Report No. 22043-BT

Botswana
Selected Development Impact of HIV/AIDS

April 20, 2001

Macroeconomic Technical Group
Africa Region

Document of the World Bank

CURRENCY EQUIVALENT
(April 20, 2001)

Currency Unit	=	Pula (P)
Pula 1	=	US$ 0.1792
US$ 1.00	=	P 5.58 (Pula)

ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Clinics
BBTS	Botswana Blood Transfusion Services
BIDPA	Botswana Institute for Development Policy Analysis
CBO	Community Based Organizations
CIDA	Canadian International Development Agency
DMC	Direct Manpower Cost
CMTC	Crisis Management and Technical Committee
EU	European Union
GDP	Gross Domestic Product
HIES	Household Income and Expenditure Surveys
HIV	Human Immunodeficiency Syndrome
IEC	Information, Education and Communication
LFPR	Labor Force Participation Rates
MOH	Ministry of Health
NACA	National AIDS Coordinating Agency
NACP	National AIDS Control Program
NGO	Non-Government Organizations
SSA	Sub-Saharan Africa
SSS	Sentinel Surveillance System
STD	Sexually Transmitted Disease
TB	Tuberculosis
UN	United Nations
UNAIDS	United Nations AIDS Agency
UNICEF	United Nations International Children Emergency Fund
USIAD	United States Agency for International Development
WHO	World Health Organization

Vice President	:	Callisto E. Madavo
Country Director	:	Fayez Omar
Sector Manager	:	Philippe Le Houerou
Task Team Leader	:	James Sackey

Botswana: Selected Development Impact of HIV/AIDS

Table of Contents

This report was prepared by James Sackey and Tejaswi Raparla (AFTM1) with inputs from Shashi Kolavalli and Bala Rajaratnam (Consultants). The report was discussed at the "First Regional Community Home Based Care Conference" in Gaborone, on March 9, 2001. Comments by the participants are duly acknowledged. Substantial support and inputs by the authorities in Botswana are also acknowledged. Secretarial assistance was provided by Felicidad Santos.

EXECUTIVE SUMMARY

Introduction

Over the past three decades, Botswana has emerged as one of the few countries in the world that has sustained rapid economic growth over an extended period. The rapid growth has been accompanied by substantial improvements in human development indicators. Primary school enrolment grew by an average compound growth rate of about 5.5 during 1966 to 1996. In health care, nearly all-urban residents and over 80 percent of rural residents are within 15 km. of primary care facility. One result of this has been a dramatic fall in infant mortality – from 100 per 1000 live births in 1971 to 45 in 1991. Before accounting for the impact of HIV/AIDS, life expectancy at birth had risen from less than 50 years at independence in 1966 to the upper 60s in the early 1990s.

Nevertheless, since the first AIDS case was diagnosed in Botswana in 1985, HIV/AIDS has emerged as a major health and development concern. The rapid increase in the HIV prevalence in the 1990s and the emerging manifestation of AIDS death are likely to reverse the progress made in building Botswana's human capital and in improving productivity. The UNAIDS estimated that about 35.8 percent of adults (15-49 years), that is an estimated 290,000 persons, out of Botswana's population of 1.6 million, were living with HIV (including those with AIDS) in 1999. In addition, it is estimated that about 24,000 people died of AIDS by end-December 1999.

The objective of this report is to provide an overview of selected likely development impact of HIV/AIDS for Botswana. The purpose is to develop a framework for dialogue with the Government, relevant stakeholders and the donor community on the appropriate actions to pursue in support of the Government's strategy on the epidemic. The review was also initiated as an exercise to complement the efforts of policy makers in Botswana to incorporate HIV/AIDS into the planning process on a regular basis. As such, it is directed at the officials at the ministries of finance and development planning. It employs conventional demographic and economic models to analyze selected development impacts of HIV/AIDS on the economy, thereby providing an illustration of how these impacts can be incorporated in the regular planning processes (including annual budgeting) in the finance and development ministries of the Government. It points out the need for monitoring the progression of the epidemic through further research and improvements in the existing research instruments.

Selected Development Impact

This section deals with selected development impact of HIV/AIDS on the economy of Botswana, focusing on the likely demographic effect of the epidemic and its implications for the overall availability of labor in the economy. The objective is to outline the key factors that could contribute to reducing both private and public savings with likely negative impact on domestic investment and growth. In interpreting the results of the analysis, one should be cognizant of data limitations, which include: (i) a general lack of information on many of the factors that determine the ultimate impact of the epidemic; (ii) the uncertainty about the level of prevalence among men, since most data on seroprevalence surveillance are obtained from antenatal clinics serving women; and (iii) the lack of data on adult mortality that would permit validation of the impact of HIV/AIDS on mortality levels and trends.

Demographic Impact: The reduction in population due to AIDS, unlike programs for population control, is unusually damaging to the economy in two fronts. First, while Planned

Parenthood and Population programs support the increase of social capital, deaths due to AIDS do essentially the opposite; they reduce the size of the economically active population. Second, AIDS mortality tends to impose a "shock" to the household's economic structure since the death of an economically active individual could force changes in size, composition and socio-economic status of the household and in the use of time devoted to building human capital. In the presence of HIV/AIDS, long term planning could suffer when social contracts fail.

The estimates suggest that the long-term demographic impact of AIDS is likely to be significant. The population in Botswana is estimated at 1.7 million by 2015, about a million or 67 percent lower than it would have been in the absence of AIDS. The results indicate annual AIDS deaths increasing from 1,535 in 1991 to close to 33,000 by 2015. Closer examination of the data reveals that the number of AIDS deaths exceeds the number of estimated adult deaths in the absence of AIDS during this period. Majority of the AIDS deaths is expected to fall on the 15-49 years age group, that is, the most sexually active and in the prime of their productive years.

Along with the decline of population growth, life expectancy in Botswana is projected to decrease on account of AIDS. Life expectancy at birth measures the average number of years that a newborn child would live if mortality remained constant through out his/her lifetime. As a result of the increasing mortality due to AIDS, life expectancy has already stagnated in Botswana and the trend is likely to continue through 2015. Life expectancy is estimated at 33.5 years for 1999, instead of 68.8 years in the absence of AIDS, a loss of almost 35 years. By 2015, the difference in life expectancy, with and without AIDS, is projected to reach a staggering 42.6 years.

Impact on Labor and Human Resource Development: Apart from directly reducing population growth and life expectancy, and through them the size of the overall labor force over time, HIV/AIDS also affects the dynamics of skill accumulation in the labor market. In the absence of adequate time series data, the labor force is defined as the total adult population 15-64 years (i.e. the economically active population). Because the economically active population tends to be highly correlated with the sexually active group in society, the relative effect of HIV/AIDS is larger among this group than the general population. Although the growth rate of the economically active population remains positive in the With-AIDS scenario, it grows slower than in the No-AIDS scenario. This is partly because the estimated infection rate among the economically active population peaks at almost 40 percent in 2005, compared to an estimated infection rate peak around 36.7 percent for the total population.

The broad conclusion from the above analysis is confirmed by estimates by the Botswana Institute for Development Policy Analysis (BIDPA, 1999), which utilized labor statistics and analyzed them alongside age-specific HIV prevalence rates to project the effect of HIV/AIDS on the future size of the labor force. The projections indicate that growth in the labor force will be significantly smaller in 25 years as a result of AIDS. Without AIDS, the labor force would total 841,000 in 2025 but with AIDS, the labor force would only total 543,000, or just 66% of what it would have been without AIDS. In terms of age profile, the labor force would also be about three years younger (at 32.4 years) with AIDS. Because work experience is more important to skilled than unskilled labor, the shifting of the labor force to a younger age structure would have a slightly greater effect on skilled workers. In an environment where skilled labor is limited, HIV/AIDS is likely to exacerbate the situation.

Macroeconomic Impact: The impact of HIV/AIDS on macroeconomic fundamentals is much more complex than with the foregoing. From the macroeconomic perspective, HIV/AIDS is likely to affect the savings/investment relations. Expenditures for mitigating the impact of

HIV/AIDS at both the household and public sector levels are likely to reduce the amount of capital (both public and private) available for more productive investment; thus the higher the proportion of care financed from savings, the larger the reduction in economic growth resulting from the epidemic.

The report uses a growth model extended to incorporate the increase in morbidity and mortality resulting from HIV/AIDS. The model incorporates, among other parameters, labor productivity losses and AIDS costs met from reduced savings. Using estimates of AIDS deaths, it is estimated that the presence of AIDS in Botswana would reduce the average real GDP growth rate during the period 2000 – 2015 from 4.7 percent without AIDS to 2.2 percent with AIDS. This implies that the economy will grow 2.5 percentage points smaller by 2015 because of the epidemic. This constitutes a projected income loss of about 17 percent of per capita income per year for 2000-15, in part because of population decline. The model assumes that the baseline growth rate will be positive on the basis of past experience and the possibility of other shocks have not been incorporated. The estimates are thus conservative in view of ongoing structural changes in Botswana that have tended to dampen growth performance.

Although the macroeconomic effects of HIV/AIDS do not appear devastating, the impact is not uniformly felt across households. At the household level, HIV/AIDS morbidity and death exacerbates poverty and social inequality. Lower income households will be less able than others to cope with the medical expenses and other impacts, including loss of income. The loss of social capital, coping mechanisms, and the resilience level of the household (that is the ability of households with better education to cope with AIDS compared to others) are key areas requiring policy focus.

Other Effects: HIV/AIDS will likely lead to increasing public expenditures and decreasing government revenues, resulting in the finances of the Government of Botswana ending up in a fiscal deficit. Estimates suggest that the deficit could grow as high as 8 percent of GDP. This unsustainable level could necessitate cut backs in other areas of government spending if a sustainable budget situation is to be re-established. While the magnitude of the impact of the epidemic is subject to the limitations of existing data, it highlights the need for speedy action in order to mitigate its negative consequences.

Policy Options

Developing a policy response to the epidemic in Botswana requires cognizance of ongoing public, donor and private activities to mitigate its impact. National response to HIV/AIDS was initiated shortly after the first AIDS case was reported to the Ministry of Health (MOH) in 1987, a year after the first HIV infected person was identified. In collaboration with the World Health Organization (WHO), MOH established the Botswana National AIDS/STD Program and drafted an emergency plan of action, which resulted in the formation of a number of advisory bodies and the development of new initiatives.

To support ongoing initiatives to deal with the impact of HIV/AIDS in Botswana, the report proposes that Government's focus should be directed at: (a) further reducing the transmission of HIV; (b) prolonging life and reducing AIDS morbidity; and (c) mitigating the negative impact of AIDS on the economy, especially by initiating programs for skills replacement. The report outlines the key areas of action on prevention and mitigation and provides some cost estimates for several components/programs. Because of the limited scope of this study and data limitations, the policy options outlined below are mainly for illustrative purposes. They do not cover all ranges of options.

The preliminary estimates suggest that various elements of prevention could each amount to less than 1 percent of GDP per year. In terms of mitigation, orphan care, for example, is estimated at about an average of 1 percent of GDP per year. The largest single cost element is hospital care, which is estimated at about 4.2 percent of GDP per year on average during 2000-2015. The latter points to the need for alternative programs for handling AIDS and terminal care. Although the above may underestimate the likely cost of prevention/mitigation activities, they point to the likely magnitudes and suggest that such programs can be accommodated by existing resources of Government.

Monitoring HIV/AIDS: The establishment of the HIV sentinel surveillance sites is providing program planners with prevalence data. Nevertheless, there is need to enhance existing systems by the conduct of special seroprevalence surveys on target groups found in situations of high risk, such as the military, commercial sex workers and their clients, and transport workers. Furthermore, available evidence suggests that efforts by the National AIDS Control Program, with the help of several NGOs and international agencies, have increased awareness of HIV/AIDS in Botswana, its mode of transmission and its consequences. However, there is little evidence to suggest that the average citizen considers herself/himself to be at risk of acquiring AIDS, has a good understanding of the asymptomatic nature of STD/HIV infection, or has altered her/his behavior to lower the risk of STD/HIV acquisition. Part of the problem is the lack of frequent behavior studies, and their wide dissemination.

Finally, dealing with the data constraints will require identifying areas where the impact is severe and conducting appropriate studies. An important area is the impact of HIV/AIDS on the household. The microeconomic basis for the development impact of the epidemic indicates substantially more damaging implications at the household level. Furthermore, prevention and mitigation programs require more information than currently available. A household level survey focusing on impact of HIV/AIDS on consumption (expenditures), labor supply, and coping mechanisms could provide valuable information for designing appropriate responses to the epidemic. Furthermore, such a survey can provide behavioral indicators that may be useful for developing preventive messages.

CHAPTER I

HIV/AIDS in Botswana

Over the past three decades, Botswana has emerged as one of the few countries in the world that has sustained rapid economic growth over an extended period.[1] The rapid growth has been accompanied by substantial improvements in human development indicators. Primary school enrolment grew by an average compound growth rate of about 5.5 during 1966 to 1996. In health care, nearly all-urban residents and over 80 percent of rural residents are within 15 km. of primary care facility. One result of this has been a dramatic fall in infant mortality – from 100 per 1000 live births in 1971 to 45 in 1991. Before accounting for the impact of HIV/AIDS, life expectancy at birth had risen from less than 50 years at independence to the upper 60s in the early 1990s.

Nevertheless, since the first AIDS case was diagnosed in Botswana in 1985, HIV/AIDS has emerged as a major health and development concern. The rapid increase in the HIV prevalence in the 1990s and the emerging manifestation of AIDS death are likely to reverse the progress made in developing Botswana's human capital, and in improving productivity. This chapter deals with the status of the epidemic and discusses some of the factors that could contribute to high prevalence rates. It serves as a prelude to a detailed analysis of the likely demographic and economic impact of the epidemic in Botswana.

A. HIV Prevalence

As in other countries, the principal source of data for monitoring HIV prevalence is the sentinel surveillance system (SSS). It includes data gathered at antenatal clinics (ANCs) and facilities for sexually transmitted disease (STD) and tuberculosis (TB). These are usually supplemented by information from blood transfusion services.[2] The first survey of HIV prevalence among pregnant women attending antenatal clinics was conducted in 1992.

The Surveillance at Antenatal Clinics: The survey of pregnant women at antenatal clinics forms the basis of the SSS in Botswana. It is currently the best available method for estimating HIV prevalence among the adult population. The surveys have been conducted since 1992 at six to eight sites on an annual basis over a period of eight weeks, with Gaborone and Francistown always included, while the other six sites vary from year to year. The subjects enter the sample as they come, until the expected number of 300 or 800 sample per ANC clinic is attained. Table 1.1 assembles the outcome of the surveys for 1992-98, which indicates HIV prevalence rate for pregnant women ranging from 7.5 percent in Boteti in 1992 to 49.9 percent in Selibe Phikwe in 1998. The wide variation in prevalence rates is partly a reflection of the timing of the first HIV incidence

[1] Refer to World Bank (1999), Botswana – A case Study of Economic Policy Prudence and Growth, Washington DC.
[2] Although all donated blood in Botswana is tested for HIV, the results of the tests are not available to the public because of the need to safeguard the integrity of the country blood supply system.

in different parts of the country, and partly the nature of reporting.[3] The estimated prevalence rates among the sample of pregnant women in Botswana show a remarkable consistent upward trend in almost every site. As has been observed in other parts of Sub-Sahara Africa, there is a substantial convergence between the prevalence rates observed at sites in major urban areas and those outside major urban areas (rural),[4] although the catchment served by the relevant health institutions could have both urban and rural patients.

Table 1.1: HIV Surveillance Data by Site

Area	Site	1992	1993	1994	1995	1996	1997	1998	1999
Rural	Boteti	7.5							
	Chobe		18.3		37.9		38.3		50.8
	Ghanzi		9.5		18.9			22.3	
	Kgatleng						30.5		29.5
	Kweneng		13.7		18.9	43.8		37.2	
	Lobatse		17.8		38.9		33.7		31.3
	Mahalapye						28.2		32.0
	Maun	12.7				33.1		33.5	
	Ngami/Maun			19.4					
	Serowe		19.9		29.9				
	Serowe/Palapye						34.4		41.8
	Southern			16.0		21.8		24.7	
	Tutume			23.1		30.0		37.5	
Urban	Francistown	23.7	34.3	29.7	39.6	43.1	42.9	43.0	42.7
	Gaborone	14.9	19.2	27.8	28.7	31.4	34.0	39.1	37.1
	Selebi-Pikwe			27.0		37.8		49.9	

Source: UNAIDS: Botswana - Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, November 1999; and NACP, Sentinel Surveillance Report 1999, Ministry of Health, 1999.

In general, estimates of prevalence rates based on ANC data may be biased, because of the method of data collection (which focuses mainly on pregnant women) and thus their extrapolation to the general population would be problematic for the following reasons. First, data from ANC do not include those who use private facilities (typically the higher and medium income groups) and those with no access to such facilities (poor rural residents). The former could have high-risk behavior because of mobility, while the latter are more likely to have less access to information and be prone to high rate of infection. Second, ANC attendees are sexually active group and it cannot be assumed that all women of child bearing age are sexually active nor are those outside the child bearing age not sexually active.

In addition, the method of sampling in Botswana introduces specific biases in the ANC data. First several clinics are included in each site, rather than a single clinic, making it difficult to ascertain the catchment area for the site;[5]second, certain sites are

[3] The first set of surveillance data for HIV were recorded in Boteti and Gaborone, with rates of 4.1 percent and 6.0 percent respectively.

[4] The differentiation used by the UNAIDS for major urban areas (urban) and outside urban areas (rural) is not based on a strict criteria. Urban areas refer to metropolitan areas, while rural areas may not be strictly rural.

[5] This is necessitated by Botswana's small population and limited coverage at each clinic, especially outside the main metropolitan towns.

not covered every year, making it difficult to identify trends and patterns in different communities; and finally, the sentinel sites do not correspond to the census sampling frame, thereby making sub-national projections difficult.

Prevalence Rates for STD Patients: Except for 1996, the Sentinel Surveillance System has also provided information on the pervasiveness of HIV in patients with sexually transmitted diseases (STD) through routine analysis of blood samples. The procedure is similar to the methodology used for ANC in that a target of 250 or 300 samples are collected in the selected six sites, with Gaborone and Francistown analyzed on an annual basis while the other sites feature every other year. Unlike the ANC, the sample includes both sexes but it is collected on a first-come basis until the target is reached.

The estimated prevalence rates, surprisingly, do not exhibit significant variation in any single site over time. Differences in the rates among sites could be attributed to the likely onset of the epidemic at the given location; they reflect largely the relative homogeneity of HIV prevalence rates at the different sites. Because the sample of STD patients is not reflective of the general population, in general, the figures portray HIV prevalence rates than of the general population.[6]

Table 1.2: HIV Prevalence in Selected Sample of STD Patients

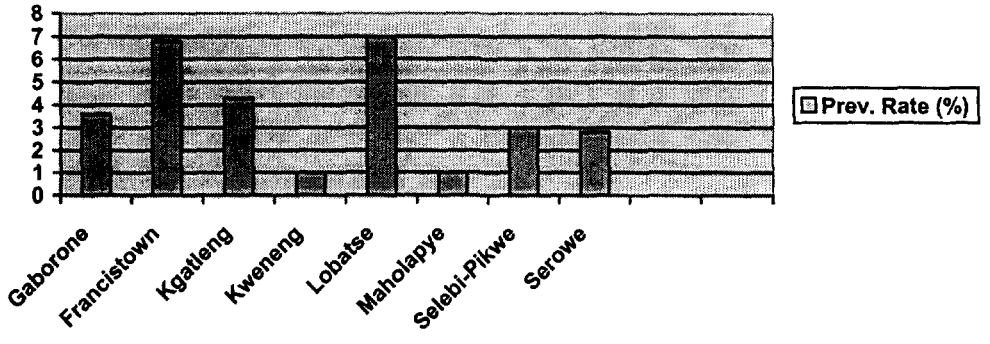
Area	Site	1992	1993	1994	1995	1996	1997	1998	1999
Rural	Chobe		43.6		41.0				56.7
	Ghanzi		15.2		11.5				
	Kgatleng						33.7		51.6
	Lobatse		16.2		50.6		49.3		44.2
	Mahalapye	23.2					36.9		52.7
	Serowe				48.7				
	Serowe/Palapye						34.5		57.6
Urban	Francistown		48.5	53.8	50.7		60.1		62.0
	Gaborone	21.8	30.2	38.1	34.9		39.8		50.7

Source: UNAIDS: Botswana - Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, November 1999, and NACP, Sentinel Surveillance Report 1999, Ministry of Health, 1999.

Other Source of HIV Prevalence Data: Analysis of data from blood transfusion services provides a complementary source for information on HIV prevalence, although the sampling is not necessarily random. Every year, the Botswana Blood Transfusion Services (BBTS) collects blood from voluntary blood donors at sites generally mirroring the sentinel sites. Every unit of the blood is screened for syphilis (VDRL), hepatitis (HbsAg) and HIV. The information on HIV prevalence in this sample is not available to the public in order to protect the integrity of the blood transfusion system. Nevertheless, data available for 1990-91, indicate substantially low level of infection among this group compared to the samples from ANC (Figure 1.1). No information on age and gender was available.

[6] Analysis of TB patients provides similar levels of HIV prevalence as in the case of STD patients. They range from 21.3 percent in Kweneng in 1993 to 52.32 percent in Gaborone. Since STD and TB constitute opportunistic diseases, the higher-level prevalence rates are not surprising.

Figure 1.1: HIV Prevalence Rates Based on Blood Transfusion Services Data: 1990-91



Source: UNAIDS: Botswana - Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, November 1999

Estimated Number of HIV Infection in Botswana: In order to derive the national prevalence rate of HIV infection, the UNAIDS/WHO working group on Global HIV/AIDS Surveillance, in collaboration with national and regional expects, adopted the following approach:

- All previous data from sentinel surveillance in Botswana were reviewed and median rates were calculated for "major urban areas" and "outside major urban areas". The figures were then applied to the official urban-rural population distribution in Botswana.
- The WHO Epimodel 2[7] was applied to the derived data to yield estimates for HIV and AIDS incidence by age and gender.

On the basis of the above, it is estimated by the UNAIDS (2000) that about 35.8 percent of adults (15-49 years), that is an estimated 280,000 adults were living with HIV (including those with AIDS) in Botswana in 1999. For the general population, it is estimated that about 290,000 adults and children in Botswana were infected with HIV, whether or not they have developed symptoms of AIDS.

B. AIDS Statistics

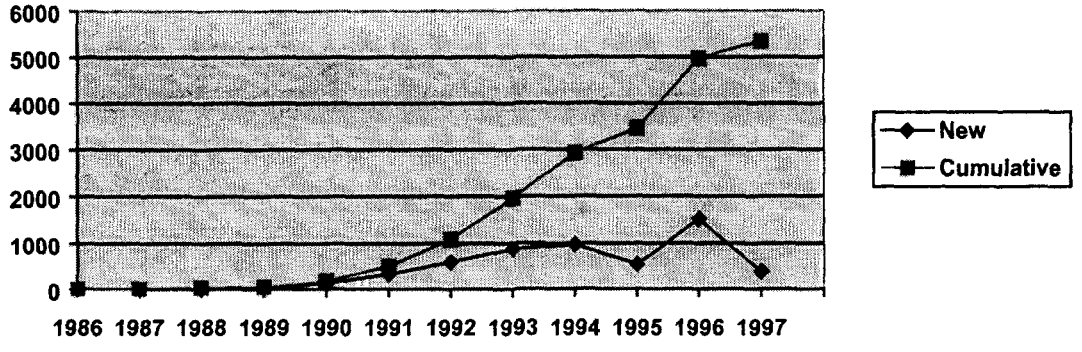
The AIDS/STD Unit of the Ministry of Health maintains statistics on reported full-blown AIDS cases in Botswana.[8] The total number of cumulative reported AIDS cases by end-December 1997 was 5,340 (Figure 1.2). This number is likely to be lower that actual

[7] Epimodel 2 is a microcomputer program originally developed by the WHO Global Program on AIDS to make medium term (less than 5 years) estimates of the number of persons with HIV/AIDS.

[8] There three sources for data on AIDS cases in Botswana: the AIDS/STD Unit, linked to laboratory requests for HIV testing; reports by the Health Statistics Units based on death data by health institutions; and the Vital Events data produced by the Civil Registration System. Each is characterized by various forms of under-reporting and inconsistencies.

number of AIDS cases for the following reasons: (a) inadequate diagnosis, especially because of the relationship between opportunistic diseases like TB and AIDS; (b) failure to seek hospital services, especially in remote rural areas with no health facilities; and (c) poor maintenance of diagnostic AIDS data at health units, especially at the onset of the epidemic.[9]

Figure 1.2: New and Cumulative AIDS cases in Botswana



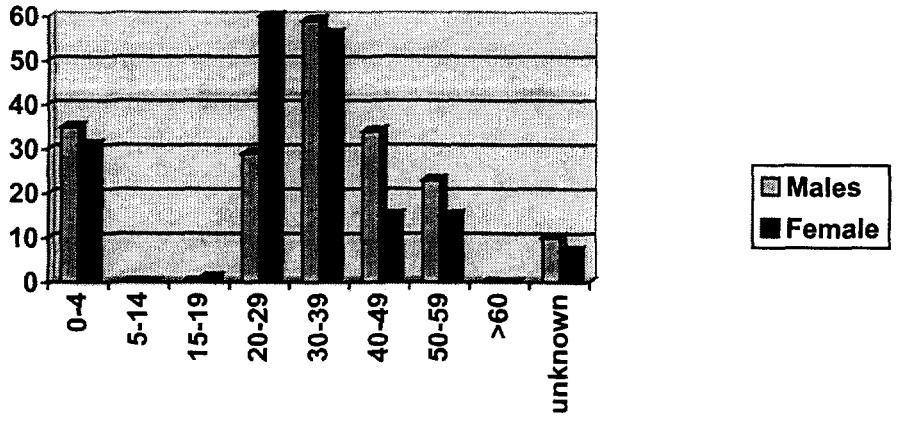
Source: AIDS/STD Unit of the Ministry of Health

Despite the deficiency in the reported AIDS cases, the pattern of evolution reflects the exponential growth characteristic of the epidemic. It is also reflective of the high rate of HIV infection in sexually active adults in Botswana. The pattern of AIDS cases is also a cause for concern:

- The reported AIDS cases are primarily clustered in the 20-59 years age group that accounted for 78 percent of all cases in 1997 (Figure 1.3). With the rise of new infections increasingly concentrated in this age group, HIV/AIDS epidemic is likely to have substantial impact on the demographics of Botswana during the next few years.
- Although the rate of progression from HIV infection to full blown AIDS is faster in women than men, it still a concern that female AIDS cases are much higher than male counterparts in the 20-29 age group. In 1997, 67 percent of all reported cases in the age group were female.
- Eighteen percent of reported AIDS cases in 1997 were children under 4 years of age. Mother to child (MTC) transmission, therefore, appears to be a significant mode of transmission in Botswana.

[9] Poor reporting on the part of the individual is partly attributed to the lack of effort to test for HIV/AIDS and partly the unwillingness to own up because of the stigma associated with HIV/AIDS.

Figure 1.3: Age/Sex Composition of New AIDS Cases in 1997



Source: UNAIDS: Botswana - Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, November 1999

C. Factors Exacerbating HIV/AIDS Spread in Botswana

Identifying the key risk factors in the spread of HIV is important for two purposes. From an analytic point of view, it is necessary to incorporate information of risk groups for projection purposes. Similarly, knowing the groups with high risk, is useful for policy formulation. The discussion in this section focuses on two issues relevant for the spread of HIV: (a) sexual behavior and partnering practices; and (b) knowledge of preventive measures. Both factors are influenced by poverty and migratory practices in Botswana.

Sexual Behavior and Partnering Practices: Information on knowledge and behavior related to HIV/AIDS, is essential for identifying population groups in Botswana at risk of HIV infection. It is also useful for assessing changes over time for evaluating the effectiveness of public prevention efforts. Unfortunately, such information is limited in Botswana. The majority of information on sexual and partnering behavior is limited to descriptive sources, including the knowledge, attitudes, behavior and practices (KABP) survey in 1992, the national census of 1991, and a review of socio-economic and cultural practices influencing the transmission of HIV undertaken in 1996.

With respect to sexual practices, in the 1992 base-line study of 18-25 year age group of male and female, 55 percent of male and 29 percent of female reported to have one or more casual partner (beside the regular partner) over the past year. Although, outdated, a study in 1988 also found that the median age at first sexual intercourse for females in the age group 20-24 years was 17.2 years, while that for the 45-49 years was 18.1 years.[10] It indicates that first sexual contacts are starting more progressively at a

[10] Sources cited as DHS/1988 in UNAIDS, Botswana – Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, 1999.

younger age, which is consistent with trends in other African countries.[11] Research in other African countries suggests that this difference in age of first sexual contact is not a factor of memory (poor recollection of older respondents) but an actual shift to younger age (particularly noted among young women) for first sexual experience.

Unfortunately, detailed and current information on both proximate factors (such as, frequency of partner change) and contextual factors (socio-cultural and demographic variables) of specific population groups at risk, are not available. Such information is vital for determining what behaviors and thus what populations are most at risk of HIV infection and transmission (target behavior and target groups); and for understanding what prevention messages and programs would be effective in reducing this risk in slowing the growth of the epidemic. Research in other countries suggests that commercial sex workers, commercial sex clients and persons who migrate for employment, are some of the population groups practicing risk behavior.

Knowledge of Preventive Measures: Several studies indicate that sexually transmitted diseases (STD) are well known in Botswana, with AIDS being the most widely known. Knowledge of preventive measures is also well widespread. The 1992 base-line survey found that 84.3 percent in Gaborone, 76 percent in Francistown, and 69.8 percent in Maun (three major urban towns) indicated knowledge of at least two correct methods of HIV prevention. For the whole sample, an average 80 percent of respondents correctly cited at least two acceptable ways of protection from HIV infection. Similarly, a 1996 study on condom use in risk sex, found that 85 percent of the respondents among the 18-25 year age group had used condom during their last sexual encounter.[12]

An analysis of risk factors contributing to the exacerbation of HIV/AIDS in Botswana thus identifies two key factors:

- Multiple and frequent change of sexual partnership is facilitated by high mobility of the population. Higher mobility is further facilitated by rapid urbanization, the tradition of having several homes (village, lands and cattle posts), and accentuated by the good quality of local transportation.

- Poverty, unemployment, and gender inequality coupled with the erosion of traditional safety nets and safeguards led to lesser controls on social behavior.

[11] A KABP study for Lesotho for the same year (1998/90) found that the mean age at first sexual intercourse, by current age of respondent, was 20.1 years for the 45-49 years age group, but 18.7 years for the 25-39 years age group, and 17.5 years for the 20-25 years group (Reference: NAPCP/WHO, National KABP/PR Survey on AIDS, 1990).
[12] Sources cited as DHS/1988 in UNAIDS, Botswana – Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Diseases, 1999.

D. Policy Conclusions

The overview of the status of HIV/AIDS in Botswana has highlighted a number of immediate actions that could be undertaken. While awaiting a detailed analysis in subsequent chapters on the demographic and some aspects of the development impact of the epidemic (as well as discussion on ongoing interventions), the following propositions stand out:

Enhancing the sentinel surveillance system: The establishment of the HIV sentinel surveillance sites is providing program planners with prevalence data from two population groups: ANC attendees and STD patients. The first could be a reasonably good proxy for the general population under certain sampling refinement, and the second, for persons practicing behaviors that are obviously at risk in acquiring infections. In addition, information is currently available from blood donor although it is not factored into national discussion.

On the other hand, there have not been any special seroprevalence surveys on target groups found in situations of high risk, such as the military, commercial sex workers and their clients, and transport workers. Furthermore, the KABP surveys have been irregular and it is not possible to derive national trends from these studies. Ascertaining HIV prevalence levels and behavior profiles among likely risk groups would provide important information in defining core and non-core groups in Botswana, as well as baseline data for monitoring effectiveness of intervention. Additionally, such information would assist in decisions regarding the feasibility of aggressive campaign strategies.

Targeted Information Flow: Available evidence suggests that efforts by the National AIDS Control Program (NACP), established in 1987, with the help of several NGOs and international agencies, have increased awareness of HIV/AIDS in Botswana, its mode of transmission and its consequences. However, there is little evidence to suggest that the average citizen neither considers herself/himself to be at risk of acquiring the virus (even though he/she has a good understanding of the asymptomatic nature of STD/HIV infection), nor has altered her/his behavior to lower the risk of STD/HIV acquisition. Part of the problem is the lack of behavior studies, alluded above, and its wide dissemination.

To facilitate individual assessment of risk and behavior change towards prevention, aggressive, accelerated and intensive peer education efforts must be targeted at identified risk groups (e.g. the adolescents). These efforts will require increased and frequent behavior and epidemiological research to determine who in Botswana is playing the most active role in transmitting STD/HIV (the core group) within the population, through unprotected sex and frequent changes in sexual partners, for example. Such research on target groups, would be of great help in Botswana provided it uses appropriate code of confidentiality, in providing counseling, partner referral and follow-up activities.

CHAPTER II

The Demographic Impact of HIV/AIDS

Since independence, mortality rates have declined consistently in Botswana, life expectancy has increased, and impressive gains have been made in reducing infant and child mortality. The onset of HIV/AIDS over the past two decades has, however, caused a reversal in these trends and is likely to result in a demographic profile that may have major implications for labor and the production base of the economy. This chapter sets out to review the likely demographic changes in Botswana brought about by the HIV/AIDS epidemic. The first section discusses the modeling process, followed by an impact analysis in section B. The conclusions are outlined in section C with some key policy implications.

A. Modeling HIV/AIDS

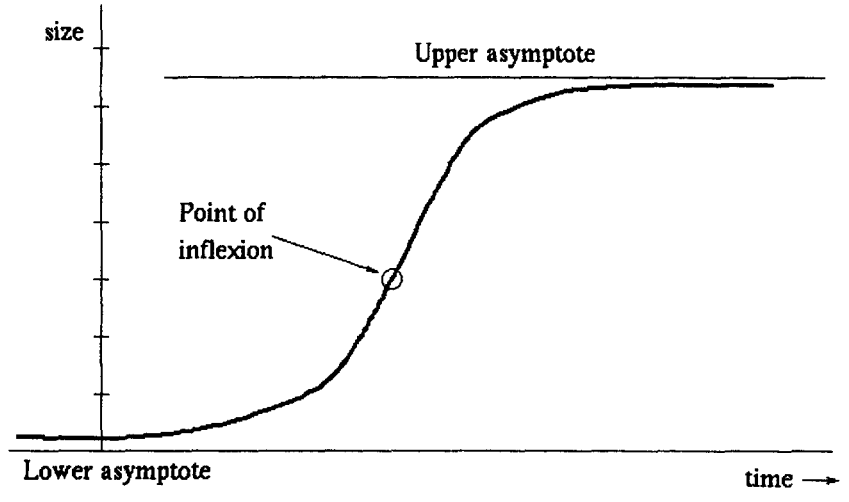
Introduction: Analyzing the future demographic impact of HIV/AIDS requires a sound methodology for projecting the number of future HIV infections and for determining the effect of those infections on the future pattern of adult and child deaths. A number of demographic models have been used to study the future impact of the epidemic. Despite the care taken in deriving existing estimates of HIV prevalence, their accuracy is impaired by data deficiency. Given the uncertainty that surrounds many of the assumptions made in both estimating and projecting the course of the epidemic, it is desirable to explore various models. This study, therefore, focused on seven different demographic models (Annex I).[1] The application of a number of models to the Botswana data is to emphasize the fact that different models perform differently in providing answers to the key concerns in modeling the future pattern of the epidemic. The review also helps to stress the fact that there is as yet insufficient information and understanding of the intricacies of HIV/AIDS transmission in Botswana so as to predict with any reliability the likely future of the epidemic in various settings. Using different models provide an opportunity to discuss likely range of effect of the epidemic.

Common to all the models used in analyzing the demographic impact of HIV/AIDS is a two stage estimation framework: first, the models estimate the annual incidence of AIDS on the basis of recent estimates of HIV prevalence; second, by making assumptions about the probability of progress from HIV infection to AIDS and from AIDS to death, estimates of the annual number of deaths caused by AIDS are obtained. The growth of HIV infection is usually based on the hypothesis that many growth phenomena (especially of epidemics) in nature show an "S" shaped pattern, with initially slow growth speeding up before slowing down to approach a limit (Fig. 2.1). These patterns can be modeled using several mathematical functions. The generalized logistic curve is a widely used as flexible function for growth modeling and presents a possible basis for AIDS modeling. Based on the review of the merits and the demerits of the various demographic

[1] They are the Edelston's simple AIDS model, the Logistic curve model, UNAIDS' Epimodel, the Wilkie's Actuarial model, the IwgAIDS model, the Actuarial Society of Southern Africa (ASSA) model and DemProj by the Futures Group International.

models in Annex I, it was decided to use the outputs of the DemProj as the basis for the analysis of the demographic impact for Botswana, although the results of the ASSA model and other studies would be discussed for comparative purposes.

Figure 2.1: Observed Epidemiological Pattern



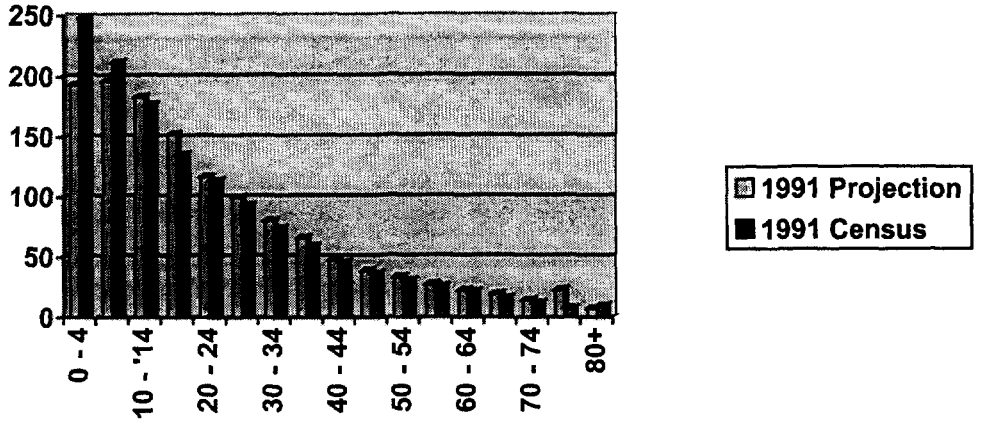
The Demographic Projections (DemProj) Model: The DemProj model forms part of a window-based projection models referred to as Spectrum,[2]developed by the Futures Group International with funding from USAID. The model employs a two stage estimation framework: first, it estimates the incidence of AIDS on the basis of recent estimates of HIV prevalence; and second, by making assumptions about the probability of progress from HIV infection to AIDS and from AIDS to death, various demographic assumptions are derived.

The base year in the model is 1981, which uses the 1981 census data for the population, prior to 1985 when the first AIDS case was diagnosed.[3] And employs estimates of total fertility rate, age distribution of fertility, life expectancy at birth, life table and international migration by sex (Annex I). It is assumed that the transmission rate is essentially through three modes: sexual contact (83 percent), perinatal (15 percent), and blood transfusion (2 percent) based on available information (Chapter 1). The model reasonably tracked the population trends as illustrated in the With-AIDS age profile for 1991 compared with the actual 1991 estimated based on the Population Census (Figure 2.1).

[2] The Spectrum Models were developed by the Policy Project, a United States Agency for International Development (USAID) – funded project implemented by the Futures Group International. Two sub-routines, DemProj and AIDS Impact Model (AIM) are used.

[3] 1981 Population Census presents the best available data, prior to the first HIV diagnosis in 1985, which is used to project the population in 1991 that is compared with actual census population in 1991. Population Census is undertaken on a 10-year cycle in Botswana.

Figure 2.2: Comparison of Population With-AIDS Projection with Actual 1991 Age Distribution



B. The Demographic Impact of HIV/AIDS

The following section assesses the impact of HIV/AIDS by considering the demographic variables such as total population size, additional death due to AIDS, the crude death rate, the life expectancy at birth and infant mortality. 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 discussing uses the information generated by the DemProj model, with comparative reference to ASSA and the results generated by other agencies.

AIDS Mortality: The estimated number of deaths from 1998 through 2015 attributable to HIV/AIDS is presented in Table 2.1. Also shown are the projected number of deaths assuming that there is no such epidemic. The results indicate AIDS death rate of about 14 percent per annum, and that the impact of AIDS on the number of deaths reaches its peak by 2009 and declines thereafter on the assumption that the number of new infections will eventually stabilize. Closer examination indicates that that by the year 2007, the number of AIDS deaths will exceed the number of normal deaths.

Crude Death Rate: The impact of AIDS on the crude death rate is usually severe in countries with high HIV prevalence. Per DemProj model, the crude death rate for Botswana was projected to decline from 6.1 per 1,000 in 2000 to 3.8 per 1000 in 2015 in the absence of AIDS, whereas with AIDS the crude death rate is projected to reach 23.2 per 1000 in 2015. That is, by 2015, the crude death rate is projected to be approximately five times higher than it would have been in the absence of AIDS. An alternative estimate by the UN (1999) indicates that if AIDS had not spread, the crude death rate in Botswana would have been 12 deaths per 1,000 in 1995-2000 and would have declined to 17 deaths per 1000 in 2005-2010. Because of AIDS, the crude death rate is estimated to be 12.7 per 1000 in 1991-1995 and is projected to rise to 27.2 deaths per 1000 in 2000-2005 before

tapers off to 27.8 deaths per 1000 in 2005-2015. AIDS is thus expected to double the crude death rate of Botswana.

Table 2.1: Mortality Impacts, With and Without AIDS

		1991	1996	2000	2005	2010	2015
AIDS deaths		1,533	12,974	23,993	38,384	40,203	33,070
Cumulative AIDS deaths		2,357	44,442	123,309	296,813	502,721	677,437
Young adult deaths	With AIDS	3,044	12,850	22,822	33,845	33,672	28,328
	No AIDS	1,230	1,258	1,272	1,248	1,157	1,063
Under 5 years	With AIDS	140.5	146.1	158.1	162.7	147.6	125.5
	No AIDS	131.0	115.2	103.7	90.1	77.0	65.5
Crude death rate	With AIDS	10.0	16.5	22.7	29.6	28.4	23.2
	No AIDS	8.2	6.9	6.1	5.2	4.4	3.8
Crude birth rate	With AIDS	38.8	35.7	33.6	32.6	32.1	31.7
	No AIDS	40.1	38.5	37.9	36.5	34.1	31.8

Infant Mortality: A contributory factor in the expected high crude death rate is the expected increase in infant mortality. It is estimated that approximately one-fourth to one-third of the children born to HIV-positive women is likely to acquire the infection from their mothers. Table 2.2 presents the infant mortality rate for Botswana, taking into account the impact of AIDS and in the absence of it. Even with AIDS, the infant mortality rate is expected to decline, but such a decline is expected to be less steep. While the various models used different initial estimates of mortality, they all reach broad conclusions about the magnitude of the impact in the outer years, with HIV/AIDS reducing the positive impact of gains in health care over the past three decades.

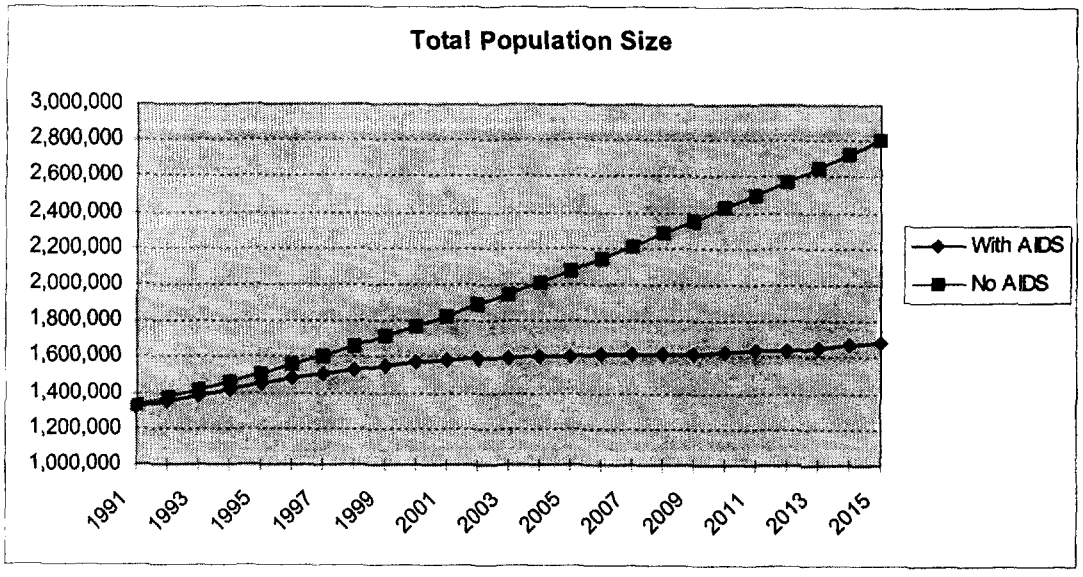
Table 2.2: Comparable Projected Infant Mortality Rates, With and Without AIDS (Per 1000 Population)

Indicator	1991	1996	2000	2005	2010	2015
DemProj						
With AIDS	78.9	75.7	76.7	70.8	60.3	50.0
Without AIDS	78.7	74.5	72.8	64.5	53.7	44.0
US Census Bureau						
With AIDS		59.3			55.2	
Without AIDS		36.4			26.3	

Population Size: Figure 2.3 presents the projected population size from 1998 to 2015 taking into account the demographic impact of AIDS as well as the hypothetical projected population excluding the impact of AIDS. The absolute difference between the projected population with and without AIDS indicates that the cumulative impact of AIDS. The population in Botswana is estimated at 2.8 million by 2015, about 1.2 million fewer or 67 percent lower than it would have been in the absence of AIDS. In general, it might be concluded that although AIDS has a very serious relative effect on population size over the long term, it is not expected to lead to absolute population decline during the projected period.[4]

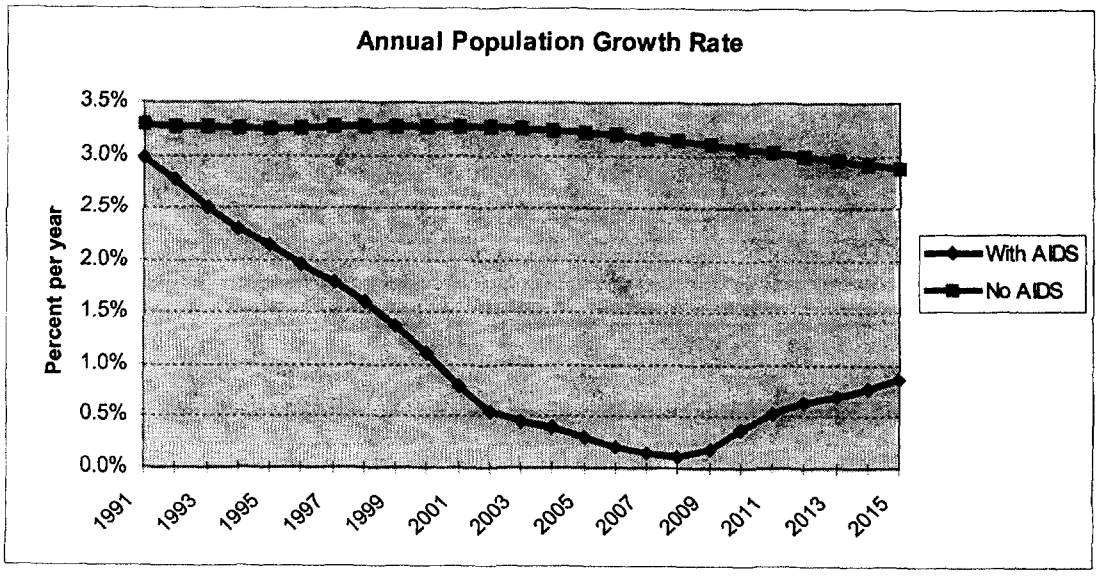
[4] The estimates do not assume major behavioral changes which is likely to alter the trend in the long term population growth.

Figure 2.3: Population Size With and Without AIDS



Population Growth: In view of the above, it is expected that the rate of population growth would decline mainly because of the increase in mortality brought about by the HIV/AIDS epidemic (Figure 2.4). An increased use of condoms to prevent the spread of HIV could also contribute to the decline but this has not been factored into the analysis.

Figure 2.4: Annual Rate of Population Growth With and Without AIDS



In the absence of AIDS, it is projected that Botswana's population would have been growing at about 2.9 percent by 2015. With AIDS, the impact is likely to be staggering. Estimated at 2.9 percent per annum in the early 1990s, the growth fell to 1.1 percent a year by 2000, and is expected to decline to an alarming 0.9 percent by 2015. Comparable estimates by the UN and other researchers confirm this trend.

Life Expectancy: Along with the decline on population growth, life expectancy in Botswana is expected to decline on account of AIDS. Life expectancy at birth measures the average number of years that a new born child would live if mortality remained constant through out his/her lifetime. As a result of the increasing mortality due to AIDS, life expectancy has already stagnated in Botswana and the trend is likely to continue through 2015. Life expectancy is thus estimated at 31.0 years for 2000, instead of 69.2 in the absence of AIDS, a loss of almost 38 years. 2010 project the difference in life expectancy with and without AIDS projected to reach a staggering 42 years by 2015. Comparable estimates of life expectancy With-AIDS by the US Bureau of Census is 37.8 years in 2010, a loss of about 30 years. In general, all the models point to a devastating impact of HIV/AIDS on life expectancy in Botswana by 2010-15 in the absence of a major response to the epidemic.

C. Conclusions

This chapter has documented the likely impact of HIV/AIDS on the demography of Botswana. The toll of the epidemic is now becoming obvious and it is likely to worsen in the medium term. Nevertheless, before arriving at some policy conclusions, the limitations of the analysis need to be highlighted as a basis for qualifying the conclusions of the analysis.

Limitations: The precise magnitude of the epidemic is difficult to determine because of the following:

- As the results of the alternative models indicate, there is a general lack of information on the many factors that determine the ultimate impact of the epidemic. Thus, there is the need for a better understanding of the distribution of the time of progression from HIV infection to AIDS and from AIDS to death. Small changes on the assumptions made regarding the progression time can have important effect on the ultimate mortality estimates.

- The type of data which serves the basis of analysis are also subject to many limitations (Chapter I). In particular, there is considerable uncertainty about the level of prevalence among men, since most data on seroprevalence surveillance are obtained from antenatal clinics serving pregnant women. Data from STD sources are equally biased.

- The lack of adequate data on adult mortality that would permit a validation of the impact of HIV/AIDS on mortality levels and trends needs to be rectified. It is therefore necessary to establish an HIV/AIDS monitoring system that recognizes the multi-sectoral nature of the epidemic. Surveys and other data gathering sources should thus go beyond epidemiological needs.

- It is worth noting that most HIV/AIDS projection models, such as the Epimodel, were developed with specific objectives in mind.[5] They were not intended to be used to provide information for all eventualities. Therefore, diversities in results should be recognized in deriving policy conclusions.

In view of the above, there is a need for a nationally representative survey, to collect relevant data for the estimation of HIV prevalence and for the purposes of medium to long-term projections. Information on the number of deaths occurring in a household over a given period, for example, together with the age and sex of the diseased or information related to the number of orphans, etc. could provide crucial data for validating estimates about the course of HIV/AIDS epidemic. Socio-economic data also provides information that would permit the identification of vulnerable and high-risk groups.

Policy Conclusions: Despite the uncertainties surrounding any measure of the impact of HIV/AIDS on the demography of Botswana, it is important to underscore that all available data buttress the case for concern. The epidemic is already widespread and if the projections assembled in this report is reflective of the pattern of development in the medium-term, then AIDS is expected to have a major detrimental effect on the population dynamics of Botswana in the absence of an effective measure to steam the rapid spread of HIV. In summary AIDS will:

- *Have an important effect on the annual rate of population growth in Botswana.* But the most dramatic effect of AIDS is its impact on life expectancy at birth. In Botswana life expectancy is expected to sharply drop, reversing the substantial gains made since the 1960s.

- *Affect infant and child mortality.* Infant mortality is projected to fall during the projected time period, but at a slower rate than in the absence of AIDS.

- *Exacerbate the problem of the number of orphans (defined as children without mothers).* With an estimated AIDS related deaths of about 36,000 deaths per year during 2000-2015, the estimated average number of orphans is expected to increase by 18,000 per year.

In view of the above, Government authorities, in conjunction with the civil society, urgently need to strengthen HIV/AIDS awareness programs for the general population, focusing on the seriousness of the HIV/AIDS epidemic and take action to support preventive measures and to mitigate the impact of the epidemic. From the planning perspective, steps need to be taken to factor the above demographic information into the planning process in Botswana. Since the accuracy of existing estimates are limited by data inadequacies, the establishment of socio-economic monitoring programs would be desirable.

[5] The Epimodel, for example 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.

CHAPTER III

The Macro-Economy and HIV/AIDS

Beyond changing the demographic structure of a country, HIV/AIDS could have substantial impact on productivity and consequently savings/investment relations and growth. However, these relationships are complex. For example, in the presence of surplus labor and differential wage rates in various categories of labor, as a result of the epidemic, the choice in production technique may likely shift the relative prices of the factors of production and thus the effect on growth becomes ambivalence. The objective of this chapter is to investigate the likely impact of the epidemic on the macro-economy of Botswana. It reviews Botswana's growth record and highlights the likely impact of the epidemic on key macroeconomic fundamentals using the results of ongoing studies commissioned by the Government and estimates generated by the AIM model.

A. Botswana's Economic Growth Record[1]

Botswana is one of a very small group of countries in the contemporary era, and virtually the only African country that has sustained rapid economic growth over an extended period of time. Between 1966 and 2000, real per capita GDP growth averaged nearly 8 percent per annum. From being one of the 25 poorest countries in the world in 1966, with a per capita income of about $660, Botswana has graduated to a middle-income country, with an income per head of over $3,000 in 1998.

Minerals have provided the basis for Botswana's high level of economic growth; the country is now the third largest African mining producer by value, after South Africa and Democratic Republic of Congo (DRC) and the second largest diamond producer in the world. The mining sector's contribution to GDP has risen from only 1 percent in fiscal year 1971/72 to nearly 40 percent of GDP by 2000. However, mining has not been the main source of growth as the government, manufacturing, service and traditional sectors of the economy have grown as well.

Botswana's growth has been supported by prudent and pragmatic government economic policy. It is not unusual for an economy heavily dependent on one mineral export to experience booms and dramatic slumps. Botswana's mineral sector has indeed exhibited such a pattern, but government has been successful in managing this by building substantial savings- an average of 30 months of import cover-- to act as a shock absorber during bad times. It has also used revenues and savings from the mining sector to invest in infrastructure and skills necessary to diversify the economy.

Poverty levels have fallen during this period of sustained growth. According to National Household Income and Expenditure Surveys (HIES) undertaken in 1985/86 and 1993, national poverty levels declined from 59 percent to 47 percent of the population.

[1] For a review of Botswana's growth record refer to World Bank (1999), Botswana: A Case Study of Economic Policy Prudence and Growth, AFTM1, Washington, DC.

In terms of households, the poverty rate declined from 49 percent of households to 38 percent during the same period. Despite these improvements, poverty levels are still high in relation to the overall per capita GDP and the sustained rate of economic growth. A contributing factor to income inequality and poverty in Botswana may be the high level of unemployment. The most recent Labor Force Survey (1996/97 LFS) indicated unemployment at 21 percent, an increase of 5 percentage points from the 1984/85 LFS.

Botswana's compelling story of economic growth and success is seriously threatened by HIV/AIDS. Botswana's HIV prevalence rates are among the highest in the world and have the potential to slow down economic growth and poverty reduction efforts significantly through such channels as falling investment, reduction of skilled labor and losses in worker productivity, as well as through lower government revenue and higher spending. Analyzing the inter-dependence and impact of these variables is an evolving discipline and, despite their importance to the economic planning process, the exercise is only at an early stage. The following review utilizes the few assessments that have been undertaken, primarily relying on the recent work undertaken by the Botswana Institute for Development Policy Analysis (BIDPA), supplemented by analysis using the AIM model.

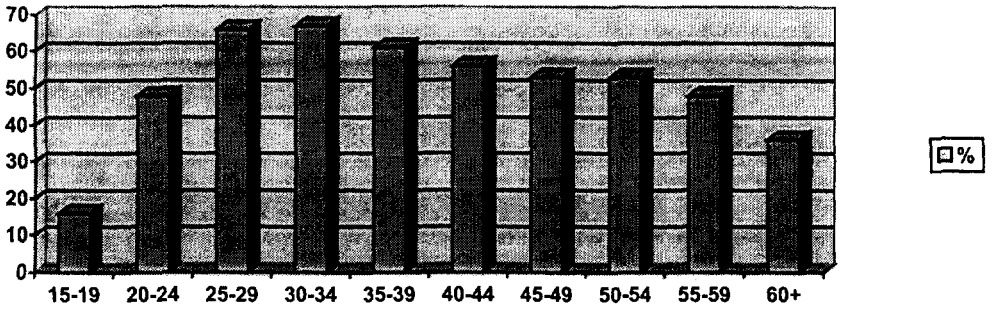
The economic effects of HIV/AIDS would be felt first by individuals and their families, then ripple outwards to firms and businesses and the macro-economy. The following discussion primarily focuses on the macro-economy. Within the macro-economy, the following key economic variables are considered the most relevant: labor force, productivity and wages; savings, investment and consumption; and government revenues and expenditures. The impact on poverty and inequality is also explored.

B. Impact on Labor and Human Resource Development

Apart from directly reducing population growth and life expectancy, and through them the size of the overall labor force over time, HIV/AIDS also affects the dynamics of skill accumulation in the labor market. AIDS tends to kill prime age adults, many of who are skilled and at the peak of their economic productivity. This section focuses on the impact of HIV/AIDS on labor supply and human resource development in Botswana. It also discusses the likely impact on public sector staffing, since the public sector is the single largest employer of labor.

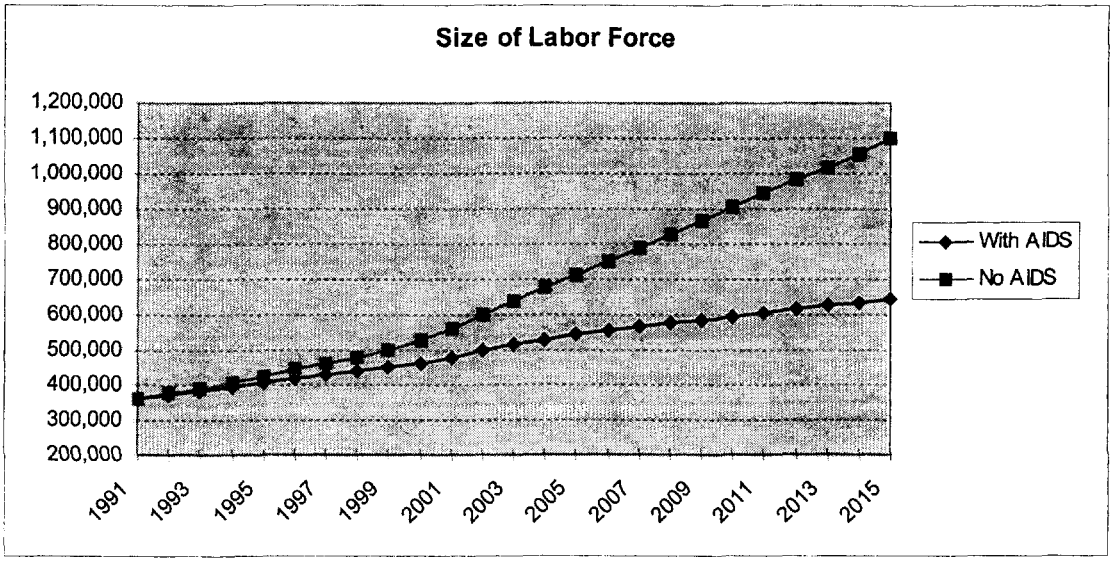
Labor Force Participation: Botswana's high HIV/AIDS prevalence is likely to have a major impact on the labor force by affecting its size, employment levels, productivity and wages. The 1995/96 Labor Force Survey (LFS) provides information on the existing size, age and distribution of the labor force and, in combination with the population census, produces labor force participation rates (LFPR). The total labor force in 1995/96 was 401,000, or 48 percent of the working age population, with a maximum LFPR of 67 percent in the 30-34 age category (Figure 3.1). This is reflective of youthful labor force participation and one, which could be substantially impacted by the AIDS epidemic.

Figure 3.1: Labor Force Participation Rates (in Percentage)



Of the total labor force of 401,000, nearly 53 percent were employed in the formal sector of the economy. The rest was employed in traditional agriculture (10 percent), and urban informal sector (13.5 percent), or were classified as unemployed (23.2 percent). The high rate of unemployment supports the hypothesis of a labor surplus economy. Furthermore, classification by skill levels indicates that about 80 percent of the labor could be categorized as unskilled.

Figure 3.2: The Size of the Labor Force – With and Without AIDS



In the absence of an adequate time series, the labor force is defined as the total adult population 15-64 years (i.e. the economically active population). Figure 3.2 presents the total economically active population, with and without AIDS.[2] Because the economically active population tends to be highly correlated with the sexually active group in society, the relative effect of HIV/AIDS is larger among this group than the general population. Although the growth rate of the economically active population

[2] The magnitude of the economically active population in the No-AIDS scenario is obtained by adding back the AIDS deaths among the economically active and applying fertility and mortality rates of the total population.

remains positive in the With-AIDS scenario, it grows slower than in the No-AIDS scenario. This is partly because the estimated infection rate among the economically active population peaks at almost 40 percent in 2005, compared to an estimated infection rate peak around 36.7 percent for the total population.

The broad conclusion from the above analysis is confirmed by estimates by BIDPA (1999), which utilized labor statistics and analyzed them alongside age-specific HIV prevalence rates to project the effect of HIV/AIDS on the future size of the labor force. The projections indicate that growth in the labor force will be significantly smaller in 25 years as a result of AIDS. Without AIDS, the labor force would total 841,000 in 2025 but with AIDS, the labor force would only total 543,000, or just 66% of what it would have been without AIDS. In terms of age profile, the labor force would also be about three years younger (at 32.4 years) with AIDS. Because work experience is more important to skilled than unskilled labor, the shifting of the labor force to a younger age structure would have a slightly greater effect on skilled workers. In an environment where skilled labor is limited, HIV/AIDS is likely to exacerbate the situation.

Worker Productivity: The productivity impact of AIDS-related illness comes from workers taking time off work because they are sick and also those at work working less hard because of illness or anxiety. Working days will be also be lost because of HIV/AIDS infection of workers' family members, as employees take time off to look after sick relatives. These effects will reduce the supply of labor and increase its cost. A second channel through which AIDS can affect productivity is through the disruptive effects of more frequent replacement of workers. Even if sick or dying workers can be replaced, their replacements will not immediately reach the same levels of productivity; this effect will be more pronounced where experience and learned skills are more important.

While the impact of HIV/AIDS on productivity is clearly negative, quantifying the above effects is extremely difficult. Some of the difficulty lies in the nature of AIDS and Botswana's health status. Better health care, fewer opportunistic infections, and a longer incubation period between infection and development of the virus and between development of the virus and death would dampen the loss in worker productivity. Perhaps more importantly, for the economic analysis, HIV prevalence rates for different sections of the labor force or socio-economic status are unknown. Those segments with higher infection rates would be expected to grow more slowly (due to deaths) and have higher productivity losses. Because Botswana is characterized by a shortage of skilled workers and if skilled workers have relatively high infection rates, this shortage would be exacerbated, with potentially adverse effects on economic growth and output. At the same time, Botswana has high unemployment and an unskilled labor force with marginal productivity close to zero. HIV/AIDS infection among this segment of the labor force is more likely to reduce unemployment than have a major effect on productivity and economic output.

C. Aspects of Macroeconomic Impact

From the macroeconomic perspective, HIV/AIDS is likely to affect the savings/investment relations. Since expenditures for mitigating the impact of HIV/AIDS, at both the household and public sector, are likely to reduce the amount of capital (both public and private) available for more productive investment; the higher the proportion of care financed from savings, the larger the reduction in growth resulting from the epidemic. In recognition to the above, two approaches have been adopted in the literature. The *first* uses a growth model extended to incorporate the increase in morbidity and mortality resulting from HIV/AIDS (Cuddington, 1992; Over, 1992, and others). The model incorporates, among other parameters, labor productivity losses and AIDS cost met from reduced savings. The *second* uses a Computable General Equilibrium (CGE) model in which the labor market incorporates various labor skill categories (Kambou, Devarajan and Over, 1992). The discussion in this study follows the first approach and is based on simulations using the AIMS model.

Savings and Investment: Investment is a key determinant of economic growth and any reduction in the rate of investment is likely to have an adverse affect on future income growth. Investment intentions may change if the returns to investment change. For instance, if AIDS causes a shortage of labor or raises the relative cost of wages, firms may decide to adopt more capital intensive production techniques and increase investment. Alternatively, higher labor costs may cause the overall profitability of investment to fall, which could cause a reduction in investment.

Investment is also strongly influenced by the degree of uncertainty or risk in an economy. An increase in uncertainty about future costs, revenues and profits will reduce the investment rate. HIV/AIDS adds to the level of uncertainty in an economy, as firms may be unsure as to whether they will be able to secure the necessary supplies of skilled labor in order to maintain production, given that HIV/AIDS is anticipated to reduce the labor supplies in future. Uncertainty is heightened when there is lack of a clear policy direction on how the government or firms will deal with AIDS.

Savings also affect investment. Many African countries are characterized by a shortage of domestic savings and dependence on foreign capital inflows to finance investment. A reduction in the rate of domestic savings may cause overall investment to fall as access to foreign inflows is highly constrained. If part of the costs of dealing with AIDS is financed through savings, then the overall savings rate will fall and lead to lower investment. Botswana is not in this typical situation however, as domestic savings have exceeded investment over the past decade. Between 1987 and 1997, gross fixed capital formation averaged 28 percent of GDP and savings averaged 42 percent of GDP. The result has been an accumulation of foreign assets and a buffer from the effects of a fall in savings.

The cost of paying for AIDS (out of savings) varies depending on the types of treatment, length of incubation periods, and the type of opportunistic infections. .AIDS-related health expenditure is often estimated by using a general formula that estimates the treatment cost of HIV/AIDS as 1 to 4 times the level of GDP per capita. In Botswana, such a formula would result in estimates of annual treatment cost between P 15,000 and

P 60,000 per case, and aggregate public sector costs up to 7 percent of GDP (health expenditures are discussed in more detail below). If expenditures fall entirely on savings (and not consumption), savings rate could fall considerably from current rates of 40 percent.

The encouraging part of this story is that Botswana's savings rates have some latitude to fall before they would be unable to finance investment. Even if the savings rate dropped by a third, they would only be marginally below the average rate of investment over the past 20 years. Furthermore, at least part of the cost of caring for AIDS patients is likely to be met from consumption, which would reduce the impact on savings. A further cushion is provided by foreign exchange reserves, which can be used to finance any temporary shortfall of savings below desired investment as reserves are at present 150 percent of GDP.

Overall Economic Growth: Modeling the impact and interaction of labor shortages, worker productivity loss, and decreases in investment and savings will provide projections of the overall effect of HIV/AIDS on economic growth and output. Botswana is one of the few countries in the Southern Africa region that has developed a model to predict the impact of AIDS on GDP. BIDPA (1999) has constructed a model that uses a production function of labor, capital and productivity changes. The economy is divided into formal and informal sectors, and labor force projections are made for AIDS and no-AIDS in each of three labor markets (skilled and unskilled in formal sector and unskilled in informal sector). This provides outcomes for wages and employment in each of three labor markets and real output in the formal and informal sectors.

If there were No-AIDS, the BIDPA model projects GDP annual growth of 3.9 percent between 1996 and 2021. With population growth, GDP per capita grows more slowly at 1.5 percent per annum. Growth in the formal sector is faster (4 percent) than informal sector (2 percent), mainly because of lower gross investment in the latter. Demand for skilled labor pushes skilled worker's wages up one percent, while unskilled wages remain constant as a result of a ready pool of underemployed and unemployed labor. As a result of higher wages, there is some substitution of unskilled for skilled labor and employment grows faster (4 percent) for unskilled than skilled labor (3 percent). Average wages rise by 0.8 percent.

With AIDS, several key parameters are affected. These include:

- Smaller growth in the labor force. As highlighted above, the labor force after 25 years would be about 543,000 workers, just 66 percent of what it would be without AIDS. Perhaps more importantly, the number of skilled workers would be 104,000 compared to 161,000 if there were no AIDS.

- Productivity of workers will drop. The model undertakes sensitivity analysis ranging from a 10 to 20 percent drop, equivalent to one to two years lost over a ten year HIV/AIDS infection period.

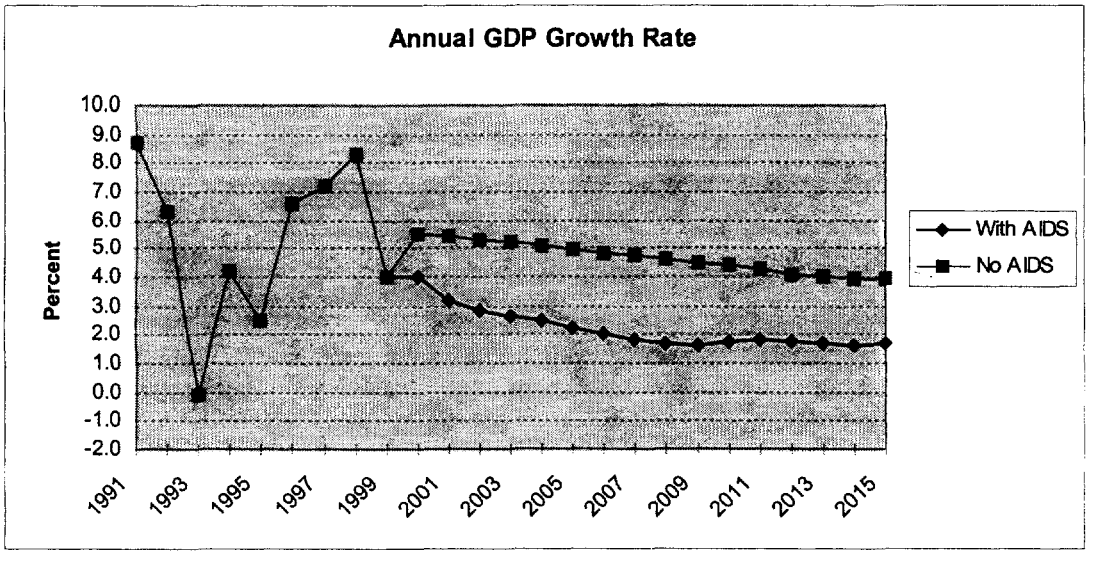
- The investment rate falls as a result of lower domestic savings. The model undertakes sensitivity analysis that projects the effect of savings falling from current 40 percent to between 25-30 percent;

- Annual growth rate of total factor productivity (TFP) falls to just 0.25 percent (compared to 0.5 percent in no-AIDS scenario.

The results provide some useful insight into the possible impact of AIDS on the economy. AIDS would have a negative impact on the rate of economic growth in Botswana; the rate of GDP growth would fall from a projected 3.9 percent a year without AIDS to between 2.0 and 3.1 a year with AIDS, depending on the magnitude of the fall in productivity, investment, and TFP. After 25 years, the economy would be 24 to 38 percent smaller. It is important to note that although both GDP and average income growth rates may fall as a result of AIDS; both remain positive and may simply be lower than they would have been without AIDS. However, the impact on GDP per capita is less clear. In some cases, GDP per capita could rise as population growth falls more rapidly than economic growth.

Average wages rise while unemployment falls. Without AIDS, they rise by 0.8 percent a year or 21 percent over the 25 year period. With AIDS, the growth rate varies between 1.4 percent a year (41 percent in total) and 0.9 percent a year (24 percent in total). In all cases, skilled wages rise by more than unskilled wages. Without AIDS, underemployment falls from 47 percent to 36 percent over the period. With AIDS, underemployment falls more quickly to between 26 percent and 37 percent, with corresponding falls in unemployment.

Figure 3.3: Annual GDP Growth in Constant Prices (With and Without AIDS)



The BIDPA simulations are supported by estimates obtained by using simplistic assumptions (Annex II) through the AIMS model. It is estimated that the present of AIDS

in Botswana reduces the average real GDP growth rate during the period 1999 – 2015 from 4 percent without AIDS to 1.7 percent with AIDS (Figure 3.3). This implies that the economy will grow 2.3 percentage points percent smaller (or close to 40 percent smaller) by 2015 because of the epidemic. The model assumes that the baseline growth rate will be positive on the basis of past experience and the possibility of other shocks have not been incorporated. The estimates are thus conservative in view of ongoing structural changes in Botswana that have tended to dampen growth performance.

In general, the results from the growth models are highly sensitive to changes in the investment rate, which is not surprising given the major share that capital has in the production function, which drives the model. AIDS-caused reductions in the investment rate and productivity growth rate are not at all unlikely, and present the greatest potential for a highly adverse economic impact. It is worth emphasizing that the above results make no reference to the human suffering caused by HIV/AIDS. Even in cases where per capita incomes rise as a result of the epidemic (as population falls faster than GDP), it must be stressed that they rise for only the survivors.

D. Impact of HIV/AIDS on Poverty and Inequality

The estimates of the aggregate macroeconomic impacts of HIV/AIDS may give the impression that these impacts are likely to be minimal. Since national GDP per capita is unlikely to be significantly affected, this may seem to imply that the socio-economic impacts will be small. However, aggregate measures such as GDP per capita conceal information about income distribution. Although overall GDP per capita may not be drastically affected, this may be the result of a rise in income for those households not affected by HIV/AIDS and a huge or catastrophic fall in income for households that are affected.

Given Botswana's high prevalence rates, it is likely that many households will have at least one member affected by AIDS. Demographic estimates discussed in Chapter II by BIDPA (1999) suggest that nearly 50 percent of households will be affected by HIV/AIDS. Furthermore, because of the employment structure, 26 percent of households could lose income as a result of death of a major income earner. This is less than the total affected because of the high rate of unemployment in the country.

The most obvious impacts of HIV/AIDS apply to the expenditure needs of households. Affected households must pay for the medical costs of treating infected household members. This expenditure will be affected by income level, with wealthier households likely opting for more expensive treatments. Poorer households, which rely heavily on state medical care provision, would face additional costs in terms of transport and food. Households must also pay the cost of funerals when a person with AIDS dies and these costs can be large in Botswana. These additional expenditure requirements will be added to the package of basic household needs. In other words, there is an addition to the poverty line, which re-defines the level of income upwards that constitutes poverty—and a family affected by HIV/AIDS is therefore more likely to be classified as poor. Households would also be affected by the loss of income from infected household members who die of AIDS.

An analysis of the impact of HIV/AIDS on household poverty was conducted by BIDPA (1999). Using the HIES alongside the 1998 sentinel survey, the analysis assigns a probability of being HIV infected with the socio-economic status of households, and compares household income distribution before and after the 10 year period during which all HIV positive individuals would die. Since the HIES contains employment and income data, the income of employed HIV positive persons was subtracted from the household at the end of the ten year period. At the same time, unemployment would decrease and skilled wages increase as a result of HIV/AIDS.

The results indicate that HIV/AIDS will cause a decrease of between 8-10 percent in the household per capita income in Botswana over the next 10 years. Income inequality, as measured by the GINI coefficient, is unlikely to be affected despite the forecast income changes. The percentage of people living in poverty in Botswana is likely to increase by between 4 and 6 percent as a result of HIV/AIDS or between 65,000 and 95,000 people. This would reverse about half of the gain in poverty alleviation from the previous decade. The percentage of households in poverty is likely to increase by between 6 and 85 (17,000 to 22,500 households). Poor households will become more vulnerable. Every income earner in the lowest quartile of per-capita household income can expect 4 additional dependents. The poor will become poorer. The average income of the poorest quarter of households is likely to fall by 10 to 15 percent.

E. The Impact on the Government Budget

The impact of AIDS is so large that it will inevitably have an impact on the government revenue and spending and therefore on the budget balance and government saving and borrowing. Most directly, AIDS will affect the health budget, but there will also be a range of indirect effects.

Expenditures: The macroeconomic projections discussed above indicated that wages, primarily those of skilled workers, could rise as a result of HIV/AIDS. Since government is a major employer, it will face the higher wage rates. The proportion of the wage bill paid to skilled workers affects the employment costs to government, which is higher than in private sector. An estimated 27 percent of workers in government or parastatals are skilled. The effect would be greatest in education and health sectors, both of which are major employers of skilled workers. It could also be expected that there will be an increase in death benefits and funeral expenses as a result of increased mortality among employees. Savings in pension costs resulting from earlier mortality of employees could however, significantly offset this. Population projections indicate that the population aged 45 or over will be smaller in future than it would be without AIDS, which will have a major impact on pension liabilities.

The other cost arises from AIDS deaths and the loss of trained staff who have to be replaced. Government will need to train more than the usual number of pole in order to compensate for those who will die. The amount of training required depends on the length of the training course, and the length of time for which the government would expect to benefit from the skills provided. A four-year degree course could be expected

to be followed by a further four years of service. The number dying over the eight years period, compounded (25 deaths per 1,000 per annum), amounts to about 220 per thousand. That is, government would need to send an extra 22 percent of individuals on degree courses.
The effects of this need to train additional staff are being felt throughout the region, especially in the education sectors of neighboring countries where trained teachers are in short supply.

Health expenditures will rise significantly as a result of HIV/AIDS. Health expenditures will increase as: (i) great numbers of people seek health services; and (ii) health care for AIDS patients is more expensive than for most other conditions. Expenditures are dependent on a number of factors:

- Decisions taken about making drug therapies generally available. These therapies are currently very expensive (P 1,200 to P 4,000 per month), and the (unknown) future availability of new treatments.
- The degree to which care for AIDS patients is split between hospital based and home based care.
- The degree to which costs are met by privately funded medical insurance or by patients from their own resources.
- The ability of the public health service to manage its functions and spend the budgets provided.

In the absence of adequate data, health expenditure can be estimated by using a general formula that estimates the treatment cost of HIV/AIDS as 1 to 4 times the level of GDP per capita (given current GDP per capita as P 14,500). If Botswana were to provide a relatively generous treatment for HIV/AIDS patients by international standards (i.e. spends 4 times per capita GDP on each AIDS case), the cost of treatment would be about 6 percent of GDP and, if funded entirely by Government, would require recurrent spending on health to be increased 300 percent. If Botswana were to provide a relatively less generous treatment by international standards (only equal to GDP per capita per AIDS case); heath spending would increase 80 percent. However, part of the costs would be met by private sources such as private insurance. Assuming that Government would pay 85 percent of the costs of AIDS care, the recurrent health budget would increase 70 to 270 percent after 10 years or 5-14 percent a year (Table 3.1).[3]

Table 3.1: AIDS Costs (millions Pula at 1999/2000 prices)

	2001	2006	2011	2016	2021
Low (1)	57	89	170	279	427
High (4)	227	351	681	1,115	1,707
AIDS cases	6,000	9,000	16,000	24,000	33,000

The above estimate excludes the capital cost of an expansion of health service facilities that might be required. At present, about 60 percent of hospital beds are

[3] Estimates of the cost of mitigation are provided in Chapter IV.

occupied by AIDS cases. If non-AIDS related health care is still provided at acceptable levels, then it would be necessary to expand facilities accordingly.

Education expenditures will also be affected. Earlier chapters indicate a smaller population aged 5 to 20 and would suggest smaller enrollment. However, as noted above, the costs of training sufficient teachers will be very high. To keep enrollments high, government may have to assist increasing numbers of orphans and destitute with school fees.

Revenues: Botswana's revenue base is better off and more sustainable than most African countries. Botswana's revenues come primarily from the capital-intensive mineral sector (about 50 percent of total revenue), which should be less affected by AIDS than other sectors and therefore able to maintain its revenue base. SACU receipts (currently 17 percent of total) could be affected if there is a lower level of import demand, but the decline is not expected to be significant and would be in very close relation to the drop in GDP levels.

The most likely area that will be affected is through the earnings from the Bank of Botswana as they are related to the foreign exchange reserves. Reserves will likely fall as likely deficit spending comes about from HIV/AIDS. BIDPA (1999) estimates that the health, education, and indirect expenditures described above may be about 12 percent higher in 10 years than they would be without-AIDS, and would require Botswana to dip into reserves. If this occurs, there would be less interest earnings than is now derived from the reserves. Overall, BIDPA estimates that government revenue is predicted to be smaller- in the order of 10 percent less after 10 years.

With HIV/AIDS leading to increasing public expenditures and decreasing government revenues, the finances of the Government of Botswana would likely end up in a deficit. Estimates suggest the deficit could grow to be around 8 percent of GDP. This unsustainable level would necessitate additional cutbacks in other areas of government spending if a sustainable budget situation is to be re-established.

F. Conclusions

Botswana's compelling story of economic growth and success is seriously threatened by HIV/AIDS. Botswana's HIV prevalence rates are among the highest in the world and have the potential to significantly slow-down economic growth and poverty reduction through such channels as falling investment, shortage of skilled labor and losses in worker productivity, as well as, leading to lower government revenue and greater spending.

Apart from directly reducing population growth and life expectancy, and through them the size of the overall labor force over time, HIV/AIDS also affects the dynamics of skill accumulation in the labor market. Because the economically active population tends to be almost the same as the sexually active group in society, the relative effect of HIV/AIDS is larger among this group than the general population. Although the growth rate of the economically active population remains positive in the With-AIDS scenario

for Botswana, it grows slower than in the No-AIDS scenario. Furthermore, because work experience is more important to skilled than unskilled labor, the shifting of the labor force to a younger age structure would have a slightly greater effect on skilled workers. In an environment where skilled labor is limited, HIV/AIDS is likely to exacerbate the situation.

Given Botswana's high prevalence rates, it is likely that many households will have at least one member affected by AIDS. Demographic estimates suggest that nearly 50 percent of households will be affected by HIV/AIDS. Furthermore, because of the employment structure, 26 percent of households could lose income as a result of death of a major income earner. This is less than the total affected because of the high rate of unemployment in the country.

Finally, with HIV/AIDS leading to increasing public expenditures and decreasing government revenues, the finances of the Government of Botswana could likely end up in a deficit. Estimates suggest the deficit could grow to be around 8 percent of GDP. This unsustainable level could necessitate additional cut backs in other areas of government spending if a sustainable budget situation is to be re-established. While the magnitude of the impact of the epidemic are subject to the limitations of existing data, it highlights the need for speedy action in order to mitigate its negative consequences.

CHAPTER IV

Policy Options

HIV is spread mainly through voluntary unprotected sexual contact. It largely affects the most sexually active group in society, which essentially consists of young adults. In this context, as a priority, the main strategy for controlling the epidemic is to have the youth focus on the following: (i) develop an adequate understanding of the epidemic and assessment of the risks of contracting the virus given their sexual practices; ii) take precautions or change their sexual practices to reduce their risk; iii) seek full information on their status of infection through testing; and iv). for those who are infected, take measures to avoid infecting others, including possibly, and sharing the information with their spouses and regular sex partners.

It is likely that individuals would have the incentives to take the above actions if the following conditions prevail: information on the nature of the epidemic, including consequences and the means of avoiding are widely accessible; the means to reduce transmission such as condoms are easily accessible; reliable and confidential testing facilities along with counseling are available; the stigma attached to the epidemic is reduced enough not to subject infected individuals to social isolation; social factors that may shape individual behavior have been appropriately changed; infected individuals are legally protected from discrimination in the workplace and have access to essential services; and exposure to some of the risky situations, such as having to live for extended periods away from the family or alcohol consumption in public places, that encourage casual sexual relations, are reduced.

For women in particular, bringing about change is more challenging. Recent studies suggest that husbands could be responsible for the high rate of infection among married couples (World Bank, 1996). While the issue is complex, it is associated with the economic status of women and gender relations, all of which is part of a larger problem of poverty and gender discrimination.

Given the magnitude and devastating nature of the HIV/AIDS, the government has a role to play in controlling the epidemic. Government needs to provide information relating to prevention of the epidemic, a public good that may not be provided by the private sector (World Bank, 1997). Government may also need to foster the development of norms of behavior that reduce negative externalities, and ensure that the epidemic neither exacerbates poverty nor denies access to the poor the means to protect themselves (World Bank, 1999). But if the case is made that public assistance should be extended equally to all those affected by the AIDS epidemic, there could be substantial impact on government expenditures (World Bank, 1997). Nevertheless, implementation of AIDS control projects at an early stage of the epidemic brings higher returns (Dayton, 1998).

Mitigation of the epidemic raises a number of issues for middle income countries like Botswana. These countries may feel that it is too expensive to support people who will die eventually. The choices may be easier to make in preventing mother to child transmission. Nevertheless, in the case of adults, some simple measures may be available

to extend the productive life of those that are affected. These measures may include improved nutritional intake and preventive medication against opportunistic diseases. There is evidence that seems to suggest that it may be even profitable for private firms to invest in extending the productive life of affected employees (Simon, 2000).

Developing policy options to the epidemic in Botswana requires cognizance of ongoing public, donor community and private sector activities to mitigate its impact. This approach will permit consistency in action plans to support ongoing interventions and assist to define areas where adequate response is lacking. Section A reviews the existing Government policies and programs as well as donor and private sector responses to complement those efforts. Section B outlines proposals to strengthen Governments efforts in three key areas: (i) reducing and containing the transmission of HIV; (ii) prolonging life and reducing AIDS morbidity; and (iii) developing programs for skills replacement. Finally, section C defines areas for further socio-economic research to support HIV/AIDS policy formulation. It is important to point out that the discussion in this chapter is not exhaustive. It is offered to highlight a broad range of possible interventions that may form the basis for planning.

A. Ongoing Response to HIV/AIDS in Botswana

Institutional Framework: National response to HIV/AIDS was initiated in 1987, shortly after the first AIDS case was diagnosed in 1985. It involved the institution of a one-year emergency plan, followed by the first strategic plan, covering a period of five years. The strategic plan identified key areas of focus for HIV/AIDS activities, which included: blood screening; information, education, and communication; surveillance; and clinical management of HIV/AIDS. Furthermore, a National Policy on HIV/AIDS was formulated and adopted in 1993. This policy defined Botswana's response to the epidemic, outlined the roles of the state, communities, NGOs, the private sector, individuals and persons living with AIDS, and provided the basis for the establishment of an updated national strategic plan.

The second strategic plan was monumental in highlighting the fact that HIV/AIDS is more than a health issue and therefore required a multi-sectoral approach. It proposed the implementation of the multi-sectoral approach through the National AIDS Council, with the National AIDS Coordinating Agency (NACA) as the secretariat.[1] The plan had three key components: (i) preventing transmission of HIV; (ii) developing appropriate response on care for the infected; and (iii) strengthening the monitoring activities.

Strategy and Work Program: To support policy development, the Government initiated six socio-economic studies aimed at quantifying and assessing the impact of HIV in Botswana. The studies were motivated by the Finance Ministry's concern about

[1] NACA was formerly the National AIDS Control Program (NACP).

the future budgetary stress resulting from HIV/AIDS and the need to plan for the impact of the epidemic. The studies are supported by the UNDP and included:

- *A review of HIV/AIDS related data for an expanded national response to the HIV/AIDS epidemic in Botswana*: This study was undertaken by Botswana Institute of Development Policy (BIDPA), a private consultancy agency. It involved the review and evaluation of existing database on HIV/AIDS in Botswana, the establishment of a data bank and recommendations for the collection of relevant data.
- *Impact assessment of HIV/AIDS on current and future population characteristics and demographics in Botswana*: This study was conducted by a private consultancy agency, the ABT Associates (South Africa) and was completed in 1999. It explored the impact of HIV/AIDS on current and future demographic variables such as population size, growth, age structure, life expectancy, infant mortality, child mortality, fertility, dependency ratio, sex ratio and adult mortality.
- *A rapid assessment of HIV/AIDS impact at the sectoral level (Phase I - The Health Sector):* This study was also conducted by ABT Associates and was completed in 1999. The objective of the study was to assess how the health sector was responding to the demands by HIV/AIDS, and to identify the resources required in order to maintain an efficient and effective health care system.
- *The impact of HIV/AIDS on macroeconomic variables*: The objective was to determine, through a simple macroeconomic model, the likely impact of HIV/AIDS on the economy of Botswana and to recommend strategies and programs to minimize the impact of the epidemic on the economy. This review was conducted by BIDPA and was completed in early-September, 1999.

The Annex at the end of this chapter outlines the nature of ongoing HIV/AIDS related activities being undertaken in Botswana with the support from UN Agencies and other development partners. The interventions cover all the key areas of promotional/communication, health services support, mitigation services and analytic work.

B. Proposals to Strengthen Ongoing Initiatives

Ongoing initiatives to deal with the impact of HIV/AIDS in Botswana may be grouped into three main activities: (a) reducing the transmission of HIV; (b) prolonging the life and reducing AIDS morbidity; and (c) mitigating the negative impact of AIDS on the economy, especially programs for skills replacement. A key policy for reducing new HIV infection is the promotion of condom usage. Public radio and the mass media have been mobilized to transmit the message. However, the evidence of condom use indicates substantial scope for expansion.

In view of the above, and building upon ongoing initiatives to deal with the impact of HIV/AIDS in Botswana, the focus of this section will be (a) reducing the transmission of HIV (prevention), and (b) prolonging life and reducing AIDS morbidity (mitigation). Table 4.1 outlines broad strategies for pursuing prevention and mitigation

options. It is important to note that these options are not exhaustive and are presented to illustrate a methodology of incorporating the costing of HIV/AIDS programs into the planning framework. *All estimates of cost in this chapter are averages over a 15-year period 2000-15.* They are presented to highlight possible cost range and are for illustrative purposes only. The discussion concludes with recommendations for mitigating the negative impact of AIDS on the economy of Botswana.

Table 4.1: **Selected Strategies and Options**

Category	Selected Policy Option	Implementation
I. Prevention		
Ages 0 – 4 years	Close to zero mother to child transmission.	100% testing of pregnant women and encouraged use of antiviral drugs (e.g. AZT, Nevirapine, etc) as necessary.
Ages 5 – 9 years Ages 10– 14 years *(Childhood)*	Close to zero new infection. Close to zero new infection.	Age specific sex education. Age specific sex education/ Development of youth activities.
Ages 15 – 19 years *(Teenage cohort)*	Focused and monitored reduction in new infections.	Age specific sex education/youth counseling/community condom distribution, reward for good behavior, part time employment.
Ages 20+ years *(Adult)*	Reduction of new infection through behavior modification and safe sex.	Work place condom distribution, free and voluntary counseling centers, information dissemination through media, religious groups and indigenous groups, and stage performances/talk shows using PLWHA.
Risk groups	Special programs for targeted groups such as miners and commercial sex workers.	Same as 20 plus category with emphasis on counseling and anonymity.
II. Mitigation		
Ages 0 – 4 years	Improved quality of life.	Medical care.
Ages 5 – 14 years *(Childhood)*	Community based orphan care.	Educational, medical care and food programs through school.
Ages 15 – 49 years	Improved quality of life/ Prevent further spread	HIV counseling/medical care/community & work place condom distribution/community home based care.
Ages 50+ years	Improved quality of life	Medical care/ Pension benefits.

Reducing the Transmission of HIV: Policies aimed at reducing the transmission of HIV has to be directed at two main groups, with substantially different approaches. The two groups are the youth (under 15 years) and the sexually active population (15 – 49 years).

Policies focused at the youth under 15 years should aim at Close to zero new infection. While this target may be ambitious, it is attainable under appropriate environment involving participating parent/youth involvement. This group is not yet

sexually active or only at the onset of sexual activity. Two specific focused policies could be implemented on this group, recognizing the possible sources of transmission:

- *Age group 0-4 years*: MTC of the HIV virus could occur in newborn children in three ways: during pregnancy, delivery or breast-feeding. In the absence of data on Botswana, it may be assumed that similar conditions to Zimbabwe exit where MTC is estimated at 20 percent during pregnancy, while 30 percent transmission took place during delivery and another 30 percent occurred during breast-feeding[2]. Existing medical knowledge suggests that if drugs, such as AZT or Nevirapine, are provided to pregnant mothers, the transmission rate could be reduced significantly. There are side effects associated with these drugs such as toxicity and resistance. But two doses of the drug Nevirapine, one to mother and the other to the child, it is reported, can reduce MTC by 35 to 40 percent. Unit cost of AZT is approximately US$150 or P 814 per mother, which is more expensive than Nevirapine which costs about US$8 or P 43 per treatment[3] of two doses, one to the mother and one to the child. Further reduction in prices could be expected in the future.

    - *Mothers and Infants*: Estimated number of females in the child bearing age group averages to about 146,561 between 2000-15. If we assume that 15 percent of them would become pregnant, the estimated number of pregnant mothers would be around 21,984. The potential risk group in this category is estimated at about a fourth at 5,496[4]. The total cost per year for a close to zero MTC using AZT is therefore P 5.061 million (about 0.014 percent of GDP) or alternatively P 269,895 using Nevirapine (about 0.001 percent of GDP).

    - *Children:* Children in the age groups 6 months to 4 years need regular checkups and vaccinations to maintain good health. They (not orphans) need to be monitored since not all mothers with HIV are tested. This age group constitutes about 71,484 persons and the estimated cost per child to support programs up is estimated at about half of per capita health expenditure (P 138) implying a total cost of about P 10 million or 0.026 percent of GDP.

- *Age group 5-9 years*: For this age group, early sex education would be the best preventive policy. These young children are the most important group to protect since they are not yet effected by the epidemic, as they are not sexually active. There are 215,962 children in this age group. Estimated cost per child for identified programs is based on a fifth of per capita education expenditure or P 213 per year, yielding total average cost of P 46 million per year, or 0.1 percent of GDP.

- *The 10 – 14 year age Group*: This cohort constitutes a group on the onset of sexual activity. For this group adequate sex/health education which is tailored appropriately to their age and capacity to enable them to deal positively and responsibly with their sexuality is the first step. The program should deal with both abstinence and proper

[2] Herald Daily Newspaper from Zimbabwe, July 26, 2000.
[3] CNN: http://cnn.com/SPECIALS/2000/aids/stories/treatment.
[4] Herald Daily Newspaper from Zimbabwe, October 3, 2000 At least a quarter of all expectant mothers in Mutare are infected with HIV virus according to a survey.

condom usage at the appropriate time. Based on assumptions about the framework for such a program[5], it is estimated that an expenditure of P 58 million would cover 216,455 beneficiaries. This amounts to about 0.2 percent of the GDP.

The identified programs above (while not exhaustive) require aggressive, accelerated and intensive IEC and peer education efforts targeted at the youth in order to facilitate individual assessment of risk and behavior change towards prevention. Parental/Youth participatory involvement with the assistance of the community and NGOs/CBOs is necessary. A successful publicity campaign focussing on the youth with effective IEC messages can prevent HIV transmission over the medium term. These efforts would further require support from behavioral and epidemiological research to determine the characteristics of the youth contributing to high risk.

There is growing evidence that sexual activity among the youth is widespread, yet most health and educational institutions ignore their needs, resulting in unwanted pregnancies and an alarming high prevalence of STD. If the Government does not yet feel ready to openly promote youth counseling activities, it should at the minimum continue to encourage and assist those agencies and NGOs which do, in order to ensure that such services are available nationwide. This would entail the need for an expansion of facilities to provide appropriate space for counseling and for educational films and informational materials. Such facilities, provided in conjunction with playground and sporting game facilities, will help facilitate fruitful use of the free time of the youth.

Toward the goal of providing comprehensive health care for the youth, the existing efforts to provide family life education to secondary school students should also be targeted at primary students as well. Several of the under 12 years found with HIV, suggest that some students probably begin sexual relations while still in primary school. Targeting primary school students with HIV related education is a very difficult task that will require health workers and parent/teacher to work cooperatively as a team.

The second group involves the sexually active population (15–49 years). The policy proposal for this group is to promote increased and consistent condom use for the sexually active population. A framework of logistics and management information system for condom supply and promotion already exists but it needs to be pulled together and adequately monitored. The main problems which persist include inadequate appreciation by health service management and staff of the importance of maintaining user statistics and using these to determine future requirements; the absence of a tracking system which signals low stock levels; and the availability of too wide a range of contraceptive types and brands, as a result of the high reliance on donor funding. In this context, it is suggested that Government should:

- *Ensure adequate condom supplies* : The MOH relies too heavily on donors for the funding of condoms (for male). It is essential that funding be identified to meet requirements for two to three years into the future if reliable supplies are to be

[5] Age group 10-14 consists of 218,591 in 2000 and projected to decrease to 215,235 by 2015. Cost of these activities is estimated at P267 per person per year.

assured. For purposes of estimating the cost of condoms required, it is assumed that (male) youth in the age group 15-19 require 2 condoms per week or 156 per year and adults require 4 per week or 234 per year. The number of male youth in the 15-19 year age group is estimated at 103,658 and those in 20 plus age group at 275,988. Total estimated cost per year for condoms for all youth 15-19 age group is P 11 million or 0.03 percent of GDP; for adults it is P 43 million or 0.13 percent of GDP. Given these cost ranges, in the absence of donor assistance, the Government must be in a position to ensure that funding will be available from the budget. To support the process, the Government should explore the concept of social marketing of condoms. Evidence from surveys in Zimbabwe and elsewhere indicate that people are willing to pay for condoms.

- *Enhance NGO support for condom distribution*: The extent to which HIV/AIDS counseling and condom distribution services are offered differ markedly between Government and that of the private facilities. This suggests that Government needs to increase its efforts to enlist non-governmental institutions in its efforts.

- *Provide community based and work-based services*: Experience worldwide has demonstrated that the use of alternative delivery systems, such as community-based delivery of condom can increase usage, even in inaccessible rural communities. With a pool of rural village health workers, Botswana has the potential to extend HIV prevention programs in the rural areas at a relatively low cost. Work-based condom distribution and HIV education programs (already being implemented) may require active participation of management and appropriate allocation of required budget.

- *IEC, voluntary testing and counseling:* It is extremely important, when appropriate, to provide voluntary testing and counseling (described in detail in the following paragraphs) for prevention purposes. For the 15-19 year age group, it is estimated that such a program would cost about P 118 million or 0.3 percent of GDP to cover 221,701 male and female youth at a rate of P 533 per person (which is about half of the per capita education budget). The comparable estimate for adults is P 228 million or 0.7 percent of GDP that covers an estimated 634,837 million people at an average cost of P 626 (which equals one fourth of per capita education budget plus one third of per capita health budget).

Prolonging Life and Reducing AIDS morbidity: Because HIV/AIDS is stigmatized, affected people are often prevented from gaining access to some of the few social support mechanisms for which they might be eligible. Programs to mitigate the household impact of HIV/AIDS therefore should deal with legal concerns, voluntary HIV counseling and testing, ration of health care, and the role of home-based care.

Voluntary counseling and testing can play a useful role in helping individuals with HIV/AIDS to seek assistance in dealing with the epidemic. Active public promotion could also serve as an instrument in assisting potential AIDS patients and serving as a prevention measure for controlling risk behavior. Studies conducted in Malawi (World Bank, 1998) indicated that, males who received voluntary counseling and testing reported

a decrease in unprotected sex from 30 percent to 18 percent, compared to males who only received health information who reported a decrease from 30 to 26 percent.

Counseling on HIV can be useful in decision-making on a variety of areas – from prevention to care. Testing however helps to solve the issue of uncertainty in that a positive test serves as a strong incentive for the use of condom, while a negative test may help to reinforce responsible sexual behavior. The role of counseling and testing is to handle the psychological aspects of HIV/AIDS, but may serve as a useful instrument for finding individual solution for prolonging live and reducing AIDS related morbidity. Counseling and testing sites need to be established in each urban center, with special facility devoted for high-risk groups.

In an environment of high AIDS cases, the inevitable increase in health care demand may lead to the ***rationing of health care***, mainly on the public hospital sector. Figure 4.1 shows the projected increase in hospital bed-days attributable to AIDS based on projections in Chapter III. It is possible that in a constrained resource environment, non-HIV related patients would experience a greater degree of rationing than AIDS related patients. In Botswana, close to about 60 percent of hospital beds are already being allocated to AIDS-related patients. The options are either to increase the number of hospital beds or to seek alternatives to hospital-based care. The challenge is for both the public and the private sectors to shift to fundamentally more cost-effective mode for terminal care.

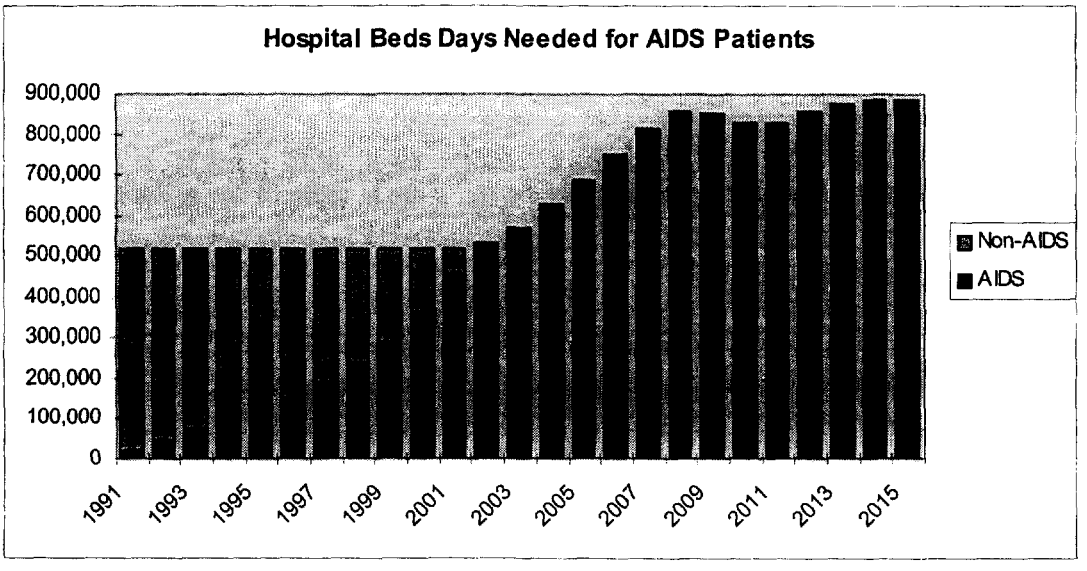
In this connection, a widespread adoption of cost-effective program such as ***home-based care*** may be recommended. The type of home-based care envisaged in Botswana will not be limited to only AIDS patients but also to all terminal patients. It will aim at providing a range of services (clinical and nursing care, counseling and social support) extending from home to hospital and different levels of health facilities, all linked by discharge planning and referral network. Besides being cost-effective in reducing caseload at health facilities, home-based care is likely to promote positive outlook for terminal patients and enhance the capacity for preventive education for other members of the extended family.

In order to promote the concept of community home-based care widely, there is the need for a comprehensive study to address the following:

- Feasibility issues concerning the availability and adequacy of staffing, transport, supervision and drug supply arrangement. Furthermore, the acceptance of the concept by the community and households would need to be ascertained.
- Detailed work would need to be done concerning the number of patients that would be covered, frequency of visits, type of home visitor (e.g. Family Welfare Educator, nurse or both), and the nature of administrative support, including the staffing of clinics to support home visit.
- The extent to which home-based care lowers costs of inpatient care. It should be noted that home based care works in a more organized and densely populated urban

setting but it is more complicated in rural areas due to the distances to be covered by any supporting outreach services.

Figure 4.1: **Hospital Bed Days Needed for AIDS Patients**



Mitigating the Negative Impact of AIDS on the Economy: Policies to deal with the negative impact of HIV/AIDS would need to focus, along with other policies, on: (a) strategies for human resource development (replacement of lost labor and skills), and (b) preserving savings and investment levels. These policies would need to apply at the household, enterprise, and public levels (both sectoral and national).

Human resource development efforts must aim at replacing lost skills and ensuring adequate pool of skills. Botswana is generally skilled labor deficient although a great deal has been done since independence to narrow this gap. The impact of HIV/AIDS is to exacerbate the shortage of skilled labor, especially in the public sector where most trained personnel are employed. Because salaries, benefits and other incentive policies to retain skilled people are reasonably better in Botswana, this shortage might be easily filled by migration.

Dealing with the skilled labor shortage in Botswana may require increased information as well as incentives. In the area of information gathering, there may be a need to update existing census of skills both in the private and public sectors. Such a census may be followed by projections and plans of skills needed at sectoral level that may be necessary for developing an incentive program for the private sector. Private sector incentives could be in the form of tax rebates for retraining programs.

The need for skills replacement is likely to be more important for the public sector than the private sector. The public sector may need to identify critical areas for the preservation of skills. There may also be the need to intensify staff development programs, training and public/private partnership in these areas.

Related to the skills replacement needs of the economy is the role of AIDS deaths in increasing the number of *orphans*. The estimates suggest that the number of orphans (loss of mother or both parents) in Botswana will increase from an estimated 63,416 in 2000 to about 162,115 by 2015. As of 1999 there were an estimated 53,605 existing orphans (living) and every year 18,000 on average would be added to this pool. An orphan's status has major implications for the growth of the child and human capital development. Orphans tend to feel low sense of self-esteem and in the absence of appropriate programs could lead to abuse, neglect and a life of crime both as a child and adult. Based on assumptions of development needs, including schooling, feeding and clothing, it is estimated that a comprehensive incremental orphan care in Botswana would cost about P 605 million per year or 1.8 percent of GDP.

Dealing with the orphan problem may require studies that address the following options:

- Given the resource constraint of the extended family, orphanages provide an option that has been used in western countries, but may be problematic in Botswana's cultural context.
- To the extent to which home based orphan care in the community, especially in the rural areas, provide an alternative similar to the home based care in which support is provided to the extended family in kind. The intervention could be in the form of financial resources, advice and counseling to the extended family.
- Complementing the home based orphan care is support for schooling and the establishment of income generation projects to provide employment for orphans exiting from the school system.

The proposal for home based orphanage could be developed in the context of the home based care for AIDS patients. The rationale for this is that during the period before the death of AIDS parents, older siblings and other members of the extended family who provide care for the sick tend to withdraw from the labor market, resulting in major implications for household income. The most affected are children who tend to be neglected and may withdraw from the school system even before they become orphans. An expanded home based system incorporating care of the terminally ill with assistance for potential orphans may provide the most cost-effective means for dealing with both problems. Costing such a program should be the objective of further study.

The costing of some of the proposed initiatives in this study are summarized in Table 4.2 (with necessary assumptions outlined in Annex II). Recognizing that both the proposed options and the costing are for illustrative purposes, the preliminary estimates suggest that various individual elements of prevention could range between 0.03 to 0.7 percent of GDP per year adding up to an average 1.4 percent of GDP per year (or P 514 million). In terms of mitigation, orphan care is estimated at about an average of 6.2 percent of GDP per year (or P 2,126 million). The largest single cost element is hospital care, which is estimated at about an additional 4.3 percent of GDP p.a. (or P 1,473 million), on average, during 2000-2015. The latter points to the need for alternative

programs for handling AIDS and terminal care. Although these illustrative programs may underestimate the likely cost of prevention/mitigation activities, they point to the likely magnitudes and suggest that such programs can be accommodated by existing resources of Government. The loss of GDP associated with HIV/AIDS is estimated at, on average, P10,173 million per year in constant terms, or about 26 percent of GDP in the absence of HIV/AIDS during 2000-15. If the country is loosing such a magnitude in potential GDP, it should be able to contain these losses by appropriate prevention programs that amount to less than 1.4 percent of GDP per year. On the other hand, since mitigation costs are substantially higher than the loss of GDP, it is prudent that Government intensify preventive measures. Finally, policies to reduce the cost of both preventive and mitigation programs may be warranted.

Table 4.2: **Summary of Estimated Costs of Selected Policy Interventions**

Category	**Cost per year** (Million Pula in 1999/2000 prices)	% GDP
I. Selected Prevention		
Support for MTC transmission (Age cohort: 0-5 years)	10	0.03
Sex Education, & Community Programs (Age cohort: 6-15 years)	104	0.3
Sex Education for Teenagers (Age cohort: 15-19 years)	129	0.3
Increased Condom Use (Age cohort: Adults)	43	0.1
IEC/Voluntary testing/Counseling	228	0.7
II. Selected Mitigation		
Orphan care	605	1.8
Hospital care for AIDS patients	1,473	4.3
Old age pension for AIDS patients	47	0.1

C. Conclusions

A key limitation of current studies on the development impact of HIV/AIDS is the constraints posed by existing data. Dealing with the data constraints will require identifying areas where the impact is severe and conducting appropriate studies. An important area is the impact of HIV/AIDS on the household. The microeconomic basis for the development impact of the epidemic indicates substantially more damaging implications at the household level. Furthermore, prevention and mitigation programs require more information than currently available. A household level survey focusing on the impact of HIV/AIDS on household consumption (expenditures), labor supply, and coping mechanisms; could provide valuable information for designing appropriate response to the epidemic. Furthermore, such a survey can provide behavioral indicators that may be useful for developing preventive messages.

Botswana: 1999-2000
HIV/AIDS ACTIVITY MATRIX FOR UN AGENCIES

Programs/Activity	Scope	Donor Agencies	Local Agencies	Comments
Promotional/Communication				
Mass Media	National/STD	WHO	MOH, MLG&L	$497,000 for WHO STD program.
Strategy Development	National, Districts	UNICEF, UNFPA	MOE, DPM, CJSS, BNYC, BOFWA, YMCA, Disciplined Forces, NGOs, MLGL&H	Curriculum development, re HIV/AIDS and training. UNFPA work in developing indicators for monitoring ARH information, training of educators, gender issues, etc.
Material Development	National	UNICEF	MOE, CJSS	Support for the development of strategies for training life skills.
Advocacy/Counseling	National, Districts	WHO, UNFPA	MOH, HBC, MLGL&H, MOE, OHU, MLHA, BFTU, MOL, BNYC	$200,000 for HBC component. UNFPA component includes support for NGOs on ARH and STDs/HIV/AIDS prevention, retraining of teachers and youth outreach campaigns.
Youth Targeting				
Health Services Support				
Health System Development	National/selected Districts	UNICEF	FHD, BNLS, MLGL&H, BOFWA, YWCA, BYC, MOE, NGOs.	UNICEF program involving: life skills training for the youth, development of parent peer education ($24,000)
Epidemiological Analysis	National	WHO	MOH	TA for blood transfusion (WHO-$5,000)
Prevention	National	UNICEF	MOH, MLG&H, UNAIDS,	Reducing mother-to-child transmission

			WHO, UNFPA, CDC	(UNICEF budget $115,000).
Reproductive Health				
Nutrition				
Medical Research				
Capacity Building	National	WHO, UNDP	MOH, NGOs, PLWA, BONASA, BDF, PRS	WHO fellowship for training ($9,000); UNDP component on capacity building of NGOs.
Mitigation services				
Home-based Care				
Orphans/Community Care	National	UNICEF	MLGL&H, TCC, BOT, Rotary, SOS, UB, CSO	Development of community based orphan care (including legislative review - $73,000)
Analytic Services				
Human Rights & Legal Issues				
Impact Analysis and Planning	National	UNDP	MFDP, MOH, MLGL&H	Capacity building for IEC, MFDP on integration of HIV. Six studies on economic impact of HIV/AIDS ($350 000) and evaluation ($20,000).
Behavioral Studies	U of Botswana	WHO	MOH, UB, UNAIDS	$5,000

BIBLIOGRAPHY

Abt Associates Inc. (1999), The Impact of HIV/AIDS on Current and Future Population Characteristics and Demographics in Botswana.

Ainsworth, Martha, Lievefransen, & Mead Over (Ed) (1998), Confronting AIDS: Evidence from the Developing World, Selected background paper for the World Bank Policy Research Report, Confronting AIDS: Public Priorities in a Global Epidemic, Brussels: European Commission & D.C.: World Bank.

Alan Whiteside and Greg Wood (1994) , Socio-Economic Impact of HIV/AIDS in Swaziland, Mbabane: Min. of Economic Planning and Development.

Bloom, David and Ajay S. Mahal (1985), Does the AIDS Epidemic Really Threaten Economic Growth? NBER Working Paper #5148.

Botswana Institute for Development Policy Analysis (1999), Macroeconomic Impacts of the HIV/AIDS Epidemic in Botswana, Interim Report.

Botswana Network of AIDS Service Organizations (1999), Directory of Members.

Caldwell, John C. (2000), Rethinking the African AIDS Epidemic. Population and Development Review. Vol. 26, No. 1, pp. 117-135.

Cuddington, John T. (1993), Modeling the Macroeconomic Effects of AIDS with an Application to Tanzania, World Bank Economic Review 7 (2): 173-89.

Dalton, Julia (1998), World Bank HIV/AIDS Interventions: Ex-ante and Ex-post Evaluation. World Bank Discussion Paper No. 389.

Elias, Ralph (2000), Managing the Impact of HIV/AIDS on African Mining. African Mining 2000 Symposium, Quagadougou, Burkina Faso, 4-6 December.

Gregson, Simon, and Basia Zaba (1998), Measuring the Impact of HIV on fertility in Africa, AIDS (London) Vol. 12, Supplement 2, pp. 541-550.

Kambou, Gerard; Shantayanan Devaraja and Mead Over (1993), "The Economic Impact of AIDS in an African Country: Simulation with a Computable General Equilibrium Model of Cameroon, " Journal of African Economics, Vol. No. 1, pp 109-130.

Over, Mead (1998), Coping with the Impact of AIDS. Finance and Development. March, pp. 22-24.

Over, Mead (1992), The Macroeconomic Impact of AIDS in Sub-Saharan Africa, AFTPN Technical Working Paper 3, World Bank, Africa Technical Department, Population, Health, and Nutrition Division, Washington, D.C.

Reid E. (1993), The HIV Epidemic and Development: The Unfolding Epidemic, New York: UNDP.

Simon, Jonathan, Sydney Rosen, Alan Whiteside, Jeffrey R. Vincent and Donald M. Thea (2000), The Response of African Businesses to HIV/AIDS in the Commonwealth 2000/01. London: Kensington Publications.

Sneider, Ralph (Undated), Cost of Aids to an Employer Based in Botswana.

U.S. Census Bureau (1999), World Population Profile: 1998 Report WP/98, U.S. Government Printing Office, Washington D.C.

UN (1998), The Demographic Impact of HIV/AIDS, Report of the Technical Meeting, New York, 10 Nov 1999 (UN, Population Division, Dept. of Economic and Social Affairs).

UNAIDS (2000a), Botswana Epidemiological fact sheet on HIV/AIDS and sexually transmitted infections, Geneva: UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance.

UNAIDS (2000b), Guidelines for Studies of the social and Economic Impact of HIV/AIDS. Geneva: UNAIDS.

UNAIDS (2000c), Trends in HIV Incidence and Prevalence: natural course of the Epidemic or results of behavioral change? Geneva, Switzerland: UNAIDS.

UNAIDS/PennState (1999). Communications Framework for HIV/AIDS: A New Direction. Geneva: UNAIDS.

UNDP and the Government of Botswana (1998), Botswana Human Development Report 1997: Challenges For Sustainable Human Development, A Longer Term Perspective.

Warren Sanderson (Undated), Will There Be More Batswana Alive in 2020 Than There Are now?.

WHO&UNAIDS (2000), Second-generation surveillance for HIV: The next decade. http://www.who.int/emc.

World Bank (1996), AIDS Prevention and Mitigation in sub-Saharan Africa: An Updated World Bank strategy, Washington, D.C.: The World Bank.

World Bank (1997), Confronting AIDS: Public Priorities in a Global Epidemic, World Bank Policy Research Report, Oxford University Press.

World Bank (1998), AIDS Assessment Study, Report No. 17740MAL (Volumes I & II).

World Bank (1998), African Development Indicators, Washington D.C.

World Bank (1999), Botswana: A Case Study of Economic Policy Prudence and Growth, Washington D.C.

Modeling the Impact of HIV/AIDS in Botswana

1. The purpose of this Annex is to describe, in detail, the models used in the report to analyze the impact of HIV/AIDS on Botswana's economy. It also outlines the assumptions and the sensitivity of the results.

2. The main model is Spectrum, which is a windows-based program, developed by The Futures Group International with funding from the USAID. This model analyzes existing information to determine the future consequences of current population programs and policies. It has several modules of which two are relevant for our purpose here: DemProj (Demographic Projections) used for the demographic projections on the basis of current population, fertility, mortality, and migration; and AIM (AIDS Impact Model) used for projecting the consequences of the AIDS epidemic.

3. DemProj: The following information is required by the DemProj module.

   - Base year population by age and sex.
   - Total fertility rate.
   - The age distribution of fertility.
   - Life expectancy at birth.
   - Life table.
   - International migration by sex.

   All the above variables require future assumptions relating to expected future trends except the population estimates which are derived as the basis of the estimates generated for these parameters.

   The following information is used in the demographic projections module for Botswana.

   - Base year population by age and sex for 1981 (actual):

Age group (in years)	Male	Female	
0 - 4	92,388	92,582	
5 - 9	69,580	69,696	
10 – 14	57,425	60,419	
15 – 19	45,222	52,580	
20 – 24	34,378	44,186	
25 – 29	26,754	36,221	
30 – 34	21,428	27,767	
35 – 39	17,759	21,714	
40 – 44	15,486	18,290	
45 – 49	13,668	15,656	
50 – 54	11,813	13,549	
55 – 59	10,097	11,194	
60 – 64	8,529	9,453	
65 – 69	6,643	7,157	
70 – 74	4,985	5,639	
75 – 79	5,211	8,865	
80+	1,738	2,955	
Total	443,104	497,923	(=941,027)

(*Source*: Statistical Bulletin June 1999: Table 1.112, pp. 11. Model uses 1981 as the base year, five years before the first HIV/AIDS case was detected in 1986).

- Total Fertility Rate (TFR): 6.6 for 1981, 5.2 for 1991 (from population census) and projected to decline to 3.75 by 2015. Interpolated for the intermediate years.
  (Source: Statistical Abstract 1999 pp.13 for 1981 and 1991).

- Age Specific Fertility Rates (ASFR): These are defined as the number of live births per 1,000 women in the age groups.

Age group (in years)	% distribution in 1981	% distribution in 2015
15 – 19	15.39	14.69
20 – 24	23.99	27.23
25 – 29	21.99	22.78
30 – 34	17.67	17.00
35 – 39	12.36	11.09
40 – 44	6.80	5.71
45 – 49	1.80	1.50
	100.00	100.0

(Source: Default from AIM model which uses UN Sub-Saharan Africa averages).

- Sex Ratio at Birth: 89 male births per every 100 female births.
  (Source: Statistical Abstract 1999 pp. 12 for 1981).

- Life Expectancy: (without AIDS)

	1981	2015
Male:	52.3	74.0
Female:	59.7	77.0

(Source: Statistical Abstract 1999 pp. 13 for 1981 and 1991).

- Infant Mortality Rate (IMR) and Crude Death Rate (CDR):
  IMR: 87.5 ; CDR: 10.4
  (Source: Statistical Abstract 1999 pp.12 . CDR was 13.9 for 1981 and 11.5 for 1991. The model uses UN assumptions of IMR 90 and CDR 11.7 as an average which were close to the actual data).

- International Migration (net): negative number indicates more people from Botswana went out than entering the country. Net migration was zero for Botswana.

	1981	2015
Male:	0	0
Female:	0	0

(Source: Statistical Abstract 1999 pp.10).

4. AIM: The following assumptions are used in the AIDS impact module for Botswana.

• Epidemiology:	1981	2015
Adult HIV Prevalence:	0.00	30.0
HIV/AIDS parameters		
• Start year of AIDS epidemic	1986	
• Percent infants with AIDS dying in the first year	67.0	
• Life expectancy after AIDS onset (years)	1.0	
• Reduction in fertility among HIV+ (%women)	30.0	
• Prenatal transmission rate (%)	30.0	30.0

HIV Incubation period	Adults	Children
Cumulative percent developing AIDS by number of years since infection		
Years		
1	0.0	29.0
2	6.0	62.0
3	20.0	75.0
4	30.0	85.0
5	40.0	90.0
6	50.0	95.0
7	59.0	95.0
8	68.0	95.0
9	77.0	95.0
10	86.0	95.0
11	90.0	95.0
12	90.0	95.0
13	90.0	95.0
14	90.0	95.0
15	90.0	95.0
16	90.0	95.0
17	90.0	95.0
18	90.0	95.0
19	90.0	95.0
20	90.0	95.0

(Source: Faster pattern of cumulative percent developing AIDS by the number of years since infection for both adults and children based on UNAIDS estimates).

Age Distribution of New HIV	Male	Female
(Ratio of HIV prevalence at 25-29)		
Age group		
0 - 4	0.0	0.0
5 - 9	0.0	0.0
10 – 14	0.0	0.0
15 – 19	0.2	0.4
20 – 24	0.3	1.0
25 – 29	1.0	1.0
30 – 34	1.5	1.0
35 – 39	1.4	0.7
40 – 44	1.0	0.6
45 – 49	0.9	0.7
50 – 54	0.9	0.6
55 – 59	0.6	0.3
60 – 64	0.4	0.3
65 – 69	0.2	0.1
70 – 74	0.0	0.0
75 – 79	0.0	0.0
80+	0.0	0.0

• Impacts:	1981	2015
• Expenditure per AIDS patient	2,837	17,285
• Percent AIDS hospitalized	20	70
• Ministry of Health budget (Million Pula)	29	835
• Hospital beds	2,364	10,471
• Bed capacity factor (1=100% beds used)	0.60	0.95
• Bed days/AIDS patient (days)	10	40
• Prop of 0-5 vaccination for measles (%)	40	50
• Measles vaccine efficacy (%)	80	80
• Measles case fatality rate (%)	2.4	2.4
• Malaria episodes/person/year	3	3
• Malaria case fatality rate	0.01	0.03
• TB incidence without HIV (%)	2.4	2.4
• Percent population with latent TB	50	50
• TB incidence with HIV (%)	90	90

(Source: Informal discussions with the Government and NGOs).

5. Analysis of the Results and Conclusions:

- Number of HIV patients will increase from 308,383 in 2000 to a peak of 358,051 in 2005 and decreases to 295,313 in 2015.
- Cumulative AIDS cases will increase from 151,524 in 2000 to 709,016 in 2015 an annual increase of 10 percent.
- Annual AIDS deaths for the next 15 years will be around 36,000 (cumulative 677,437) or 11 percent increase per annum.
- Life expectancy will go down by 42.5 years during the next fifteen years due to HIV/AIDS thus reducing the average life of a person in Botswana by 2.8 years per annum.
- On average 18,000 orphans will be added to the cost of government budget to provide food, education and employment. By 2015 a total of 162,115 orphans will be waiting to be taken care of by somebody.

The following tables and diagrams provide the complete outputs for the modeling process. The analysis and qualifications of the projections are undertaken in the main body of the report.

Demography

Demographic impacts of AIDS																										
Indicator	**Projection**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Population size	With AIDS	1,317,941	1,354,329	1,386,238	1,420,157	1,450,591	1,479,042	1,505,407	1,529,430	1,550,383	1,567,457	1,579,982	1,588,624	1,595,892	1,601,905	1,606,710	1,610,129	1,612,474	1,614,282	1,617,332	1,623,303	1,631,984	1,642,277	1,653,610	1,666,226	1,680,532
	No AIDS	1,325,218	1,368,622	1,413,310	1,459,375	1,506,895	1,555,946	1,606,752	1,659,338	1,713,705	1,769,874	1,827,843	1,887,685	1,949,176	2,012,398	2,077,273	2,143,713	2,211,634	2,280,966	2,351,701	2,423,712	2,496,977	2,571,604	2,647,588	2,724,904	2,803,540
	Pop_size = from DemProj projection																									
Annual population growth rate (Percent/year)	With AIDS	3.0%	2.8%	2.5%	2.3%	2.1%	2.0%	1.8%	1.6%	1.4%	1.1%	0.8%	0.5%	0.4%	0.4%	0.3%	0.2%	0.1%	0.1%	0.2%	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%
	No AIDS	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.2%	3.2%	3.2%	3.2%	3.1%	3.1%	3.1%	3.0%	3.0%	3.0%	2.9%	2.9%
	Annual_pop_growth_rate = (pop[t] / pop[t-1]) - 1																									
Adult population	With AIDS	693,846	716,414	738,270	759,984	781,989	803,292	823,540	842,399	859,783	875,122	886,980	895,789	903,693	910,980	916,740	920,764	923,991	926,803	930,848	937,697	947,007	957,603	968,489	979,330	990,913
	No AIDS	697,094	723,549	751,924	782,291	814,547	848,186	883,059	918,990	956,937	993,841	1,032,542	1,071,935	1,111,956	1,152,548	1,193,679	1,235,312	1,278,098	1,322,115	1,367,455	1,414,200	1,462,418	1,512,324	1,563,949	1,617,316	1,672,459
	Adult_pop = pop aged 15 and over, from DemProj																									
Crude birth rate (Births per 1000 people)	With AIDS	38.8	38.1	37.4	36.8	36.2	35.7	35.3	35	34.3	33.6	33.4	33.2	33	32.8	32.6	32.4	32.3	32.2	32.2	32.1	32	32	32	31.9	31.7
	No AIDS	40.1	39.6	39.3	39	38.7	38.5	38.3	38.2	38.1	37.9	37.7	37.5	37.2	36.8	36.5	36.1	35.6	35.1	34.6	34.1	33.6	33.2	32.7	32.3	31.8
	Crude_birth_rate = births / (pop / 1000), from DemProj																									
Crude death rate (Deaths per 1000 people)	With AIDS	10	11.2	13	14.3	15.2	16.5	17.8	19.3	20.8	22.7	25.4	27.8	28.5	28.9	29.6	30.3	30.9	31.1	30.3	28.4	26.7	25.7	25.1	24.3	23.2
	No AIDS	*8.2*	*7.9*	*7.7*	*7.4*	*7.2*	*6.9*	*6.7*	*6.5*	*6.3*	*6.1*	*6*	*5.8*	*5.6*	*5.4*	*5.2*	*5.1*	*4.9*	*4.7*	*4.6*	*4.4*	*4.3*	*4.2*	*4*	*3.9*	*3.8*
	Crude_death_rate = deaths / (pop / 1000), from DemProj																									
Dependency ratio (Dependents per adult 15-64)	With AIDS	1.03	1.02	1.01	1.00	0.98	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88	0.88	0.87	0.87	0.86	0.86	0.86	0.85	0.84	0.83	0.82	0.82	0.81
	No AIDS	1.04	1.02	1.01	0.99	0.97	0.95	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78
	Dependency_ratio = (pop_0-14 + pop_65+) / pop_15-64																									

HIV-AIDS

HIV/AIDS Projections																										
Indicator	Projection	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Adults	With AIDS	693,846	716,414	738,270	759,964	781,999	803,292	823,540	842,399	859,783	875,122	886,980	895,769	903,693	910,980	916,740	920,764	923,991	926,803	930,848	937,897	947,007	957,603	968,480	979,330	990,913
	Adults = pop. 15+, from DemProj																									
HIV+ adults	With AIDS	75,186	91,967	109,390	127,814	146,847	166,923	187,626	231,194	277,717	292,285	302,560	311,617	320,166	328,633	336,753	330,873	323,751	316,124	308,673	302,172	296,710	291,622	286,837	281,652	276,471
	HIV+ adults = pop. 15+ with HIV infection, from DemProj																									
Adult HIV prevalence (%)	With AIDS	10.8	12.8	14.8	16.8	18.8	20.8	22.8	27.4	32.3	33.4	34.1	34.8	35.4	36.1	36.7	35.9	35.0	34.1	33.2	32.2	31.3	30.5	29.6	28.8	27.9
	HIV prevalence = HIV+ adults / adults * 100																									
HIV+ population	With AIDS	76,388	96,367	114,970	134,356	154,769	176,048	197,999	243,230	291,885	308,383	320,259	330,496	339,992	348,237	358,051	352,612	345,498	337,752	330,039	323,199	317,347	312,054	306,636	300,980	295,313
	HIV+ adults = pop. with HIV infection, from DemProj																									
AIDS cases	With AIDS	3,268	5,925	9,146	10,772	12,974	15,552	18,201	21,121	23,993	28,220	33,821	36,401	36,878	36,384	39,619	41,064	42,321	42,481	40,203	37,154	35,407	34,867	34,218	33,070	31,579
	AIDS_cases = from DemProj																									
Cumulative AIDS cases	With AIDS	5,625	11,550	20,696	31,468	44,442	59,994	78,196	99,316	123,309	151,529	185,150	221,551	258,429	296,813	336,432	377,716	420,037	462,518	502,721	539,875	575,282	610,149	644,367	677,437	709,016
	Cum_AIDS_cases[t] = Cum_AIDS_cases[t-1] + AIDS_cases[t]																									
Adult AIDS cases	With AIDS	2,727	5,072	8,027	9,352	11,317	13,619	15,999	18,642	21,120	24,810	29,770	32,264	32,520	33,849	35,142	36,303	37,500	37,703	35,501	32,565	30,923	30,504	29,974	28,941	27,564
	Adult_AIDS_cases = from DemProj																									
Adult HIV incidence	With AIDS	18,640	19,508	22,495	26,251	28,815	31,393	34,322	59,567	65,165	35,868	35,105	36,807	40,813	40,987	41,999	29,332	29,061	29,873	30,252	29,000	27,093	26,035	25,519	24,789	23,760
	HIV_incidence = HIV+_adult[t] - HIV+_adults[t-1] + AIDS_deaths[t]																									
Adult HIV incidence (Percent)	With AIDS	2.69%	2.72%	3.05%	3.45%	3.68%	3.91%	4.17%	7.07%	7.58%	4.06%	3.96%	4.33%	4.52%	4.50%	4.58%	3.19%	3.15%	3.22%	3.25%	3.09%	2.86%	2.72%	2.63%	2.53%	2.40%
	HIV_incidence_percent = HIV_incidence / adults																									

Mortality

Mortality Impacts of AIDS																										
Indicator	**Projection**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Young adult deaths	With AIDS	3,044	4,799	7,247	9,267	10,840	12,850	15,070	17,454	19,896	22,822	26,890	30,412	31,765	32,569	33,845	35,045	36,205	36,913	36,029	33,672	31,570	30,627	30,188	29,460	28,328
(Annual deaths to	No AIDS	1,230	1,237	1,244	1,249	1,255	1,258	1,259	1,260	1,267	1,272	1,273	1,272	1,267	1,259	1,248	1,233	1,215	1,194	1,176	1,157	1,143	1,128	1,109	1,088	1,063
adults 15-49)	Young_adult_deaths = from DemProj																									
Infant mortality rate	With AIDS	78.9	78.1	77.5	76.9	76.3	75.7	75.2	76.1	77.4	76.7	75.5	74.3	73.2	72.0	70.8	68.8	66.7	64.5	62.4	60.3	58.2	56.2	54.1	52.1	50.0
(Infant deaths per	No AIDS	78.7	77.8	77.1	76.2	75.4	74.5	73.6	73.9	74.2	72.8	71.1	69.5	67.8	66.2	64.5	62.3	60.1	57.9	55.8	53.7	51.7	49.8	47.9	45.9	44.0
1000 live births)	Infant_mortality_rate = Infant_deaths / (Total_births / 1000), from DemProj																									
Under 5 mortality rate	With AIDS	140.5	142.5	143.7	144.7	145.4	146.1	146.9	147.9	151.7	158.1	162.3	164.0	164.4	163.6	162.7	161.9	159.8	156.2	152.2	147.6	143.1	138.6	134.1	129.8	125.5
(Deaths to 0-4 per	No AIDS	131.0	127.8	124.7	121.5	118.4	115.2	112.1	109.1	106.3	103.7	101.0	98.3	95.5	92.8	90.1	87.4	84.7	82.0	79.5	77.0	74.6	72.4	70.1	67.8	65.5
1000 live births)	Under_5_mortality_rate = Deaths_to_children_0-4 / (Total_births / 1000)																									
Life expectancy	With AIDS	56.3	51.6	46.8	45.0	42.6	40.2	37.9	35.7	33.7	31.0	28.2	27.0	26.8	26.3	25.9	25.6	25.3	25.3	26.2	27.6	28.7	29.3	30.1	31.3	33.1
at birth	No AIDS	65.3	65.8	66.2	66.6	67.0	67.5	67.9	68.3	68.8	69.2	69.6	70.0	70.5	70.9	71.3	71.7	72.2	72.6	73.0	73.5	73.9	74.3	74.7	75.2	75.6
	Life_expectar	9.0																								
Annual AIDS deaths	With AIDS	1,533	3,268	5,925	9,146	10,772	12,974	15,552	18,201	21,121	23,993	28,220	33,621	36,401	36,878	38,384	39,819	41,084	42,321	42,481	40,203	37,154	35,407	34,867	34,218	33,070
	AIDS_deaths[t] = AIDS_cases[t-1]																									
Cumulative AIDS	With AIDS	2,357	5,625	11,550	20,696	31,468	44,442	59,994	78,195	99,316	123,309	151,529	185,150	221,551	258,429	296,813	336,632	377,716	420,037	462,518	502,721	539,875	575,282	610,149	644,367	677,437
deaths	Cum_AIDS_deaths[t] = Cum_AIDS_Deaths[t-1] + AIDS_deaths[t]																									
Crude AIDS death rate	With AIDS	1.2	2.4	4.3	6.4	7.4	8.8	10.3	11.9	13.6	15.3	17.9	21.2	22.8	23.0	23.9	24.7	25.5	26.2	26.3	24.8	22.8	21.6	21.1	20.5	19.7
	*Crude_AIDS_death_rate = AIDS_deaths / pop_size * 1000*																									

Health

Health care impacts of AIDS																									
Indicator	Projection	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Direct expenditure for AIDS care	With AIDS	5,223,181	10,364,629	17,481,986	22,463,969	29,476,857	38,444,992	48,894,922	61,588,836	75,862,479	97,574,395	127,003,891	160,093,879	185,842,643	188,131,796	212,504,818	236,592,326	267,271,974	291,560,673	299,685,574	300,631,917	310,814,589	331,880,000	352,585,585	369,541,726	382,080,226
	No AIDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Expenditure = AIDS cases * Percent_hospitalized * Expenditure_per_hospitalized_AIDS_patient																									
Percent of MOH expenditure for AIDS	With AIDS	5.5	8.4	10.7	12.2	13.1	15.9	18.2	15.8	17.0	21.0	26.3	29.9	31.8	34.7	37.7	40.7	43.8	45.9	45.4	43.8	43.5	44.7	45.7	46.0	45.7
	No AIDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent = Direct_expenditure_for_AIDS_care / MOH_recurrent_budget * 100																									
Hospital bed-days needed for AIDS	With AIDS	21,349	42,239	70,889	90,472	117,709	151,982	191,079	237,611	288,580	362,100	459,293	528,413	567,845	625,865	666,430	747,651	811,860	857,888	853,583	828,348	827,960	854,211	877,354	886,511	884,212
	No AIDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bed-days_needed = AIDS cases * Percent_hospitalized * Bed_days_per_AIDS_patient																									
Percent of beds needed for AIDS	With AIDS	4	8	14	17	23	29	37	46	56	70	89	102	110	121	133	144	157	166	165	160	160	165	169	171	171
	No AIDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Percent = Bed-days_needed / (Hospital_beds * bed_capacity_factor * 365) * 100																									
Child cases of measles	With AIDS	30,506	30,480	30,419	30,364	30,362	30,452	30,533	30,606	30,586	30,447	30,258	30,019	29,774	29,622	29,520	29,379	29,236	29,118	29,024	28,976	28,974	29,010	29,082	29,181	29,295
	No AIDS	31,031	31,390	31,826	32,356	33,001	33,766	34,599	35,490	36,431	37,411	38,421	39,441	40,441	41,426	42,385	43,305	44,170	44,999	45,776	46,503	47,188	47,854	48,509	49,157	49,805
	Measles_cases = Pop_ages_0-4 / 5 * ((1 - Proportion_vaccinated_for_measles) + Proportion_vaccinated_for_measles * (1 - Measles_vaccine_efficacy))																									
Child deaths due to measles	With AIDS	732	732	730	729	729	731	733	735	734	731	726	720	715	711	708	705	702	699	697	695	695	696	698	700	703
	No AIDS	745	753	764	777	792	810	830	852	874	898	922	947	971	994	1,017	1,039	1,060	1,080	1,099	1,116	1,133	1,149	1,164	1,180	1,195
	Measles_deaths = Measles_cases * Measles_case_fatality_rate																									
Child cases of malaria	With AIDS	667,082	688,955	700,080	701,343	703,848	708,516	713,007	717,324	719,569	718,881	717,087	714,063	710,889	709,926	710,148	709,431	708,675	706,510	706,921	710,472	713,154	716,805	721,395	726,675	732,375
	No AIDS	709,053	719,832	732,466	747,411	765,012	785,619	807,933	831,807	856,995	883,314	910,530	938,202	965,586	992,832	1,019,628	1,045,725	1,070,652	1,094,822	1,118,091	1,140,219	1,161,474	1,182,450	1,203,288	1,224,129	1,245,120
	Malaria_cases = Pop_ages_0-4 * Malaria_cases_rate																									
Child deaths due to malaria	With AIDS	6,971	6,990	7,001	7,013	7,038	7,085	7,130	7,173	7,196	7,189	7,171	7,141	7,109	7,099	7,101	7,094	7,087	7,085	7,089	7,105	7,132	7,168	7,214	7,267	7,324
	No AIDS	7,091	7,198	7,325	7,474	7,650	7,856	8,079	8,319	8,570	8,833	9,105	9,382	9,656	9,928	10,196	10,457	10,707	10,949	11,181	11,402	11,615	11,825	12,033	12,241	12,451
	Malaria_deaths = Malaria_cases * Malaria_case_fatality_rate																									
Child deaths due to AIDS	With AIDS	536	844	1,099	1,348	1,579	1,814	2,057	2,310	2,578	3,185	3,596	3,853	4,025	4,131	4,226	4,316	4,343	4,291	4,203	4,069	3,978	3,865	3,760	3,659	3,566
	No AIDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Child_deaths_due_to_AIDS = from DemProj																									
TB cases	With AIDS	5,426	6,318	7,241	8,205	9,219	10,274	11,358	13,581	15,849	16,715	17,258	17,731	18,177	18,618	19,039	18,758	18,405	18,031	17,668	17,356	17,108	16,899	16,666	16,433	16,202
	No AIDS	1,673	1,737	1,805	1,877	1,955	2,036	2,119	2,208	2,294	2,385	2,478	2,573	2,669	2,766	2,865	2,965	3,067	3,173	3,282	3,394	3,510	3,630	3,753	3,882	4,014
	TB-cases = Adult_pop * (TB_incidence_without_HIV / 1000) + HIV_adults * (Percent_of_adults_with_latent_TB_infection / 100) * (TB_incidence_for_HIV_and_TB / 100)																									
Extra TB cases due to HIV	With AIDS	3,752	4,581	5,437	6,327	7,264	8,238	9,238	11,376	13,655	14,329	14,780	15,158	15,508	15,852	16,174	15,794	15,338	14,857	14,386	13,965	13,599	13,290	12,913	12,551	12,189
	Extra_TB_cases = TB_cases_AIDS_projection - TB_cases_NoAIDS_projection																									

Orphans

Number of AIDS Orphans																									
Indicator	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
AIDS deaths to adult females	1464	2707	4261	4939	5947	7146	8374	9735	11,018	12,966	15,576	16,671	16,984	17,704	18,379	18,988	19,625	19,722	18,553	16,984	15,126	15,918	15,632	15,084	14,351
Total fertility rate	5.2	5.1	5.1	5	5	4.9	4.8	4.8	4.7	4.7	4.6	4.5	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4	3.9	3.9	3.8	3.8
New orphans / death	1.6	1.6	1.6	1.6	1.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Average age of orphans	3.6	3.6	3.6	3.6	3.6	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9
Average survival to age 5	0.86	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.86	0.86	0.87	0.87	0.87
New orphans	2,045	3,772	5,929	6,865	8,259	8,152	9,544	11,082	12,487	14,584	17,432	18,843	18,960	19,783	20,559	21,261	22,029	22,233	21,014	19,341	18,461	14,027	13,847	13,428	12,839
Total orphans	3,296	6,779	12,113	17,914	24,599	30,561	37,384	45,138	53,805	63,416	75,201	87,348	98,530	109,540	120,345	130,890	141,264	150,918	158,494	163,722	167,605	166,572	165,452	164,014	162,115

Economy

Macro-economic impacts of AIDS																										
Indicator	Projection	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Labor force size	With AIDS	359,591	371,668	383,316	394,863	406,557	417,867	429,592	438,547	447,899	460,298	480,353	498,066	514,551	529,952	543,657	555,473	565,915	575,193	584,426	594,661	606,600	615,924	626,930	635,436	645,473
	No AIDS	361,368	375,988	390,774	407,033	424,709	442,295	460,934	480,119	499,820	525,214	562,233	599,720	637,536	675,546	713,620	751,620	789,846	828,231	866,708	906,190	943,578	981,079	1,019,126	1,057,852	1,097,457
	LF_size = pop_15-64 * labor_force_participation_rate																									
AIDS care expenditure	With AIDS	5,223,181	10,364,629	17,461,986	22,463,999	29,476,857	38,444,992	48,894,922	61,588,836	75,862,479	97,574,395	127,003,891	150,093,679	165,842,843	188,111,798	212,504,816	236,592,326	267,271,974	291,560,573	299,685,574	300,631,917	310,814,589	331,860,000	352,986,585	369,541,726	382,080,226
	No AIDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	AIDS_care_expenditure = AIDS_cases * Percent_hospitalized * Expenditure_per_hospitalized_patient																									
Capital stock (millions)	With AIDS	87,701	82,634	78,421	74,556	71,532	68,871	66,649	65,450	64,701	64,286	64,424	64,759	65,253	65,886	66,630	67,456	68,338	69,253	70,191	71,163	72,194	73,250	74,342	75,457	76,590
	No AIDS	87,703	82,641	78,435	74,692	71,574	68,931	66,933	65,564	64,852	64,481	65,395	66,646	68,212	70,071	72,203	74,590	77,214	80,060	83,118	86,373	89,815	93,431	97,202	101,124	105,193
	Capital_stock[t] = Capital_stock[t-1] - depreciation + Gross_domestic_investment																									
	Depreciation = Capital_stock / average_capital_lifetime																									
Index of technical progress		1.010	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022	1.023	1.024	1.025	1.026	1.027	1.028	1.029	1.030	1.031	1.033	1.034	1.035
	Index_tech_prog [t] = Index_tech_prog [t-1] * (1 + Rate_tech_prog)																									
Cobb-Douglas constant																										
	C-D_constant = GDP[1] / [(Capital_stock[1] ^ Elasticity_output_to_capital) * (Labor_force[1] / 1e6 ^ Elasticity_output_to_labor)]																									
Gross domestic product	With AIDS	15,607	16,580	16,573	17,269	17,701	18,809	20,228	21,807	22,783	24,530	25,316	26,037	26,720	27,383	27,999	28,568	29,074	29,564	30,037	30,560	31,116	31,657	32,197	32,710	33,253
(millions) CONSTANT	No AIDS	15,607	16,580	16,573	17,269	17,701	18,809	20,228	21,807	22,783	24,529	26,391	29,803	31,480	33,060	34,895	36,371	38,087	39,843	41,536	43,463	45,318	47,173	49,074	51,018	53,031
	GDP = CD	14,494	14,958	15,436	15,930	16,440	16,966	17,509	18,069	18,648	19,244	19,860	20,496	21,151	21,826	22,527	23,248	23,992	24,759	25,552	26,369	27,213	28,084	28,983	29,910	30,867
Gross domestic investment	With AIDS	4,678	4,989	4,956	5,163	5,287	5,630	6,029	6,523	6,774	7,281	7,493	7,690	7,883	8,065	8,230	8,376	8,508	8,633	8,771	8,926	9,096	9,232	9,375	9,517	9,670
(millions)	No AIDS	4,682	4,977	4,972	5,181	5,310	5,661	6,068	6,572	6,835	8,079	8,517	8,971	9,438	9,918	10,410	10,911	11,426	11,953	12,491	13,038	13,595	14,152	14,722	15,305	15,909
	GDI = GDP	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
GDP growth rate	With AIDS	6.7	6.3	-0.1	4.2	2.5	6.6	7.2	6.3	4.0	4.0	3.2	2.8	2.6	2.5	2.2	2.0	1.8	1.7	1.6	1.7	1.8	1.7	1.7	1.6	1.7
(percent)	No AIDS	8.7	6.3	-0.1	4.2	2.5	6.6	7.2	6.3	4.0	5.5	5.4	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.1	4.0	4.0	3.9
	GDP_growth_rate = (GDP[t] / GDP[t-1] - 1) * 100																									
GDP per capita	With AIDS	11,642	12,249	11,936	12,160	12,203	12,758	13,437	14,323	14,995	15,650	16,023	16,386	16,745	17,094	17,426	17,736	18,031	18,306	18,572	18,826	19,066	19,276	19,467	19,631	19,767
	No AIDS	11,777	12,122	11,726	11,833	11,747	12,127	12,589	13,202	13,795	15,215	15,533	15,841	16,140	16,428	16,704	16,966	17,221	17,467	17,705	17,932	18,149	18,344	18,535	18,723	18,916
	GDP_per_capita = GDP / population																									
GDP per capita growth rate	With AIDS	5.6	3.4	-2.5	1.9	0.3	4.5	5.3	6.6	4.6	6.5	2.4	2.3	2.2	2.1	1.9	1.8	1.7	1.5	1.4	1.4	1.3	1.1	1.0	0.8	0.8
(percent)	No AIDS	5.2	2.9	-3.3	0.9	-0.7	3.2	3.8	4.9	0.7	14.4	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.0	1.0	1.0
	GDP_per_capita_growth_rate = (GDP_per_capita[t] / GDP_per_capita[t-1] - 1) * 100																									

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	Per Year
PREVENTION+MITIGATION 2000-15	
Total Cost Million (Pula)	
Average Cost per year Million (Pula)	**2,557**
Total Cost % to GDP	
Average Cost % to GDP	**7.6%**
PREVENTION	
Total Cost Million (Pula)	
Average Cost per year Million (Pula)	**520**
Total Cost % to GDP	
Average Cost % to GDP	**1.4%**
1. AGE 0-4	
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	10
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.027%
1a. AGE 0-6 months : MTC	
Policy: Zero MTC	
Source: Herald (Zimbabwe Daily News Paper) July 26,2000	
Cost of Nevirapine (US$) + 10% administration cost	$8.8
Exchange rate Pula per US$	***5.58***
Cost of Nevirapine (Pula)	49
Number of Females 15-49 (Average 2000-15)	146,561
Proportion of these Pregnant	15%
Pregnant Women 15-49 (Average 2000-15)	21,984
Proportion of these Pregnant women HIV+	25%
Mothers requiring Nevirapine	5,496
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	0.270
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.001%
1b. AGE 0.6-4 :	
Policy: Health care	
Source:	
Health Budget (Actual) for 1999/00 Million (Pula)	446
Population in 1999 Million	1.611
Percapita Health Expenditure	277
Cost per Child per year (1/2 of per capita Health exp)	138
Number of children 0.6-4 **(Excluding Orphans)** (Average 2000-15)	71,484
Total cost per year Million (Pula)	

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	Per Year
Average Cost per year Million (Pula)	10
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.026%
2. AGE 5-14 :	
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	104
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.3%
2a. AGE 5-9 :	
Policy: Age Specific Sex Education	
Source:	
Education Budget (Actual) for 1999/0 Million (Pula)	1,718
Population in 1999 Million	1.611
Percapita Education Expenditure	1,066
Cost per Child per year (1/5 of per capita Education exp)	213
Number of children 6-10 **(Excluding Orphans)** (Average 2000-15)	215,962
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	46
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.1%
2b. AGE 10-14 :	
Policy: Age Specific Sex Education/Youth Activities	
Source:	
Education Budget (Actual) for 1998/9 Million (Pula)	1,718
Population in 1999 Million	1.611
Percapita Education Expenditure	1,066
Cost per Young Child per year (1/4 of per capita Education exp)	267
Number of Young children 10-14 (Average 2000-15)	216,455
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	58
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.2%
3. AGE 15-19 :	
Policy: Age Specific Sex Education/Youth & Community Activities/Condom Distribution	
Source:	
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	129
Real GDP (1999/2000) Million Pula	

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	**Per Year**
Ratio to GDP	
Average Ratio for 2000-15	0.3%
3a. AGE 15-19 : Both Male and Female	
Policy: Age Specific Sex Education & Youth Activities	
Education Budget (Actual) for 1998/9 Million (Pula)	1718
Population in 1999 Million	1.611
Percapita Education Expenditure	1066
Cost per Youth per year (1/2 of per capita Education exp)	***533***
Number of **MALE & FEMALE** Youth 15-19 (Average 2000-15)	221,701
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	118
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.3%
3b. AGE 15-19 : Male only	
Policy: Condom Distribution	
CONDOM cost per year (2 /week, 1 condom Pula 1.00)	***104***
Number of **MALE** Youth 15-19 (Average 2000-15)	103,658
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	11
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.03%
4. AGE 20+	
Policy:Work place condom distribution/IEC/Voluntary and free counseling	
Source:	
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	277
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.7%
4a. AGE 20+: Both Male and Female	
Source:	
Education Budget (Actual) for 1998/9 Million (Pula)	1718
Population in 1999 Million	1.611
Percapita Education Expenditure	1066
Cost per Adult per year (1/4 of per capita Education exp)	***267***
Health Budget (Actual) for 1998/9 Million (Pula)	446
Population in 1999 Million	1.611
Percapita Health Expenditure	277
Counseling Cost (1/3 of Health percapita exp)	***92***
Cost per Adult (20-64) per year	**359**
Number of Adults 20-64 (Average 2000-15)	634,837

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	**Per Year**
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	228
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.7%
4b. AGE 20+: Male only	
Source:	
CONDOM cost per MALE adult year (4 per week, 1 condom Pula 1.00)	***156***
Number of **MALE** Adults 20-59 (Average 2000-15)	275,988
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	43
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.13%
MITIGATION	
Total Cost Million (Pula)	
Average Cost per year Million (Pula)	**2,108**
Total Cost % to GDP	
Average Cost % to GDP	**6.2%**
1. AGE 0-14	
Policy:Orphan Care	
Number of Children 0-14 (Average 2000-15)	185,667
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	605
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	1.8%
1a. AGE 0-4:	
Policy: Improved quality of life	
Source:	
Health Budget (Actual) for 1998/9 Million (Pula)	446
Population in 1999 Million	1.611
Percapita Health Expenditure	277
Cost per Child per year (1/2 of per capita Health exp)	138
Number of Children 0-4 (Average 2000-15)	166,027
Total Cost of all orphans age 0-4	
Average Ratio for 2000-15	23
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.1%
1b. AGE 5-14 ORPHANS:	
Policy: Provide better health services and education	

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	**Per Year**
Source:	
Number of Children 0-14 (Average 2000-15)	19,640
TOTAL COST of ALL ORPHANS (Pula Million)	
Average Cost per year Million (Pula)	565
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	1.7%
1b(i). AGE 5-14 NEW ORPHANS:	
Education Budget (Actual) for 1998/9 Million (Pula)	1718
Population in 1999 Million	1.611
Percapita Education Expenditure	1066
Cost per Child per year (1/2 of per capita Education exp)	***533***
Health Budget (Actual) for 1998/9 Million (Pula)	446
Population in 1999 Million	1.611
Percapita Health Expenditure	277
Cost per Child per year (1/2 of per capita Health exp)	***138***
Cost of FOOD per Child per year Pula (1/10h of percaptia income)	1,305
Total Cost per Orphan per year	**1977**
Cost per Orphan for 15 years	**29,648**
NEW orphans (Average 2000-15)	19,640
TOTAL COST of New ORPHANS (Pula Million) (10 years per orphan)	
Average Cost per year Million (Pula)	582
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	1.7%
1b(ii). AGE 6-14 EXISTING ORPHANS:	
EXISTING orphans as of END OF 1999	53,605
Cost per Orphan per year (estimated same as above)	**1977**
Cost per Orphan for 8 years	**15,812**
Cost per Orphan for 8 years adjusted for Inflation	0%
TOTAL COST of EXISTING ORPHANS (Pula Million) (8 years per orphans)	848
Average Cost per year Million (Pula)	106
Real GDP (1999/2000) Million Pula	
Ratio to GDP	3.7%
Average Ratio for 2000-15	0.5%
2. AGE 15-49 :	
Policy: Improved quality of Life by providing Medcinies,food, water	
Source: Feasibility of Home-Based AIDS Care Report February 1, 1995	
Cost of medcines/hospitalization per HIV patpient per year Pula	7,031
Number of Youth/Adults 15-49 (Average 2000-15)	209,563
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	1,473
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	4.3%

Botswana: Assumptions Used in Costing Selected HIV/AIDS Programs

Indicator	Per Year
3. AGE 50+:	
Policy: Improved quality of life through pension	
Source:	
Average Pension Amount for Civil Servants for 1998/9 (Pula) per year	2,610
Cost per Person per year (1/3 of average civil servant's pension)	870
Number of persons 50+ (Average 2000-15)	54,111
Total cost per year Million (Pula)	
Average Cost per year Million (Pula)	47
Real GDP (1999/2000) Million Pula	
Ratio to GDP	
Average Ratio for 2000-15	0.1%