% infected % infected % infected

Botswana, VCT clients (n = 49,726)

(P. Kilmarx)

Age 15-19 0.8 8.3

20-24 6.6 21.4

25-29 18.7 37.0

30-34 34.5 41.1

35-39 41.5 35.2

40+ 35.2 33.4

Burundi, 1989, national survey

Age 5-14 (n = 225) 0.9 0.9

15-24 (n = 477) 6.5 12.8

25-34 (n = 468) 10.2 10.7

Ethiopia, 1994, random household survey
 Age 5-13 (n = 621) 0 0.3
 5-19 (n = 793) 2.1 3.9
 20-29 (n = 879) 10.4 10.0
 South Africa, 1990, children with malaria
 Age 10-14 (n = 744) 0 0.5
 Tanzania, 1987, one region
 Age 5-9 (n = 531) 0.4
 10-14 (n = 454) 0
 15-24 (n = 626) 3.5
 25-34 (n = 510) 6.9
 Uganda, 1992, rural surveillance cohort (Kengeya-Kayongo et al).
 Age 0-4 (n = 1,411) 1.7
 5-12 (n = 2,500) 0.4
 13+ (n = 4,183) 8.2
 Additional assessment of all 10 HIV+ children aged 5-12:
 6/10 (60%) infected through mother-to-child transmission
 3/10 (30%) one each: sexual exposure, transfusion, unknown
 1/10 (10%) multiple injections

(Sources: Global AIDS Program, CDC; US Bureau of the Census; Kengeya-Kayongo, 1992; P. Kilmarz, e-mail communication, Tepelolepe VCT clients)

References:

- Abdala N, AA Gleghorn, MJ Carney and Robert Heimer. *J Acquir Immun Def Syndr*. 2001, 487-94.
- Gray RH, MJ Wawer, R Brookmeyer, NK Sewankambo, D Serwadda, F Wabwire-Mangen, T Lutalo, X Li, T vanCott, TC Quinn and the Rakai Project Team. Probability of HIV-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda. *Lancet*, 2001: 357: 1149-53.
- Kane A, J Loyd, M Zaffran, L Simonsen, M Kane. Transmission of hepatitis B, hepatitis C and human immunodeficiency viruses through unsafe injections in the developing world: model-based regional estimates. *Bulletin of the WHO*. 1999, 77: 801-7.
- Kengeya-Kayondo JF, SS Malamba, AJ Nunn, JA Seeley, A Ssali, DW Mulder. HIV-1 seropositivity among children in a rural population of south-west Uganda: probable routes of exposure. *Ann Trop Peadiatr*. 1995, 15: 115-20.
- Madhava V, C Burgess, E Drucker. Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa. *The Lancet Infectious Disease*. 2002, 2: 293.
- Mann JM, H Francis, F Davachi, et al. Risk factors for human immunodeficiency virus seropositivity among children 1-24 months old in Kinshasa, Zaire. *Lancet* 1986, 20: 654-7.
- Mulder DW, A Nunn, A Kamali, JF Kengeya-Kayondo. Post-natal incidence of HIV-1 infection among children in a rural Ugandan population: no evidence for transmission other than mother-to-child. *Trop Med Int Health*. 1996, 1: 81-5.
- Muller O, R Moser. Risk factors for paediatric HIV-1 infection in Uganda. Abstract PIC 4733, VIIIth International Conference on AIDS, Amsterdam, July 19-24, 1992.

Rich JD et al. AIDS, 1998; 12: 2345.

Simonsen L, A Kane, J Lloyd, M Zaffran, M Kane. Unsafe injections in the developing world and transmission of bloodborn pathogens: a review. Bull of the WHO. 1999, 7: 789-800.

Wawer MJ, D Serwadda, X Li, TC Quinn, NK Sewankambo, N Kiwanuka, G Kigozi, RH Gray. HIV-1 transmission per coital act, ay stage of HIV infection in the HIV+ index partner in discordant couples, Rakai , Uganda. Oral. Abstract. 40, 10th Conf on Retroviruses and Opportunistic Infections. Boston, Feb 10-14, 2003.

Wawer MJ, SM Eng, D Serwadda, MK Sewankambo, N Kiwanuka, C Li, RH Gray. Prevalence of Kaposi sarcoma-associated Herpesvirus compared with selected sexually transmitted diseases in adolescents and young adults in rural Rakai District, Uganda.. Sex Trans Dis, 2001; 28: 77-81.

WHO. AIDS Epidemic Update December 2002. Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organization. UNSAID/02.46E