



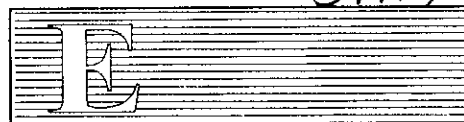
UNITED NATIONS

ECONOMIC AND SOCIAL COUNCIL

ECONOMIC COMMISSION FOR AFRICA

First meeting of the Committee on Information
Development (CODI)

28 June - 2 July 1999
Addis Ababa (Ethiopia)



Distr.: GENERAL

E/ECA/DISD/CODI.1/29
25 June 1999

Original: ENGLISH

**MEASUREMENT, COLLECTION AND
COMPILATION OF HIV/AIDS STATISTICS**

Measurement, collection and compilation of HIV/AIDS statistics

**Extract from the report on the Technical Meeting,
New York, 10 November 1998**

(Population Division, Department of Economic and Social Affairs)

Population Division
Department of Economic and Social Affairs
United Nations Secretariat

The Demographic Impact of HIV/AIDS

Report on the Technical Meeting
New York, 10 November 1998



**Population Division, Department of Economic
and Social Affairs, United Nations**



**The Joint United Nations Programme on
HIV/AIDS (UNAIDS)**

I. THE DEMOGRAPHIC IMPACT OF HIV/AIDS: RESULTS FROM THE 1998 REVISION OF THE UNITED NATIONS WORLD POPULATION ESTIMATES AND PROJECTIONS

The first part of the Meeting was devoted to a presentation and discussion of the impact of AIDS according to the 1998 Revision of the official United Nations world population estimates and projections (United Nations, forthcoming). Mr. Victor Gaigbe-Togbe of the Population Division presented the paper entitled "AIDS, Mortality and Population Change" (see Part 2). The next three sections summarize his presentation and the final section in this chapter summarizes the discussion that followed.

A. BACKGROUND AND STATEMENT OF THE PROBLEM

Since the 1950s, mortality has been declining in both developed and developing countries. Life expectancy has been increasing and impressive gains have been made in reducing infant and child mortality. Recently, however, AIDS has caused a reversal of these trends in the most severely affected countries, particularly in sub-Saharan Africa. It is estimated by UNAIDS and WHO that more than 40 million people have been infected with HIV since the beginning of the epidemic and 13 million have progressed to AIDS. Beginning with the 1992 Revision, the Population Division of the United Nations Secretariat has made explicit allowance for the potential demographic impact of AIDS in preparing the population estimates and projections of countries where the epidemic has reached significant proportions. In the 1998 Revision the impact of AIDS is considered for 34 countries, all of which had populations of at least one million in 1995 and most of which had an estimated adult HIV prevalence of 2 per cent or higher in 1997. Brazil and India are countries included because, although their adult HIV prevalence is not yet above 2 per cent, their large populations imply that the number of HIV-infected persons is sizeable even at lower levels of prevalence.

B. METHODS AND SOURCES OF DATA

The number of HIV-positive adults in each of the 34 countries considered was provided by UNAIDS. These figures were used as input for the computer program called EPIMODEL (developed by Chin and Lwanga then at WHO) to estimate the annual number of newly infected adults over a given period. EPIMODEL uses a gamma distribution to fit the adult HIV-prevalence. For each country considered, the curve fitted depends on three input values: the year when the epidemic started and the estimated number of adults who are HIV-positive in 1994 and 1997. For most countries, the curve fitted approximates fairly well the 1994 and 1997 estimates of HIV prevalence among the adult population, but for a few countries, the estimated prevalence level for 1994 was found to be inconsistent with the 1997 level and was discounted in fitting the gamma curve. Once a gamma curve is fitted, EPIMODEL can estimate the number of newly infected adults for each year from the start of the epidemic to 2050. However, it was found that after the number of newly infected adults reaches a maximum value, the trajectory it follows is not always plausible. Consequently, in preparing projected numbers of newly infected individuals for the period 1995-2050, the Population Division adjusts the annual number of newly infected adults as produced by EPIMODEL so that there is a smooth decline from the maximum value yielded by the program to half that value over a period of 20 years. Once 20 years have elapsed after the maximum has been reached, the number of newly infected adults remains constant for the rest of the projection period (i.e., until 2050). That is, for projection purposes, it is assumed that the annual number of newly infected adults will stabilize at 50 per cent of its peak value for each of the countries considered.

On the basis of assumptions about the proportion of HIV-cases that occur among women, the age distribution of infected women and their age-specific fertility, EPIMODEL estimates the annual number of children born to HIV-positive women. Then, assuming that 35 per cent of the children born to HIV-positive women contract the disease (30 per cent in Cambodia and India; and 25 per cent in Brazil, Haiti and Thailand), the program estimates the number of new pediatric HIV-positive cases expected per year.

Once the numbers of newly infected children and adults are available for each year of the period that begins with the start of the epidemic and ends in 2050, it is possible to calculate the number of deaths expected by following each infection cohort through time and applying model probability schedules that encapsulate the chances of progressing from HIV-infection to AIDS and from AIDS to death. Different progression schedules are used for children and adults. Furthermore, for adults two schedules are used that differ from each other in the median survival time from infection to full-blown AIDS. For African countries and Cambodia, the adult progression schedule used has a median progression time of 8 years whereas for Brazil, Haiti, India and Thailand, the schedule used has a median progression time of 10 years. When the median survival time from AIDS to death is added, the procedure used assumes that median survival time from HIV-infection to death is 9 years in African countries and in Cambodia, and it is 11 years for the other countries in Asia as well as for Brazil and Haiti. These assumptions are consistent with those made by UNAIDS in estimating the global prevalence of HIV/AIDS.

EPIMODEL thus produces the number of AIDS deaths expected annually among children and among adults (i.e., persons aged 15 years or over). Then, another set of programs is used to distribute the AIDS deaths by five-year age groups and sex. In doing so, it is assumed that HIV infection and therefore AIDS affect as many women as men in sub-Saharan Africa but that both are more common among men than among women in other countries. Specifically, it is assumed that 50 per cent of AIDS deaths occur among men in sub-Saharan Africa; 67 per cent in Cambodia, India and Thailand; and 75 per cent in Brazil and Haiti.

Once the number of AIDS deaths by age and sex are available they are added to the number of deaths estimated for each country through the "normal" assumptions about the course of mortality in the absence of HIV infection. New life tables are produced that include the effects of AIDS and projections are carried out using these life tables and the standard assumptions about the future course of fertility according to the medium-projection variant. The availability of projections that coincide in all other respects but incorporate mortality assumptions that do not take explicitly into account the effects of AIDS provides a basis for assessing the impact of the latter.

C. RESULTS

A comparison of the estimates and projections with and without HIV/AIDS shows that the disease has already had and is likely to have a major effect on the population dynamics of the countries affected. The population of the 29 African countries with a high prevalence of HIV is estimated to have been 446 million in mid-1995, 5 million lower than it would have been in the absence of AIDS. By 2015, their population is projected to grow to 698 million, 61 million fewer than it would have been without AIDS. The most severely affected countries—Botswana, Namibia and Zimbabwe—will have a population 20 per cent lower in 2015 than it would have been without AIDS.

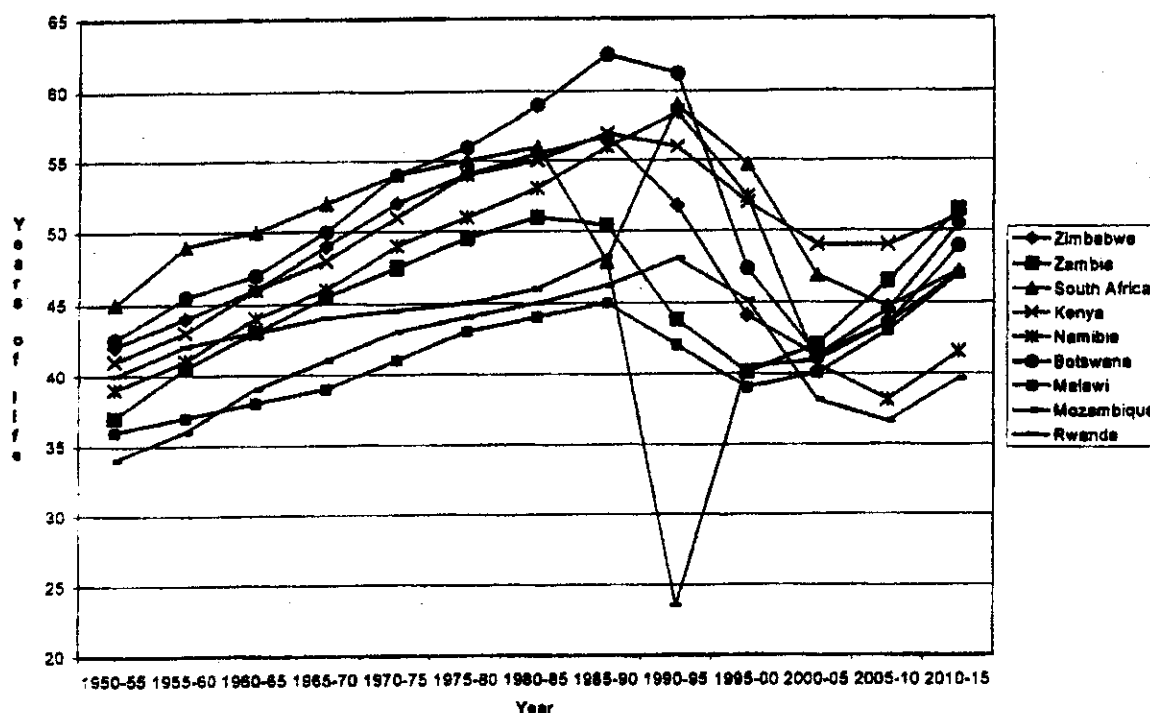
AIDS will have important effects on the annual rate of population growth in many countries. In the 29 African countries considered, the rate of growth is projected to decline from about 2.4 per cent today to 2.1 per cent by 2015. Without AIDS it would have declined from 2.8 today to 2.4 per cent in 2015. In the most severely affected countries, the impact of AIDS will be dramatic. In Zimbabwe the annual rate of growth is estimated to have fallen to 1.5 per cent today instead of being the 2.4 per cent expected if there were no AIDS, and it is projected to drop to just under one per cent by 2000-2005. In South Africa, the annual rate of growth is expected to decline to 0.4 per cent by 2005-2010 instead of the 1.5 per cent expected in the absence of AIDS. Although AIDS clearly will have a serious impact on population growth rates, it is not expected to lead to negative population growth in any country.

The most dramatic effect of AIDS is on life expectancy at birth (the number of years a newborn child would be expected to live if the prevailing mortality conditions remained constant). In the 29 African countries considered, life expectancy has already been reduced by about 7 years due to AIDS and it is expected to remain constant at about 47 years for the next decade instead of rising to 56 years as expected in the absence

of AIDS. The most severe impacts are seen in Botswana and Namibia. In Botswana, life expectancy is expected to drop from 61 years in 1990-1995 to 41 years by 2000-2005, almost 29 years less than it would have been in the absence of AIDS. In Namibia, life expectancy is projected to fall from 58 years in 1990-1995 to 38 years in 2000-2005. Figure 1 shows the estimated and projected life expectancy for the nine countries with the most severe AIDS epidemics. By 2015, life expectancy is expected to be no higher than it was in 1965, implying that AIDS will effectively erase the progress made since then.

AIDS will also affect infant and child mortality. In the nine most severely affected countries in Africa AIDS has already increased the infant mortality rate by about 10 deaths per 1,000, from 76 to 86 infant deaths per 1,000 live births. By 2015, the infant mortality rate in these countries would have been expected to decline to 27 per 1,000 in the absence of AIDS, but because of the epidemic it is expected to drop only to 52 per 1,000.

FIGURE 1. LIFE EXPECTANCY AT BIRTH IN THE 9 COUNTRIES WITH THE HIGHEST HIV PREVALENCE IN 1997, 1950-1955 TO 2010-2015



Source: United Nations, *World Population Prospects: The 1998 Revision*, forthcoming

D. DISCUSSION

Participants expressed their general satisfaction with the approach and results produced by the United Nations Population Division. It was noted that these and other estimates and projections play a major role in raising awareness among policy-makers about the seriousness of the AIDS epidemic. In particular, projections of significantly declining life expectancy in some countries have shocked many into recognizing that AIDS is eroding many of the development gains of the past decades.

Several key points were raised during the discussion that should be noted in future work.

- There was agreement that both the United Nations Population Division and the United States Census Bureau should provide descriptions of their methodologies and assumptions so that the process could be understood by both researchers and policy-makers.
- It was noted that EPIMODEL was developed in order to make short-term projections of the expected number of AIDS cases in African countries. It was not intended to be used for long-term projections. Several participants remarked that EPIMODEL has so far provided good fits to the beginning stages of the epidemic in most countries, when prevalence is still rising, but it is not clear whether it will be equally successful in approximating the course of the epidemic when incidence declines. All recognized, however, that no better alternatives exist at present.
- It was noted that the health systems in some countries were deteriorating and that the long-term increase in life expectancy witnessed during large part of the twentieth century might not have continued in some countries even in the absence of HIV/AIDS. In countries seriously affected by the epidemic, the increased burden on health-care systems associated with HIV/AIDS was further contributing to the deterioration of health services. In addition, the full impact of the rising number of deaths because of tuberculosis might not be captured by assuming that all of them were AIDS-related. Consequently, it might be necessary to re-evaluate the assumptions made about the evolution of non-AIDS mortality.
- The lack of adequate data on adult mortality that would permit a validation of the impact of HIV/AIDS on mortality levels and trends was stressed and deplored. It was stated that there were almost no recent studies of adult mortality that could be used to identify clearly the increases due to AIDS. It was noted, however, that techniques to estimate adult mortality from survey data (such as the sibling method) and to adjust incomplete data on registered deaths might be useful in obtaining further insights about the impact of the disease. It was noted that the Population Division had begun work in preparing a manual on the techniques available for the estimation of adult mortality.

I. METHODS AND SOURCES OF DATA

Beginning with the *1992 Revision*, the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat has incorporated the demographic impact of AIDS into its biennial world population estimates and projections. The impact of the epidemic was explicitly taken into account in carrying out the projections of the 16 countries with an adult HIV prevalence of 1 per cent or more in both the *1992 Revision* and the *1994 Revision*. In the *1996 Revision*, allowance for the impact of HIV/AIDS was made for the 28 countries with an adult HIV prevalence of 2 per cent or more, plus Brazil and India, and in the *1998 Revision*, those countries plus a further six that had passed the threshold of an adult HIV prevalence of 2 per cent by 1997 were considered (table 1 shows the full list of countries). Each of the 34 countries considered had a population of at least 1 million by 1995. Among them, 29 are in Africa, three in Asia, and two in Latin America and the Caribbean.

It is estimated that those 34 countries had 26 million HIV-positive persons in 1997, accounting for 85 per cent of the total HIV-positive persons in the world (30.6 million) and for 89 per cent of the number of infected persons in the less developed regions. The 29 African countries included in that group had 20 million HIV-positive persons, representing 94 per cent of the total number of persons infected with HIV in Africa (21 million). At the country level, adult HIV prevalence ranged from less than 1 per cent in Brazil and India to about 22 per cent in Botswana and Zimbabwe (table 1).

The demographic impact of HIV/AIDS is assessed by comparing estimates and projections that make allowance for the impact of AIDS with estimates and projections that hypothetically exclude AIDS. The latter are derived from the application of the United Nations Population Division standard projection program on the basis of assumptions regarding the future course of mortality that are similar and consistent with those made with respect to countries that are still largely free from the HIV/AIDS epidemic. The process to derive estimates and projections that incorporate explicitly the effect of HIV/AIDS is more complex and will be described briefly here.

The estimation and projection of the impact of HIV/AIDS is made in several steps. First, models are used to estimate the annual incidence of the disease on the basis of recent estimates of prevalence, that is, the annual number of newly infected individuals is derived from information on the total number of HIV-positive individuals at particular points in time. Second, making assumptions about the probability of progressing from HIV infection to AIDS and from AIDS to death, estimates of the annual number of deaths caused by AIDS are obtained. Third, those deaths are added to the deaths expected in the absence of AIDS and revised life tables are calculated that reflect the impact of the disease. Lastly, those life tables are used to project the population.

The first two steps are carried out by using a version of the program called EPIMODEL, developed in the early 1990s by the Global Programme on AIDS of the World Health Organization (WHO) (Chin and Luanga, 1991) and revised in 1995. EPIMODEL uses a gamma distribution to fit adult HIV prevalence. Specifically, for the *1998 Revision*, three points provide the basis for fitting the distribution: the year when the epidemic started (i.e., a point in time when prevalence was assumed to be virtually nil), and the estimated numbers of HIV-positive adults in 1994 and 1997. All these estimates were provided by the Joint United Nations Programme on HIV/AIDS (UNAIDS). UNAIDS estimates current HIV prevalence for about 90 countries. For most of those countries, the gamma curve fitted approximates fairly well the estimated prevalence levels in both 1994 and 1997 but for a handful of countries the 1994 estimates appeared to be inconsistent with those relative to 1997 (in that the gamma curve could not fit the two adequately). In those cases, the 1994 estimates were discounted in favour of those referring to 1997.

Once a distribution is fitted to the estimated prevalence, it is possible to derive annual projected values of adult HIV prevalence for any period and to obtain also estimated and projected values of the annual number of newly infected adults over the period (i.e., values of annual incidence). EPIMODEL was used to produce those

TABLE 1. COUNTRIES FOR WHICH THE DEMOGRAPHIC IMPACT OF HIV/AIDS IS EXPLICITLY INCLUDED
IN THE 1998 REVISION OF THE OFFICIAL UNITED NATIONS ESTIMATES AND PROJECTIONS

Country	Adult HIV prevalence 1997	Per cent of adult population	Year when widespread transmission began
AFRICA			
1. Benin.....	52,000	1.76	1968
2. Botswana	190,000	22.09	1985
3. Burkina Faso.....	350,000	6.00	1974
4. Burundi.....	242,000	7.02	1976
5. Cameroon.....	310,000	3.99	1968
6. Central African Republic.....	170,000	8.61	1972
7. Chad.....	83,000	2.20	1976
8. Congo.....	95,000	6.37	1976
9. Côte d'Ivoire	670,000	8.49	1978
10. Democratic Republic of the Congo.....	900,000	3.55	1974
11. Eritrea.....	49,000	2.57	1983
12. Ethiopia.....	2,500,000	7.73	1980
13. Gabon.....	22,000	3.12	1974
14. Guinea-Bissau.....	11,000	1.71	1974
15. Kenya.....	1,600,000	10.43	1974
16. Lesotho.....	82,000	6.66	1983
17. Liberia.....	42,000	2.96	1978
18. Malawi.....	670,000	12.51	1975
19. Mozambique	1,200,000	11.92	1985
20. Namibia.....	150,000	16.12	1985
21. Nigeria.....	2,200,000	3.41	1974
22. Rwanda.....	350,000	11.16	1970
23. Sierra Leone.....	64,000	2.59	1978
24. South Africa.....	2,800,000	11.80	1985
25. Togo.....	160,000	6.85	1978
26. Uganda.....	870,000	8.14	1976
27. United Republic of Tanzania.....	1,400,000	8.21	1976
28. Zambia.....	730,000	16.62	1976
29. Zimbabwe.....	1,400,000	21.52	1976
ASIA			
30. Cambodia.....	120,000	1.98	1987
31. India.....	4,100,000	0.65	1986
32. Thailand.....	770,000	1.81	1985
LATIN AMERICA AND THE CARIBBEAN			
33. Brazil.....	570,000	0.51	1980
34. Haiti.....	180,000	4.08	1976

Source: UNAIDS, 1998; United Nations, *World Population Prospects: The 1998 Revision*, forthcoming.

those values for the period ranging from the start of the epidemic to the year in which the number of new infections reached half of its maximum value, and from there until 2050 the number of new infections was maintained constant. However, for the 9 countries that had an HIV prevalence above 10 per cent in 1997, EPIMODEL produced sharply declining numbers of new infections after the maximum was reached, an outcome that was judged implausible. Consequently, in projecting the number of future infections for those countries, the gamma estimates were used until the maximum was reached and for the next 20 years the

projected number of new infections was made to decline linearly to half the maximum level. Then, as for the other 25 countries, the projected number of new infections was kept constant at half the maximum level until 2050.

To complete the derivation of the overall number of newly infected persons per year, it is necessary to estimate the number of pediatric HIV cases. Using for each country an estimate of the proportion of HIV cases that occur among women, in conjunction with the likely age distribution for the total number of infected women and a set of age-specific fertility rates consistent with the experience of the country concerned, the number of children born to HIV-positive women is calculated. Then, assuming that 35 per cent of the children born to HIV-positive women contract the disease (30 per cent in the cases of Cambodia and India; and 25 per cent in the cases of Brazil, Haiti and Thailand), EPIMODEL estimates the annual number of HIV-positive children expected.

Once the numbers of newly infected children and adults are available for each year of the period that begins with the start of the epidemic and ends in 2050, EPIMODEL calculates the number of deaths expected by following each infection cohort through time and applying model probability schedules that encapsulate the chances of progressing from HIV-infection to AIDS and from AIDS to death. Different progression schedules are used for children and adults (tables 2 and 3). Furthermore, for adults two schedules are used that differ from each other in the median survival time from infection to full-blown AIDS. For African countries and Cambodia, the adult progression schedule used has a median progression time of 8 years whereas for Brazil, Haiti, India and Thailand, the schedule used has a median progression time of 10 years. When the median survival time from AIDS to death is added, the procedure used assumes that median survival time from HIV infection to death is 9 years in African countries and in Cambodia, and it is 11 years for the other countries in Asia as well as for Brazil and Haiti. These assumptions are consistent with those made by UNAIDS in estimating the global prevalence of HIV/AIDS.

EPIMODEL thus yields the number of AIDS deaths expected annually among children and among adults (i.e., persons aged 15 years or over). Then another set of programs is used to distribute the number of AIDS deaths by five-year age group and sex. In doing so, it is assumed that HIV infection and therefore AIDS affect as many women as men in sub-Saharan African countries but that both are more common among men than among women in other countries. Specifically, it is assumed that 50 per cent of AIDS deaths occur among men in sub-Saharan Africa; 67 per cent in Cambodia, India and Thailand; and 75 per cent in Brazil and Haiti.

The resulting AIDS deaths classified by age group and sex are added to the number of deaths calculated for each country by using the standard assumptions about the future course of mortality that underlie the United Nations projections in countries not affected by HIV/AIDS. The adjusted number of deaths is then used to derive new life tables that are in turn the basis for a modified projection of the total population that thus incorporates explicitly the effect of AIDS.