

THE DEMOGRAPHIC IMPACTS OF HIV/AIDS

PERSPECTIVES FROM THE WORLD POPULATION PROFILE: 1996

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**IPC Staff Paper
No. 86
March 1997**

IPC STAFF PAPER
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SUMMARY

In countries with high levels of human immunodeficiency virus (HIV) prevalence, acquired immunodeficiency syndrome (AIDS) mortality will have major demographic impacts on populations.

- Crude death rates will increase
- Infant and child mortality rates will increase
- Population growth will slow and in some countries become negative
- Life expectancies will fall

The HIV/AIDS pandemic is the most severe in Sub-Saharan Africa. And in this region, the most dramatic impacts will be in countries which have made the most progress in improving these mortality indicators over the past two decades (e.g., Botswana and Zimbabwe).

The HIV/AIDS epidemics continue to develop in Sub-Saharan Africa. Although HIV seroprevalence levels have stabilized or declined in some areas (Uganda), in other countries the epidemics are increasing rapidly (Botswana, South Africa). Some countries initially spared are now seeing increases in HIV seroprevalence (Nigeria, Cameroon).

The HIV epidemics in Asia are extremely diverse ranging from countries with low HIV prevalence rates (Mongolia, South Korea) to countries with high HIV prevalence (Thailand). The epidemic in India is diverse with high HIV prevalence levels in western and southern India, but low HIV seroprevalence levels in eastern and northern India.

In 1994, population projections for Thailand indicated negative population growth by the year 2010. As a result of increases in condom use and declines of other sexually transmitted diseases (STDs), the projected number of people expected to become HIV positive in Thailand is now less than previously projected. As a result, current projections show that at least through the year 2010, population growth will remain positive.

In the Caribbean and Latin American Region, current levels of HIV prevalence and subsequent AIDS mortality will have impacts on populations in Guyana, Haiti, and Brazil. The level of HIV prevalence in Guyana is similar to those seen in some Sub-Saharan African countries. HIV prevalence in Haiti has remained stable for several years--a pattern similar to the trends seen in Zaire.

The U.S. Bureau of the Census estimates and projects populations, population growth, fertility, life expectancy and infant mortality worldwide. For high HIV prevalence countries, we include the impact of AIDS mortality. This report presents these results.

PREFACE

The International Programs Center conducts specialized studies of population, economics, labor force, health and aging issues. However, the use of data not generated by the U.S. Bureau of the Census precludes performing the same statistical reviews normally conducted on its own data.

This report was supported by funding from the U.S. Agency for International Development.

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TABLE OF CONTENTS

SUMMARY	iii
PREFACE	v
PERSPECTIVES FROM WORLD POPULATION PROFILE: 1996	1
CONCLUSION	8
TEXT FIGURES	11
APPENDIX	31
APPENDIX TABLES	37
BIBLIOGRAPHY	43

Text Figures

Figure

1. Empirical Evidence of AIDS Impact on Mortality	13
2. Crude Death Rate With and Without AIDS, East Africa: 2010	13
3. Crude Death Rate With and Without AIDS, Southern Africa: 2010	14
4. Crude Death Rate With and Without AIDS, West and Central Africa: 2010	14
5. Infant Mortality Rate With and Without AIDS, East Africa: 1996	15
6. Infant Mortality Rate With and Without AIDS, Southern Africa: 1996	15
7. Infant Mortality Rate With and Without AIDS, West and Central Africa: 1996	16
8. Infant Mortality Rate With and Without AIDS, Selected Countries: 1996	16
9. Infant Mortality Rate With and Without AIDS, East Africa: 2010	17

CONTENTS--Continued

10. Infant Mortality Rate With and Without AIDS, Southern Africa: 2010	17
11. Infant Mortality Rate With and Without AIDS, West and Central Africa: 2010	18
12. Infant Mortality Rate With and Without AIDS, Selected Countries: 2010	18
13. Child Mortality Rate With and Without AIDS, East Africa: 1996	19
14. Child Mortality Rate With and Without AIDS, Southern Africa: 1996	19
15. Child Mortality Rate With and Without AIDS, West and Central Africa: 1996	20
16. Child Mortality Rate With and Without AIDS, Selected Countries: 1996	20
17. Child Mortality Rate With and Without AIDS, East Africa: 2010	21
18. Child Mortality Rate With and Without AIDS, Southern Africa: 2010	21
19. Child Mortality Rate With and Without AIDS, West and Central Africa: 2010	22
20. Child Mortality Rate With and Without AIDS, Selected Countries: 2010	22
21. Growth Rates With and Without AIDS, East Africa: 2010	23
22. Growth Rates With and Without AIDS, Southern Africa: 2010	23
23. Growth Rates With and Without AIDS, West and Central Africa: 2010	24
24. Growth Rates With and Without AIDS, Selected Countries: 2010	24
25. Life Expectancy With and Without AIDS, East Africa: 1996	25
26. Life Expectancy With and Without AIDS, Southern Africa: 1996	25
27. Life Expectancy With and Without AIDS, West and Central Africa: 1996	26
28. Life Expectancy With and Without AIDS, Selected Countries: 1996	26
29. Life Expectancy With and Without AIDS, East Africa: 2010	27

CONTENTS--Continued

30. Life Expectancy With and Without AIDS, Southern Africa: 2010	27
31. Life Expectancy With and Without AIDS, West and Central Africa: 2010	28
32. Life Expectancy With and Without AIDS, Selected Countries: 2010	28
33. HIV Seroprevalence for Pregnant Women in Selected Urban Areas of Africa: 1985-1995 .	29
34. HIV Seroprevalence of Adult Population Masaka, Uganda by Age and Sex: 1989-90	29

Appendix Tables

Table

A-1. Empirical Seroprevalence Data For Urban And Rural Areas of Selected Countries	39
Demographic Indicators for 1996 With and Without AIDS	40
Demographic Indicators for 2010 With and Without AIDS	41

Demographic Impacts of HIV/AIDS Perspectives from the World Population Profile: 1996

AIDS Mortality Will Have Major Demographic Impacts on Populations in Countries Where the Epidemic Is Most Severe

Deaths resulting from AIDS are having demonstrable impacts on populations, particularly in countries where HIV prevalence is high. Recent cohort studies in Uganda have reported high levels of mortality due to AIDS in those age groups that generally have low levels of mortality (Figure 1). In Masaka, Uganda, where 8 percent of adults (13 years or more) are HIV positive, 89 percent of deaths between the ages of 25 and 34 are due to AIDS.¹ In Rakai District, where 21 percent of the adult population (15 years or more) is HIV positive, 87 percent of deaths between the ages of 20 and 39 are due to AIDS.²

As a result of these mortality levels due to high HIV prevalence, all mortality indicators will be affected. Within the next decade, crude death rates will increase by more than 50 percent in some countries and will more than double in others. Infant mortality rates and child mortality rates will increase. And perhaps the most significant impact will be seen in projected life expectancies due to the increases in mortality in the young adult ages.

The U.S. Bureau of the Census estimates and projects populations,^{3,4} population growth, fertility, life expectancy and infant mortality worldwide. For high HIV prevalence countries, we include the impact of AIDS mortality. This report presents these results.

Crude Death Rates Will be Higher

The most direct impact of AIDS is to increase the number of deaths in populations affected. By the year 2010, crude death rates, number of people dying divided by the number of people in the

¹Mulder, DW, AJ Nunn, HU Wagner, *et al.* 1994. "HIV-1 Incidence and HIV-1 Associated Mortality in Rural Ugandan Population Cohort." *AIDS*, Vol. 8, no. 1, pp. 87-92.

²Sewankambo, NK, MJ Wawer, RH Gray, *et al.* 1994. "Demographic Impact of HIV Infection in Rural Rakai District, Uganda: Results of a population-Based Cohort Study." *AIDS*, vol. 8, no. 12, pp. 1707-1713.

³U.S. Bureau of the Census. 1996. *World Population Profile: 1996*. Report WP/96, U.S. Government Printing Office, Washington, D.C.

⁴U.S. Bureau of the Census. International Data Base. International Programs Center, Population Division, Washington, D.C.

population, will be considerably higher in those countries severely affected by the HIV/AIDS epidemics.

In Africa, HIV epidemics have had their greatest impact in the eastern and the southern regions. HIV prevalence levels in many urban areas either are at or are approaching 25 percent among the general population. And in many countries in these regions, reports indicate the presence of the virus since the early 1980's.

As a result of these long-term high levels of HIV infection, estimated crude death rates including AIDS mortality will be greater by at least 50 percent to almost 500 percent in eastern and southern Africa over projected crude death rates without AIDS. In eastern Africa, the projected crude death rate with AIDS mortality will be 50 percent greater than the projected crude death rate without AIDS in Ethiopia, will almost double in Burundi, and will more than double in Tanzania and Uganda. In southern Africa, where projected non-AIDS crude death rates are relatively low, AIDS mortality will have an even larger impact on crude death rates. By the year 2010, AIDS mortality will produce an the estimated crude death rate nearly sixfold higher in Zimbabwe, fourfold in Botswana, and threefold in Zambia than would have been expected without AIDS (Figures 2 and 3).

Country	With AIDS	Without AIDS
Burundi	17	9
Ethiopia	18	12
Tanzania	24	9
Uganda	24	9
Botswana	29	6
Zambia	29	9
Zimbabwe	29	5

In west and central Africa, where the prevalence of HIV has remained lower than in eastern or southern Africa, estimated crude death rates with AIDS will still be greater than what would have been expected without AIDS. Crude death rates will be more than double due to AIDS mortality in Burkina Faso, Central African Republic, the Congo, and Côte d'Ivoire. Although the difference between the projected crude death rate with AIDS mortality and the crude death rate that would have been expected without AIDS will be relatively less in Nigeria, 9.2 per 1,000 versus 7.1 per 1,000, the difference will amount to an additional 300,000 deaths due to AIDS in the year 2010 (Figure 4).

In other parts of the world, AIDS mortality will result in higher crude death rates in Thailand, Brazil, Guyana and Haiti over what would have been expected without AIDS.

AIDS Will Reverse the Recent Declines in Infant Mortality Rates....

Infant mortality rates⁵ will increase due to AIDS reversing the declines that had been occurring in many countries over the past decades. Over 30 percent of all children born to HIV infected mothers in Sub-Saharan Africa will themselves become HIV positive. The relative impact of AIDS on infant mortality will depend on both the level of HIV in the population and the infant mortality rate from other causes. Those countries that had significantly reduced non-AIDS infant mortality will see a greater relative impact.

Even today, AIDS is affecting infant mortality rates. In eastern Africa, for example, without AIDS, Kenya would have an infant mortality rate of 46.9 per 1,000 births, but as a result of the AIDS epidemic, the infant mortality is now 55.3. Likewise, in southern Africa, in Zambia and Zimbabwe, estimated infant mortality rates are more than 25 percent higher than what they would have been without AIDS. In Zambia, infant mortality rates are now 96.1 per 1,000 live births rather than 74.3 and in Zimbabwe where infant mortality rates without AIDS would have been 51.7, they are now estimated to be 72.8 with the AIDS epidemic (Figures 5-8).

By the year 2010, Kenya would have expected an infant mortality rate of 32.9 per 1,000 births. With the AIDS epidemic, an estimated 55.9 infants per 1,000 live births will die in the year 2010, 70 percent greater. Projected infant mortality rates in Tanzania and Uganda will be over 40 percent higher than projected rates without AIDS (Figure 9).

In southern Africa, with rapidly increasing epidemics in Botswana and Zimbabwe, projections indicate that deaths due to AIDS will more than double infant mortality rates.

In Malawi, where infant deaths due to other causes are high, AIDS mortality will inflate infant mortality rates more than 40 percent over what would have been expected without AIDS by the year 2010. And in Zambia, infant mortality rates will be more than 60 percent higher (Figure 10).

In countries with a less severe epidemic, for example, in western and central Africa, infant mortality rates are already higher and will be 10 to 25 percent higher over what would have been expected without AIDS by the year 2010. In west Africa, projected infant mortality rates will be over 35 percent higher in Burkina Faso from 73.7 to 101.9 and in Côte d'Ivoire from 48.4 to 65.4 due to AIDS mortality. In Nigeria and Zaire, the infant mortality rates will be about 10 percent higher by the year 2010 (Figure 11).

Selected Infant Mortality Rates: 2010

Country	With AIDS	Without AIDS
Kenya	55.9	32.9
Tanzania	90.9	65.2
Uganda	86.1	58.5
Botswana	66.1	26.3
Malawi	126.1	88.4
Zimbabwe	71.0	29.8
Zambia	97.4	58.4

⁵Infant mortality rate is the number of deaths of infants under 1 year of age from a cohort of 1,000 live births.

Although HIV prevalence in Thailand is not at the level as seen in some parts of Sub-Saharan Africa, the continuing spread of the HIV epidemic in Thailand and the resulting AIDS mortality will affect infant mortality rates. Infant mortality rates will be 18.7 per 1,000 live births instead of 17.8 without AIDS in 2010 (Figure 12).

In other regions of the world, AIDS is also projected to impact on infant mortality. In Brazil, by the year 2010, projected infant mortality rates are 31.5 per 1,000 live births instead of 27.7 without AIDS and in Haiti, 85.6 per 1,000 live births instead of 80.1 without AIDS. In Guyana, AIDS mortality will result in a 40 percent higher infant mortality rate, 51.7 instead of 36.9 (Figure 12).

....And in Child Mortality Rates

Two-thirds of AIDS deaths among children will occur among those 1-4 years of age. Child mortality rates⁶ will increase due to AIDS mortality since many HIV infected children survive beyond their first birthday. A recent study of HIV infected children in Kampala reported a median survival rate of 21 months. Once again, those countries with elevated levels of HIV prevalence and low non-AIDS child mortality, will see increases in child mortality reversing the declines that had been occurring.

By 1996, AIDS mortality was already affecting child mortality rates. In eastern Africa, the estimated child mortality rates in Kenya would have been 68.6 per 1,000 but with AIDS are now nearly 40 higher at 94.6. Estimated child mortality rates are about 25 percent higher in Tanzania (180.1 versus 145.4) and in Uganda (179.0 versus 140.3) than they would be without AIDS. In southern Africa, the AIDS epidemic has resulted in 75 percent higher estimated child mortality rates in Botswana from an estimated 61.2 without AIDS to 107.1 with AIDS mortality and 85 percent higher in Zimbabwe from 69.1 without AIDS to 128.3 with AIDS mortality. In Malawi, estimated child mortality rates are now 243.1 instead of 199.8 without AIDS and in Zambia, 188.7 instead of 130.8 (Figures 13-16).

By the year 2010, AIDS will result in a doubling of projected child mortality rates in Kenya and Zambia over what would have been expected without AIDS, more than three times higher in Botswana, and four times higher in Zimbabwe. Nearly 100 childhood deaths per 1,000 in Botswana, Malawi, Zambia and Zimbabwe will be due to AIDS (Figures 17-18).

Selected Child Mortality Rates: 2010

Country	With AIDS	Without AIDS
Kenya	110.3	45.4
Tanzania	166.1	95.8
Uganda	168.1	92.2
Botswana	147.5	38.3
Malawi	233.8	136
Zambia	202.1	96.9
Zimbabwe	152.9	37.8

⁶Child Mortality, ${}_5q_0$, is the probability of a child dying before age 5 per 1,000 live births.

In other regions in Africa, by the year 2010, AIDS will result in projected child mortality rates 15 to nearly 70 percent over what would have been expected without AIDS. Child mortality rates will be nearly 70 percent higher by the year 2010 in Burkina Faso (184.3 with AIDS versus 108.7 without) and in Côte d'Ivoire (118.7 with AIDS versus 70.7 without). In Nigeria, estimated child mortality rates will be 15 percent higher (79.2 versus 68.2) and in Zaire, 20 percent higher (118.7 versus 97.3) (Figure 19).

In Thailand, estimated child mortality rates are already higher at 43.7 per 1000 instead of 39.6 that would have been expected without AIDS. The projected child mortality rate will be 25.0 with AIDS by the year 2010 versus 21.2 per 1,000 children without AIDS (Figure 20).

The AIDS epidemic has already resulted in 15 percent higher estimated child mortality rates in Brazil (77.0 versus 66.0), in Guyana over 20 percent higher (77.5 versus 63.6) and in Haiti 10 percent higher (165.5 versus 150.5). By the year 2010, projected child mortality rates with AIDS in Brazil will be higher than would have been expected without AIDS, 43.9 instead of 33.3, and in Haiti, 134.4 instead of 119.0. In Guyana, the projected child mortality rates will nearly double from 48.7 to 92.0 (Figure 20).

Population Growth Rates Will Slow and Some Countries Will Have Negative Growth

Even with increases in mortality due to AIDS, growth rates will remain positive in the year 2010 except in three countries -- Botswana and Zimbabwe in Africa, and Guyana in the Caribbean. In these countries, low projected total fertility rates (2.92 births per woman in Botswana, 2.44 in Zimbabwe, and 1.88 in Guyana) combined with high expected mortality from AIDS will result in a projected negative population growth. In Zambia and Malawi where the HIV epidemics are also projected to be high in the year 2010, total fertility rates are projected to remain high, 5.44 and 3.94, respectively, and projected population growth will be positive (Figures 21-24).

AIDS mortality, however, will reduce the growth rates in all countries. In eastern Africa, by the year 2010 the AIDS epidemic will have reduced the growth rate in Kenya from 1.8 to 0.5 percent and in Uganda from 3.0 to 1.6 percent. In southern Africa, the AIDS epidemic will reduce the growth rate in Zambia 3.1 to 1.2 percent and in Malawi from 2.2 to 0.1 percent by the year 2010.

As a result of increases in condom use and the declines of other STDs, the projected number of people expected to become HIV positive in Thailand is now less than previously projected. Population growth is now expected to remain positive through the year 2010.

Life Expectancies Will Decrease Due to Increases in Mortality Among Young Adults

Perhaps the largest demographic impact of AIDS mortality will be on life expectancies. Many years of life will be lost due to the AIDS epidemic. AIDS will increase mortality rates in childhood and young adults where normal mortality is quite low.

As a result, AIDS deaths will have a relatively larger impact on life expectancies than perhaps on any other demographic indicator. The AIDS epidemic has already reduced estimated life expectancies in Kenya from 65 to 55.6, in Uganda from 53.2 to 40.3 and in Zimbabwe from 64.1 to 41.9 (Figures 25-28).

In Zimbabwe, without AIDS, life expectancy would have reached 70 years by 2010. However, with AIDS, projection of life expectancy in Zimbabwe is now less than 35 by the year 2010. In Uganda, instead of an estimated life expectancy of 54.5 by the year 2010, AIDS mortality will reduce the life expectancy to 35.5. In Nigeria and Zaire, with lower levels of projected HIV prevalence, AIDS mortality will reduce estimated life expectancy from 64.9 to 59.7 years and 59.8 to 51.3 years, respectively (Figures 29-31).

By 2010, AIDS will have relatively small impacts on populations in Brazil and Haiti compared to those projected for Guyana. As a result of AIDS mortality, estimated life expectancies will decline in Brazil from 72.5 to 65.1 years, in Haiti from 58.8 to 52.5 years, and in Guyana from 67.9 to 49.9 years (Figure 32).

By 2010, estimated life expectancies in Thailand will be a few years lower than would have been expected without AIDS, 72.9 versus 75.1 (Figure 32).

In 19 African Countries More Than 5 Percent of the Urban Population Is HIV Positive

In 19 African countries, HIV prevalence among low-risk urban adult populations (15-49 year olds) has reached 5 percent, or, based on recent trends, appeared to be likely to reach this level in the near future. More than 12.6 million (6.8 percent) of the nearly 185 million adults living in these countries of Africa were HIV positive in 1995. The most severely affected countries are Malawi (17.4 percent), Zambia (21.0 percent) and Zimbabwe (20.2 percent) where an estimated 2.6 million people were HIV positive in 1995. Although HIV prevalence in Nigeria is still relatively low compared to other countries in Sub-Saharan Africa, 1.8 percent of adults, nearly 800 thousand, were estimated to be HIV positive in 1995.

Among urban antenatal women, HIV prevalence has reached or passed 25 percent in many settings. In some countries HIV seroprevalence among urban antenatal women appears to have reached a plateau (e.g., Lusaka, Zambia and Blantyre, Malawi). There is even some

Sub-Saharan African Countries Most affected by the HIV/AIDS Epidemic

Botswana
Burkina Faso
Burundi
Cameroon
Central African Republic
Congo
Côte d'Ivoire
Ethiopia
Kenya
Lesotho
Malawi
Nigeria
Rwanda
South Africa
Tanzania
Uganda
Zaire
Zambia
Zimbabwe

evidence of recent declines in HIV seroprevalence among antenatal women in Uganda. But in other countries, urban HIV seroprevalence continues to rise (e.g., Harare, Zimbabwe; Francistown, Botswana; and Kwazulu-Natal, South Africa (Figure 33).

In Sub-Saharan Africa, peak HIV infection among women occurs around 20-25 years of age, 5-10 years earlier than among men. HIV infection among women as young as 13-14 have been reported from studies in Tanzania and Uganda (Figure 34).

By 2010, a projected 34.5 million adults will be infected with HIV in these countries, or 12.7 percent of the estimated 273 million adults. By 2010, Botswana will be as severely impacted by the HIV/AIDS epidemic as Malawi, Zambia and Zimbabwe. About one-third of the adults are projected to be infected with HIV. More than six million adults will be infected in these four countries by 2010. The epidemic in Nigeria will remain relatively low compared to the rest of Sub-Saharan countries at 3.1 percent; however, with its large population, 2.2 million adults are projected to be HIV positive in 2010.

The HIV Epidemic in Asia Is Extremely Diverse

In Asia, HIV seroprevalence rates in the general population range from less than a tenth of a percent in countries such as Mongolia and South Korea to rates seen in Thailand of 2.1 percent.⁷

The epidemic in India differs from state to state, with high HIV prevalence in west and southern India to low levels of HIV in east and northern India. In Bombay, HIV seroprevalence increased from two to three percent in STD clinic attendees before 1990 to 36 percent in 1994. HIV prevalence in commercial sex workers rose from 1 to 51 percent between 1987 and 1993. Studies among commercial sex workers in Calcutta, in contrast, show clear and consistently low prevalence of 1 percent.

In South-East Asia, the HIV epidemic is increasing rapidly in Burma, Cambodia, and Vietnam. The most severe regional epidemic is in Burma where it began among IV drug users (IVDU) and has spread to commercial sex workers. Substantial geographic variability exists, with infection rates ranging from 0 to 12 percent among antenatal women attending sentinel surveillance sites in 1993. The epidemic in Cambodia is predominantly occurring among heterosexuals with multiple sex partners. HIV prevalence has risen dramatically among sex workers (from 10 percent in 1992 to 40 percent in 1996) and STD clinic patients (from 3 percent in 1992 to 9 percent in 1994). As of 1996, nearly 2 percent of antenatal women are HIV positive. In Vietnam some evidence exists that the HIV epidemic is now growing rapidly. Studies of IV drug users in treatment have found high levels of HIV infection (32 percent in 1992-95). Reports from sentinel surveillance indicate about 1 percent of commercial sex workers tested in Ho Chi Minh City are HIV positive. In some provinces, the rate is now as high as 3 percent among commercial sex workers.

⁷UNAIDS. "The Current Global Situation of the HIV/AIDS Pandemic as of 15 December 1995."

More data on HIV prevalence and trends, particularly from India and China, will be required to determine the scope of the epidemic and its demographic consequences in this region.

In the Caribbean and Latin American Region HIV/AIDS is Well Established

The rate of spread of HIV/AIDS has been slower in Latin America and the Caribbean than in other developing regions of the world, but the pandemic is well established. The HIV epidemic varies from country to country, progressing in some countries from one predominantly homosexual/bisexual to one with accelerated heterosexual transmission. In some countries, transmission through IVDU has had an important impact on the epidemic.

In the Caribbean and in Central America the HIV epidemic has been characterized as mostly a heterosexual epidemic. In Haiti, HIV prevalence has remained stable over the past several years at around 4 percent and is projected to reach 4.5 percent by the year 2010. In Guyana, however, projections indicate HIV prevalence will increase from 2 percent in 1992 to 13 percent in 2010 and will result in impacts similar to those seen in some countries in Sub-Saharan Africa. Recent data from Honduras indicate increases in HIV prevalence in major urban centers. In San Pedro Sula, HIV prevalence among commercial sex workers increased from 14 percent in 1991 to 21 percent in 1995 and among antenatal women from 2 percent in 1993 to 4 percent in 1995.

In Brazil, there is considerable HIV transmission due to injecting drugs and the epidemic has progressed since the early 1980's from one predominantly due to homosexual/bisexual transmission to one with an increasing heterosexual component.

In Conclusion....

Various organizations have produced estimates and projections of populations since the early 1950s. At this time, both the U.S. Bureau of the Census and the United Nations continue to publish population estimates and projections for all countries of the world. Estimates since 1994 incorporate AIDS mortality.

These estimates and projections treat AIDS mortality differently from other causes of death since it occurs during those ages where mortality is generally low. Once a person has passed his/her fifth birthday, they can expect to live for many years.

In the countries that have been most severely affected by AIDS, the majority of HIV transmission has occurred through heterosexual sex. In other words, those who are most sexually active are most at risk of acquiring HIV. As a result, peak HIV prevalence occurs around the ages of 25-30 for women and 30-35 for men. AIDS mortality peaks 5-10 years later. And these are the ages for which adult mortality due to other causes is very low.

Since many women who are HIV infected are often unaware of their status, they will continue to have children. We assume that they will continue to produce children at the same rate as other uninfected women in their country. This assumption may need to be modified in the future. A recent study in Rakai, Uganda, has documented lower fertility among women who are HIV infected.⁸ The numbers presented in this report however, assume no differences in fertility between infected and noninfected women.

Of children born to HIV infected mothers, one-third will themselves become infected. The death of these infected children will increase both infant and child mortality rates.

The increases in infant and child mortality combined with the increases in adult mortality will decrease life expectancies in many countries. Countries which had seen the most improvements in life expectancies will now see dramatic declines in these estimates and projections.

Encouraging signs exist, however, that countries can modify the trends in HIV prevalence. In Thailand, recent data suggest that behaviors have changed and HIV prevalence among new military recruits has declined.⁹ Levels of other STDs have also declined.¹⁰ Declines in HIV prevalence have also been documented among young antenatal women in some areas of Uganda.¹¹ Further analysis of these data is required to validate the results and to document behavioral changes that may have contributed to these declines.

More than 90 percent of all adults with HIV infection or AIDS live in developing countries. Countries in Sub-Saharan Africa and the Caribbean have the highest national rates of adult HIV prevalence. As these epidemics continue their course, future estimates and projections will have to reflect the changes that occur in these trends. And these will require the continual monitoring of HIV prevalence in populations.

⁸Sewankambo NK, MJ Wawer, RH Gray, *et al.* 1995. "Demographic effects of the HIV-1 epidemic in three community strata of rural Rakai District Uganda. IXth International Conference on AIDS and STD in Africa, Kampala, Uganda, 12/10-14, Abstract MoB440.

⁹Nelson KE, DD Celentano, S Eiumtrakol, *et al.* 1996. "Changes in Sexual Behavior and a Decline in HIV Infection Among Young Men in Thailand." *The New England Journal of Medicine*. Vol 335, No. 5, pp 297-303. August.

¹⁰W. Rojanapithayakorn and R. Hanenberg. 1996. "The 100% Condom Program in Thailand. *AIDS*. Vol 10, pp 1-7. January.

¹¹Asiimwe-Okiror, GJ Musinguzi, G. Tembo, *et al.* 1995. "Declining Trends in HIV Infection in Urban Areas in Uganda." IX International Conference on AIDS and STD in Africa, Kampala, Uganda, 12/10-14, Session WeC206.

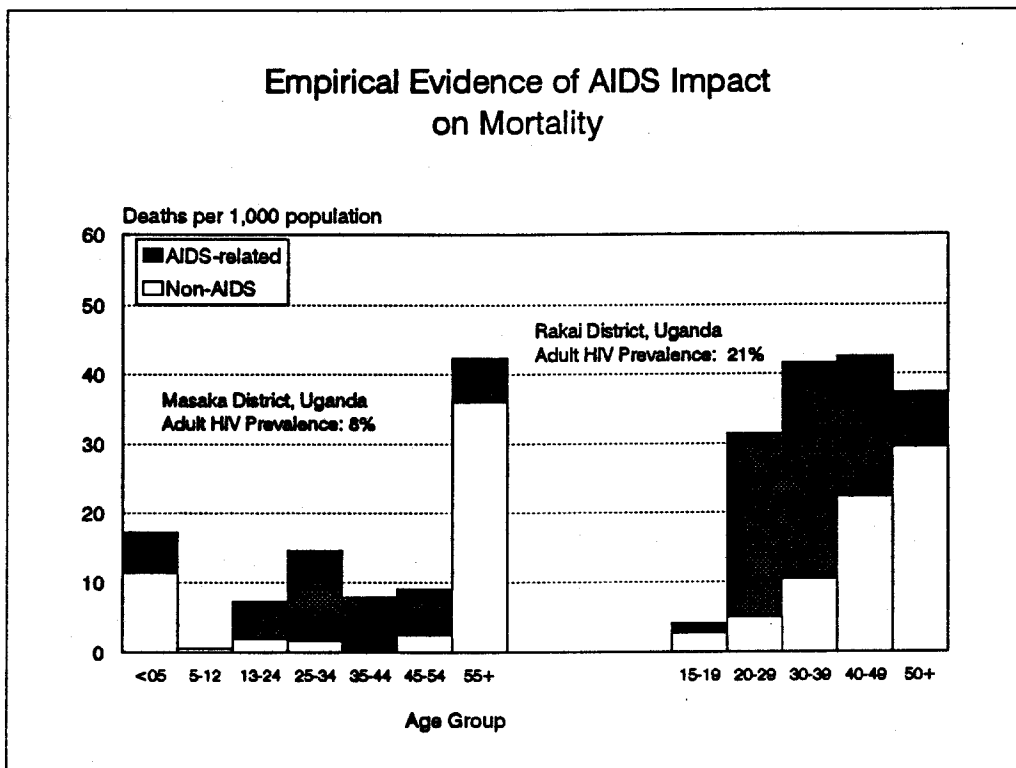


Figure 1

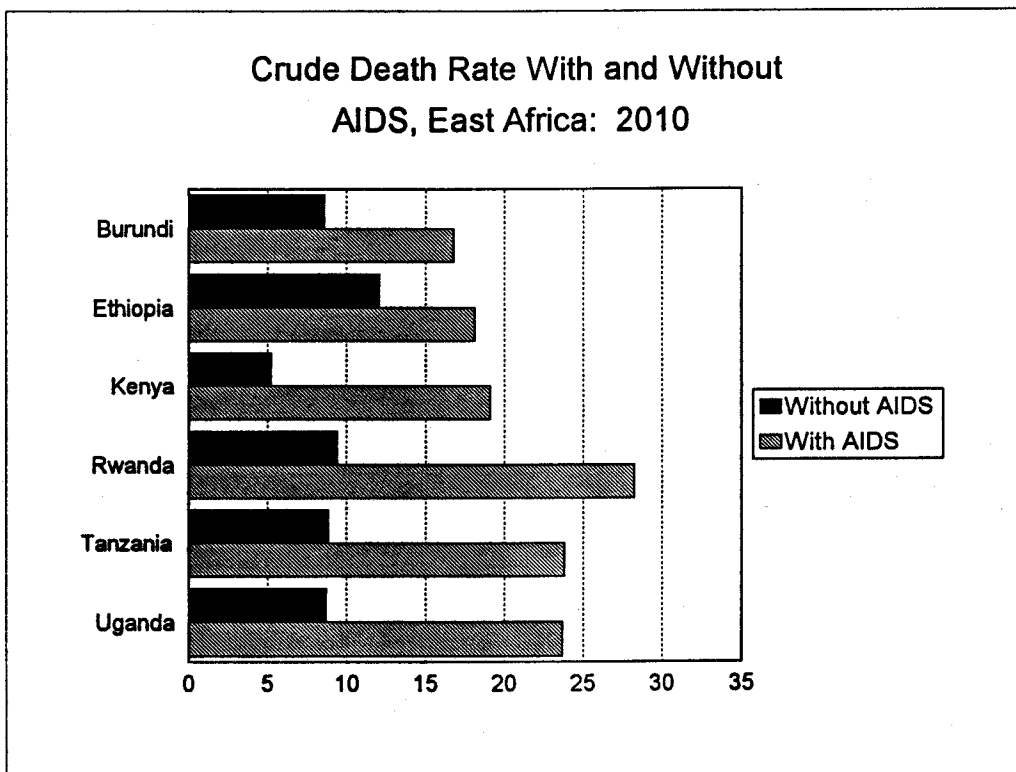


Figure 2

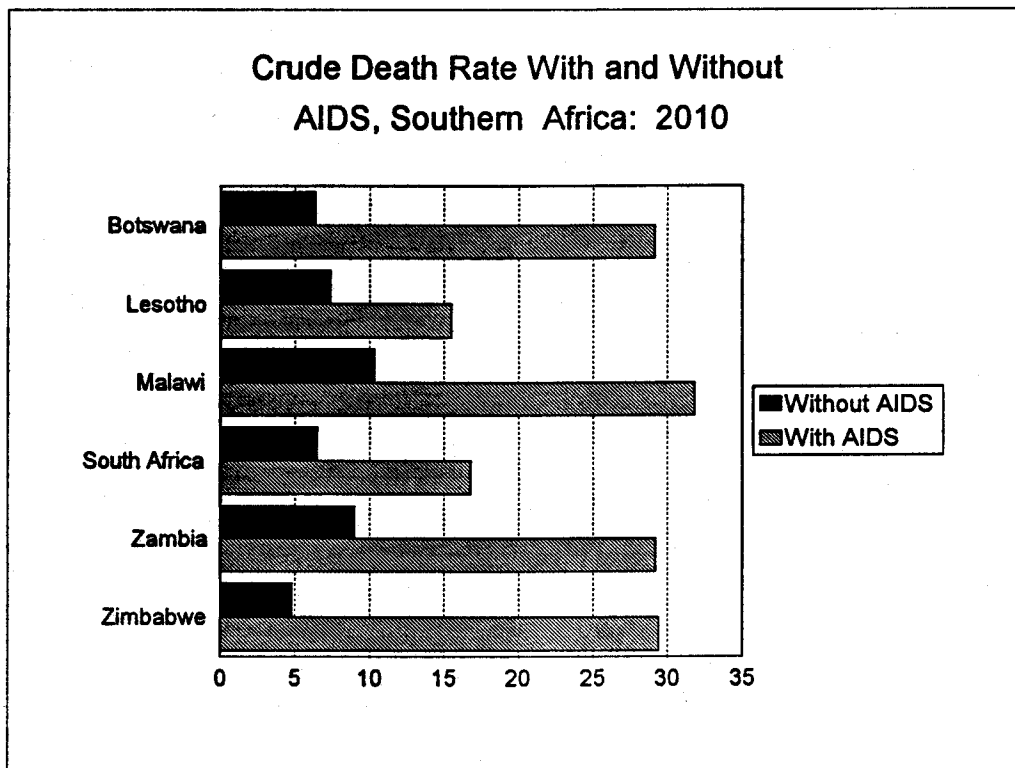


Figure 3

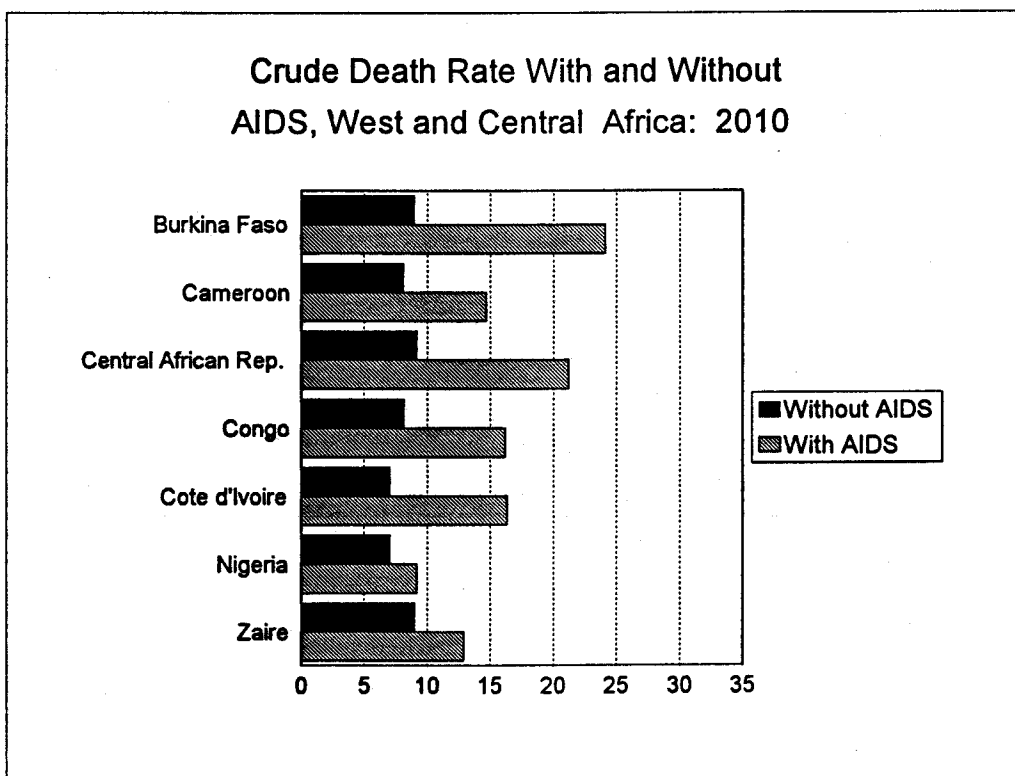


Figure 4

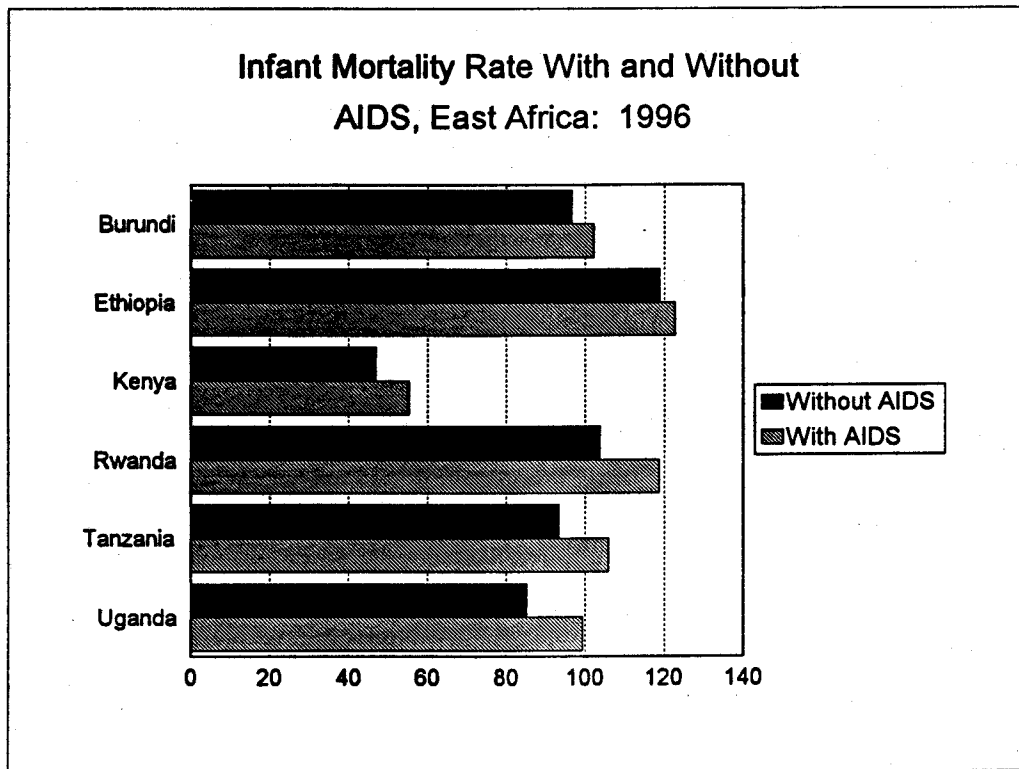


Figure 5

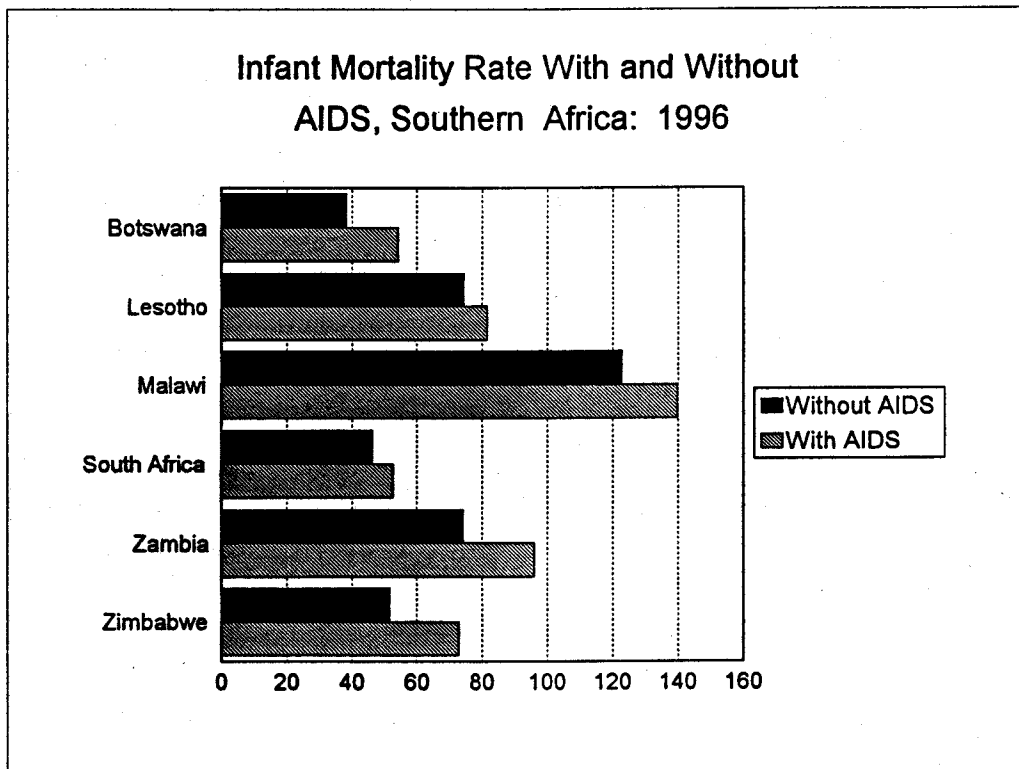


Figure 6

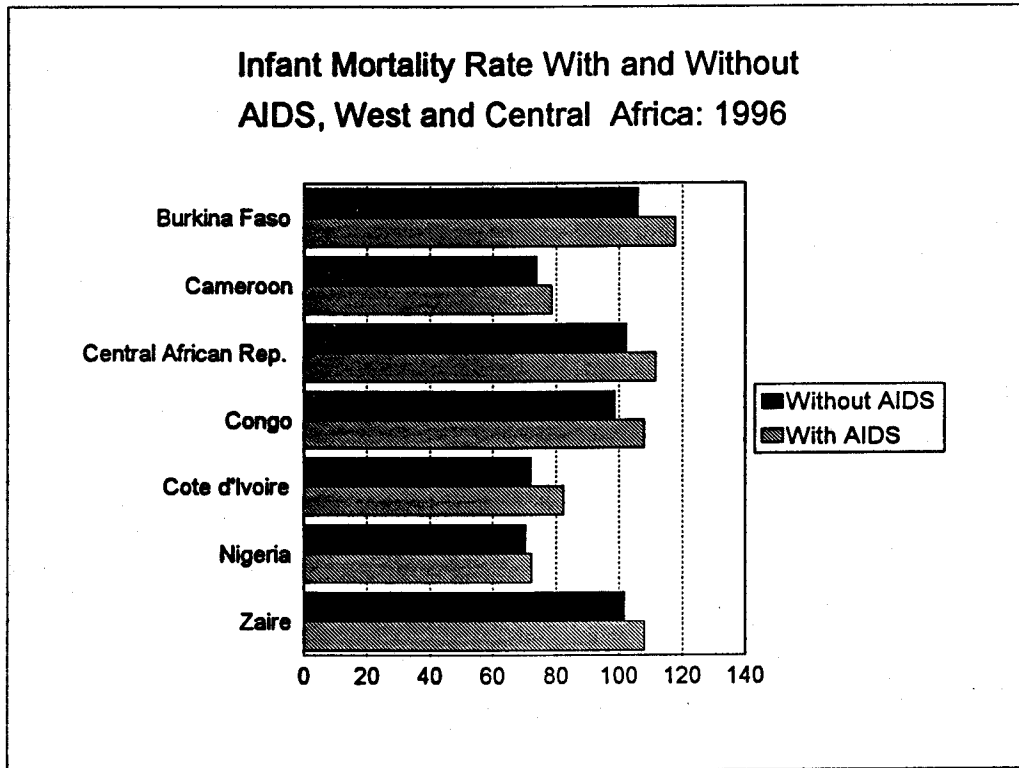


Figure 7

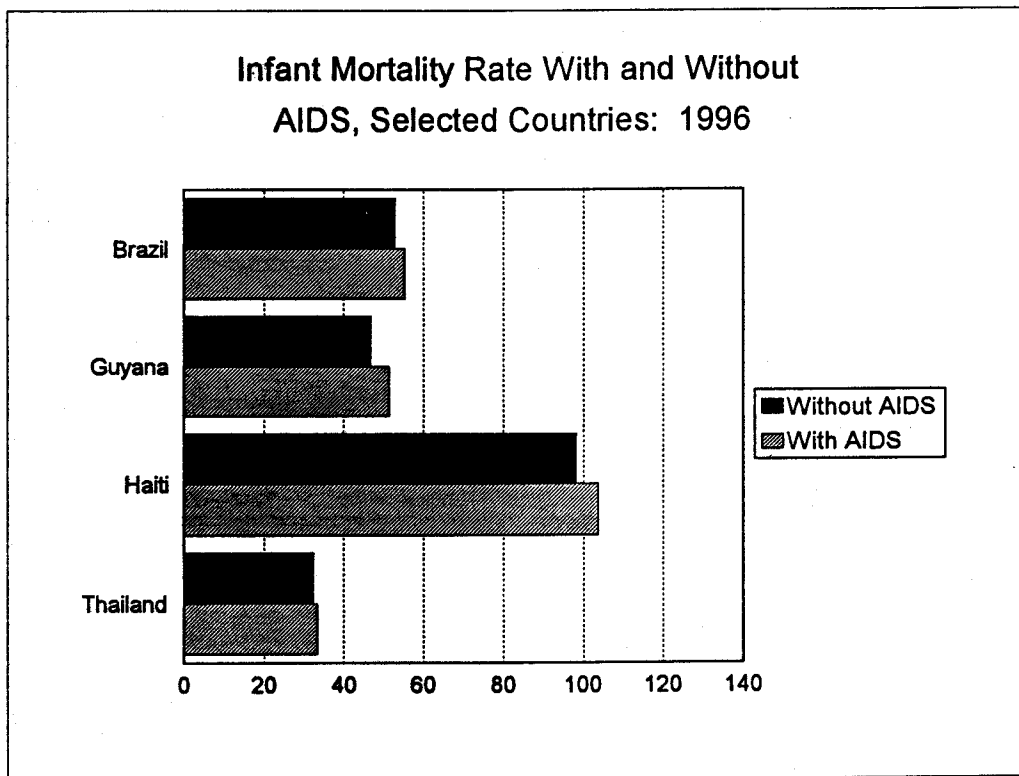


Figure 8

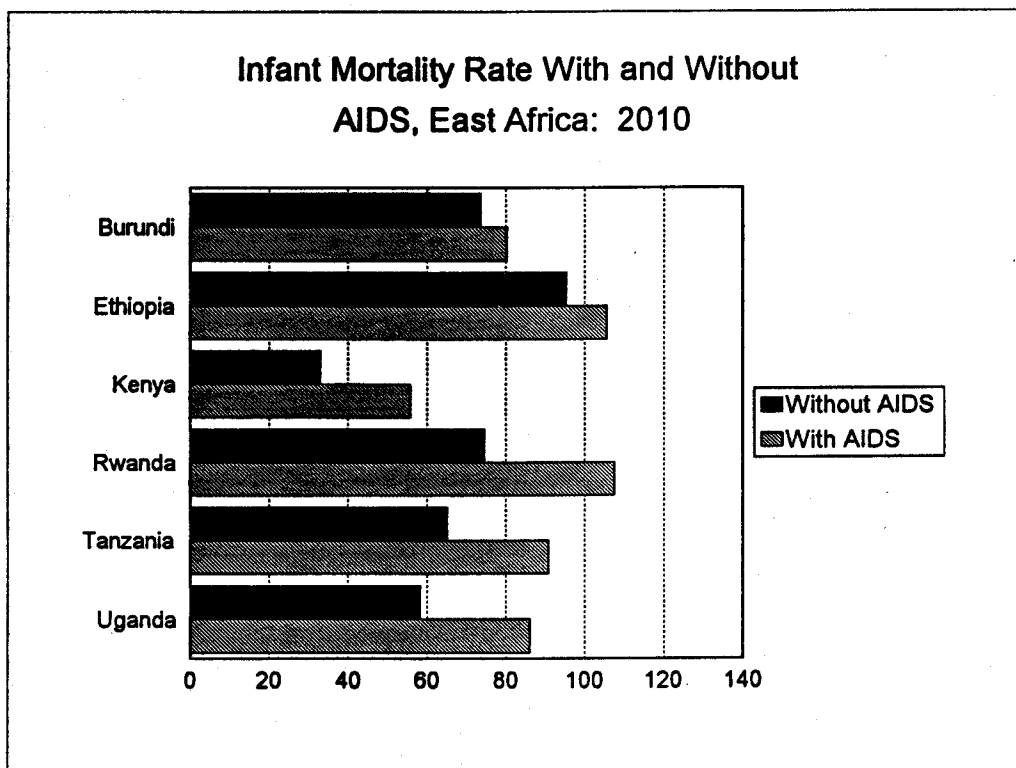


Figure 9

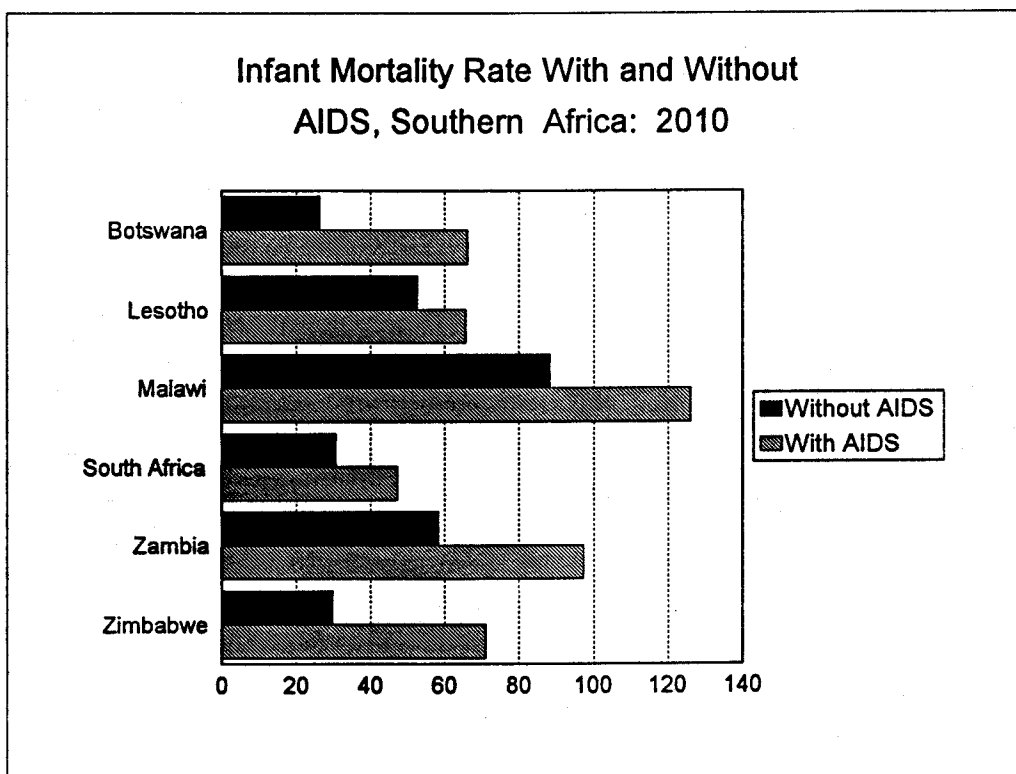


Figure 10

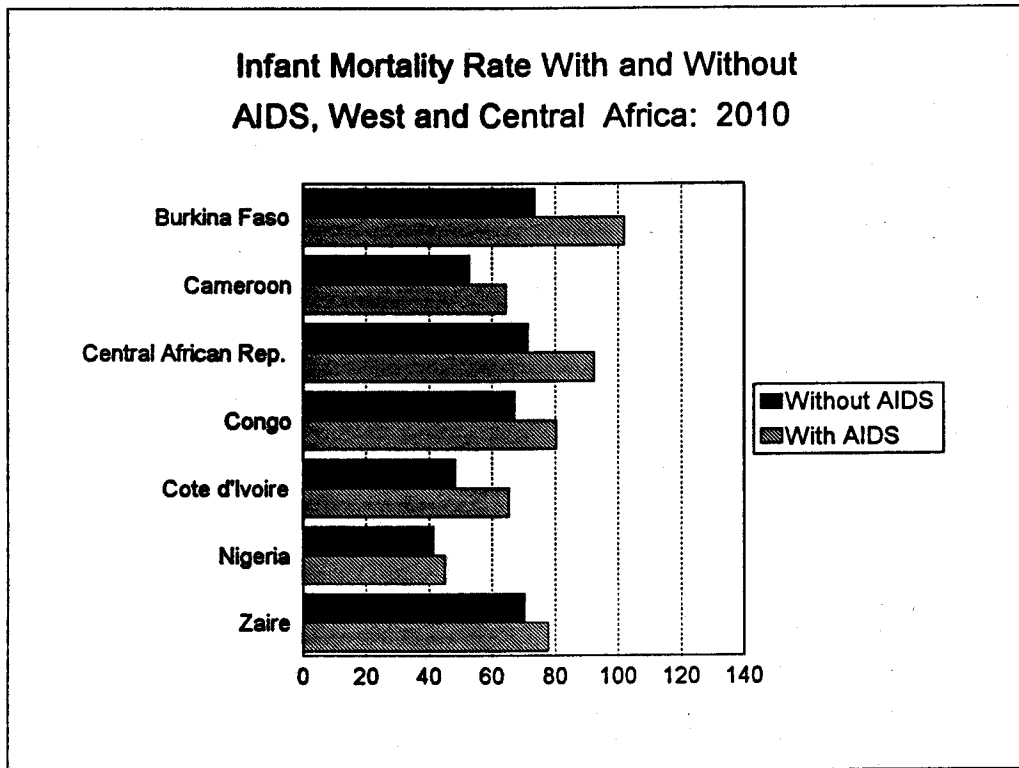


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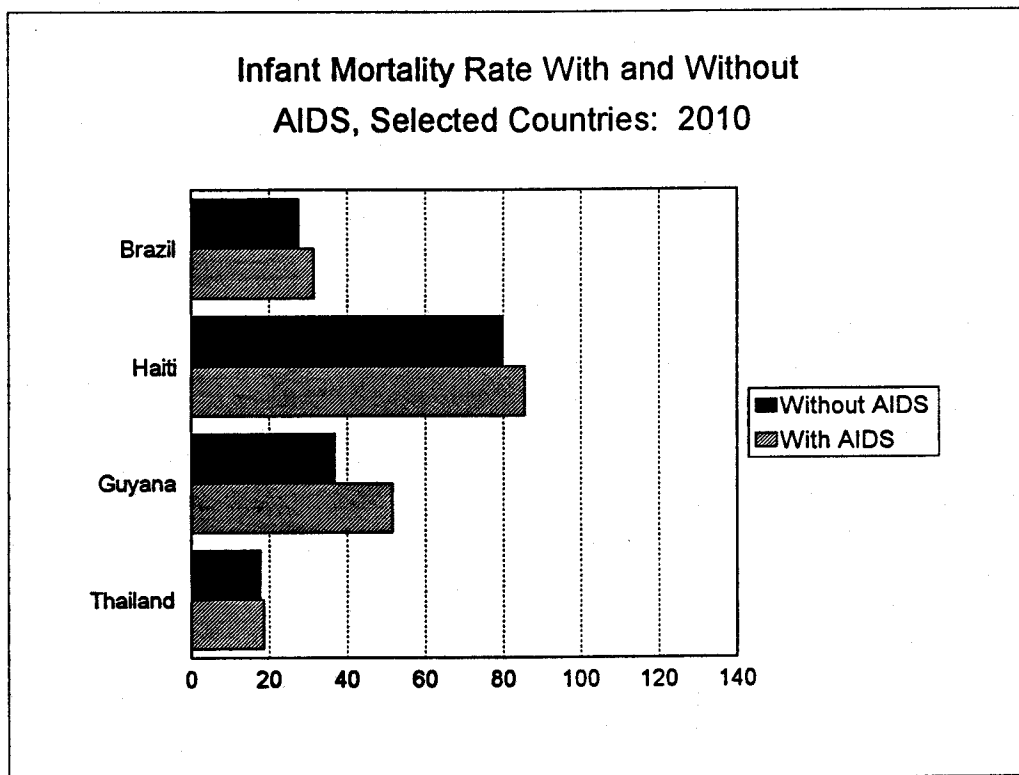


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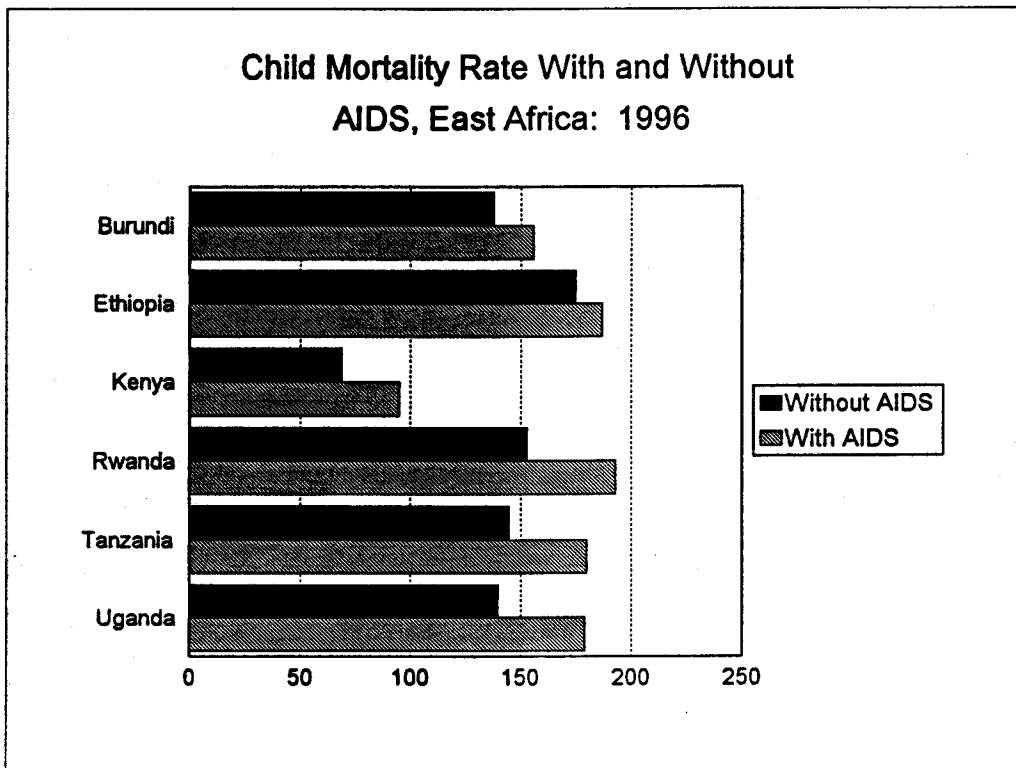


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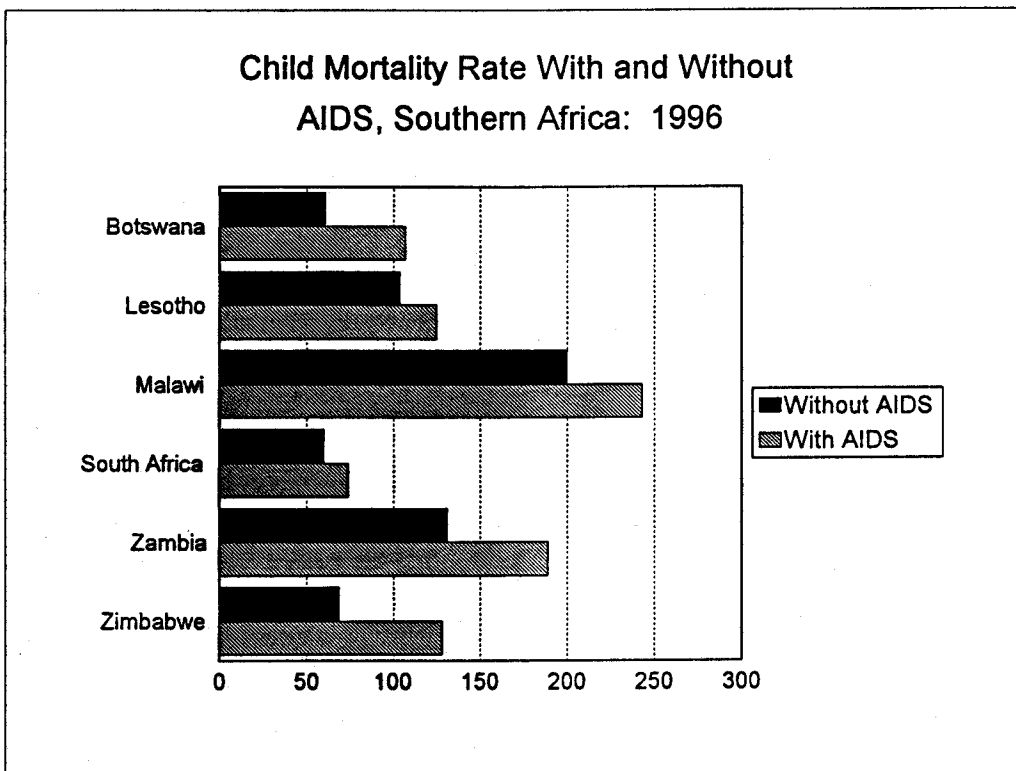


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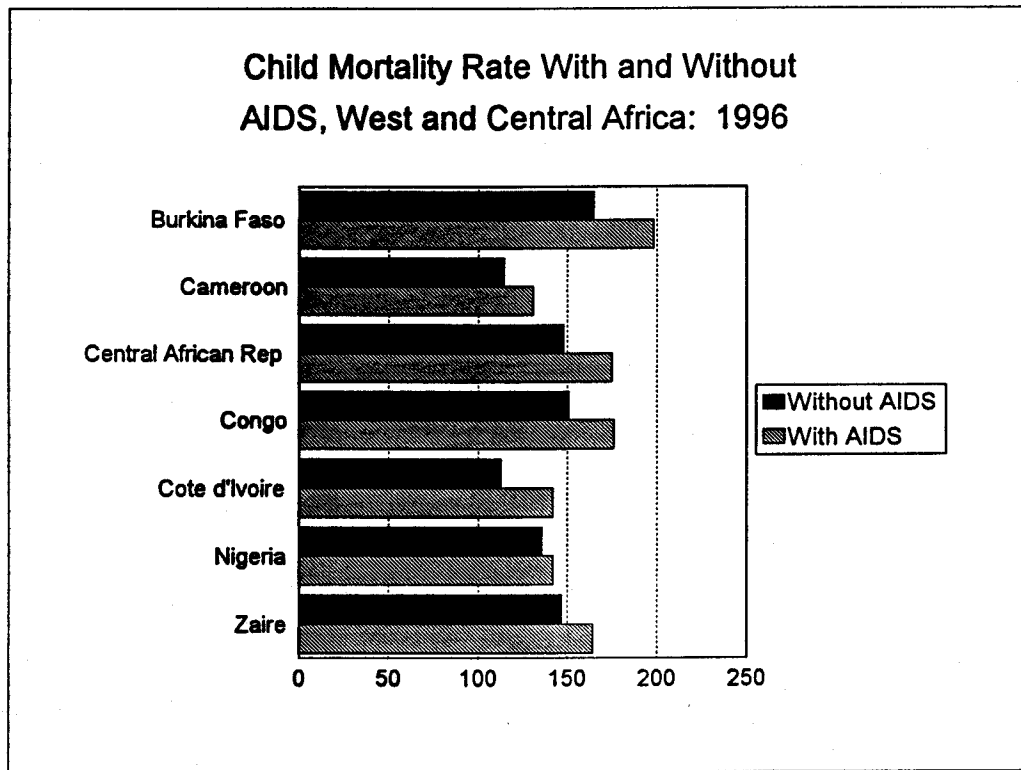


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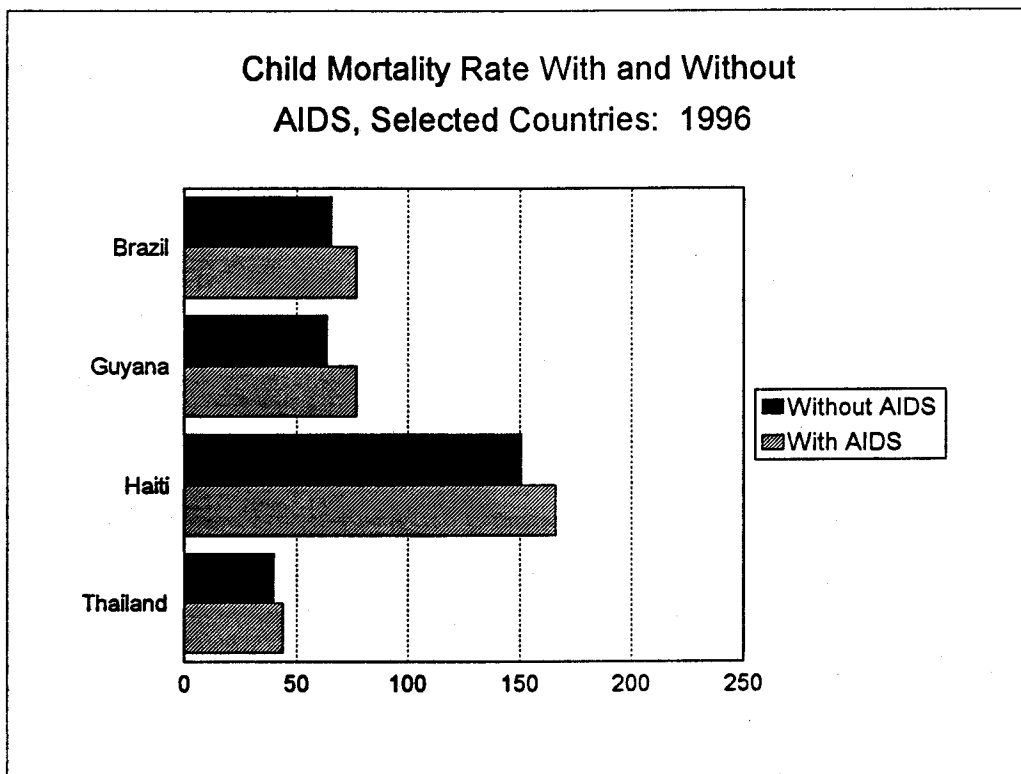


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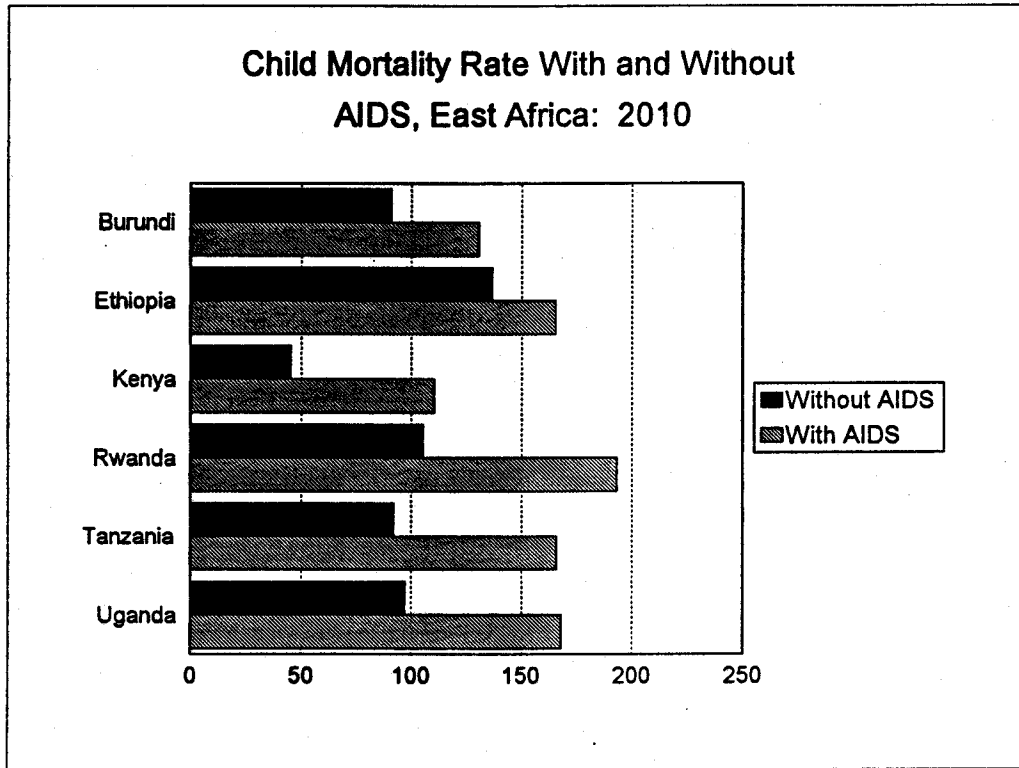


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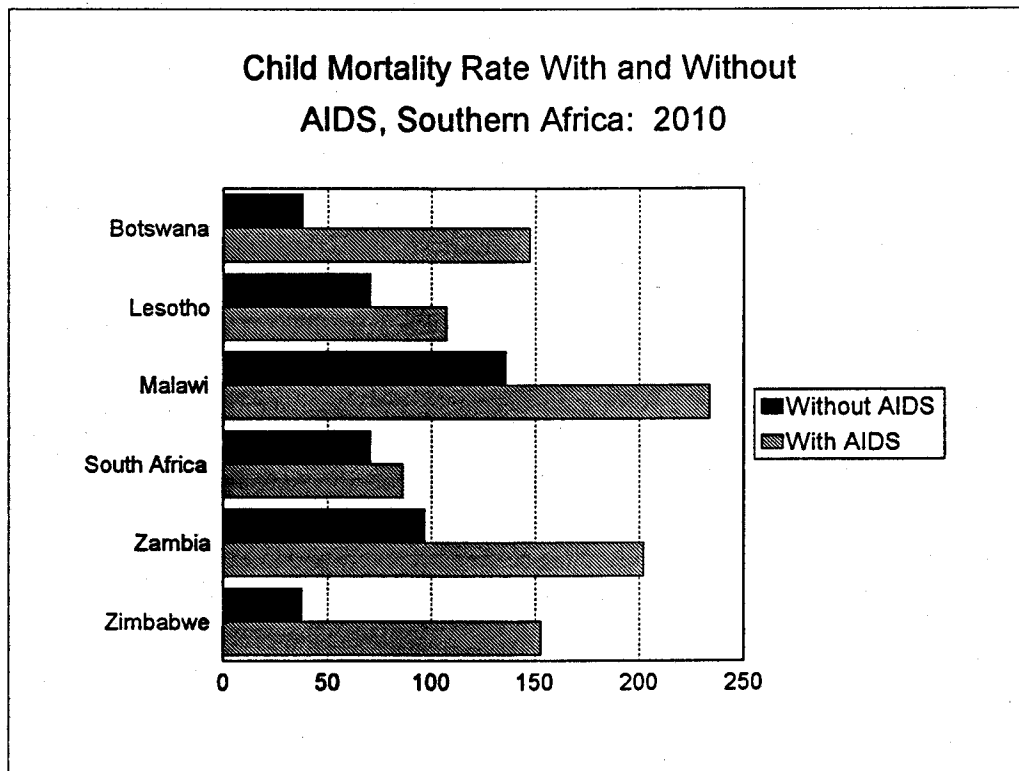


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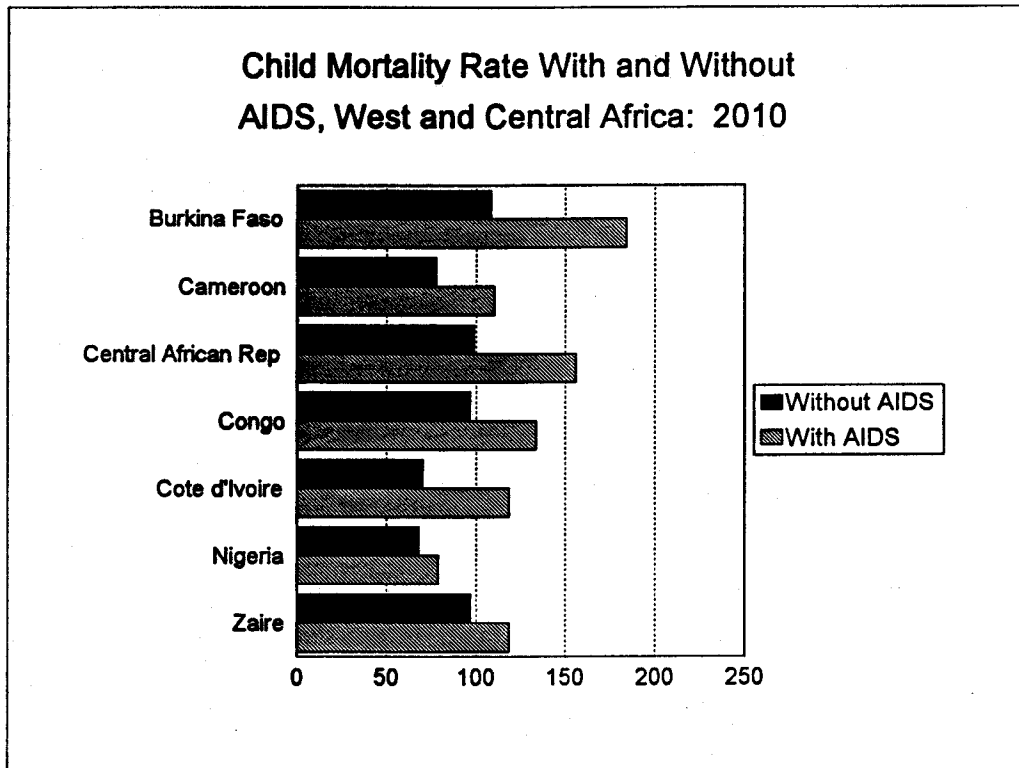


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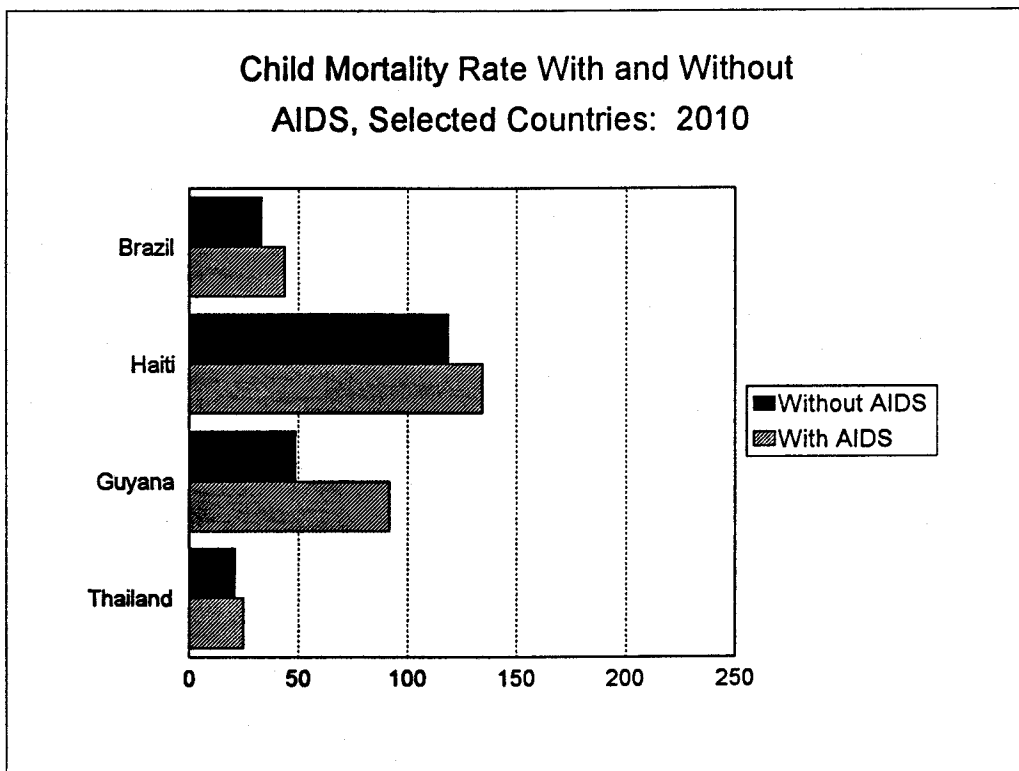


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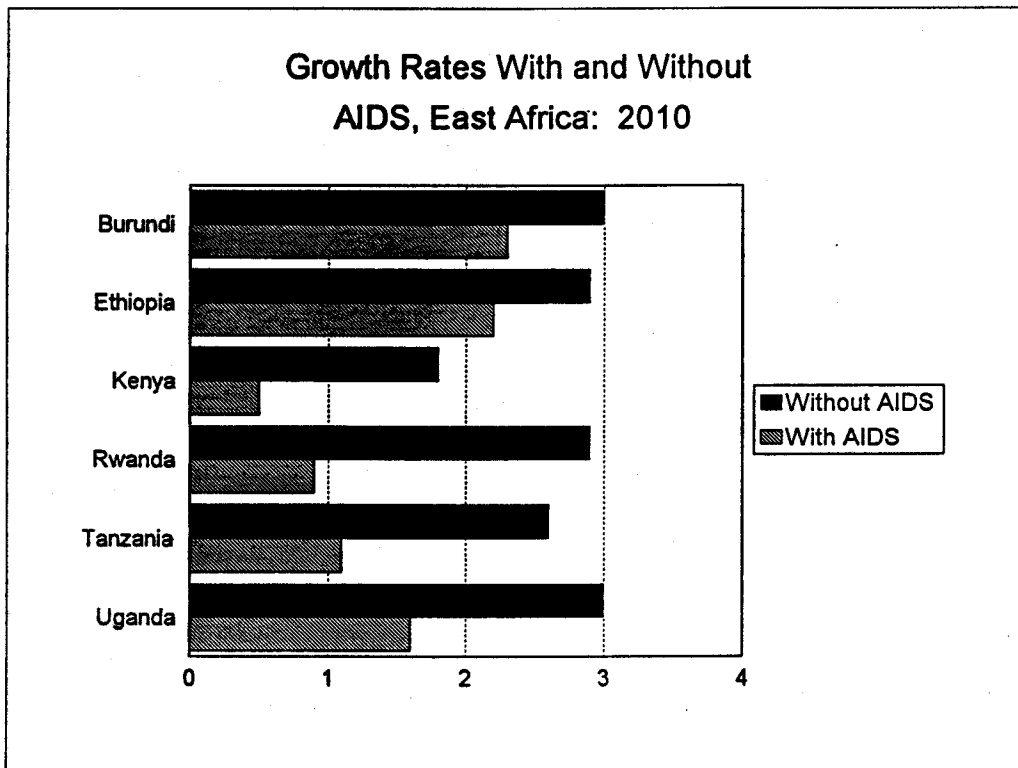


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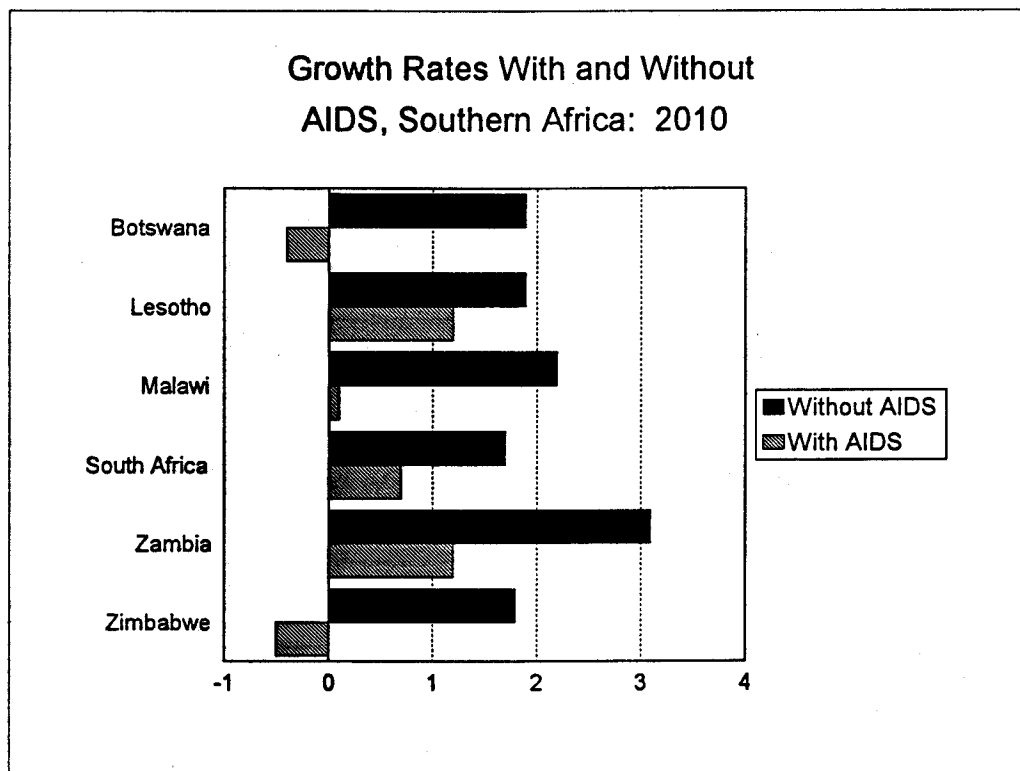


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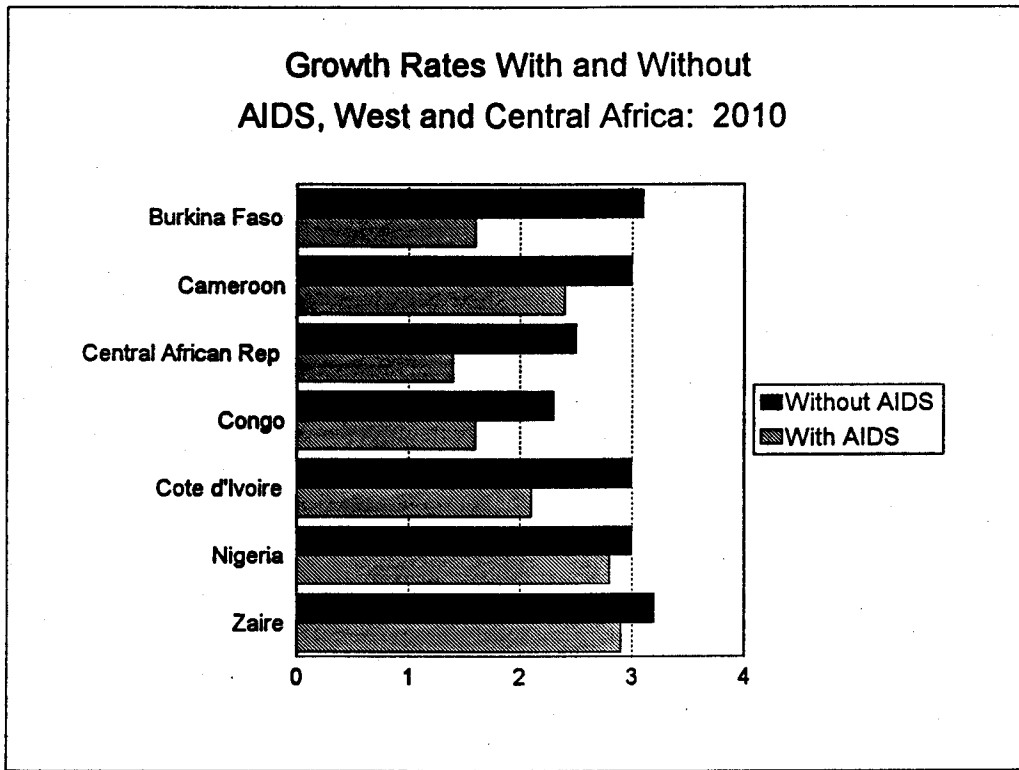


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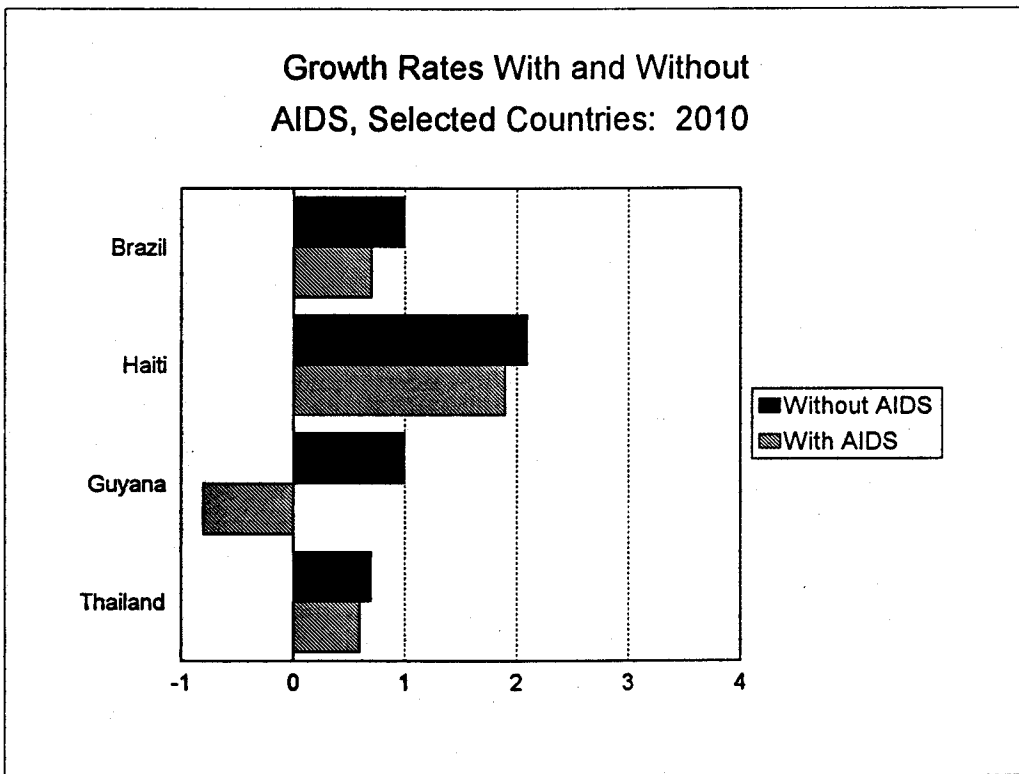


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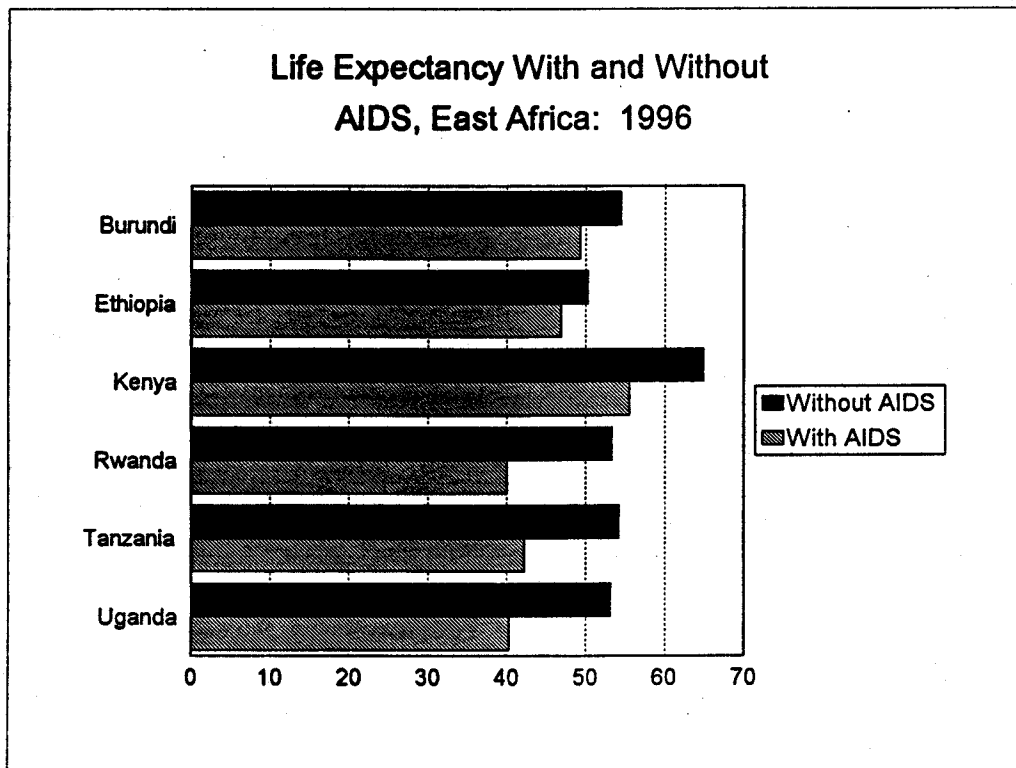


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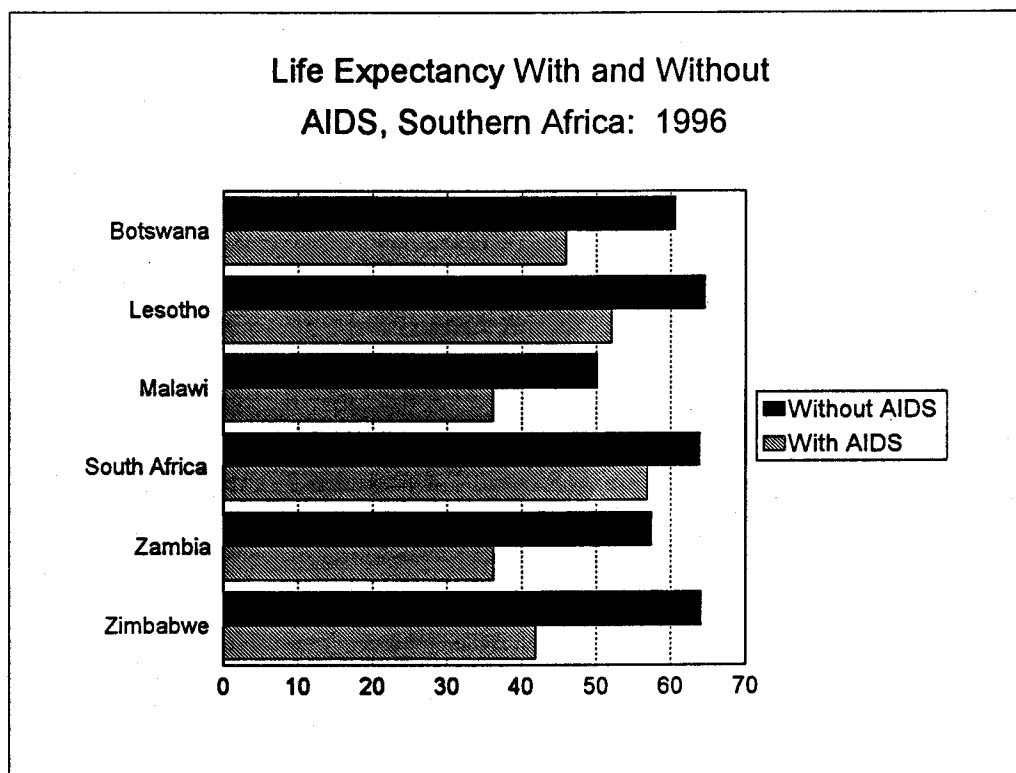


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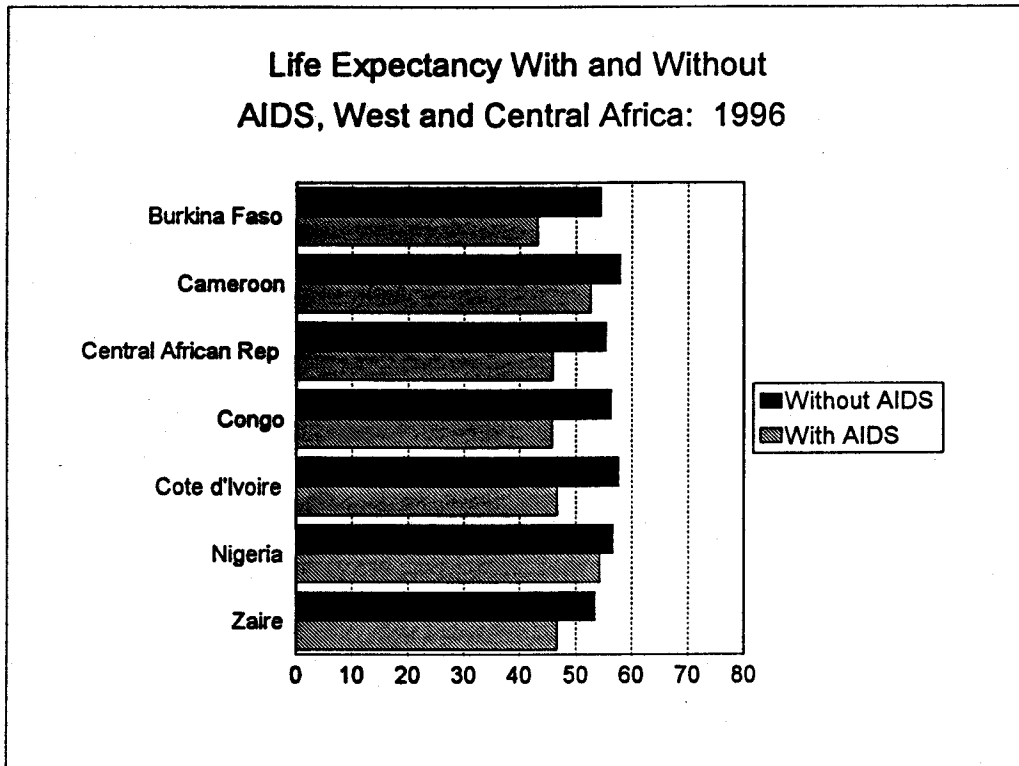


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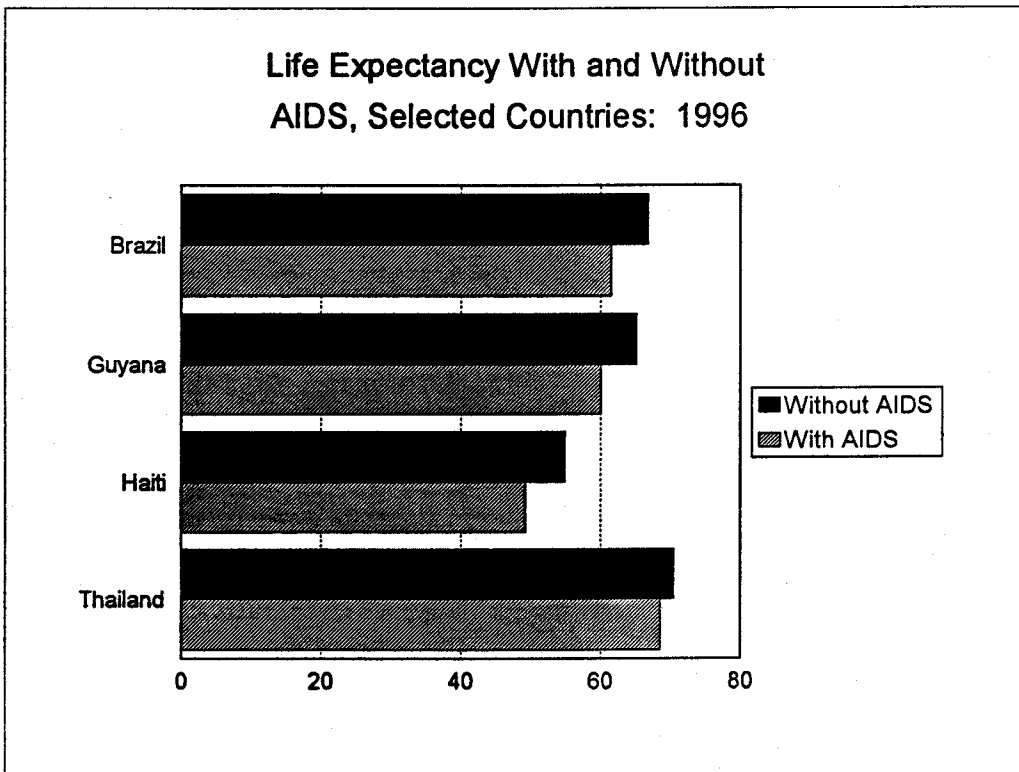


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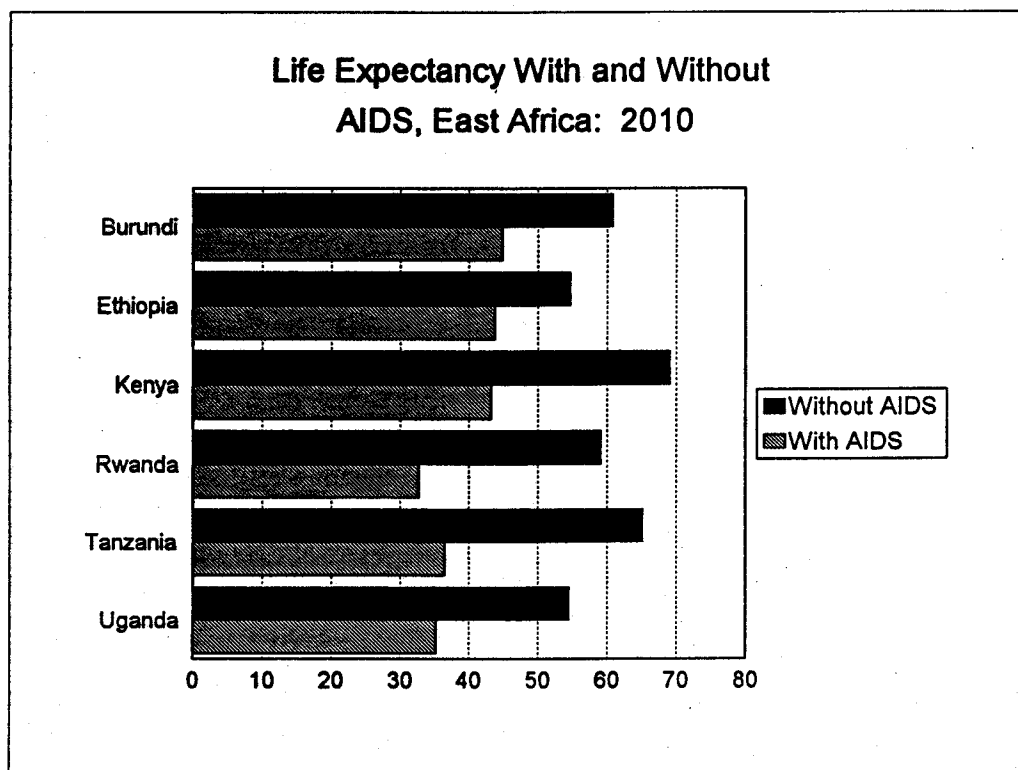


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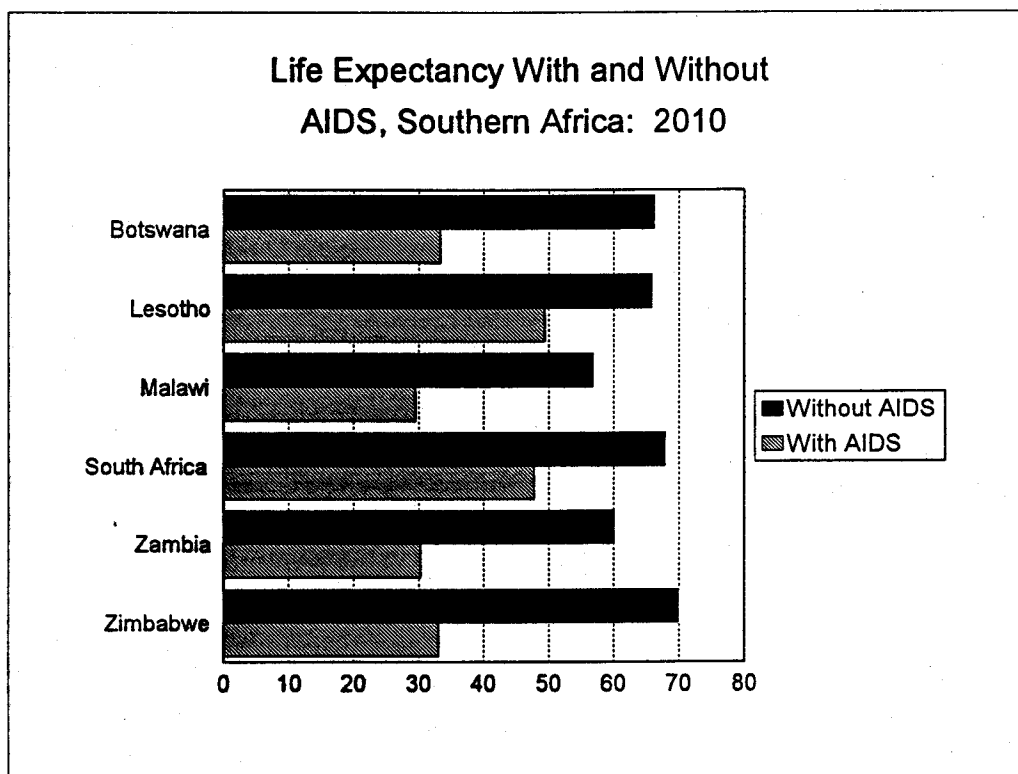


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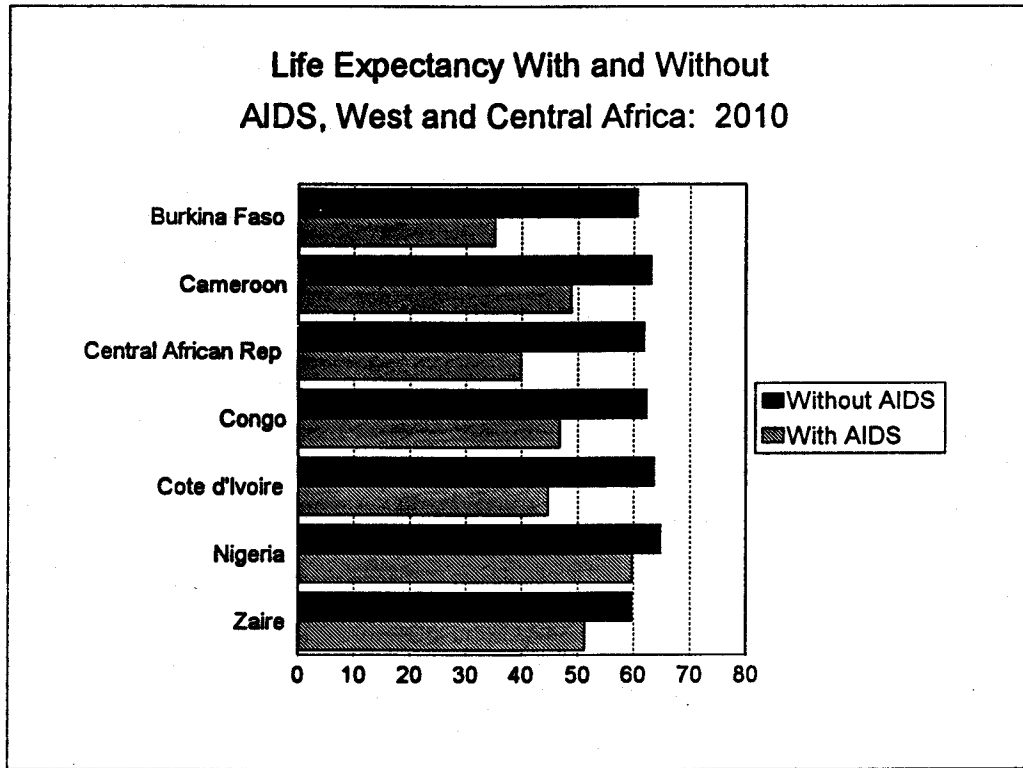


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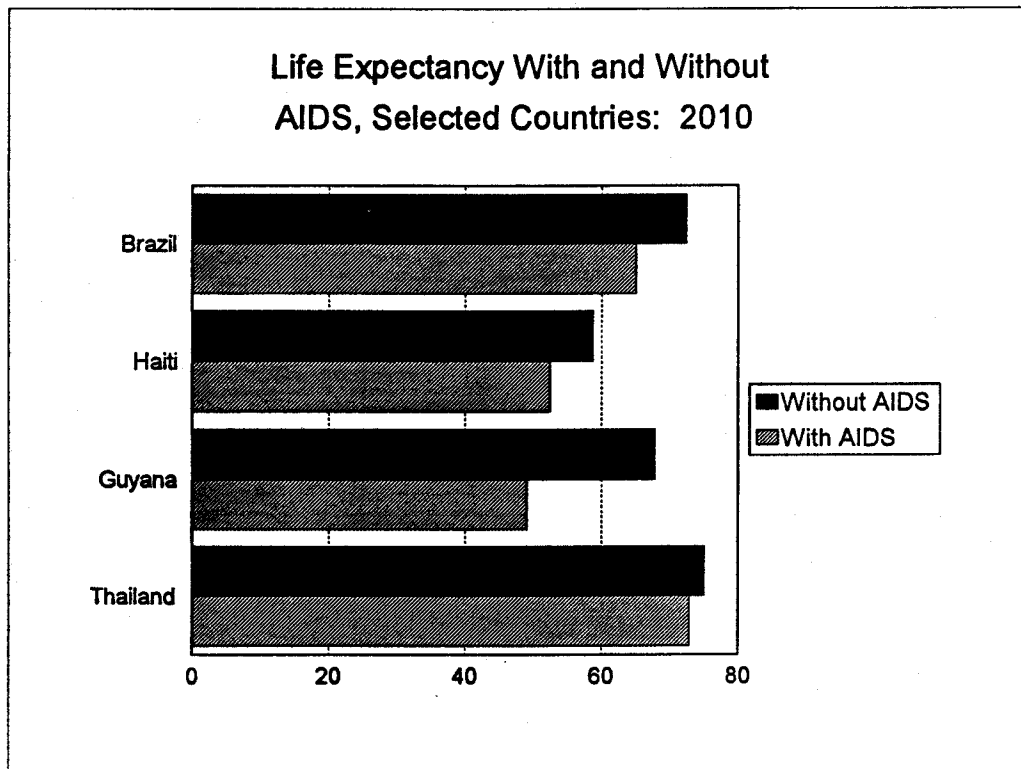


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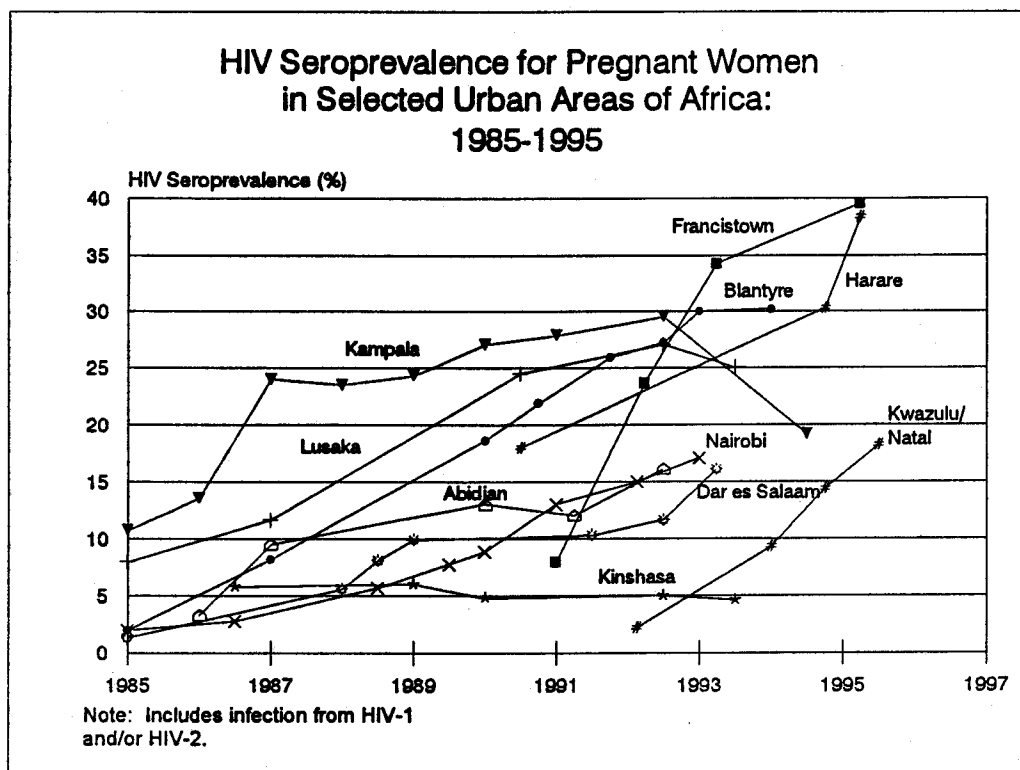


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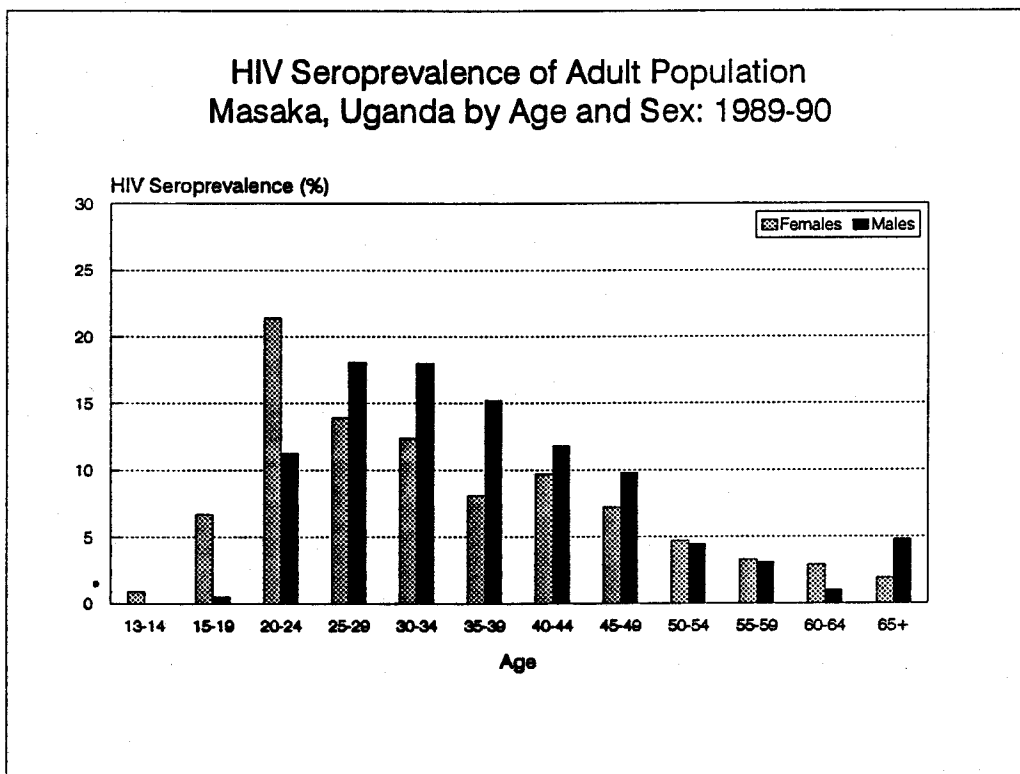


Figure 34

APPENDIX

Population Projections Incorporating AIDS

Background

Although it has been clear for a number of years that mortality estimates and projections for many countries would have to be revised due to AIDS mortality, the lack of accurate empirical data on AIDS deaths, the paucity of data on HIV infection among the general population and the absence of tools to project the impact of AIDS epidemics into the future have all hampered these efforts. Currently, although the accuracy of data on AIDS deaths has not substantially improved, knowledge of HIV infection has expanded and modeling tools have become available to project current epidemics into the future.

The methodology used to project AIDS mortality into the future for this report follows generally the method adopted for World Population Profile, 1994, with several modifications. The method consists of the following steps:

1. Establish criteria for selecting countries for which AIDS mortality will be incorporated into the projections.
2. For each selected country, determine the empirical epidemic trend and a point estimate of national HIV prevalence.
3. Model the spread of HIV infection and the development of AIDS in the population generating alternative scenarios ranging from high to low AIDS epidemics, and produce the seroprevalence rates and AIDS-related age-specific mortality rates which correspond to each epidemic.
4. Use the empirical levels and trends (from step 2) to establish a factor representing each country's position on a continuum between high and low epidemics (from step 3). Use the derived factor to generate a unique interpolated epidemic.
5. Use weighted country total adult seroprevalence to determine an appropriate location on the total country epidemic curve implied by the interpolation factor. This projects adult HIV seroprevalence for the total country.
6. Interpolate AIDS-related mortality rates, by age and sex, associated with the estimated speed and level of HIV from epidemic results for the period 1990 to 2010.

In the sections that follow, each of these steps is described, and the method is illustrated.

Country Selection Criteria

The International Programs Center, U.S. Bureau of the Census, maintains an HIV/AIDS Surveillance Data Base. This data base is a compilation of aggregate data from HIV seroprevalence studies in developing countries. Currently, it contains more than 25,000 data items drawn from nearly 3,200 publications and presentations. As a part of the biannual updating of the data base, new data are reviewed for inclusion into a summary table which, for each country, lists the most recent and best study of seroprevalence levels for high- and low-risk populations in urban and rural areas.¹²

A review of the data in the summary table suggested that a reasonable cut-off point for selection would be countries which had reached 5 percent HIV prevalence among their low-risk urban populations or, based on recent trends, appeared to be likely to reach this level in the near future.

A total of 21 countries met these criteria for the incorporation of AIDS mortality in the projections. All but two of these countries were in Africa. The countries are as follows:

Botswana	Ethiopia	Rwanda
Burkina	Guyana	South Africa
Burundi	Haiti	Tanzania
Cameroon	Kenya	Uganda
Central African Republic	Lesotho	Zaire
Congo	Malawi	Zambia
Côte d'Ivoire	Nigeria	Zimbabwe

Two other countries, Brazil and Thailand, were also included because some country-specific modeling work had already been completed. The simplified approach taken in these special cases is described in a later section.

Empirical Epidemic Trends

For each of the 21 countries meeting the selection criteria, staff members reviewed the HIV seroprevalence information available in the HIV/AIDS Surveillance Data Base to establish urban seroprevalence trends over time (Table A-1, col. 1-4) and to identify available rural data points (Table A-1, col. 5-6). The two data points judged to be most representative for the urban low-risk population were identified and used to calculate the annual change between the dates of the two studies. Rural data were used in conjunction with the urban data to establish a total-country seroprevalence estimate (Table A-1, col. 7).

¹²High risk includes samples of prostitutes and their clients, sexually-transmitted disease patients, or other persons with known risk factors. Low risk includes samples of pregnant women, volunteer blood donors, or others with no known risk factors. For a more complete description of the selection criteria, see U.S. Bureau of the Census, 1995.

Alternative Scenarios

To project the impact in the selected countries, three alternative epidemic scenarios were developed, corresponding to low, medium, and high AIDS epidemics. These scenarios were developed using iwgAIDS, which is a complex deterministic model of the spread of HIV infection and the development of AIDS in a population. It was developed under the sponsorship of the Interagency Working Group (iwg) on AIDS Models and Methods of the U.S. Department of State (Stanley et al., 1991).

All three of these epidemic scenarios incorporate increasing levels of behavior change in the form of increased condom use. This new assumption corresponds to actual changes in behavior that are now beginning to occur in some countries.

Interpolation of a Unique Epidemic

The empirical urban trend from each country was used to interpolate among the three epidemic scenarios to derive an epidemic trend line matching the observed HIV seroprevalence increase between the two points. Thus, both the level and the rate of increase of the urban epidemic were matched through this procedure and resulted in an interpolation factor used in subsequent steps.

Projected Total Seroprevalence

At this point in the estimation procedure, no direct linkage has been made to the total country prevalence or to a particular calendar year in this country's epidemic. The next step accomplishes these tasks. The total-country adult prevalence estimate (Table A-1, col. 7) was matched with the one implied using the interpolation factor. From this comparison, an "offset" figure was calculated, corresponding to the number of years of difference between the start of the epidemics in the three scenarios, and the empirical epidemic at the reference date.

AIDS-Related Mortality Rates

Based on the "interpolation factor" and the "offset" described above, AIDS-related age-sex-specific mortality rates (${}_n m_x$ values) at 5-year intervals from 1990 to 2010 were interpolated and added to non-AIDS ${}_n m_x$ values for the same period.¹³ Population projections were prepared with the combined ${}_n m_x$ values as input, using the rural/urban projection program of the U.S. Bureau of the Census.

The future course of the AIDS pandemic is uncertain, but the projections require that some assumptions be made. It was assumed that the epidemics would peak in 2010, with no further growth in HIV infection after that year. AIDS mortality was assumed to decline from the level

¹³Non-AIDS ${}_n m_x$ values were derived by making standard assumptions concerning the improvement in mortality conditions as described earlier in this appendix.

reached in 2010 to nil by 2050, thus implying a return to "normal" mortality levels in the latter year. To implement the projection process, life tables for 2050, assuming no AIDS mortality, were used.

The Special Cases of Brazil and Thailand

Modeling activities have also been undertaken for Brazil and Thailand with the support of the Interagency Working Group. AIDS epidemics in these two countries have substantial homosexual and intravenous drug use components, while those in Africa do not (WHO/GPA, 1993a). For Brazil, AIDS-related age-sex-specific mortality rates were estimated from the iwgAIDS model and added directly to the non-AIDS mortality rates previously prepared for the projection program. For Thailand, AIDS-related mortality rates from recent epidemiological and demographic projections (TNESDB, 1994) were added to the non-AIDS m_x values for the 1990 to 2010 period.

Caveats and Limitations

In developing the methodology for these projections, the International Programs Center has attempted to maximize the use of both the empirical data and the modeling tools available. However, much is unknown about the dynamics of AIDS epidemics in countries around the world, and the methodology is necessarily imprecise. The actual path of AIDS epidemics in the countries that were selected will undoubtedly differ from the course projected. As epidemics grow, future behavior changes and interventions being implemented in countries around the world may alter that course.

What if AIDS epidemics do not peak early in the next century as projected? Will entire populations become infected with HIV and eventually die of AIDS? The simulations used for this report suggest that this will not happen in any population, although population declines are possible with a sustained widespread epidemic. Variations in sexual behavior help to ensure that the majority of the population in countries around the world is not at high risk of HIV infection. With substantial proportions of the population at lower risk of infection, each of the epidemic scenarios displays a definite plateau in HIV seroprevalence after the initial rapid rise.

A-1 EMPIRICAL SEROPREVALENCE DATA FOR URBAN AND RURAL AREAS OF SELECTED COUNTRIES

Country	URBAN TREND - PREGNANT WOMEN			RURAL POINT		Estimated Total Country	Estimated Urban Point	Percent Urban
	Date	HIV% Point	Date	HIV% Point	Date			
Botswana	1990.13	6.00	1993.21	19.20	1992.30	9.48	15.30	25.40
Burkina Faso	1987.50	3.10	1991.00	8.80	1989.50	4.50	6.36	17.90
Burundi	1986.84	16.30	1992.50	20.00	1992.50	3.06	20.00	6.90
Cameroon	1990.50	1.10	1994.50	5.70	1992.28	2.80	3.15	42.40
C.A.R.	1986.50	4.70	1993.50	16.00	1992.16	6.35	13.84	38.30
Congo	1990.25	7.70	1991.50	9.00	1990.50	6.74	7.96	54.00
Cote d'Ivoire	1987.50	8.00	1992.50	14.81	1989.15	6.10	10.25	39.90
Ethiopia	1988.50	3.70	1991.29	6.20	1993.50	2.62	8.18	13.10
Kenya	1991.00	13.00	1992.00	15.00	1993.50	5.70 (1)	18.00	26.50
Lesotho	1992.50	5.10	1993.50	6.10	1993.50	5.75 (5)	6.10	
Malawi	1989.04	18.62	1994.17	33.00	1993.83	14.89	32.05	13.10
Nigeria					1992.00	1.13 (2)		36.80
Rwanda	1989.96	23.20	1991.75	26.70	1991.74	9.93	26.68	5.80
South Africa	1992.87	3.06	1993.87	4.72	1993.50	4.24	4.11	50.30
Tanzania	1988.50	10.60	1992.50	17.70	1993.00	9.72	18.59	22.60
Uganda	1987.50	24.00	1992.00	29.50	1992.16	10.38	29.70	11.60
Zaire	1985.50	6.90	1991.50	9.20	1991.50	4.68	9.20	28.40
Zambia	1987.25	11.60	1993.50	24.70	1993.50	18.31	24.70	42.80
Zimbabwe	1990.50	18.00	1993.00	25.90	1990.50	12.84 (3)	18.00	
Haiti	1989.79	8.00	1993.50	8.50	1990.50	5.18	8.10	28.90
Guyana	1990.50	1.20	1992.50	2.00	1992.50	2.00 (4)		

(1) Kenya National AIDS Control Program estimate

(2) Average of Nigeria states sentinel surveillance programs for pregnant women

(3) Average of three provinces for national total

(4) Assume 1992.5 blood donor data 2.0 as country total

(5) average of districts for country total

Demographic Indicators for 1996 With and Without AIDS

Country	Growth Rates		Life Expectancy		Crude Death Rates		Infant Mortality		Child Mortality	
	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o
Botswana	1.6	2.5	46.0	60.7	17.0	9.2	54.2	38.3	107.1	61.2
Burkina Faso	2.5	3.2	43.2	54.5	20.0	13.9	117.8	106.0	198.4	165.2
Burundi	1.5	1.9	49.3	54.5	15.2	12.4	102.2	96.7	155.7	138.3
Cameroon	2.9	3.2	52.6	57.9	13.6	11.1	78.7	73.9	131.2	115.4
CAR	2.1	2.6	45.9	55.4	17.6	12.6	111.7	102.4	175.0	147.8
Congo	2.2	2.8	45.8	56.3	17.4	11.8	108.1	98.8	176.3	150.9
Cote d'Ivoire	2.9	3.5	46.7	57.7	15.7	10.1	82.4	72.2	142.1	112.9
Ethiopia	2.7	2.9	46.9	50.3	17.5	15.5	122.8	118.9	186.6	174.8
Kenya	2.3	2.7	55.6	65.0	10.3	6.5	55.3	46.9	94.6	68.6
Lesotho	1.9	2.4	52.1	64.6	13.7	9.5	81.6	74.5	124.5	103.5
Malawi	1.7	2.7	36.2	50.2	24.5	15.3	139.9	123.0	243.1	199.8
Nigeria	3.1	3.2	54.3	56.6	12.7	11.6	72.4	70.4	141.6	135.5
Rwanda	16.5	16.8	40.1	53.4	20.3	12.5	118.8	103.9	193.1	152.7
South Africa	2.1	2.4	56.9	63.9	10.8	7.7	52.6	46.4	80.3	59.9
Tanzania	1.1	1.9	42.3	54.3	19.5	12.4	105.9	93.4	180.1	145.4
Uganda	2.2	3.1	40.3	53.2	20.7	12.9	99.4	85.3	179.0	140.3
Zaire	1.7	2.1	46.7	53.5	16.9	13.4	108.0	101.8	163.5	147.0
Zambia	2.1	3.4	36.3	57.5	23.7	11.9	96.1	74.3	188.7	130.8
Zimbabwe	1.4	2.6	41.9	64.1	18.2	6.8	72.8	51.7	128.3	69.1
Brazil	1.2	1.4	61.6	66.9	9.2	6.8	55.3	52.9	77.0	66.0
Guyana	-0.9	-0.7	60.1	65.3	9.6	7.3	51.4	46.9	77.5	63.6
Haiti	1.8	2.1	49.3	55.0	16.0	13.2	103.8	98.3	165.5	150.5
Thailand	1.0	1.1	68.6	70.6	7.0	6.2	33.4	32.4	43.7	39.6

Demographic Indicators for 2010 With and Without AIDS

Country	Growth Rates		Life Expectancy		Crude Death Rates		Infant Mortality		Child Mortality	
	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o	w/AIDS	w/o
Botswana	-0.4	1.9	33.4	66.3	29.2	6.4	66.1	26.3	147.5	38.3
Burkina Faso	1.6	3.1	35.2	60.7	24.1	9.0	101.9	73.7	184.3	108.7
Burundi	2.3	3.0	44.9	60.8	16.8	8.6	80.4	66.3	130.8	90.9
Cameroon	2.4	3.0	48.9	63.2	14.7	8.2	64.5	52.9	110.6	78.0
CAR	1.4	2.5	39.9	61.9	21.2	9.2	92.5	71.6	156.1	99.1
Congo	1.6	2.3	46.8	62.4	16.2	8.2	80.4	67.3	133.7	97.1
Cote d'Ivoire	2.1	3.0	44.8	63.8	16.3	7.1	65.4	48.4	118.7	70.7
Ethiopia	2.2	2.9	43.8	54.7	18.1	12.1	105.7	95.4	165.6	136.7
Kenya	0.5	1.8	43.2	69.2	19.1	5.2	55.9	32.9	110.3	45.4
Lesotho	1.2	1.9	49.4	65.9	15.5	7.4	65.7	52.8	107.5	70.7
Malawi	0.1	2.2	29.5	56.8	31.8	10.4	126.1	88.4	233.8	136.0
Nigeria	2.8	3.0	59.7	64.9	9.2	7.1	45.1	41.4	79.2	68.2
Rwanda	0.9	2.9	32.7	59.2	18.2	9.4	107.6	74.7	193.4	105.5
South Africa	0.7	1.7	47.8	67.9	16.8	6.5	47.3	30.7	86.3	70.7
Tanzania	1.1	2.6	36.5	65.2	23.8	8.9	90.9	65.2	166.1	95.8
Uganda	1.6	3.0	35.2	54.5	23.7	8.7	86.1	58.5	168.1	92.2
Zaire	2.9	3.2	51.3	59.8	12.9	9.1	77.9	70.4	118.7	97.3
Zambia	1.2	3.1	30.3	60.1	29.2	9.0	97.4	58.4	202.1	96.9
Zimbabwe	-0.5	1.8	33.1	69.9	29.4	4.8	71.0	29.8	152.9	37.8
Brazil	0.7	1.0	65.1	72.5	9.5	6.3	31.5	27.7	43.9	33.3
Guyana	-0.8	1.0	49.1	67.9	18.5	7.5	51.7	36.9	92.0	48.7
Haiti	1.9	2.1	52.5	58.8	13.1	10.2	85.6	80.1	134.4	119.0
Thailand	0.6	0.7	72.9	75.1	7.4	6.5	18.7	17.8	25.0	21.2

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UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, DC 20233-0001

April 21, 1997

Dear Colleague:

Enclosed is a copy of International Programs Center Staff Paper No. 86, "The Demographic Impacts of HIV/AIDS; Perspectives from the World Population Profile: 1996." It was presented at the 1997 Population Association of America Annual Meeting held in Washington, D.C.

This paper documents the impacts of HIV/AIDS epidemics on populations as estimated by the Bureau of the Census. We estimate and project populations for every country of the world. Since 1994, we have been incorporating AIDS mortality into our projections. This paper documents the procedures and outputs of our 1996 round of estimates and projections.

We are currently in the process of reviewing these procedures and preparing for our 1998 round of estimates and projections. Please feel free to send us your comments and questions.

Sincerely,

Karen A. Stanecki
Director, Health Studies Branch
International Programs Center
Population Division
E-mail: kstaneck@census.gov

Enclosure