strikes a population which is not only susceptible to sexually transmitted diseases but which is also structured socially to hasten the transmission of the HIV-1 virus. Such structuring of a population to make it vulnerable to STDs is an integral part of the peripheral status of eastern, central, and southern Africa. As argued above, the social structuring of the family unit and labor migrancy are related closely to partial proletarianization and incomplete separation from the land, characteristics of a peripheral labor force (Friedman 1984; Martin 1984; J. Smith 1984; Wallerstein 1984; Wallerstein and Martin 1979).

Past data on prevalence of sexually transmitted diseases show clearly that the pattern of STD spread described above has occurred. For instance, in studies completed in the 1960s and early 1970s, the primary risk factor for gonorrhea in eastern Africa was male labor migrancy, with a pool of infection in the female prostitute population (Bennett 1962; Verhagen and Gemert 1972). The pattern of spread from urban and labor concentrations to rural areas also was confirmed for gonorrhea (Bennett 1964). Prevalence data also establish that higher rates of STDs are present around labor concentrations.

An especially well-documented example in west Africa may suffice to show this relationship. In Cameroon, migrant workers "were and are considered to be a major cause of a high incidence of venereal disease among the population in the plantation environs" (DeLancey 1978, p. 172). This is the area of labor concentration in Cameroon; DeLancey regards the return of migrant laborers to rural areas as a problem in this area. Further, a 1949 health survey showed a 4.2 percent rate of gonorrhea infection in rural areas far from these labor concentrations, in contrast to 13.1 percent and 10.4 percent rates in areas directly surrounding the concentrations. In 1948 a 21 percent rate of gonorrhea infection was found in the heart of the migrant labor district in Cameroon (DeLancey 1978, p. 179). Labor migrancy in west Africa has declined since the 1940s, however, so this pattern may no longer be in evidence in that area.

Urethral stricture is a common long-term result of STD, particularly of gonorrhea. A spatial mapping of this condition for Zambia, in east central Africa, shows that it is most prevalent in the copper belt of Zambia, the primary labor concentration area. The second highest area of prevalence is in the northeast of Zambia, a labor reserve area (Kibukamusoke 1975). Further, the condition is much more prevalent in Uganda in the labor concentration area: it forms a half moon around Kampala and Lake Victoria, and shows secondary concentrations in the West Nile district and in Kigezi and Ankole. Migrant labor is drawn from these areas into the Kampala area (Kibukamusoke 1975).

Thus the pattern of the eastern and central African labor market—a migrant labor system based on labor reserves, surpluses of laborers, and a laboring population separated only partially from the land—may account for many of the differences between the AIDS epidemic in the United States in the African population. In Africa as in North America, AIDS required a population that was vulnerable to sexually transmitted diseases. In each case the virus first made its inroads into these populations. In Africa, a population structured socially by capitalist agriculture and a labor market created in its present form by dependency development gave AIDS the foothold it required. The prevalence of malnutrition, malaria, measles, and other diseases that resulted from the collapse of local food production and from Africa's dependency development pattern has resulted in a population whose health is continually compromised. Large numbers of persons have immune systems weakened not only by diseases but also by malnutrition, a condition which also may help to set the stage for AIDS infection (P. Epstein and Packard 1987; Hall and Langlands 1975; McCance and Rutishauser 1975). In North America, a gay population that had had a sexually transmitted disease problem for at least a decade was the foothold for the HIV virus (Altman 1986; Shilts 1987). In each case the initial stages of the epidemic were determined by the population in which the virus was able to establish itself. In both cases it appears that although these populations affect profoundly the perceptions of AIDS, the HIV-1 virus will not confine itself to these sites. They are simply the populations that were most vulnerable at the outset.

This model for the spread of the AIDS epidemic relies on the scientific understanding of the HIV-1 virus and of its transmission capabilities. We know that this virus is spread in much the same way as hepatitis B, by body

fluids and particularly during sexual activity. We also know that previously untreated STDs, especially when they may cause breaks in the skin or ulcers, increase the likelihood of infection on exposure to HIV-1 (Schoub et al. 1988; Simonsen 1988; Stamm et al. 1988). Both in Africa and in the United States, large numbers of sexual partners increase the possibility of infection with HIV-1 and the resulting development of AIDS (Carswell 1987; Curran 1985).

This model of the AIDS epidemic in eastern and central Africa also relies on an understanding of historic patterns of development in this area. The context of dependency development, combined with studies of medical and population geography for the region, gives an outline of the probable high-prevalence areas in countries in east Africa and indicates which groups in the population will have high prevalence and high incidence rates of HIV-1 infection. The following section will discuss in greater detail the implications of this model in medical and population geography and in population subgroups by presenting a series of hypotheses regarding the prevalence rates of HIV-1 infection, primarily in Uganda and in neighboring Burundi and Rwanda in eastern Africa.

AIDS: THE PATTERN OF AN EPIDEMIC IN AFRICA

If the model that was presented above its valid for the AIDS epidemic in eastern and central Africa, the pattern in which the epidemic appears should show some evidence of the expected modes of transmission. In other words, if the epidemic occurs geographically in areas with high concentrations of male migrant labor, and particularly among males and females who have high levels of heterosexual activity, then high prevalence or incidence rates should appear first geographically in areas where labor is concentrated. Further, two population groups in these areas should be affected: the male migrant laborers themselves and their partners, usually female prostitutes living near the enclave of development. Thus a high rate of infection in these two groups would fit the model.

Further, if the spread of the HIV-1 virus occurs through the return of male migrant laborers and female prostitutes to their villages due to illness, the second geographic sites that should begin to show high rates of infection are those areas in eastern and central Africa known as labor reserves. If we assume that the rural areas are infected with HIV-1 after the labor concentration areas are infected, these rural areas should show lower prevalence rates than the labor concentration areas. Yet the labor reserves—the migrant labor pool areas—should show higher rates of infection than surrounding rural areas which do not provide migrant labor. Thus prevalence of HIV-1 in the areas from which migrants are drawn by contract in order to provide the workers necessary for production should lag somewhat behind the areas where these workers labor. When the workers return home carrying HIV-1, it is assumed in this model that they will pass the infection on to their partners and to others after their return.

The prostitutes from these areas of male migrant labor concentration also tend to return home when illness prevents them from continuing their work. This trend may be less definite because prostitutes are not dismissed formally. They may continue prostitution activities and delay returning home, even though they are quite ill. They may be able to continue working and generating some income, although their capacity may be reduced considerably.

The brief discussion in this paper concerning the historical, social, and economic development of eastern, central, and southern Africa points in a number of directions for further research and study. As a start, available data concerning HIV-1 seropositivity and AIDS prevalences can be used to test the pattern of the epidemic. Do the available data on seropositivity and AIDS prevalence fit the pattern that would result from the description presented above? We can use this description to generate the following 14 hypotheses based on the above argument:

1. Geographically, areas of migrant labor concentration should show high prevalence rates of HIV-1 infection. These sites include mining areas, commercial plantations, and some large cities.
2. Geographic areas from which migrant laborers are drawn should show high rates of prevalence for HIV-1 infection.
3. The prevalence of HIV-1 infection in labor reserves should be higher than in

rural areas that do not form labor reserves.

4. Geographic areas from which young women migrate to become prostitutes should show high prevalence levels of HIV-1 infection. These rates should be higher than for other rural areas. Again, the rate of HIV infection in rural labor reserves should be higher than in areas of stable commodity production by peasants.
5. Because of earliest transmission by migrant labor to the rural labor reserves, HIV-1 seropositivity should appear earlier in these areas than in surrounding rural areas or in areas of stable peasant agricultural commodity production. This difference may be due to temporal differences in transmission as well as to reduction in the number of sexual partners once a migrant laborer returns home.
6. The prevalence rates for areas where migrant labor is concentrated should be somewhat higher than for the rural labor reserves, the areas from which migrant labor is drawn.
7. HIV-1 seropositivity should appear earliest in the areas where migrant labor is concentrated, such as mining areas, plantations, and cities.
8. Migrant laborers themselves should show higher rates of infection than other groups in the population.
9. For male migrant workers, the rate of HIV-1 seropositivity may increase with length of labor contract or time away from the family.
10. There should be a lower rate of prevalence among permanent migrant laborers who are allowed to take their families to the job site.
11. Prostitutes concentrated in areas where male migrant labor is located should show higher rates of infection than other women in the population. Further, prostitutes located in areas of migrant labor concentration should show higher levels of HIV-1 seropositivity and AIDS than prostitutes in areas migrant labor does not concentrate. These rates should bias the age and marital status data concerning women who are infected with HIV-1. Therefore infected women should be younger and more often single than infected men.
12. Higher prevalences and earlier occurrences should appear among those who previously suffered sexually transmitted diseases (STDs). This population is constructed socially and biologically to transmit these diseases.
13. There should be lower prevalences among persons on the rural labor reserves who have not migrated for laboring contracts, and among their families.
14. HIV-1 seropositivity should evidence a complex pattern of spread. The epidemic will not spread from rural areas to the city, as would be posited by a disease which is endemic for long periods of time in rural areas and which breaks out into the larger population because of social disruption. Such a pattern should appear earlier and in higher prevalences in rural areas. Rather, HIV-1 seropositivity should evidence a movement from areas of labor concentration to rural labor reserves and outward from these latter foci of infection to the general rural community. The degree of movement of HIV-1 seropositivity and AIDS into a labor reserve should depend on the quantity of migrant labor employed from that reserve, the length of time of contracts or absences, the age of laborers who migrate, the type of employment to which migrants are moving, the number of women leaving for the city and the work they obtain, and the rate of return of ill women and migrant laborers. The direction of movement should depend on where most of the migrant labor originates, where recruiting occurs, and from what areas women are leaving. In other words, numerous factors that influence the sexual and migratory patterns in eastern, central, and southern Africa will affect the spread and transmission of HIV-1 seropositivity and AIDS. The principal organizing factor, however, is the fact of labor migrancy and the labor reserve. From this central point one can begin to investigate the variations and the complex movement of the epidemic.

DATA AND PREVALENCE SURVEYS

Hypotheses 1, 2, 3, 4, 5, 6 & 7

Do the available data support the 14 hypotheses presented above? Do the actual AIDS prevalence and seropositivity studies conducted in eastern, central, and southern Africa conform to these hypotheses? Caution is advised because, as already mentioned, data are sometimes unreliable and fragmentary. In addition, as mentioned earlier, the ELISA test for HIV-1 immune response may be much less reliable in Africa than elsewhere (Biggar et al. 1985). Of course, in Uganda the use of the WHO case definition (Berkeley, Okware, and Naamara 1989), which does not rely on laboratory work, makes this unreliability less of a problem.

Further, the process of HIV-1 transmission, which was outlined above, is dynamic. Much of the data concerns prevalence, which can be examined spatially or geographically; incidence data are relatively scarce. Prevalence data are inherently static, not dynamic, and we can only infer the dynamic process from the static data. It is rare, however, to find truly adequate data in social science; therefore let us pursue the available data to see if they agree with the above model and with the hypotheses that the model has generated. In the discussion that follows refer to Figure 1, a map of Uganda, including district names. See also Figure 2 which shows the labor concentration areas and the labor reserve areas in Uganda. This map is derived from historical accounts and migration data from the Ugandan census (Kabera 1982; Mamdani 1976; Gimui 1982).

FIGURE 1. Map of Uganda

These hypotheses concern the geographical and temporal distributional evidence for the pattern of HIV-1 transmission outlined above. Geographical distribution is capable of eliciting transmission patterns in some diseases (Hall and Langlands 1975; Hunter 1974; McGlashan 1972; Meade 1980; Pyle 1979).

It is clear that AIDS cases and HIV infection generally have been most serious in cities in Uganda and in much of eastern Africa (Berkley et al. 1989; Biggar 1986; Economist 1987; Georges et al. 1987; Harden 1986; Harden 1987; Mann, Francis, Quinn, et al. 1986; Mugerwa and Giraldo 1987; Mugerwa, Widy-Wirski, and Okwake 1987; Van de Perre 1984). These are areas of labor concentration. This conclusion is also confirmed by cumulative prevalence data from Uganda (see Figure 3), which establish that the highest prevalence rate of AIDS in Uganda is contained in the half-moon area along the lakeshore of Lake Victoria, particularly in the Masaka and Kampala-Entebbe areas (Berkley et al. 1989, p. 83).

The problem with these data is that they reflect not only the possible reality of the epidemic but also the availability of medical facilities in these regions of Africa. Most medical facilities that are capable of recognizing and diagnosing AIDS in central and eastern Africa are concentrated almost exclusively in cities (Hall and Langlands 1975; Navarro 1974). Thus these areas will show a predominant number of diagnosed cases. Individuals from rural areas may not even be able to travel to the cities for diagnosis and may be either misdiagnosed or not treated at all. It has been noted frequently that AIDS patients in eastern Africa are more well-to-do than the average population (Georges et al., 1987; Harden 1987; Van de Perre 1984). This finding also may reflect the comparative ease with which the most affluent classes are able to enter the medical system in contrast to poorer or rural individuals.

In Uganda, however, it has been claimed that the prevalence of HIV-1 seropositivity does not seem as high in Kampala as elsewhere (Economist 1987), and that the southwest areas of the country have higher HIV-1 prevalence rates. This conclusion seems to be refuted by recent, more comprehensive studies and cumulative prevalence data (Carswell 1987; Berkley et al. 1989) (see

FIGURE 2. Labor Concentrations and Labor Reserves in Uganda

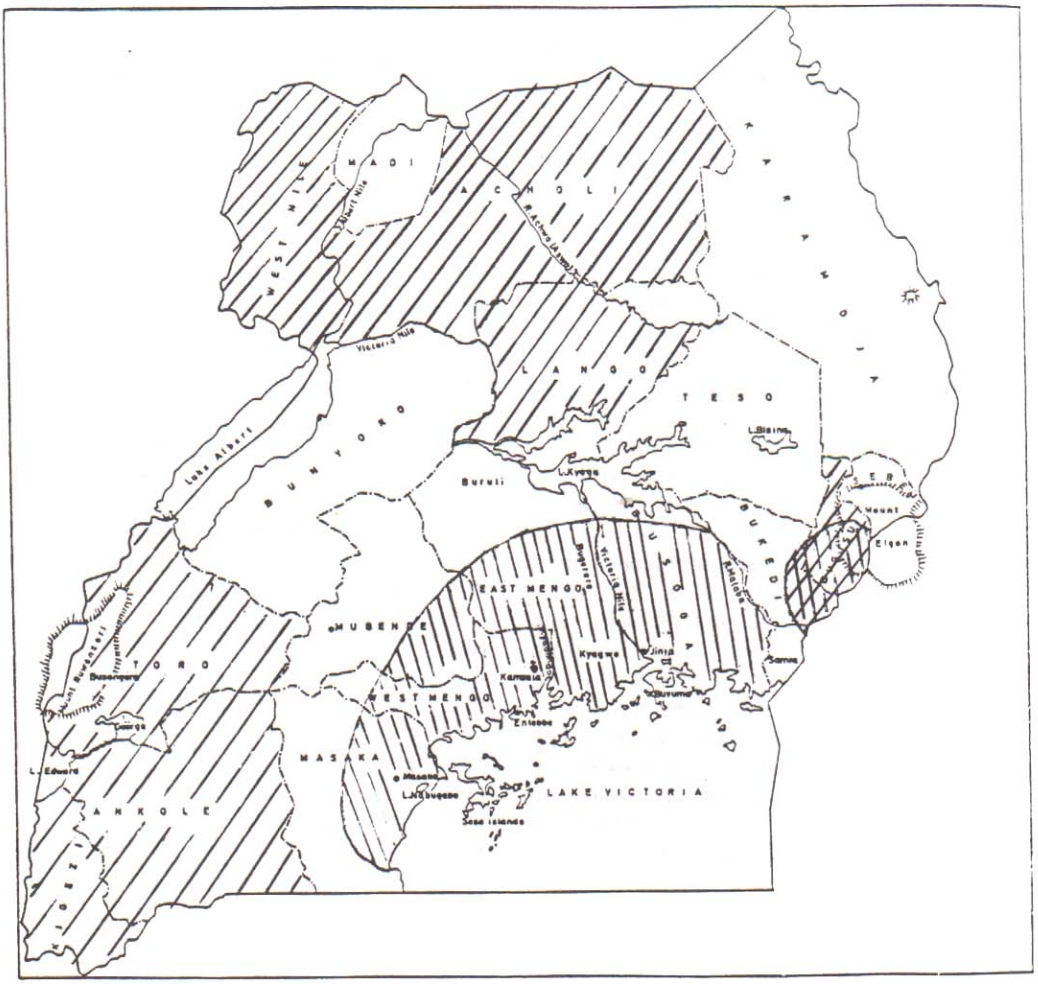

Figure 3). In general, rural residents, particularly in the peasant farming areas of central Uganda, seem to have a rather low rate of HIV-1 seropositivity and AIDS (Berkley et al., 1989; Carswell 1987; Harden 1987; Van de Perre 1984). In Rwanda and Zaire the infection rate in the country is far lower than the very high rate in the cities (Specter 1986). We can say, however, that rural southwestern Uganda appears to have very high prevalences of AIDS cases and HIV-1 infection (Berkley et al. 1989; Economist 1987; Serwadda, Seqankambo, Carswell, Bayley, Tedder, Weiss, Mugerwa, Lwegaba, Kirya, Downing, Clayden, and Dalgleish 1985). It has been estimated that one-third of this population is infected with HIV-1 (Economist 1987). It is clear from the cumulative prevalence data of AIDS cases that the southwest areas, particularly Anchole and Toro, have quite high rates of AIDS cases, in the 11-50/100,000 range. These two areas are labor reserves with high rates of circulating migration for work in the core developed areas in Uganda.

In studies of prostitutes in the town of Rakai, an area of major labor concentration south of Kampala, some 86 percent were HIV-1 positive (WHO 1988). Barmaids were 80 percent seropositive in this same area. It is