REVIEW

Seroprevalence of Human Immunodeficiency Virus Type-1 Infection in Africa

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The epidemiological characteristics of HIV-1 infection in Africa have gradually been elucidated through various studies. The HIV-1 infection is believed to have existed in the 1960s in Africa and is presently epidemic in Africa. The HIV-1 seropositive rate for the general population is higher in urban regions than in rural areas. The peak age of males infected with the HIV-1 tends to be higher than that of females infected with the HIV-1. Sex difference is recognized in the HIV-1 seropositive rates. Heterosexual contact, mother-to-child transmission and contaminated blood transfusion are confirmed as the modes of HIV-1 transmission. Prostitutes and STD patients are recognized as being high-risk groups for the HIV-1 infection. Where HIV-1 infection is widely distributed in the general population, risk reduction strategies should place strong emphasis on safe-sex techniques in addition to the promotion of partner reduction. J Epidemiol, 1995; 5: 1-9.

HIV-1 infection, Africa, epidemiology

Acquired immunodeficiency syndrome (AIDS) first originated from an abnormal increase in the number of patients suffering from pneumocystis carinii pneumonia and Kaposi’s sarcoma in the United States in 1981 and was named AIDS by the U.S. Centers for Disease Control and Prevention in September 1982. The modes of HIV-1 transmission are, however, different in each region. Homosexual contact and injecting drug use (IDU) are recognized as major modes of spread of HIV-1 in the United States, while heterosexual transmission and IDU are dominant in Thailand and most of HIV-1 infection occurred among heterosexuals in India and the Philippines. In addition, heterosexual contact of HIV-1 is increasing in Japan.

The human immunodeficiency virus type-1 (HIV-1) and type-2 (HIV-2) were later recognized as the etiologic viruses of AIDS. In Africa, the former virus is strongly epidemic in Central Africa and East Africa, and the later is mainly epidemic in West Africa.

In this paper, we describe the epidemiological characteristics of the HIV-1 infection in Africa, particularly in Sub-Sahara (south of the Sahara region), which have been comparatively elucidated in various studies.

SEROPOSITIVE RATES OF THE HIV-1 IN AFRICA

There are now a large number of reports of HIV-1 seropositive rates in African countries and we have conducted summarized comparable data on HIV-1 seropositive rates in Tables 1-4.

(1) Urban and rural regions

Table 1 shows the HIV-1 seropositive rates in urban and rural regions. The HIV-1 seropositive rates were higher in urban regions than in rural regions. The HIV-1 seropositive rates are evidently greater in Central and East African countries than in other African countries. Of the Central and East African countries, Zaire, Uganda, Rwanda and Tanzania show the highest HIV-1 seropositive rates.

(2) Sex

Table 2 shows the HIV-1 seropositive rates by sex. Sexual difference exists. The HIV-1 seropositive rates in females generally higher than in males regardless of target groups.

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Table 1. Seropositive rates of HIV-1 in general residents by urban and rural regions (%).

| Country                        | Urban | Rural | References |
|--------------------------------|-------|-------|------------|
| (CENTRAL AFRICA)               |       |       |            |
| Zaire                          | 4.8-12.5 | 0.1-4.2 | 16, 17, 18, 19, 20, 21, 22, 23, 24, 25. |
| Uganda                         | 10.2-15.5 | 0-19.7 | 22, 26, 27, 28, 29, 30. |
| Rwanda                         | 9.5-15.7 | 1.4-8.5 | 17, 31, 32, 33, 34. |
| Central African Republic       | 2.2-9.7 |       | 35, 36. |
| Cameroon                       | 0.7-3.2 | 0-0.2 | 35, 37, 38. |
| Equatorial Guinea              | 0-0.3 | 0.3-0.5 | 22, 35. |
| Gabon                          | 0.1-1.8 | 0-0.8 | 22, 35, 39. |
| Congo                          | 0-5.5 | 2.6 | 35, 40. |
| (EAST AFRICA)                  |       |       |            |
| Kenya                          | 2.6 | 0.3-1.0 | 41, 42. |
| Tanzania                       | 5.2-32.8 | 0-4.8 | 22, 43, 44. |
| (SOUTH AFRICA)                 |       |       |            |
| Zambia                         | 14.8 | | 45. |
| Angola                         | 0-3.3 | | 46, 47. |
| (WEST AFRICA)                  |       |       |            |
| Mauritania                     | 0.4-0.6 | | 48. |
| Senegal                        | 0-0.02 | 1.0 | 22, 49, 50. |
| Guinea Bissau                  | 0.1 | | 51. |
| Guinea                         | 0.2 | | 22. |
| Ivory Coast                    | 1.1-8.0 | 0-2.7 | 52, 53, 54, 55, 56. |
| Nigeria                        | 0-0.6 | 0-0.1 | 22, 57, 58. |

(3) Pregnant women and children

Table 3 shows the HIV-1 seropositive rates of pregnant women and children. The HIV-1 seropositive rates of pregnant women tend to be higher in the countries where the HIV-1 is epidemic in general residents. The HIV-1 seropositive rates of children are the highest in Zaire, Uganda, Tanzania and Zambia. The HIV-1 seropositive rates in children are lower than in pregnant women. The HIV-1 seropositive rates in non-AIDS pediatric patients are higher in general children.

(4) High risk groups

Table 4 shows the HIV-1 seropositive rates of patients with sexually transmitted disease (STD), blood transfusion or medical injection-experienced persons and prostitutes. The HIV-1 seropositive rates in these groups are evidently higher than in general residents. The prostitutes have the highest HIV-1 seropositive rates regardless of the countries and become an important key category in the spread of the HIV-1 infection in Africa.

DISCUSSION

Basic virological, serological and clinical studies are important for understanding of HIV-1 pathogenicity. However, basic studies can not clarify virus distribution, infectious risk factors and/or transmission modes. Epidemiological research and analysis is required for this purpose. The monitoring of the HIV-1 epidemic has been carried out gradually in the general residents, patients and high-risk group in Africa. As a result, although the HIV-1 infection in the general residents, children, patients and prostitutes in African regions are reported, it is known that HIV-1 infections are concentrated generally in Central and East Africa (Table 1-4). The higher seropositive rates were seen in general among prostitutes and the STD patients.

The HIV-1 infection is mainly transmitted by sexual contact in Africa. This is known because STD patients and prostitutes have the highest HIV-1 seropositive rates (Tables 4). Low-class prostitutes have higher HIV-1 seropositive rates than high-class prostitutes\(^{115-117}\). Infections are present in heterosexual-contact partners of the HIV-1 seropositive\(^{56,113,118-120}\) and in the persons with multiple sex partners\(^{29,64,106,117,121}\). The frequent sexual contacts with different partners is an important factor more than the types of sexual intercourse\(^{122}\). In addition, seropositive rates among groups with using condom are lower than with non-using condom\(^{123}\). As for the peak age with the HIV-1 infection, the female seropositives are aged from 20 to 29 years, while the male seropositives are aged between 30 and 39 years\(^{29,45,66,}\). Males tend to be older than females. These facts suggest that sexual contact plays a key role as one of the modes of HIV-1 transmission.
HIV-1 Infection in Africa

Table 2. Seropositive rates of HIV-1 by sex (%).

| Country                        | Male  | Female | Remarks                  | References |
|--------------------------------|-------|--------|--------------------------|------------|
| (CENTRAL AFRICA)               |       |        |                          |            |
| Zaire                          | 5.3   | 8.1    | General residents        | 19.        |
| Zaire                          | 2.8-4.5| 3.7-8.2| Textile workers & their wives | 22,63.    |
| Zaire                          | 5.5-5.8| 3.7-7.3| Bank workers & their wives | 22,63.    |
| Zaire                          | 47.5  | 58.9   | Inpatients               | 60.        |
| Zaire                          | 3.9-43.7| 9.4-57.6| Patients                 | 61,62.    |
| Zaire                          | 12.4-33.7| 230.0-43.3| Patients with TB        | 63.        |
| Uganda                         | 4.4-15.2| 5.3-23.9| General residents        | 26,29,30,64,65,66. |
| Uganda                         | 28.6  | 57.4   | Bar, Hotel workers       | 29.        |
| Uganda                         | 28.1  | 38.0   | Vendors                  | 29.        |
| Uganda                         | 7.1   | 18.2   | Students                 | 29.        |
| Uganda                         | 12.2  | 15.6   | Agriculture              | 29.        |
| Uganda                         | 19.4  | 29.3   | MI in 60 Months          | 29.        |
| Uganda                         | 31.2-36.0| 33.7-39.6| Patients with STD        | 29,67.    |
| Rwanda                         | 1.3-14.6| 1.4-25.0| General residents        | 31,34.    |
| Central African Republic       | 1.4-3.5| 5.5-11.4| General residents        | 37.        |
| Central African Republic       | 10.7  | 2.2    | Workers                  | 37.        |
| (EAST AFRICA)                  |       |        |                          |            |
| Kenya                          | 2.9-5.9| 4.1-8.1| Patients with STD        | 68.        |
| Kenya                          | 19.7  | 17.3   | Patients                 | 79.        |
| Tanzania                       | 9.3-24.0| 12.2-38.9| Patients with STD        | 43,70.    |
| Tanzania                       | 0-8.0   | 0-38.7  | Bar workers              | 22.        |
| (SOUTH AFRICA)                 |       |        |                          |            |
| Zambia                         | 26.9  | 45.0   | Patients with STD        | 45.        |
| Angola                         | 10.2-22.8| 10.6-30.8| Patients with STD        | 22,47.    |
| Angola                         | 3.6   | 2.5    | General residents        | 47.        |
| Angola                         | 19.0  | 3.2    | Patients with TB         | 47.        |
| Angola                         | 5.1-5.2| 4.1-5.1| Patients                 | 47.        |
| South Africa                   | 1.9   | 3.2    | Zulu patients            | 71.        |
| (WEST AFRICA)                  |       |        |                          |            |
| Ivory Coast                     | 3.6-5.1| 2.1-3.0| General residents        | 56.        |

Note: Items showed in remarks are target materials used in each article.

STD; Sexually transmitted disease. TB; Tuberculosis. MI; Medical injection.

This is likely to be due to the movement and migration of the high sexual activities spreading the HIV-1 by sexual contact.

In Africa, Blood transfusion is frequent for the therapy of malaria and sickle cell anemia. Unfortunately, the more blood transfusion the children have received, the higher the HIV-1 seropositive rates have been reported. Blood transfusion-experienced adults also have higher HIV-1 seropositive rates in the general residents. The history of blood transfusion is a behavioral factor of HIV-1 infection in Africa.

Injections are also frequently carried out in Africa, and this fact is related to the peculiar African custom of patients preferring to receiving parenteral therapy rather than oral medicine. The number of medical injections are related to the HIV-1 seropositive rates in Africa regardless of age or sex.

These facts suggest that blood transfusion and medical injections through insufficient treatment are the important mode of HIV-1 transmission. Because blood transfusion and medical injections are so frequent in Africa, guidelines should be developed for improved laboratory service and reduction of unnecessary blood transfusion.

It is also a serious problem for pregnant women that the HIV-1 can be contracted through heterosexual contact. The HIV-1 seropositive rates of pregnant women are increasing. The peak age of HIV-1 seropositive rates in pregnant women is between 20 and 29 years, and it is reported that HIV-1 seroprevalence is associated with syphilis seropositivity in pregnant women. It is feared that HIV-1 infections will spread to children, because it is estimated that the transmission rate of HIV-1 from mother...
Table 3. Seropositive rates of HIV-1 on maternal and child (%)

| Country         | Pregnant women | Children (0-12) | Children (0-24) | References     |
|-----------------|----------------|-----------------|-----------------|----------------|
| (CENTRAL AFRICA)|                |                 |                 |                |
| Zaire           | 2.2-9.0        | 0.6-12.4        | 0.3-35.6        | 19, 20, 25, 61, 72, 73, 74, 75, 76, 77, 78, 79. |
| Uganda          | 10.8-24.1      | 0 -10.1         | 15.4            | 26, 80.        |
| Rwanda          | 32.0           | 0 -10.1         | 15.4            | 34, 81, 82.    |
| Cameroon        | 0.9-2.2        | 0 - 0.2         |                 | 22, 35, 38, 83, 84. |
| Gabon           | 0 -1.2         |                 |                 | 22, 85.        |
| Congo           | 3.8-7.9        |                 |                 | 22, 40, 86.    |
| (EAST AFRICA)   |                |                 |                 |                |
| Kenya           | 0 - 8.8        |                 |                 | 22, 41, 68, 85, 87. |
| Tanzania        | 0.7-16.0       | 0 - 24.1        | 5.0-32.7        | 22, 43, 44, 70, 88, 89. |
| (SOUTH AFRICA)  |                |                 |                 |                |
| Zambia          | 8.7-22.2       | 0 - 10.7        |                 | 45, 90.        |
| Malawi          | 2.0-17.6       |                 |                 | 91.            |
| Angola          | 0.3-10.5       |                 |                 | 46, 47.        |
| (WEST AFRICA)   |                |                 |                 |                |
| Mali            | 0.3            |                 |                 | 22.            |
| Guinea Bissau   | 0 - 0.1        |                 |                 | 22, 92.        |
| Ivory Coast     | 0 - 7.4        | 0.6-2.0         | 9.2             | 22, 93, 94, 95. |
| Nigeria         | 0 -2.9         |                 |                 | 96, 97.        |

Table 4. Seropositive rates of HIV-1 in risk groups (%).

| Country         | Sexually transmitted disease | Blood transfusion | Medical injection | Prostitute | References     |
|-----------------|------------------------------|-------------------|-------------------|------------|----------------|
| (CENTRAL AFRICA)|                              |                    |                   |            |                |
| Zaire           | 15.5                         | 16.7               | 10.8-18.7         | 0 - 40.0   | 20, 22, 75, 98, 99, 100, 101. |
| Uganda          | 10.6-42.6                    | 4.2                | 25.5              | 25.0       | 22, 29, 64, 67, 102. |
| Rwanda          | 23.2-30.6                    | 30.0-56.3          | 20.4-20.7         | 74.5-87.9  | 18, 31, 103, 104. |
| Cameroon        | 1.5-2.6                      |                    | 7.1-7.3           |            | 22, 38, 40, 83, 84, 85. |
| Congo           |                              | 12.2               |                   |            | 40, 86.        |
| (EAST AFRICA)   |                              |                    |                   |            |                |
| Kenya           | 0 -20.7                      |                    | 5.1               | 4.3-5.8    | 22, 41, 68, 87, 106. |
| Tanzania        | 0 - 29.1                     | 4.7-9.1            |                   | 4.3-5.8    | 43, 44, 70, 88. |
| Somalia         |                              | 0 -3.0             |                   | 107.       |                |
| Djibouti        |                              | 4.5-9.7            |                   |            | 108.           |
| Madagascar      | 0 - 0.1                      |                    |                   |            | 109.           |
| (SOUTH AFRICA)  |                              |                    |                   |            |                |
| Zambia          | 22.8-45.0                    |                    |                   |            | 45.            |
| Angola          | 10.3-30.8                    |                    |                   |            | 22, 47.        |
| (WEST AFRICA)   |                              |                    |                   |            |                |
| Senegal         | 1.4-1.5                      |                    |                   | 0.9-3.1    | 22.            |
| Gambia          | 0 - 1.1                      |                    |                   | 0 -13.5    | 22, 110, 111, 112. |
| Ivory Coast     | 5.8                          |                    |                   | 6.9-9.5    | 22, 53, 93.    |
| Burkina Faso    |                              |                    |                   | 14.6       | 52.            |
| Benin           | 19.8                         |                    |                   |            | 113.           |
| Nigeria         | 0                            |                    |                   | 0 -12.3    | 22, 114, 115.  |
to child is 25% to 40% (53,129-133). The mother to child transmission is an important mode of HIV-1 epidemic in Africa.

With regard to clinical factors on HIV-1 infection, an evident relationship between the HIV-1 infection and history of STD (Table 4), and HIV-1 seropositive rates in STD seropositive group tend to increase (68,84). However, the whole relationship between HIV-1 infection and history of TB is now still unclear in Africa because reports are not many, although sporadic reports show the HIV-1 seropositive rates among TB patients (47,84,85,134,135). Further studies of the epidemiology of HIV-1 infection will be necessary in the future on how frequently TB appear in Africa (90,130,136-143).

The traditional cultural practices, such as/labial and gingival tootooing, clitoridectomy, scarification, and circumcision are preformed in Africa as African custom (50). Several reports suggest that the lack of circumcision is a cofactor facilitating HIV-1 transmission (90,138,144-146). However, the relationship between the traditional practices and HIV-1 transmission is not clarified so far (50). The potential for HIV-1 transmission by these traditional practices should be re-assessed.

In Africa in general, when AIDS affects the general heterosexual population (147), a very high proportion of adult transmission of HIV-1 is likely to be through heterosexual contact. STD is probably cofactors that increase the HIV-1 transmission in Africa. Where HIV-1 infection is widely distributed in the general population, risk reduction strategies should, in addition to the promotion of partner reduction, place strong emphasis on safe-sex techniques. Interventions designed to change male sexual behavior are also urgently needed.

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