Ghana's Mortality Profile: with and without HIV/AIDS

Chuks J. Mba, Ph.D.
Address: Regional Institute for Population Studies, University of Ghana, P.O. Box 96, Legon, GHANA.
Email: chuksmba@ug.edu.gh , chuksmba@yahoo.com

Abstract:
The acquired immune deficiency syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). Infection with the virus leads to the destruction of a person's immune system, making the victim highly susceptible to multiple infections and ultimately results in the inevitable death of the victim since there is no cure for AIDS . Research advances, funded through extraordinary investment in biomedical research, have resulted in effective treatments and a striking decrease in AIDS-related death rate in most developed countries. However, the toll in suffering and death in developing nations remains enormous and overshadows the epidemic in the developed world. The life expectancy in several African countries has decreased dramatically and has negated gains made during the past few decades on the pandemic.

The present study seeks to further raise awareness and expand knowledge about the deleterious effect of HIV/AIDS mortality on Ghana's life expectancy. Using the multiple and associated single decrement life table techniques, the study estimates the total number of Ghanaians who would die from HIV/AIDS by the time they reach age 75 from a hypothetical cohort of 100,000 live births, assuming that the mortality conditions of 2000 prevailed. The findings indicate that under the prevailing mortality conditions 7.2 percent of Ghanaian babies will eventually die of HIV/AIDS. Furthermore, 13.0 percent and 23.4 percent of Ghanaians aged 60 years, and 75 years and above, respectively will die of HIV/AIDS. An overwhelming majority of deaths due to AIDS will come from persons within the reproductive and productive age groups in the country. There is a remarkable gain in life expectancy to the tune of about 10 years (from 53.3 to 63.0 years) for Ghana that would result in the absence of HIV/AIDS.

As full-blown AIDS is fatal, sociologically the survivors feel its main impact. Although the survivors are considered as secondary victims, it is the survivors upon whom the full weight of sustaining a decimated, confused and demoralised community falls. The elderly persons, who are the grandmothers and grandfathers, are likely to be the most active persons to manage the family affairs in the event of the death of their adult children. This condition is likely to impoverish the elderly population.

Key Words: Ghana, HIV/AIDS mortality, life expectancy.

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INTRODUCTION

The acquired immune deficiency syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). Infection with the virus leads to the destruction of a person's immune system, making the victim highly susceptible to multiple infections and ultimately results in the inevitable death of the victim since there is no cure for AIDS (United Nations, 2005; 2001a; World Health Organization, 2001; UNAIDS, 2000). As at the end of 2000, 36.1 million people were living with HIV/AIDS, including 1.4 million children younger than 15 years. About 5 young people aged 15-24 years become infected with HIV every minute. Available evidence indicates that about 21 million people have died from AIDS, and that about 95 percent of worldwide AIDS cases occur in developing countries, with nearly 70 percent of all cases occurring in sub-Saharan Africa (United Nations, 2005; 2001b; World Health Organization, 2001; UNAIDS, 2000). The alarming and saddening consequences of this catastrophe are many and varied, one of which is the rapidly increasing number of both orphaned children and grandparenting since Africa is currently home to 70 percent of the world's AIDS orphans (Phiri, 2001).

Research advances, funded through extraordinary investment in biomedical research, have resulted in effective treatments and a striking decrease in AIDS-related death rate in most developed countries. However, the toll in suffering and death in developing nations remains enormous and overshadows the epidemic in the developed world. Everyday, 14,500 people become infected, most of them in the developing countries; and in some African countries, between 25 and 35 percent of the adult population are infected (United Nations, 2001a). The life expectancy in several African countries has decreased dramatically and has negated gains made during the past few decades on the pandemic.

Available evidence suggests that 3.6 percent of the adult population in Ghana are living with the HIV/AIDS virus (United Nations, 2001a; World Health Organization, 2001; UNAIDS, 2000).

In Ghana, the estimated number of persons infected with the HIV, the virus that causes AIDS, in 2000 was 350,000, consisting of 330,000 adults and 20,000 children (Ministry of Health, 2001). Additionally, more than 150,000 Ghanaians have died from AIDS since the beginning of the epidemic in the early 1980s. The disease continues to spread at an alarming rate, and the virus is most prevalent among young people in the prime of life. The high rate of the HIV/AIDS is already placing a strain on the social welfare system, a burden that is likely to increase dramatically in the next few years. Against this background, it is important to raise awareness and expanding knowledge about the deleterious effect of HIV/AIDS on Ghana's life expectancy, for possible policy interventions.

Granted that the effect of HIV/AIDS is felt by all population subgroups. However, some population subgroups, such as the elderly persons, are more vulnerable as they are left alone to take care of their grandchildren following the death of their children through AIDS. Thus, the thrust of this study is to attempt to answer three basic questions. First, what is the contribution of HIV/AIDS mortality to the overall mortality of Ghana? Secondly, to what extent will life expectancy be enhanced if HIV/AIDS were absent in the mortality experience of Ghana? Thirdly, what are the consequences of the HIV/AIDS pandemic for the elderly persons in the country?

DATA AND METHODS

The data for the present study emanate from two principal sources: the 2000 Population and Housing Census of Ghana (Ghana Statistical Service, 2002), and the World Health Organization (2002). The 2000 census figures are used in conjunction with Ghana's mortality profile for the 2000 provided by the World Health Organization (2002). It should be stated that the actual number of AIDS cases is not known because of under-diagnosis, incomplete reporting and reporting delays not only in Ghana but also in other parts of Africa (World Health Organization, 2004; 2001; Dorrington et al., 2001; UNAIDS,

2005; 2000; UNAIDS/World Health Organization, 2000; Zimbabwe Ministry of Health, 1995). However, available evidence indicates that deaths due to AIDS constituted about 4.6 percent in 1994 and 9.4 percent in 1999 of the total number of deaths in Ghana (Ministry of Health, 2001). This implies that the proportion of deaths due to AIDS was about 10.4 percent of the total deaths in 2000[1]. The present study employs this information on the assumption that it furnishes a credible evidence of the HIV/AIDS mortality experience of the Ghanaian society. Then, postulating that the age structure of the HIV/AIDS mortality provided by the World Health Organization (2001) is relevant, the proportion of deaths due to HIV/AIDS for each age group can then be estimated by applying the 10.4 percent to the age structure to the World Health statistics that specifies causes of death for various age groups for each country (World Health Organization, 2001).

It should be noted that the data provided by the World Health Organization (2004; 2001) from age 5 to age 74 are in broad 10-year age groups. Therefore, the Karup-King interpolation multipliers are employed to break them into 5-year age groups (Siegel and Swanson, 2004; Shryock and Siegel, 1976). Results of this computation are shown in the ${}_nD_x^i$ columns.

In an attempt to determine the effect of death due to HIV/AIDS on the overall mortality experience of Ghana, the present study employs the multiple decrement life table techniques (Preston et al., 2000; Namboodiri and Suchindran, 1987; Keyfitz, 1985; Chiang, 1968). The multiple decrement procedures are based on the principle of competing risk; that is, as human beings are exposed to the risk of dying, death could result from various causes. The basic assumption underlying this principle is that the various causes of death are mutually exclusive and exhaustive (Preston et al., 2000; Namboodiri, 1991; Chiang, 1984). The assumption of independence implies that the force of the mortality function from different causes is additive. In the specific Ghanaian context, the state of interest is being alive and

[1] The proportion is arrived at by simply applying the Waring-Lagrange extrapolation technique to the information supplied

decrements from that state are attributable to HIV/AIDS and all other causes of death. Drawing from the conventional life table technique, the force of decrement from all causes combined is the sum of the force of decrement from HIV/AIDS and the force of decrement from all other causes. That is:

$\mu(x) = \mu^1(x) + \mu^2(x) + ... + \mu^k(x)$.

Thus, the force of decrement from cause *i* at age *x* is simply the rate at which persons are leaving the defined state from cause *i*.

Because it is not possible in real life situations to observe directly associated single decrement processes, that is, processes in which one decrement alone is operating, certain functions defined for the basic life table can be extended to the associated single decrement life table. Associated with each decrement *i* in a multiple decrement process is a force of decrement function, $\mu^i(x)$. In general, the rate of decrement from $\mu^i(x)$ if *i* were the only decrement differs from what it would be if *i* were working in the presence of other decrements. The interest here is to determine the resultant life table, called the associated single decrement life table, if only the HIV/AIDS (*i*) of decrement were operating to reduce the populations of Ghana. The decrement of interest is simply all decrements other than *i* (that is, - *i*). Thus, the task is to construct a table based on $\mu^{-i}(x)$ in which cause *i* will be arbitrarily deleted from the set of multiple decrements.

It should be stated that in the ensuing analysis, the estimation of life table functions, such as ${}_na_x$, ${}_nq_x$, ${}_nd_x$, ${}_nL_x$, and so on, follows the usual conventional approach. However, the calculation of the mean number of person-years lived in the interval by those dying in the interval, ${}_na_x$, is based on Chiang's (1968) approach for ages above age 4, while for children below age 5, the procedure suggested by Coale and Demeny (1983) is adopted. The probability of dying from the HIV/AIDS, ${}_nq^i_x$, is computed by

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(Shyrock and Siegel, 1976).

applying the proportion of deaths that are due to the HIV/AIDS to the overall probability of dying between ages x and x+n, ${}_nq_x$,as indicated hereunder:

$$ {}_nq_x^i = {}_nq_x \frac{{}_nD_x^{\ i}}{{}_nD_x} $$

where ${}_nD^i_x$ is the observed total number of deaths from HIV/AIDS between ages *x* and *x*+*n*, and ${}_nD_x$ is the observed total number of deaths from *all causes* between ages *x* and *x*+*n*.

In constructing the associated single decrement life table, the constant of proportionality for decrement other than HIV/AIDS in the interval *x* to *x*+*n*, R^{-i}, is computed using the formula:

$$ R^{-i} = \frac{{}_nD_x - {}_nD_x^i}{{}_nD_x} $$

Also, the probability of surviving from age *x* to age *x*+*n* in the absence of HIV/AIDS, ${}_np_x^{-i}$, is estimated using the following formula proposed by Chiang (1968):

$$ {}_np_x^{-i} = \left[{}_np_x\right]^{R^{-i}} $$

while the average person-years lived between ages *x* and *x*+*n* in the absence HIV/AIDS, ${}_na_x^{-i}$, is calculated using the formula:

$$ {}_na_x^{-i} = n + R^{-i}\frac{{}_nq_x}{{}_nq_x^{-i}}({}_na_x - n) $$

for *x*=0, 1, 5 (ages under 10 years) and 70 (70-74 age group); but for the intervening age groups, (*x*=10 to 65), this formula is employed:

$${}_5a_x^{-i} = \frac{-\frac{5}{24}{}_5d_{x-5}^{-i} + 2.5{}_5d_x^{-i} + \frac{5}{24}{}_5d_{x+5}^{-i}}{{}_5d_x^{-i}}$$. However, it should be emphasized that vital registration system in Ghana is not complete, as in many parts of Africa (Dorrington et al., 2001), implying that death

registration coverage is not complete. Consequently, caution should be exercised while interpreting the results of subsequent analysis.

RESULTS

Table 1 shows the multiple decrement life table of Ghana in 2000 constructed with a view to finding out the contribution of HIV/AIDS to the overall mortality experience of the country. The findings reveal that the infant mortality rate and under five mortality rate are respectively about 98 deaths per 1,000 live births and 105 deaths per 1,000 live births. The graphical representations of the age-specific death rates, presented in Figure 1, indicates that mortality is high at very young ages, but declines to very low levels before age 25, and rises gradually up to age 65, and then much more rapidly thereafter in Ghana. The mortality estimates translate into expectations of life at birth of 53.3 years for the country. These findings are consistent with mortality estimates for Ghana from other sources (World Health Organization , 2004; 2002; Ghana Statistical Service, 2002; United Nations, 2001a; World Bank, 2000; Ghana Statistical Service and Macro International, 1999).

Table 1 further shows that the proportion of new born babies that will eventually die from HIV/AIDS under Ghana's age-cause-specific death rates of 2000 is 7247/100,000=7.2 percent. Furthermore, 13.0 percent and 23.4 percent of Ghanaians who survive to age 60 years, and 75 years and above, respectively will die of HIV/AIDS under the prevailing age-specific mortality conditions[2]. The corresponding figures for Ghana are respectively 13.0 percent and 23.4 percent. A striking feature of Figure 1 is that there is a noticeable improvement in age-specific death rates at all ages, especially after age 15, when HIV/AIDS is eliminated in the country.

Table 2 indicates the associated single decrement life table for Ghana under a hypothetical scenario whereby HIV/AIDS is deleted to determine the extent of the resultant gain in life expectancy.

The findings depicted in Table 2 show that the probability of surviving to age 75 in the absence of HIV/AIDS is 0.34 (33760/100000), which is higher than 0.31 (30671/100000), the probability of surviving to age 75 for all causes combined. This translates into a gain in life expectancy at birth of about 10 years, from 53.3 years for all causes combined to 63.0 years in the absence of HIV/AIDS. These results show that there is a significant improvement in the mortality profile of Ghana less HIV/AIDS disease.

This tremendous gain in both the number of persons surviving to each age and expectation of life is better illustrated pictorially in Figures 2 and 3. Figure 2 reveals that the number of survivors increased consistently from age 15 in the absence of HIV/AIDS. More remarkable are the results displayed in Figure 3. The graph indicates that there is a pronounced gain in life expectancy at every age with the deletion of HIV/AIDS. The results of this analysis support the contention that Ghana's life expectancy will fare tremendously better if the HIV/AIDS scourge is eliminated or drastically reduced.

DISCUSSION AND POLICY ISSUES

Employing the multiple and associated single decrement life table techniques, the present study has attempted to estimate the total number of Ghanaians who would eventually die from HIV/AIDS by the time they reach age 75 from a hypothetical cohort of 100,000 live births, on the assumption that the mortality conditions of 2000 prevailed. The results of the analysis revealed that if the prevailing mortality conditions continued throughout their life span, about 23.4 percent of the population of Ghana might eventually die from HIV/AIDS by the time they attain age 75 or over. This is very high, as demonstrated also by a tremendous gain in life expectancy to the tune of about 10 years that would result in the absence of HIV/AIDS. In other words, the prevalence of HIV/AIDS reduces remarkably the expectation of life of the people. This fact is buttressed by a number of other studies (United Nations,

[2] That is, (7182/55116)*100=13.0 percent; (7167/30671)*100=23.4 percent.

2001a; World Health Organization, 2001; Dorrington et al., 2001; UNAIDS, 2005; 2000). In fact, the life expectancy in Ghana, and several African countries has decreased dramatically and has negated gains made during the past few decades on the pandemic. Everyday, 14,500 people become infected, most of them in the developing countries; and in some African countries, between 25 and 35 percent of the adult population are infected (United Nations, 2005; 2001a). The ultimate fate of persons with HIV is well known since virtually without exception, within 10 years of contracting the virus, the individuals develop full-blown AIDS and die. But before the symptoms of AIDS develop, persons living with HIV infection face ostracism, poverty, physical pain, and fear of impending death.

Unfortunately, some people are unconcerned about HIV because of its long incubation period. Studies have shown that in the calculus of everyday life, the slow plague is a low priority for many, and they excuse their nonchalant attitude by arguing that by the time one dies of AIDS, one could well have died from other things many times over (Caldwell et al., 1994; Schoepf, 1988).

The government of Ghana in particular, and African authorities in general, are faced with a number of stumbling blocks in dealing with the HIV/AIDS epidemic. The most notable problem lies with the highest risk group, the youth. Although government health and social welfare departments have opened major campaigns, distributing free condoms at schools, universities, and to the public, yet statistics continue to show an increase in infections, underscoring the ineffectiveness of the campaign. The fact remains that unbridled and promiscuous sexual behaviour among the youth contributes to the rapid spread of the virus. Among adults, the largest proportion of persons with HIV/AIDS have contracted the disease through multiple heterosexual partners (Ministry of Health, 2002; Mbamaonyeukwu, 2001; 2000)[3]. Therefore, the disease will be effectively contained if a determined effort targets the youth with an abstinence approach. In fact, it is widely believed that sexual abstinence

programmes, which emphasize that abstaining from sex , are a person's best choice and the only sure way of preventing pregnancy and HIV/AIDS and other diseases (Associated Press, 2002).

Another obstacle to HIV/AIDS education among young people is apathy, couple with ignorance. The attitude of some that "AIDS will not affect me" possibly stems from the nature of the disease. This is because in its early stages, an infected person lives a normal, apparently healthy life. On the other hand, admitting to having contracted a sexually transmitted infection, especially the HIV disease, is generally a source of great embarrassment for people in most cultures (Awusabo-Asare and Anarfi, 1997; Youn, 1996; Danziger, 1994; Over and Piot, 1993).

The government of Ghana could benefit from Thailand's experience. This is because Thailand was one of the countries worst hit by HIV/AIDS in the 1980s. However, the country's most significant strategy in its AIDS prevention programme is its policy of 100 percent condom use in sex establishments. The policy, adopted in 1991, prevents customers from purchasing sexual services unless they use condoms. As a result, the incidence of STDs has dropped from more than 400,000 cases per year before 1991 to fewer than 14,000 cases per year since 2000 (BERNAMA, 2001).

Better healthcare and public health measures, as well as improved nutritional and sanitary conditions should be encouraged pursued by the government of Ghana to raise the country's life expectancy from the current level of 53 years. Indeed the government has a key role to play, in part through its own activities, and in part through its ability to mobilize to other sectors of the Ghanaian society. Additionally, communities need to be fundamentally involved in the design and implementation of programmes since community participation at all levels is critical for effective HIV/AIDS prevention and care.

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[3] These findings should be accepted because even though more recent studies argue that about 60 percent of HIV/AIDS infections are contracted through medical lapses, such as use of unsterilised syringes, one syringe for more than one person, and contaminated blood transfusion, they have not yet been internationally peer-reviewed and validated.

Parents and other family members in Africa are in a unique position to help socialize adolescents into healthy sexual adults, both by providing accurate information about sex and by fostering responsible sexual decision-making skills. This is because some studies have found that family discussions about sex are related to higher levels of knowledge about sexuality and AIDS among adolescents, as well as a lower incidence of sexual risk-taking behaviour (Pick and Palos, 1995; Fisher, 1989). Moreover, adolescents and children often cite their parents as their preferred source of education about sex, and organized prevention and education efforts continue to advocate active parental involvement in children's sexual socialization, especially in industrialized countries (Bowler et al., 1992; Alexander, 1984).

It should be stated that unlike many other endemic diseases, AIDS is not 'sensitive' to the socioeconomic status of anybody and thus does not spare the elite. As a result, levels of HIV prevalence among high-income, urban, and relatively well-educated men and women are as high as those among low-income and rural groups, if not higher. Because wealthier, more-skilled, and better-educated subsets of the population have higher levels of consumption and investment, command higher wages, and are more likely to be employers, any disease affecting this group relatively more than other groups is likely to have a greater economic impact per case.

The US Secretary of State, Colin Powell, at the 12th Annual *Africare* Dinner, vowed that America will not let the war on terrorism distract it from battling the AIDS epidemic in Africa. But he declared that "AIDS could kill a continent. It is a catastrophe. It is a disaster. It is a pandemic of the worst kind" (Carlson, 2001, p. C01).

It should be stated that although gerontology is still in its infancy in much of Africa, the aging process is gradually gaining momentum in some parts of Africa, including South Africa, as evidenced by the appreciation of the social benefits and problems associated with this process, as well as research

(Sagner, 2000; Kinsella and Ferriera, 1997; U.S. Bureau of the Census, 1994; Ferreira et al., 1992). As the continent is witnessing an upsurge in the number and proportion of the elderly persons, it should be remarked that an increase in the number of the elderly in the context of a health crisis due to the HIV/AIDS pandemic constitutes a real challenge. As full-blown AIDS is fatal, sociologically the survivors feel the main impact. Although the survivors are considered as secondary victims, it is the survivors upon whom the full weight of sustaining a decimated, confused and demoralised community falls. The elderly persons, who are the grandmothers and grandfathers, are likely to be the most active persons to manage the family affairs in the event of the death of their adult children. This condition is likely to impoverish the elderly population.

It bears repeating that adults aged 15-49 years are usually the economic backbone of their families and their communities, on whom both young children and elderly parents rely for care and support. The implication of the prevalence of HIV/AIDS in Ghana and parts of Africa is that there would be a noticeably fewer number of adults in their economically productive ages in these countries due to the ravages of the HIV/AIDS pandemic. This is likely to undermine economic progress and pose enormous challenges to these governments. It logically follows that the illness and death of these economically active prime-age adults will inevitably result not only in lower incomes for surviving elderly family members, but also in all the other sequelae of poverty, including worsened health and reduced investment in the survivors' future productivity. Secondly, the fatality of AIDS and the duration of the illness increase its impact per case relative to other causes of morbidity (Ryder, et al., 2000). The long incubation period of HIV implies that the economic impact of existing levels of infection will be felt for upwards of 10 years, even if all infections were to cease today.

Early deaths due to AIDS are generating large numbers of people, particularly the elderly, who are at increased risk of poverty. A death in the household as a result of AIDS can have profound

implications for resource allocation, production, consumption, savings, investment and the well-being of survivors (Ainsworth and Over, 1994). Thus, AIDS has an unusually devastating effect on the entire household, both through loss of income and through dissolution of normal social relationships within the family setup. Because deterioration from AIDS is such a slow process, many families exhaust their entire savings before the person with AIDS finally dies. Furthermore, families lose income not only from the infected person, but also from other family members involved in his or her care. This loss is especially acute for families with more than one infected person. It is obvious that the pendulum of this crisis swings disproportionately against the elderly family members.

It should be stated that in Ghana and many parts of Africa, the extended family usually plays the role of the social welfare systems that are found in the developed world. However, due to the rising levels of AIDS-related deaths in the face of increasing modernization and urbanization, leading to the rapid disintegration of the extended family system (United Nations, 1994), orphanhood and the loss of traditional support mechanisms for the elderly as a result of AIDS will unquestionably become increasingly large problems.

All available pieces of empirical evidence reach the common conclusion that increases in young and adult mortality are essentially a consequence of HIV/AIDS pandemic (World Health Organization, 2001; United Nations, 2001a; UNAIDS, 2000). The implication is that if nothing is done to reverse the dismal situation, the elderly persons, especially women, will be the hardest hit since they will have the dual responsibility of taking care of themselves and their grandchildren with the increasing demise of their adult children at a time they have no meaningful resource base. In fact, many African elderly persons are not covered by any kind of retirement programmes, so that the primary source of their care and support is still the family. Since economic development and widespread migration of young adults are disrupting traditional support for the older members of the family, poverty is the main threat to the

well being of the African elderly people. Therefore, the poverty reduction strategies of the African governments must focus on the poorest and most vulnerable older persons, especially women, and breaking the poverty cycle that runs from generation to another. This is because the experience of poverty in childhood and adulthood deepens with age. Also, people who have endured a lifetime of poor diet, multiple pregnancies, inadequate reproductive health care, and arduous physical labour are likely to enter old age in ill health.

These policy implications need to be considered in the light of the study's limitations, however. In the first instance, as stated previously, vital registration system is still incomplete in Ghana, as in other parts of Africa. As a result, not all deaths and their causes are recorded. Secondly, the observed data used are cross-sectional; thus, implications about causality cannot be drawn. Additionally, the data came from various sources with differing techniques of data collection.

On the other hand, this analysis is the first such study to be conducted on Ghana. Future research might build on the findings of this study by focusing on how the process of sexual communication relates to sexual risk-taking behaviour. Sample surveys should investigate the role of parents, addressing what they say, as well as their attitudes toward adolescent sexuality and their own behaviour that they present as a model for their adolescent children. To understand, and perhaps change, how parents influence adolescent sexuality, the complex set of behaviours and attitudes that constitute parenting should be studied further.

Finally, it is hypothesized that there is an inverse relationship between modernization and family support for the elderly, resulting in a growing incidence of low levels of well-being among the elderly persons. Yet, very little is known in parts of Africa about intergenerational transfers. In the traditional African society, children are expected to support their parents in old age because there is no universal social security system. With increasing urbanization and modernization, it is vitally important to know

something about intergenerational transfers from adult children (who live in towns, cities, and outside the country) to their elderly parents, and characterize their living arrangements in a fast-changing social and economic environment.

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Figure 1: Age-Specific Death Rates (ASDR), 2000, Ghana.

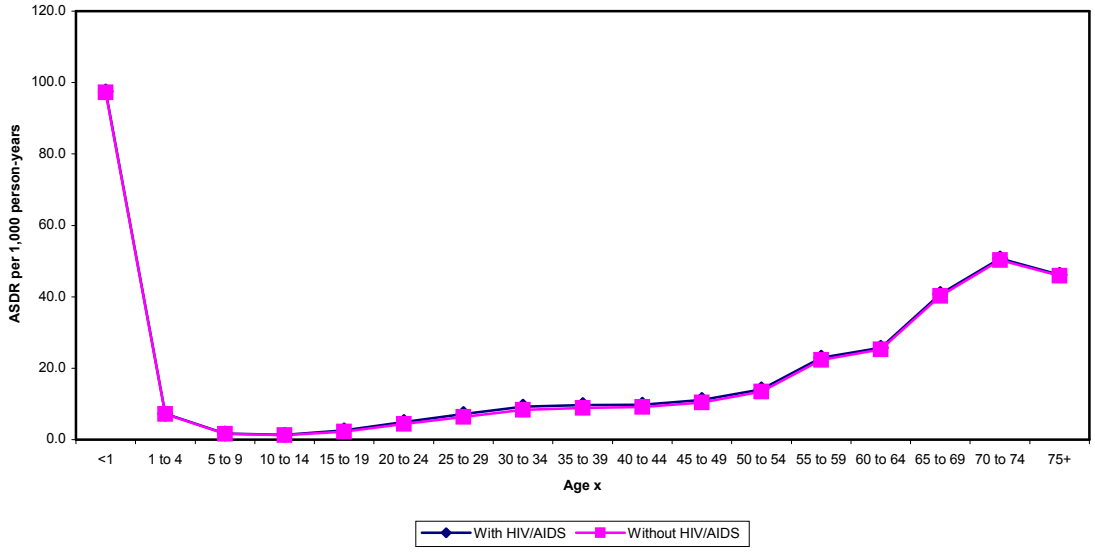

Figure 2: Number of Survivors at Age x (lx), 2000, Ghana.

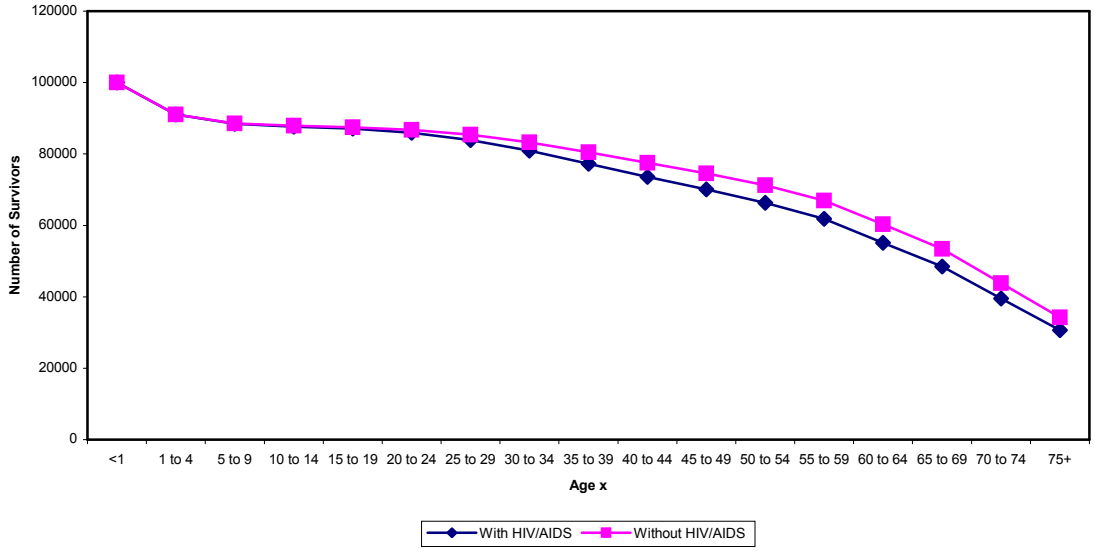

Figure 3: Life Expectancy at Age x, 2000, Ghana.

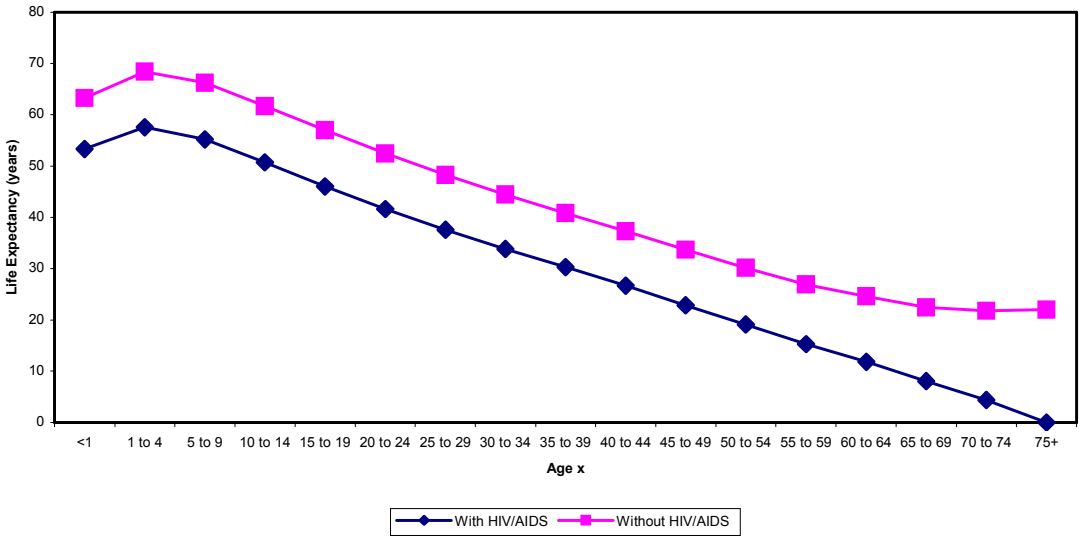

Table 1. Multiple Decrement Life Table of Ghana, 2000

Age x	${}_nN_x$	${}_nD_x$	${}_nm_x$	${}_na_x$	${}_nq_x$	${}_np_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x^o	${}_nD^i_x$	${}_nq^i_x$	${}_nd^i_x$	l^i_x
0	525258	51209	0.0975	0.113	0.0897	0.9103	100000	8973	92042	5333435	53.3	2314	0.0041	405	7247
1	2244163	16384	0.0073	1.583	0.0287	0.9713	91027	2612	357792	5241393	57.6	887	0.0016	141	7242
5	2775206	4634	0.0017	2.434	0.0083	0.9917	88414	735	440186	4883601	55.2	22	0.0000	3	7237
10	2262216	3009	0.0013	2.419	0.0066	0.9934	87679	581	436897	4443415	50.7	43	0.0001	8	7232
15	1883753	4948	0.0026	2.455	0.0130	0.9870	87098	1136	432599	4006518	46.0	843	0.0022	194	7227
20	1600820	7948	0.0050	2.469	0.0245	0.9755	85962	2108	424475	3573918	41.6	1838	0.0057	487	7222
25	1487299	10614	0.0071	2.471	0.0350	0.9650	83854	2939	411838	3149443	37.6	3806	0.0126	1054	7217
30	1206809	11159	0.0092	2.470	0.0452	0.9548	80915	3655	395327	2737605	33.8	4087	0.0165	1339	7212
35	1029765	9946	0.0097	2.469	0.0471	0.9529	77260	3642	377082	2342278	30.3	2833	0.0134	1037	7207
40	886931	8703	0.0098	2.469	0.0479	0.9521	73618	3524	359169	1965196	26.7	2097	0.0115	849	7202
45	720357	7975	0.0111	2.468	0.0538	0.9462	70094	3774	340910	1606027	22.9	1276	0.0086	604	7197
50	568369	7976	0.0140	2.463	0.0678	0.9322	66319	4493	320199	1265117	19.1	735	0.0062	414	7192
55	355842	8177	0.0230	2.448	0.1085	0.8915	61826	6710	292003	944918	15.3	432	0.0057	354	7187
60	366351	9415	0.0257	2.442	0.1206	0.8794	55116	6645	258584	652915	11.8	195	0.0025	138	7182
65	258709	10559	0.0408	2.412	0.1846	0.8154	48470	8947	219203	394331	8.1	108	0.0019	92	7177
70	225158	11420	0.0507	2.392	0.2240	0.7760	39524	8852	174536	175128	4.4	22	0.0004	17	7172
75	515073	23768	0.0461	0.012	1.0000	0.0000	30671	30671	375	592	0.0	85	0.0036	110	7167

Sources: Ghana's 2000 Census (for ${}_nN_x$ values) and World Health Organization, 2002 (for ${}_nD_x$ values).
Note: ${}_nN_x$ =Population size between ages x and $x+n$; ${}_nD_x$ =Total number of deaths between ages x and $x+n$; ${}_nm_x$ =Observed age-specific death rates between ages x and $x+n$; ${}_na_x$ = Average person-years lived between ages x and $x+n$; ${}_nq_x$ = Probability of dying between ages x and $x+n$; ${}_np_x$ = Probability of surviving from age x to age $x+n$; l_x =Number of people left alive at age x; ${}_nd_x$ =Number of people dying between ages x and $x+n$; ${}_nL_x$ = Person-years lived between ages x and $x+n$; T_x = Person-years lived above age x; e_x^o =Life Expectancy at age x; ${}_nD^i_x$ =Total number of deaths from HIV/AIDS between ages x and $x+n$; ${}_nq^i_x$ = Probability of dying from HIV/AIDS between ages x and $x+n$; ${}_nd^i_x$ = Number of people dying from HIV/AIDS between ages x and $x+n$; l^i_x = Number of people left alive from HIV/AIDS at age x; ${}_nm^i_x$ = Observed age-specific death rates from HIV/AIDS between ages x and $x+n$.

Table 2. Associated Single Decrement Life Table for Causes of Death other than HIV/AIDS, Ghana, 2000.

Age x	R^{-i}	l_x	${}_nP_x$	${}_na_x$	${}_nq_x$	e_x^o	${}_np_x^{-i}$	${}_nq_x^{-i}$	l_x^{-i}	${}_na_x^{-i}$	${}_nd_x^{-i}$	${}_nm_x^{-i}$	${}_nL_x^{-i}$	T_x^{-i}
0	0.9932	100000	0.9103	0.113	0.0897	53.3	0.9142	0.0858	100000	0.115	8583	0.0931	92400	6298441
1	0.9591	91027	0.9713	1.583	0.0287	57.6	0.9728	0.0272	91417	1.585	2484	0.0069	359672	6206041
5	0.8973	88414	0.9917	2.434	0.0083	55.2	0.9917	0.0083	88934	2.430	735	0.0017	442781	5846369
10	0.7989	87679	0.9934	2.419	0.0066	50.7	0.9935	0.0065	88199	2.577	574	0.0013	439605	5403588
15	0.5849	87098	0.9870	2.455	0.0130	46.0	0.9892	0.0108	87625	2.733	946	0.0022	435982	4963983
20	0.6599	85962	0.9755	2.469	0.0245	41.6	0.9811	0.0189	86679	2.622	1637	0.0038	429504	4528000
25	0.7046	83854	0.9650	2.471	0.0350	37.6	0.9774	0.0226	85042	2.578	1921	0.0046	420558	4098497
30	0.7268	80915	0.9548	2.47	0.0452	33.8	0.9711	0.0289	83121	2.565	2401	0.0059	409756	3677939
35	0.7739	77260	0.9529	2.469	0.0471	30.3	0.9661	0.0339	80720	2.528	2738	0.0069	396831	3268183
40	0.7963	73618	0.9521	2.469	0.0479	26.7	0.9634	0.0366	77982	2.543	2852	0.0074	382904	2871353
45	0.8346	70094	0.9462	2.468	0.0538	22.9	0.9546	0.0454	75130	2.592	3410	0.0093	367437	2488449
50	0.8780	66319	0.9322	2.463	0.0678	19.1	0.9383	0.0617	71720	2.662	4429	0.0127	348246	2121011
55	0.9154	61826	0.8915	2.448	0.1085	15.3	0.8969	0.1031	67291	2.579	6936	0.0218	319665	1772765
60	0.9472	55116	0.8794	2.442	0.1206	11.8	0.8817	0.1183	60355	2.580	7137	0.0252	284501	1453100
65	0.9632	48470	0.8154	2.412	0.1846	8.1	0.8171	0.1829	53218	2.555	9733	0.0404	242286	1168600
70	0.9735	39524	0.7760	2.392	0.2240	4.4	0.7764	0.2236	43484	2.393	9724	0.0506	192070	926313
75	0.9836	30671	0.0000	0.012	1.0000	0.0	0.0000	1.0000	33760	0.000	33760	0.0460	734243	734243

Sources: Ghana's 2000 Census (for ${}_nN_x$ values) and World Health Organization, 2002 (for ${}_nD_x$ values).

Note: R^{-i} =Constant of proportionality for decrement other than HIV/AIDS in the interval x to $x+n$; l_x =Number of people left alive at age x; ${}_nP_x$ = Probability of surviving from age x to age $x+n$; ${}_na_x$ = Average person-years lived between ages x and $x+n$; ${}_nq_x$ = Probability of dying between ages x and $x+n$; e_x^o =Life Expectancy at age x; ${}_np_x^{-i}$ = Probability of surviving from age x to age $x+n$ in the absence of HIV/AIDS; ${}_nq_x^{-i}$ = Probability of dying between ages x and $x+n$; deaths between ages x and $x+n$ in the absence of HIV/AIDS; l_x^{-i} =Number of people left alive at age x in the absence of HIV/AIDS; ${}_na_x^{-i}$ = Average person-years lived between ages x and $x+n$ in the absence of HIV/AIDS; ${}_nd_x^{-i}$ = Number of people dying between ages x and $x+n$ in the absence of HIV/AIDS; ${}_nm_x^{-i}$ =Observed age-specific death rates between ages x and $x+n$ in the absence of HIV/AIDS; ${}_nL_x^{-i}$ = Person-years lived between ages x and $x+n$ in the absence of HIV/AIDS; T_x^{-i} = Person-years lived above age x in the absence of HIV/AIDS; e_x^{-i} = Life Expectancy at age x in the absence of HIV/AIDS.