IMPACT OF HIV/AIDS ON MORTALITY AND THE STRUCTURE OF SOUTH AFRICA'S POPULATION

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ABSTRACT

The first HIV/AIDS case in South Africa was reported in 1981. Since then, HIV sero-prevalence as measured by women attending antenatal clinic has steadily increased in the country and currently, South Africa is one of the highest HIV prevalence countries in the world and in the African continent with sero-prevalence above 20% among pregnant women attending antenatal clinics. In 2002, the Nelson Mandela Fund in collaboration with the Human Sciences Research Council carried out a national HIV prevalence, behavioural risks and mass media household survey. Only four other countries in the world have carried out such a national HIV prevalence survey.

Using various national survey/census data that collected information on fertility and mortality, administrative records on migration, HIV sero-prevalence data, and cohort component method, this study examines the demographic impact of HIV/AIDS including mortality, the structure of South Africa's population especially with regard to overall sex ratio and the labour market.

Results indicate that the population of South Africa was about 1% lower than it would have been in 2001 without the impact of HIV/AIDS, the reduction in population size attributable to HIV/AIDS was more marked among the African population. Proportionately, the impact of HIV/AIDS was more marked in the 0-4 group compared to the 5-14, 15-64 or 65+ age groups. In absolute terms, AIDS is

estimated to have reduced the labour market by about 1% in 2001 largely attributable to the African population. Life expectancy at birth is estimated to have dropped from about 67.5 years in 1996 to about 56 years in 2001.

While not underplaying the seriousness of the HIV epidemic in South Africa (and elsewhere in sub-Saharan Africa), the impact may not be as marked as antenatal data might suggest.

INTRODUCTION

The first HIV/AIDS case in South Africa was reported in 1981. Since then, HIV sero-prevalence as measured by women attending antenatal clinic has steadily increased in the country and currently, South Africa is one of the highest HIV prevalence countries in the world and in the African continent (second, after Botswana) with sero-prevalence above 20% among pregnant women attending antenatal clinics. According to ILO (2000), South Africa has the largest infected population not only in Africa, but also in the world, and the fastest rate of new infections.

It has been argued that in sub-Saharan Africa, "demographic impacts include changes in population growth rate, increased mortality which is already noticeable, reversal of life expectancy at birth which is evident, and changes in age-sex pattern of population which are already underway" (Anarfi, 1994). Further more using mathematical models to simulate the spread of HIV in countries with a 3-4% pre-AIDS population growth as in most of sub-Saharan Africa, an anonymous (1990) argued that AIDS will alter the age structure of African societies by killing off large numbers of men and women in the economically active population.

In addition to the demographic implications of HIV/AIDS, ILO (2000) has outlined the impact of HIV/AIDS on the work force as follows: reduced supply of labour,

loss of skilled and experienced workers, changes in the composition of labour force and early entry of children into employment, increased pressure on women to earn income as well as care for the sick, mismatch between human resources and labour requirements, reduced productivity, absenteeism and early retirement, increased labour costs for employers, loss of wage earners in a household, reduced remittances from migrant workers and increase in female-headed households.

Accurate assessment of the impact of HIV/AIDS on a country's population is important for several reasons including the following: (1) it enables identification of the magnitude of the impact of the disease on different sub-groups (including age-sex groups) of the population, thereby enabling (2) a more focused and efficient mobilization of resources for the treatment and management of the disease among infected gropus, and prevention of new infections. The magnitude of the impact of HIV/AIDS are often presented in terms of absolute numbers usually in terms of the number of people living with HIV/AIDS, new infections, number of AIDS deaths etc. While this approach is important, especially within the context of assessing resources needed to treat and manage the diseases, it is also important to focus on demographic impact. This enables insight into the future development of the population with regard to size, and structure since among others, production and consumption of goods and services in a population depend on the age structure of that population.

Many studies on the impact of HIV/AIDS tend to utilize fertility, mortality and antenatal data as primary inputs (usually ignoring net migration due to lack of data). There is inherent danger in this approach as the impact might be exaggerated since there are reasons to suspect that antenatal data might exaggerate the prevalence of the disease because: (1) antenatal clinic antendees may not be representative of the population (see Zaba

In 2002, the Nelson Mandela Fund in collaboration with the Human Sciences Research Council carried out a national HIV prevalence, behavioural risks and mass media household survey. Only four other countries in Africa: Mali, Zambia, Kenya (as part of the Demographic and Health Survey), and Zimbabwe (among the youths) have carried out such a national HIV prevalence survey.

Using various national survey/census data that collected information on fertility and mortality, administrative records on migration, and HIV sero-prevalence data, this study examines the demographic impact of HIV/AIDS including mortality, the structure of South Africa's population especially with regard to overall sex ratio and labour market supply.

METHODS

The base population

Because of the controversies about the final results of the 1996 census (see Dorrington, 1999; Sadie 1999; Udjo, 1999; Shell 1999; Phillips et al 1999; criticisms on the recently released 2001 census results have also begun to emerge), the base period of the population estimates in this study is 1970. The 1970 census (the last census that canvassed the entire country during the apartheid era) smoothed age-sex distributions by population group adjusted for undercount were used as the base figures. The smoothing procedure is described in Udjo (2003a).

Sex ratios

Vital registration provides the basis for firmly establishing sex ratios at birth. In South Africa however, vital registration is of varying degree of completeness among the population groups with whites and Africans at both end of the continuum. In view of this and guided by available information, sex ratios at birth of 102, 103, 104 and 105 were assumed among Africans, coloureds, Indians and whites respectively for the population estimates in this study.

Fertility and mortality inputs

The total fertility rates (TFR) and life expectancies at birth (e_0) provided by Udjo (2003b, 2003c, 2003d) were used as the fertility and mortality inputs for the estimates. These are shown in Table 1.

Due to uncertainty about the levels of adult male mortality, among the population groups, a five-year difference in male-female life expectancy at birth was assumed for all except the white population where an eight-year difference was assumed (see Udjo, 1999 for details). It was assumed that the mortality levels have stagnated since 1996.

The model life tables used in the projections are the "UN East Asian pattern" in the case of Africans and coloureds, and the "UN General pattern" in the case of Indians and whites. It was necessary to use two different model life tables for the population groups because of differences in the mortality pattern between African and coloureds on the one hand, and Indians and whites on the other (see Udjo 2003b for details). The UN East Asian pattern is characterized by high older-age death rates relative to younger-age death rates, while the UN General pattern is an average mortality pattern similar to the Coale-Demeny West family life tables. It has been shown recently by Indepth Network (2002) that the mortality pattern of some southern and East African populations where HIV is recognized but not yet having a catastrophic impact on the population is most similar to the UN East Asian pattern. In an earlier study Udjo (1997) noted the relevance of the UN East Asian pattern for South Africa being characterized by a

high incidence of tuberculosis in the past, which is still evident among adult males in the population (UN, 1982).

Net migration

The most problematic aspect of population estimation is in developing migration assumptions due to lack of reliable data. Immigration and emigration statistics are available from the Department of Home Affairs through Statistics South Africa for the estimation period (1970-2001). There is however a number of problems with the statistics as follow. (1) The statistics are not broken down by population group. (2) The number of documented emigrants appears to understate the true extent of the phenomenon. For example, estimates of the ratio of South African emigrants (reported in major receiving countries) to South Africa's Home Affairs figures was estimated as 1.4 by Bah (1999) for the period 1970-96, 2.8 by Kaplan et al (1999) for the period 1989-97, and 1.4 – 4.7 by the Interim Statistics Council. (3) The scale of undocumented immigration is unknown. These make mandatory, development of assumptions about international migration if this component of population change were to be incorporated into the population estimates.

In the present study, net migration was estimated based on the following assumptions: (1) the number of documented immigration is accurate. (2) The percentage distribution of documented immigrants by population group is similar to the percentage distribution of non-South Africans by population group and sex as reported in the 1996 census (though the number may not be accurate). (3) The number of documented emigrants is inaccurate. (4) Prior to 1994, the percentage distribution of documented emigrants by population group is similar to the percentage distribution of non-South Africans by population group as reported in the 1996 census. Only whites have been emigrating since 1994 (the year of the new political dispensation). (5) The age distribution of documented immigrants for the period 1996-2001 is a reasonable estimate of the age distribution of net migrants for the estimation period.

On the basis of the above assumptions, the documented volume of immigration during the period 1970-2001 was split by population group and sex. Regarding emigration, a correction factor of 1.4 was used to adjust the number of male female documented number of emigrants for the period 1970-93 while for the period 1994 to 2001, a correction factor of 2.7 was applied. The adjusted figures for the period 1970-93 by sex were then split by population group on the basis of the above assumption. The adjusted figures by sex for the period 1994 to 2001 however, were attributed to the white population. Net migration was then computed as the difference between the estimated number of immigrants and emigrants by population group and sex. An average of the male-female age

distribution of documented immigrants for the period 1996-2001 was used as the best estimate of net migrants for the entire estimation period.

HIV/AIDS

The AIDS impact model (AIM) developed by the Futures Group was used to incorporate the impact of HIV/AIDS in the population estimates. The method is described by Stover (1999). Estimation of the basic parameters required by AIM was based on the following assumptions. First it was assumed that the Nelson Mandela/HSRC (2002) data provide a reasonable measure of HIV sero-prevalence at the national level and hence the Department of Health's antenatal sero-prevalence for the period 1990-2001 calibrated by Rehle and Shisana (2003) provide a reasonable measure of national adult HIV sero-prevalence for the period 1990-2001. Second, it was assumed that the distribution of national adult HIV sero-prevalence by population group in 2002 as measured by Nelson Mandela/HSRC study is similar to the distribution of adult sero-prevalence by population group in previous years. On this basis, the ratio of the adult HIV sero-prevalence of each population to the total adult prevalence in 2002 was used as weight on the prevalence for each year to obtain an estimate of each population group for each year during the period 1990-2002. Lastly, it was assumed that the age specific sero-prevalence among adults in the Nelson Mandela/HSRC data is similar for all population groups and is a reasonable measure of age-specific sero-prevalence in 1990-2002.

Estimation models

Two sets of population estimates were computed for each population group to enable the examination of the demographic impact of HIV/AIDS on mortality, age structure and labour market supply one each population group in South Africa. These are denoted, Model 1 and Model 2. Model 1 incorporates fertility, mortality and net migration but excludes the effect of HIV/AIDS while model 2 incorporates the effect of HIV/AIDS.

The population estimates were based on the cohort component method using the SPECTRUM software.

RESULTS

Impact of HIV/AIDS on the population size

As can be seen from Table 2, overall, the population of South Africa was probably about 1% lower than it would have been in 2001 without the impact of HIV/AIDS. The reduction in population size attributable to AIDS in 2001 was largely due to the African population due to the higher prevalence of HIV among Africans compared to the other population groups. Partly as a result, the proportion of Africans relative to the other population groups is decreasing

though the results of the 2001 population census suggests otherwise and is one of the emerging critique of the 2001 census results. Furthermore, the annual growth of the African population in 2001 without the impact of HIV/AIDS would probably have been 2% instead of 1.5% due to the impact of HIV/AIDS.

Impact of HIV/AIDS on age structure

Table 3 shows the estimated age structure of the population in 2001 with and without HIV/AIDS. As seen from the table, proportionately, the age group most affected by HIV/AIDS is the 0-4 age group. Whereas, AIDS appears to have resulted in a slightly decreased proportion of persons aged 0-4, the proportions aged 5-14, 15-64 and 65+ appear to have either slightly increased or remained constant. This is not surprising since the interval between HIV infections and death is shorter among very young children compared with older persons. As seen from Table 3, the most affected 0-4 age group is in the African population where AIDS is estimated to have reduced the proportion in this age group by about 3% compared to what the proportion would have been without HIV/AIDS in 2001. Presently, the relative impact on the 20-34 age group appears proportionately neglibible even among the African population.

It would appear from Table 3, that given current demographic processes, AIDS does not have discernable impact on overall sex ratio in South Africa.

Impact of HIV/AIDS and Labour Supply

In absolute terms, AIDS is estimated to have reduced the size of the labour market by about 1% in South Africa in 2001 and is largely attributable to the African population (see Table 4). As a result, the relative contribution of Africans to labour supply in the country has probably reduced by about 2%.

Impact of HIV/AIDS on mortality

Table 5 appears to suggest that female life expectancy at birth in South Africa probably dropped from about 67.5 years in 1996 to about 56 years in 2001 due to the impact of AIDS. The drop in life expectancy is more marked among the African population than in the other population groups. Given the low prevalence of AIDS among the white population, the estimated life expectancy among white females shown in Table 5 should be treated with caution.

DISCUSSION AND CONCLUSION

Many studies on the demographic and social impact of HIV/AIDS tend to utilize fertility, mortality and antenatal data as primary inputs. Furthermore, many of the studies do not incorporate net migration. This is understandable due to lack of

data. Until recently, sero-prevalence data on a national level was not available and even today, are available only in a few countries.

One of the dangers of using antenatal data to estimate the impact of HIV/AIDS in any population is that such impacts might be exaggerated, as there are reasons to suggest that antenatal data over state HIV prevalence in the population. This is borne out in the case of South Africa where antenatal HIV prevalence data in 2001 gave a total prevalence of 24.8% among pregnant women in 2001 in contrast with HIV prevalence of 15.6% among women aged 15-49 in the national survey of 2002.

This study shows that while not underplaying the seriousness of the HIV epidemic in South Africa (and elsewhere in sub-Saharan Africa), the impact may not be as marked as antenatal data might suggest. For example a press release of the United Nations (2001) noted that *"eight African countries will have lost at least 17 years of life expectancy to the AIDS epidemic by 2000-2005, namely, Botswana, Kenya, Lesotho, Namibia, South Africa, Swaziland, Zambia and Zimbabwe".* The above statement is not borne by the results of this study in the South African context.

The results of this study suggest that in South Africa, overall the impact of AIDS on the age structure though minimal currently is more marked among the African population. The results also suggest that the largest demographic consequence

of AIDS in South Africa currently is life expectancies especially among the African population. In view of this therefore, while not ignoring the other population groups, the African population needs to be a special focus in terms of interventions to stem the epidemic in South Africa.

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Table 1: Period estimates of total fertility rate, female life expectancy at birth and HIV prevalence

Total fertility rate*

	1970	1975	1980	1985	1990	1995	1996	1998	2001
African	5.4	5.1	4.7	4.1	3.9	3.6	3.7	3.5	3.2
Coloured	5.1	4.2	3.2	3.2	2.9	2.8	2.8	2.6	2.6
Indian	4.1	3.7	3.2	2.7	2.9	2.5	2.7	2.5	2.5
White	3.1	2.8	2.5	2.2	2.1	2	1.9	1.9	1.9
National	**4.9**	**4.6**	**4.3**	**3.5**	**3.3**	**3.2**	**3.2**	**3.2**	**3.0**

Estimated female life expectancy at birth without HIV/AIDS*

African	57.5	59.3	61.0	62.7	64.3	64.6	64.6	66.4
Coloured	59.5	61.1	62.8	64.3	65.8	66.2	66.2	68.0
Indian	63.9	64.6	65.3	66.0	66.7	67.1	67.1	67.9
White	71.5	72.0	72.5	72.9	73.4	73.7	73.7	74.2
National	**57.6**	**59.1**	**60.6**	**62.0**	**63.4**	**64.5**	**64.5**	65.9

Overall HIV prevalence, 2002**

	% +
African	12.9
Coloured	6.2
Indian	6.1
White	1.6
National	11.4

Estimated HIV adult (15-49) prevalence, 1990-2001***

Year	1990	1991	1992	1993	1994	1995	1996	1998	2001
% prevalence	0.5	1.2	1.5	2.8	5.3	7.3	9.9	14.4	17.2

Source: * Udjo (2003b,2003c, 200d, 2004)
** Nelson Mandela/HSRC
*** Rehle and Shisana (2003).

Table 2: Estimated population of South Africa in (May 31) 2001 with and Without HIV/AIDS by population group

	Model 1 Without HIV/AIDS		Model 2 With HIV/AIDS	
	Thousands	% of Total	Thousands	% of Total
African	331327	76.7	32648	76.5
Coloured	3952	9.1	3933	9.2
Indian	1138	2.6	1137	2.7
White	4996	11.6	4969	11.6
Total	**43218**	**100.0**	**42687**	**100.0**

Table 3: Estimated age structure of South Africa's population In 2001 with and without HIV/AIDS

African		
% in age group	Model 1 without HIV/AIDS	Model 2 with HIV/AIDS
0-4	13.0	12.8
5-14	23.0	23.2
15-64	60.8	60.6
65+	3.3	3.3
20-34	26.1	26.1
Overall sex ratio	97.8	97.8

Coloured		
% in age group	Model 1 without HIV/AIDS	Model 2 with HIV/AIDS
0-4	10.6	10.5
5-14	21.1	21.1
15-64	64.8	64.7
65+	3.6	3.6
20-34	26.0	26.0
Overall sex ratio	98.4	98.4

Indian		
% in age group	Model 1 without HIV/AIDS	Model 2 with HIV/AIDS
0-4	9.8	9.8
5-14	19.5	19.5
15-64	66.3	66.2
65+	4.4	4.4
20-34	25.3	25.3
Overall sex ratio	99.2	99.2

White		
% in age group	Model 1 Without HIV/AIDS	Model 2 with HIV/AIDS
0-4	7.3	7.2
5-14	15.3	15.4
15-64	68.3	68.3
65+	9.1	9.1
20-34	24.2	24.2
Overall sex ratio	96.0	96.0

Table 4: Estimated labour supply with and Without HIV/AIDS in 2001

	Model 1 No HIV/AIDS		Model 2 With HIV/AIDS	
	Pop 15-64	% of total	Pop 15-64	% of total
African	20,131,528	74.9	19,796,124	74.7
Coloured	2,561,801	9.5	2,546,090	9.6
Indian	754,354	2.8	753,095	2.8
White	3,413,972	12.7	3,393,122	12.8
Total	**268,616,55**	**100.0**	**264,88,431**	**100.0**

Table 5: Estimated female life expectancy at Birth in 2001 with and without HIV/AIDS

	Model 1 without HIV/AIDS	Model 2 with HIV/AIDS
African	66.4	53.3
Coloured	68.0	62.5
Indian	67.9	65.9
White	74.2	67.7
Total	**65.9**	**56.4**