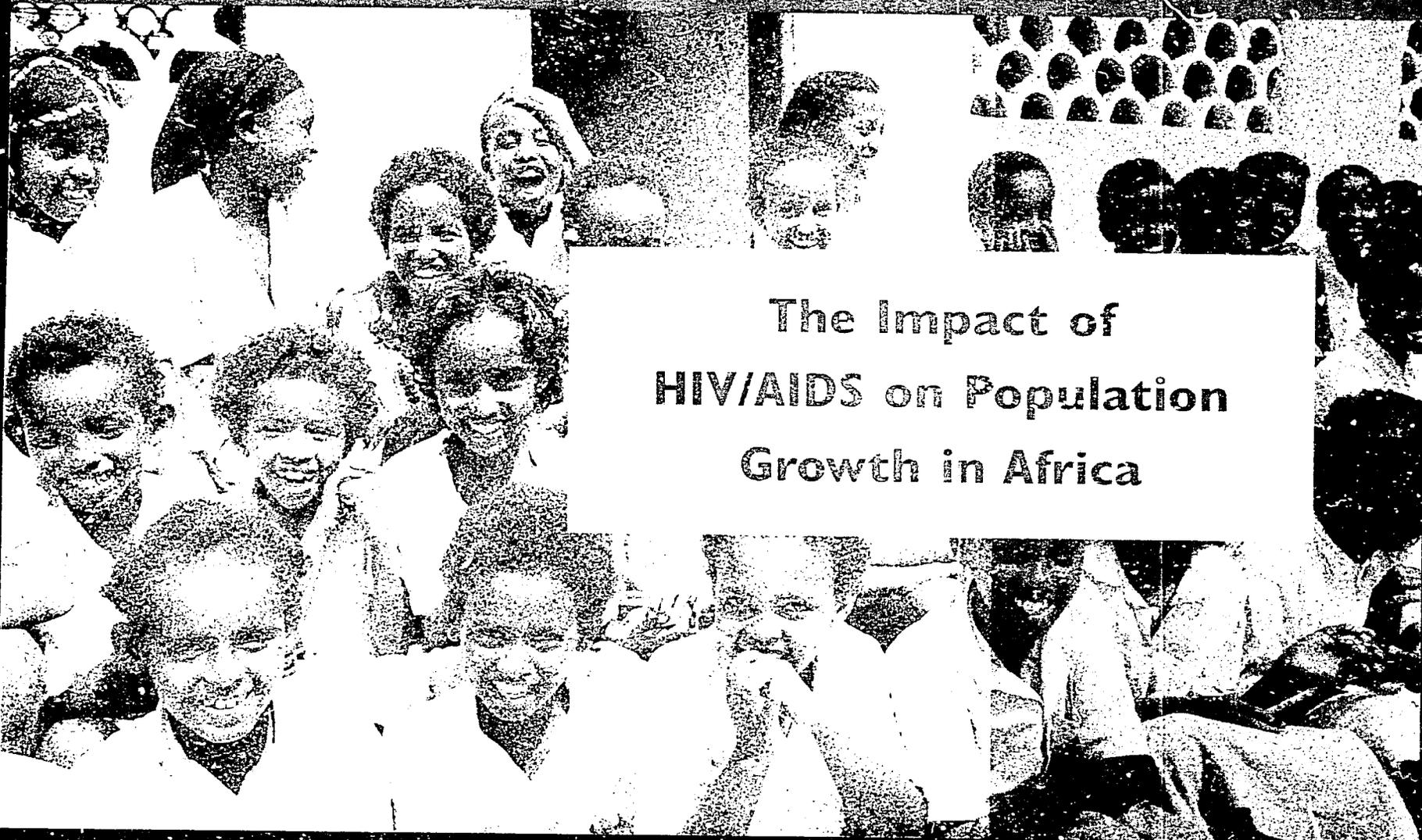


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# AFRICAN POPULATION ADVISORY COMMITTEE



## The Impact of HIV/AIDS on Population Growth in Africa

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## SUMMARY

When it was first recognized that AIDS would be a critical global health problem and that Africa would be particularly hard hit by the disease, there was speculation that AIDS might ultimately lead to population decline in many African countries. Over the last six years, various attempts have been made to model the spread of HIV and the impact of AIDS. In a number of instances these models have been used to assess the impact of AIDS on population growth. The results have been quite diverse. Some researchers have reported that AIDS will lead to negative population growth while others have said that this is not the case. Media reports on this debate have tended to highlight the potential negative impacts with headlines such as "Britain Sees AIDS Halting Africa Population Rise" (*New York Times*, June 22, 1992).

This report takes a critical look at the different projections of AIDS' effect on Africa's population growth rate and examines the reasons for the apparent disagreements. The best evidence to date leads to the conclusion that AIDS is likely to cause negative population growth in some sub-national regions in Africa and might do so in a small number of major cities, but that the disease is unlikely to cause negative population growth in any entire country in Africa. However, there is no reason for complacency. Worldwide, the epidemic is still in the early stages. Even if AIDS does not cause negative population growth in any country, it will have severe consequences. Millions of people will be affected by AIDS either directly or indirectly.

This conclusion highlights several key policy options:

- Effective AIDS control programs, particularly in urban areas, need to be implemented in order to control the spread of the disease.
- No matter what the effect of AIDS on population growth rates, development and/or expansion of effective family planning programs should still be supported. Family planning programs are designed to provide couples with the information and means to have the number of children they want, when they want them, and to improve maternal/child health—crucial services whatever the population growth rate. Family planning programs can also serve to reach the sexually active population with messages, counseling, and services to combat the spread of AIDS.
- Governments should plan for the impact of AIDS on their national development. The impact of AIDS-related mortality on special populations (in the capital city or key occupations for example) should be recognized and addressed by planners and policy makers.

## BACKGROUND

Several researchers have examined the impact of AIDS on population growth.<sup>1</sup> The conclusions they report vary significantly. Consider the following two quotes:

“.. new analyses support earlier predictions that in the worst-affected areas AIDS is likely to change population growth rates from positive to negative values in a few decades.”<sup>2</sup>

“..we can conclude that population growth rates are unlikely to turn negative in Central Africa. More likely, the population growth rates in Central and East Africa will not drop below half their current values.”<sup>3</sup>

The first quote summarizes the work of R.M. Anderson and colleagues, who have presented a number of papers describing the results of modeling work that demonstrates that AIDS could lead to zero or

negative population growth.<sup>2,4</sup> They use an age-structured model with assumptions based on international data to describe epidemiological processes, rates of partner change, and demographic trends. Their results show that AIDS can cause negative population growth within 30 to 60 years, under some circumstances, in a population with an initial growth rate of 4 percent. In Anderson's model, HIV prevalence rates rise to 50 percent at the time population growth rates become negative.

However, the work by Anderson and his colleagues has often been misinterpreted and misquoted by the popular press. The most glaring example of this is a *New York Times* article in June of 1992 that reports on comments made by Anderson at a conference in Nairobi. In this article he is described as stating that Uganda is likely to have negative population growth after the year 2002 and that

the other severely affected countries in Africa will have negative population growth rates within 20 years. Anderson's actual comments were quite different. He said that population growth *might* become negative in some countries within 20 years and that it is *likely* to become negative in some *regions* of Uganda (Rakai, maybe Kampala) within the next decade.

The second quote is based on John Bongaarts' model of AIDS and population growth that is age-structure based and includes both high and low risk groups.<sup>5</sup> He finds that the population growth rate in a high fertility setting would not decline by more than half even in the most severe cases. The major reason for this result is that HIV prevalence rates in Bongaarts' model level off at about 20 percent of adults, never reaching the high levels that are obtained in Anderson's model.

Way and Stanecki used a different model—called the iwgAIDS model (Inter-Agency Working Group on AIDS)—to reach conclusions similar to Bongaarts'.<sup>6</sup> This model disaggregates the population by several dimensions including age, sex, urban/rural residence, marital status, STD status, and risk group. In a simulation of a typical African country, they report that the population growth rate would decline from about 2.8 percent per year to 2.2 percent over a 25-year period due to demographic trends alone. Including the impact of AIDS, the population growth rate would decline to 1.8 percent, as HIV prevalence levels reach about 8 percent of adults after 25 years.

The Bulatao model, used at the World Bank, also examines the spread of HIV through a series of behavioral and epidemiological equations.<sup>7</sup> It shows that AIDS will have an impact on population

## ESTIMATING THE DEMOGRAPHIC IMPACT OF AIDS

growth but will not lead to negative population growth in any country in Africa. This model has been used to estimate the impact of AIDS on population size in all African countries. Bos and Bulatao do not expect AIDS to reduce population growth rates by more than 0.5 percent in even the most severely affected countries.

A review of this work leads to two key questions:

**Why do different researchers, each using sophisticated modeling and analysis techniques, reach different conclusions about the impact of AIDS on population growth?**

**What will be the likely impact of AIDS on Africa's population growth?**

Estimating the demographic impact of AIDS requires information about how AIDS affects the natural demographic processes of births and deaths. For AIDS to lead to negative population growth, it would have to increase the death rate and/or reduce the birth rate so that the death rate exceeds the birth rate.

### FERTILITY

It is clear that births may be affected if many women die before reaching the end of their child-bearing years. However, most births occur to women at young ages. The average age at the time of death from AIDS is usually 30 or higher for women. Therefore, the effect of AIDS deaths of potential mothers on the birth rate is not likely to be large if the total fertility rate—the average number of births per woman—remains constant. Most published modeling results confirm that this is the case.

However, it is not clear that the total fertility rate would remain constant. Some women may want to have as many children as possible while they can, in order to leave descendants behind. Others may decide to stop childbearing upon learning that they are HIV positive in order to avoid leaving orphans. It is not yet known which response will predominate. However, since most people in Africa do not know if they are infected, a large effect on the fertility rate is probably not likely.

Age at marriage may also be affected and could, in turn, affect fertility rates. On the one hand, a lower age at marriage or first union could raise fertility rates since women would be exposed longer to the possibility of pregnancy. Age at marriage could be lowered as men seek younger partners who are less likely to be infected and as parents

want to see their children in stable unions as soon as possible. On the other hand, attempts to postpone the beginning of sexual activity as long as possible in order to protect children may lead to later age at first union. A higher age at marriage would lead to lower fertility rates.

### MORTALITY

It is obvious that AIDS will have a significant effect on mortality. Although our information about the dynamics of infection leading to AIDS and to death is not complete, enough is known to make reasonably accurate projections of AIDS death rates once the prevalence of HIV infection is known. The incubation period (the time from infection with HIV to the development of AIDS) is about 8 to 10 years in industrialized countries. In developing countries, this period may be shorter—perhaps as short as 5 to 6 years—but good data are

**Adult HIV Prevalence That Will Produce Zero Population Growth by Length of Incubation Period**

Adult Incubation Period (Years)	HIV Prevalence (Percent)	
5	30	
6	34	
7	37	
8	41	
9	45	
10	48	

<b>Assumptions:</b>	
Crude birth rate	= 45 per 1000 population
Crude death rate	= 15 per 1000 population
Rate of natural increase	= 3 percent per year
Infant mortality rate	= 100 deaths per 1000 births
Perinatal transmission	= 30 percent
Life Expectancy after AIDS	= 1 year
Percent of population over age 14	= 55 percent

*Assume the impact of AIDS on the birth rate is negligible*

lacking. The average survival time after the development of AIDS is about one year. Therefore, the total time from infection to death is in the range of 6 to 11 years. This implies that once prevalence stabilizes, mortality from AIDS will result in 9 to 14 percent of the infected adult population dying each year.

For infants, the progression to AIDS is much quicker. About 25 to 40 percent of all children born to infected mothers will themselves be infected with HIV. The average survival time for infants infected at birth is only about two years.

Based on this information it is possible to estimate the adult prevalence of HIV that would be required to cause negative population growth. In fact, there is general agreement among the modelers that adult HIV prevalence would have to increase between 30 and 40 percent to reduce population growth to zero.

The length of the incubation period influences AIDS' overall effect on population growth. If a shorter incubation period is used, the population growth rate could become negative; with a longer incubation period, population growth would remain positive. The box on page 4 shows the adult HIV prevalence that would cause zero population growth, given typical demographic values for Africa, as a function of the incubation period. The range is from 30 to 50 percent HIV positive.

Migration also plays a role in population growth. This discussion ignores the effect of changing migration rates as a result of AIDS. Some people may move out of regions of high HIV prevalence in order to reduce their risk. However, it is also possible that people would migrate to high AIDS areas, such as cities, because of the employment opportunities that might open up because of increased AIDS deaths.

The differences among modelers about the likelihood of negative population growth are due in part to differences in the simulation models used by each group. However, both sides agree that, in the African setting, negative population growth will not occur unless adult HIV prevalence rates reach 30 to 50 percent. The Anderson group tends to use pessimistic assumptions that put Africa's growth rates at the lower end of the scale, and the other groups tend to use more optimistic assumptions that put growth rates at the higher end of the scale. However, there is basic agreement that adult HIV prevalence needs to reach this range before negative population growth occurs.

## HOW LIKELY IS IT THAT ADULT HIV PREVALENCE WILL REACH 30 TO 50 PERCENT IN AFRICA?

It is difficult to predict future levels of HIV infection in Africa because much is still not known about the epidemic. However, there are several approaches that can help us understand the problem.

**Simulation Modeling.** Most simulation models of AIDS that differentiate the population by risk factors (multiple partners, condom use, urban/rural residence, etc.) find a plateau effect. That is, in populations with AIDS epidemics, the level of adult seroprevalence will eventually level off well below 100 percent, even if no behavior change takes place. These plateaus occur as certain high-risk groups become saturated. In prostitute groups, for example, infection levels may quickly rise to about 80 percent. At that level, the prevalence may stabilize as infected people drop out of the group or die and new, uninfected, people join the group.

Researchers agree that, in the African setting, negative population growth will not occur unless adult HIV prevalence reaches 30 to 50 percent. The big uncertainty lies in projecting future levels of HIV infection.

**Percent of Adults Reporting Multiple Partners in Last Twelve Months<sup>a</sup>**

Country	Men	Women
Central African Republic	14	5
Côte d'Ivoire	53	16
Lesotho	30	17
Togo	20	2
Kenya <sup>b</sup>	24	8
Rwanda <sup>b,c</sup>	8	3

<sup>a</sup> Adjusted for all adults from reported figures on sexually active adults.

<sup>b,c</sup> In last six months.

The most susceptible age groups may also saturate quickly, reaching a prevalence level where the entry of new, uninfected members and the exit of infected members due to death causes an equilibrium to be reached. This does not mean that HIV incidence is zero, simply that new cases are balanced by death or out-migration. The level of the plateau will depend on the proportions of the population practicing risky behavior. However, these models all agree that infection will eventually plateau at some level well below 100 percent. Simulation exercises with several different models that disaggregate the population by AIDS-related behaviors find that adult prevalence plateaus as high as 30 to 35 percent may be reached in some population groups as large as major cities, but that for entire countries plateau levels above 15 percent are unlikely.

**Surveys of AIDS-Related Behavior.** Over the past several years the World Health Organization's Global Programme on AIDS (GPA) has sponsored a series of surveys designed to collect information on knowledge, attitudes, beliefs, and practices related to AIDS. These surveys have been conducted in over 20 countries. Although full results have not yet been made public, some results have been reported.<sup>7</sup> Of most interest to this discussion are the proportions of men and women who report having sex with multiple partners, since these will be the people most at risk for HIV infection. (Of course, even a person with a single partner can be at risk if that partner has multiple partners.) The results from six African countries show that between 2 and 17 percent of adult women and 8 to 53 percent of men report having multiple partners (see the table on the left).

These results indicate that, in at least some countries, a significant proportion of people are at risk for HIV infection. Translating these figures into ultimate plateau levels is difficult for several reasons. Plateau levels could be much lower than the percent having multiple partners at any one time if the number of partners and frequency of contact is low, the average HIV prevalence is low, or condom use is high. On the other hand, plateau levels could be higher than these reported figures if the figures understate the actual levels because of underreporting, if the number of contacts is high, HIV prevalence is high, or condom use is low.

#### **Surveillance of HIV Infection.**

A large number of studies have been performed at hospitals, clinics, and special sites to determine HIV prevalence among client populations. The most useful of these for estimating general prevalence levels are usually reports by ante-natal

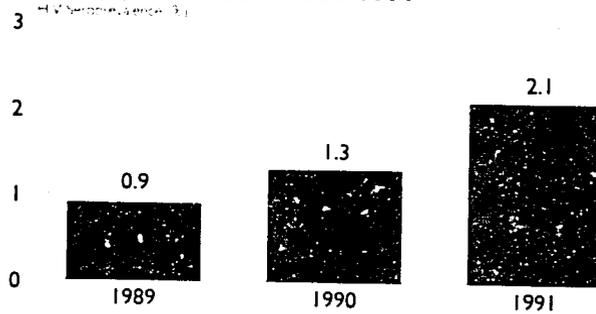
clinics since these studies report HIV prevalence among pregnant women. These results will be somewhat higher than overall adult prevalence levels (since pregnant women are all sexually active) but can give a good idea of levels and trends.

Figure 1 presents graphs showing trends in HIV prevalence from population groups in six different countries. These graphs are all examples of population groups where HIV prevalence is still increasing. They illustrate that Africa is still in the earlier stages of the epidemic. In many cases, no one yet has a good idea of just how high prevalence levels may reach. In four of the populations shown in these graphs, prevalence is significantly below the levels required to cause negative population growth. In urban Malawi and Lusaka, however,

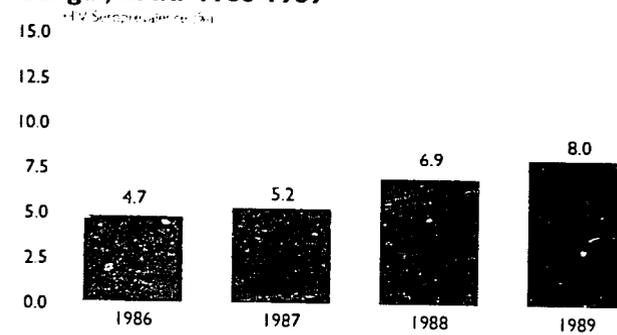
prevalence is approaching the 30 percent level. These graphs confirm that prevalence is still increasing in many areas, but do not indicate whether prevalence levels in the range of 30 to 50 percent are likely.

**FIGURE 1: EXAMPLES OF  
INCREASING ADULT HIV PREVALENCE**

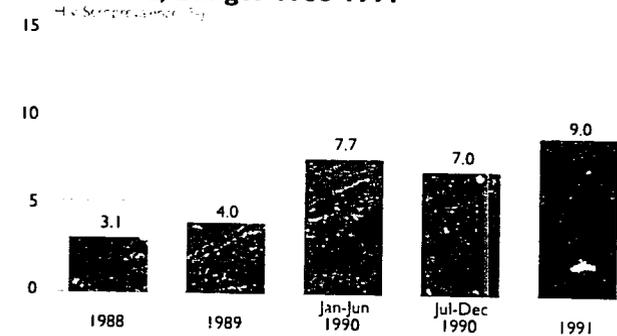
**HIV Seroprevalence for Pregnant Women,  
Yaounde, Cameroon: 1989-1991**



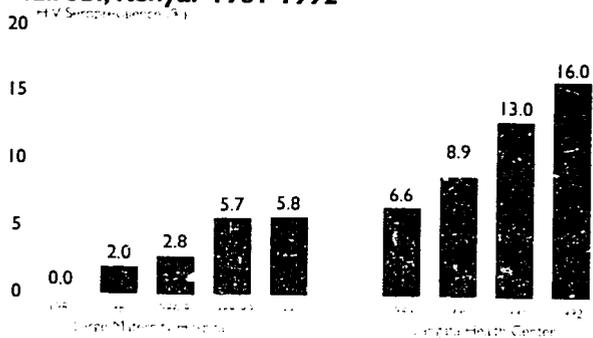
**HIV Seroprevalence for Pregnant Women,  
Bangui, CAR: 1986-1989**



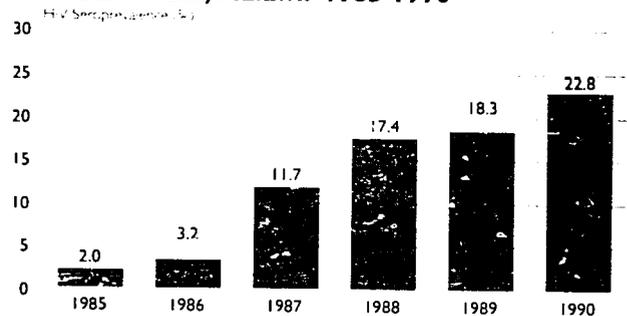
**HIV Seroprevalence for Pregnant Women,  
Brazzaville, Congo: 1988-1991**



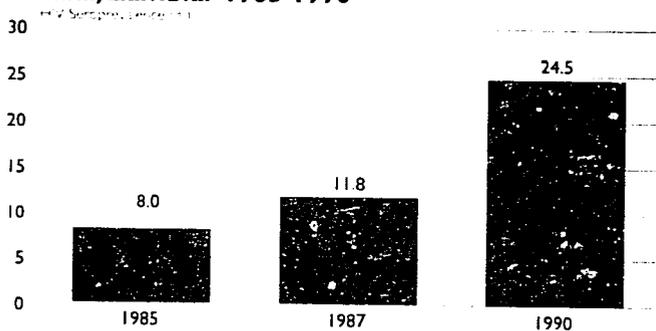
### HIV Seroprevalence for Pregnant Women, Nairobi, Kenya: 1981-1992



### HIV Seroprevalence for Pregnant Women in Urban Areas, Malawi: 1985-1990



### HIV Seroprevalence for Pregnant Women, Lusaka, Zambia: 1985-1990



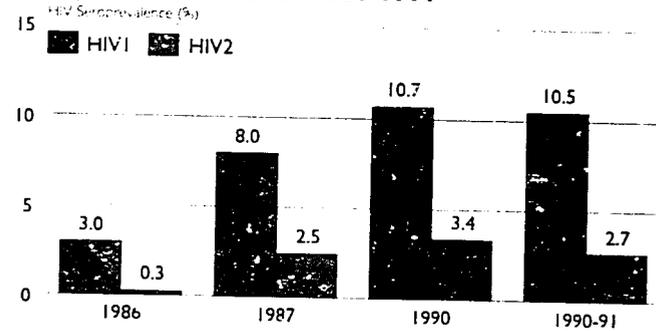
Source: *Trends and Patterns of HIV/AIDS Infection in Selected Developing Countries*, (Washington, DC: Center for International Research, U.S. Bureau of the Census, 1992).

Figure 2 presents graphs showing trends in HIV prevalence in five different population groups. These graphs are all examples of population groups where HIV prevalence has apparently reached a plateau or is increasing very slowly. These graphs illustrate several points. First, plateaus may have been reached in some population groups. This conclusion must be qualified because it is possible that these reflect temporary plateaus and not permanent ones. Second, the highest plateau levels occur among prostitute groups, as expected. The other graphs are all for urban areas. Since infection rates are usually much higher in urban areas than in rural areas, the plateau levels for entire countries would likely be considerably below these levels.

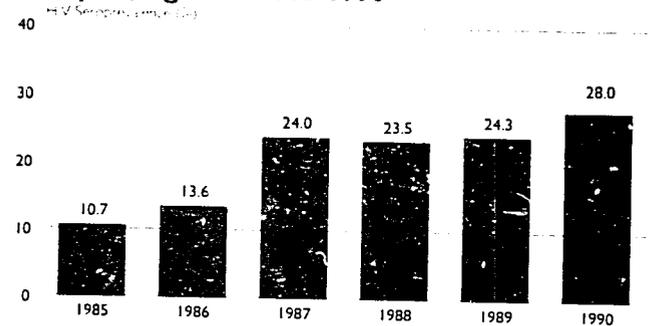
Third, in Abidjan and Kinshasa apparent plateau levels are considerably below the levels required to produce negative population growth. In Kampala, however, prevalence is approaching 30 percent among pregnant women.

**FIGURE 2: EXAMPLES OF APPARENT PLATEAUS IN HIV PREVALENCE**

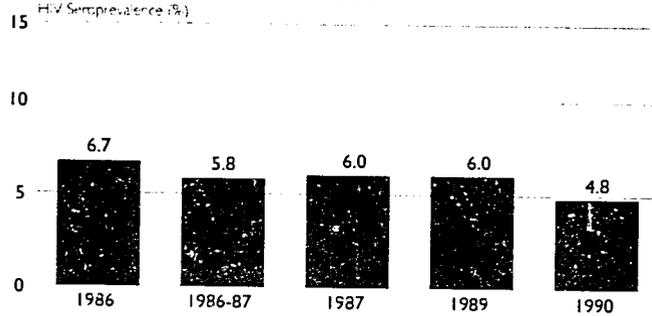
**HIV Seroprevalence for Pregnant Women, Abidjan, Cote d'Ivoire: 1986-1991**



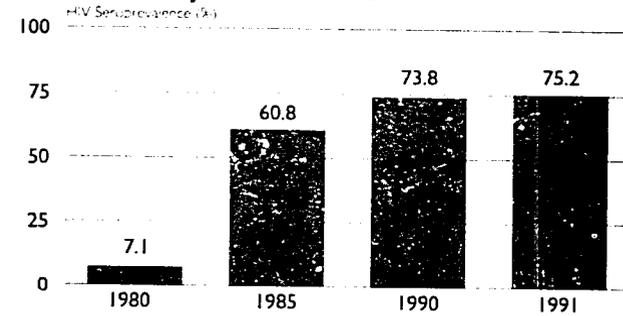
**HIV Seroprevalence for Pregnant Women, Kampala, Uganda: 1985-1990**



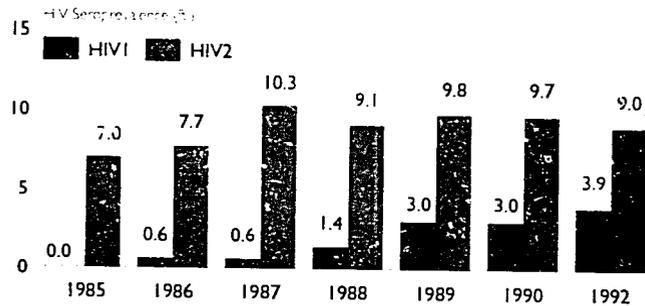
### HIV Seroprevalence for Pregnant Women, Kinshasa, Zaire: 1986-1990



### HIV Seroprevalence for Prostitutes, Nairobi, Kenya: 1980-1991



### HIV Seroprevalence for Registered Prostitutes, Dakar, Senegal: 1985-1992



Source: *Trends and Patterns of HIV/AIDS Infection in Selected Developing Countries*, (Washington, DC: Center for International Research, U.S. Bureau of the Census, 1992).

## CONCLUSION

What conclusions can we draw from the evidence presented above?

- Anderson *et al.* argue that we are still at the early stages of the epidemic. We simply do not know where prevalence will plateau. We do not have enough knowledge to state confidently that it will plateau below 30 percent. They agree that it seems unlikely that HIV prevalence would get that high in entire countries but argue that we really do not know enough to rule it out. Therefore, it is possible negative population growth will occur.
- Way and others argue that there is evidence from both simulation modeling and epidemiological data that HIV prevalence does plateau. In some specific areas, such as the worst-affected areas in Uganda (Rakai) and some cities (Kampala, Lilongwe) these plateau levels might well approach 30 to 40 percent. But

the rural areas are likely to plateau at much lower levels. Therefore, it is very unlikely that levels of 30 to 50 percent will be reached for any area as large as a country.

Of course, this entire discussion has left out the effects of AIDS interventions and spontaneous behavior change. Certainly some behavior change has taken place. AIDS interventions have proven successful in pilot studies and condom use is increasing dramatically in many African countries. To the extent that these changes continue, negative population growth becomes more unlikely. However, we have not yet seen epidemiological evidence that either spontaneous behavior change or interventions can stop HIV prevalence from rising on a national scale.

**AIDS is unlikely to cause negative population growth in any entire country in Africa.**

**AIDS is likely to cause negative population growth in some sub-national regions in Africa and might do so in a small number of major cities.**

The actions required as a result of these conclusions seem clear.

- Effective AIDS control programs need to be implemented in order to control the spread of the disease to the maximum extent possible. These need to include efforts to develop vaccines and drugs as well as efforts to inform people and encourage behavior change, condom use, and STD control.
- Effective family planning programs are still needed. Most of these programs are designed to provide couples with the information and means to have the number of children they want, when they want them. The use of family planning also reduces maternal and child mortality by

There is no reason for complacency. Worldwide, the epidemic is still in the early stages. Even if AIDS does not cause negative population growth in any country, it will have severe consequences. Millions of people will be affected by AIDS either directly or indirectly.

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spacing births and decreasing the number of births to older women and those who have had many children. These needs will still exist no matter what the effect of AIDS on population growth rates. Family planning programs can also serve to reach the sexually active population with messages, counseling and services to combat the spread of AIDS.

- Governments should plan for the impact of AIDS on their national development. In some regions of a country, there may be pockets of very high prevalence that could lead to zero or negative population growth. This is unlikely for entire countries. However, the impact of AIDS-related mortality on special populations (capital city, key occupations, tourism potential) should be recognized and addressed by planners and policy makers.

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