Demographic Impact of AIDS on the Thai Population

By Orratai Rhucharoenpornpanich and Aphichat Chamratrithirong*

Thailand continues to feel the impact of a long-standing acquired immunodeficiency syndrome AIDS epidemic. Encouraged by the ready availability of epidemiological and behavioural data, a number of modelling efforts have been undertaken in an attempt to understand the impact of the epidemic since 1990. However, as better models are developed and the course of the epidemic changes, owing to behaviourial modifications as well as advances in therapy, there remains an ongoing need to provide new estimates and projections of the impact of AIDS on the Thai population. This paper projects the important demographic parameters of population size and annual growth rate. In addition, mortality indicators such as the crude death rate, age-specific death rate, infant mortality rate, child mortality rate (1-4 years) and life expectancy at birth are projected. These projections are made through a comparison of two scenarios: in the absence of AIDS and with AIDS. The paper concludes with a discussion of some of the potential social and economic impacts of AIDS.

AIDS is recognized as a critical problem that will lead to increased adult and child mortality in many countries around the world, particularly in Africa, where HIV prevalence rates are high and mortality among adults is rising. However, the fact that many questions remain regarding the severity of the impact of the AIDS epidemic mortality in the Thai population has encouraged

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extensive modelling to clarify that impact. However, only a few studies have focused directly on the impact on demographic processes (Brown and others, 1994; Van Griensven, Surasaingsunk and Alessio, 1998; Wongboonsin and others, 1997).

The extent of the impact of AIDS upon demographic processes depends on the degree of severity of the HIV/AIDS epidemic and the age pattern of HIV infection among the adult population. Since AIDS victims are mostly in the highly sexually-active age range, the potential exists for both fertility and economic productivity to be affected. This is true in the Thai setting, as can be inferred from the age pattern among reported AIDS cases, which shows that 90 per cent are in the 20- to 49-year age group, with the peak age for developing AIDS coming between 25 and 34 years. In addition, over 80 per cent of AIDS cases have acquired HIV through heterosexual transmission, showing that the type and pattern of the HIV epidemic in Thailand has been driven by heterosexual transmission. This suggests that the HIV/AIDS epidemic affects both adult and child mortality.

In terms of impact, HIV prevalence among the general population indicates the potential severity of the effect on the Thai population. Rates of infection on pregnant women attending antenatal clinics (ANC) can provide a major source of information on HIV prevalence, which is useful for estimating the prevalence in the whole population. However, the quality of ANC data is based on the quality of the sentinel sero-surveillance system. Therefore, it is necessary to determine accuracy, both of prevalence data and the sentinel system, before undertaking the projections.

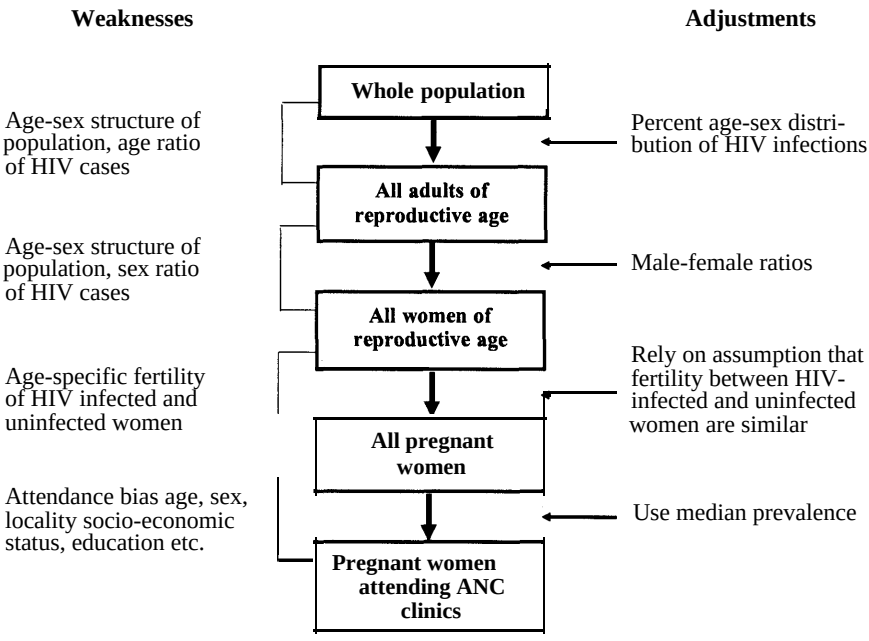
Accuracy of ANC data

Although ANC data have been collected from all provinces in Thailand, from 1989 to 1995 the sentinel sites for the population were based only in urban areas. Rural coverage only began in 1996 when the Ministry of Public Health expanded the sites to include community hospitals. The ANC data show the prevalence level derived from rural sites to be lower than that of urban sites. This implies that national HIV prevalence derived from ANC data prior to 1996 may have been overestimated.

Variations in the method of data collection may affect the accuracy of ANC data. Some sites use an unlinked anonymous process, while other sites use voluntary confidential testing for collecting blood tests. The latter method typically results in much larger sample sizes, leading to a high level of diversity in sample sizes among the sites. Since such variations can result in under- or over-representation of prevalence, some adjustment is required.

The initial adjustment to reduce bias is made by using median prevalence instead of mean prevalence when representing national HIV prevalence. By

Figure 1. Weaknesses in ANC prevalence data from sentinel sero-surveillance system and adjustments

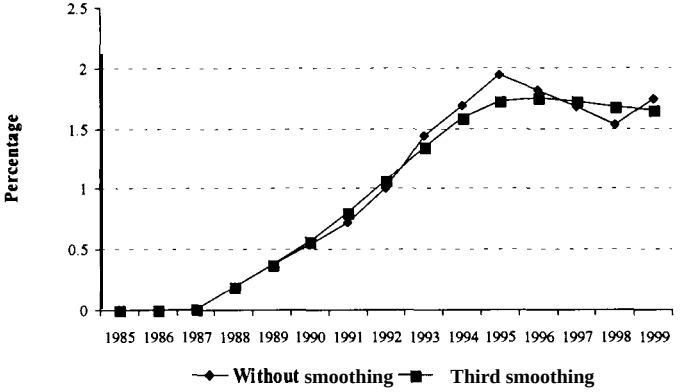


Source: Adapted from UNAIDS (1999) . *Trends in HIV incidence and prevalence: Natural course of the epidemic or results of behavioral chan*ge? UNAIDS in collaboration with Welcome Trust Centre for the Epidemiology of Infectious Diseases, UNAIDS/99.12E.

using the median approach, the effect of outliers in the sample among sites is reduced (Schwartlander and others, 1999). This adjustment also reduces urban bias, lowering the estimated prevalence outside urban areas.

Another weakness of ANC data is that, if not adjusted, such data cannot represent the prevalence for all women or the general population. The age-sex distribution of HIV prevalence can be used to adjust the ANC data in order to provide an estimate of the HIV prevalence for the overall adult population. The data required are the female-to-male ratio of HIV infection and the age distribution of HIV infection, while the adjustment for the difference in the age-specific fertility rate between infected and non-infected women relies on the assumption that they are similar. The weaknesses in, and adjustments to, ANC data are illustrated in figure 1.

Figure 2. Epidemiological curve of the Thai AIDS epidemic for 1985-2010, with and without smoothing



Methods used for projection

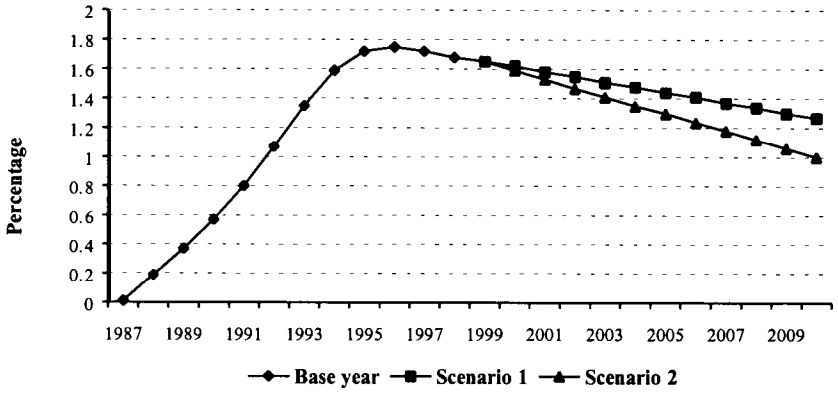
The method of projection used for this study involves two main steps. The first is to estimate and project HIV prevalence for adults. The second step involves using the model to estimate and project the magnitude and mortality impact of HIV/AIDS on the Thai population.

Procedure for estimating and projecting HIV prevalence

Prevalence estimates require two basic inputs. First, the year the epidemic began and the point prevalence estimates for 1985-1999. The starting year of the Thai epidemic is generally taken to be 1985 and the point prevalence estimates are based on median prevalence derived from ANC data. The prevalence over time and the starting date of the epidemic are then used to determine the epidemiological curve of prevalence that best describes the HIV epidemic in Thailand. A three-year moving average is used to create the Thai epidemiological curve. These new values of prevalence derived from this technique are used as the prevalence estimates for 1985-1999 (figure 2).

The prevalence during the period 2000-2010 was projected and illustrated using two scenarios, based on the assumption that prevalence would slightly decline until the end of the projection periods. The first scenario, derived from forecasting the trend, assumed that the prevalence would decline slightly at a linear rate to 1.27 per cent by 2010. The second scenario showed a faster rate of decline, with a decrease to 1 per cent by the end of the projection periods. Such a rate came from the Ministry of Public Health objective of controlling

Figure 3. Comparison of two scenarios of HIV prevalence, 2000-2010



HIV infection among pregnant women at no higher than 1 per cent (Ministry of Public Health, 1997). However, the first scenario was chosen to represent the most feasible picture of the Thai epidemic (figure 3).

Projecting the demographic impact of AIDS

The models used to produce the estimate and projection were demographic projections and the AIDS Impact Model (AIM) (Stover, 1997 and 1999). The first model was used to prepare a population projection as the basis for the HIV/AIDS calculations, while the second model was used to project the past and future course of the HIV/AIDS epidemic in the population. These models was the latest version of a computer program prepared in 1991 in collaboration with the Futures Group International and Family Health International, under the AIDS Technical Support and AIDS Control and Prevention Projects. The latest version (1.52), revised by John Stover, was used for this study.

The impact of HIV/AIDS on the demographic process was assessed by comparing estimates and projections that make allowance for the impact of AIDS with those that hypothetically exclude AIDS. The estimates and projections were made in several steps. First, the model was used to estimate the annual incidence of the disease on the basis of the estimate and projection of prevalence; that is, the annual number of newly infected individuals was derived from the information on the total number of HIV positive individuals at particular points in time. Second, with an assumption about the probability of

progressing from HIV to AIDS and from AIDS to death, the model was used to estimate the annual number of deaths caused by AIDS.

The estimated number of paediatric HIV cases is necessarily based on the assumption about the proportion of HIV cases that occur among women, the likely age distribution for the total number of infected women and a set of age-specific fertility rates. On the basis of these assumptions, and assuming 25.7 per cent to be the average percentage of children in the Thai setting who are born to HIV-positive women and who will themselves be infected, the number of new paediatric HIV-positive cases expected per year is calculated by the program.

The mortality impact of AIDS on demographic parameters is then calculated. The impact will be illustrated in terms of important demographic parameters of population size, annual growth rate and mortality indicators, such as the crude death rate, age-specific death rate, infant mortality rate, child mortality rate and life expectancy at birth. The impact is displayed through a comparison of two scenarios: the absence of AIDS and with AIDS.

Assumptions about disease progression rates and vertical transmission

Data on the rates of disease progression are still scarce in Thailand and there is little knowledge about the incubation period among Thai HIV-infected persons. Two cohort studies in Thailand related to the rate of disease progression were undertaken among female sex workers and military conscripts. Those studies only suggested that the median survival time from HIV to AIDS deaths might be more than seven years. However, individuals included in specific cohort studies were aware of their HIV infection and therefore might not be representative of the general population of HIV-infected persons, many of whom were unaware of their infection. The progression rate among those who did not know they were infected could be expected to be equal to, or slower than the rate among those who enrolled in the cohort studies.

Moreover, the specific progression rates need to be based on judgements about access to and the quality of the health-care system. The slower rate of 10 years or over may best represent progression in Western countries with good health-care systems. However, the progression rate among Thais may not be as slow as those in developed countries. Therefore, we set the median time of the expected progression rate from HIV to AIDS at approximately eight years for infected Thai adults and 2.5 years for children. The survival time from AIDS to death is assumed to be approximately one year, for both adults and children.

Vertical transmission has also seen substantial variation in the overall rates between developing and industrialized countries. In countries where breast feeding is the norm and access to obstetric care is lower, vertical HIV transmission is expected to be 35 per cent (Schwartlander and others, 1999). In Thailand, where voluntary HIV counselling and testing was introduced comparatively early and more mothers have therefore been made aware of their infection, the approximate rate of 25 per cent is appropriate. Some studies in Thailand have found relatively high rates of HIV transmission from mother to child that varied between 24.2-35 per cent among the regions. The highest rate was found in the northern region (Brown and others, 1995) while the lowest rate was recorded in Bangkok (Chotpitayasunondh and others, 1994; Shaffer and others, 1999; Wasi, Chearskul and Roongpisuthipong, 1995). The rate of 25.7 per cent is the average expected value from the studies.

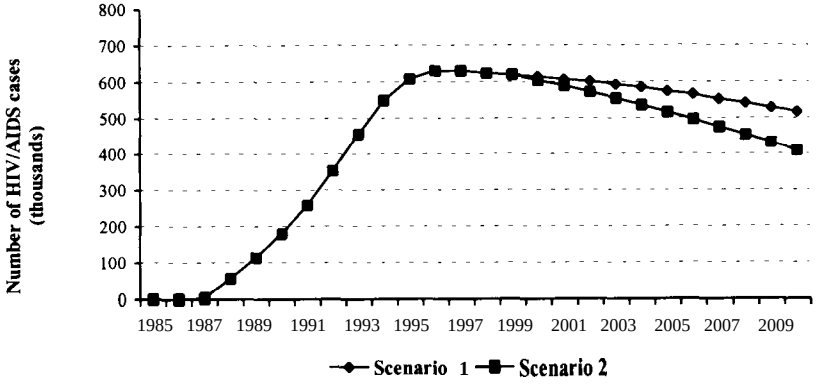
Age-sex distribution of HIV infection in the Thai population and fertility rates

Calculating the number of HIV-infected children and AIDS orphans requires data on the age distribution of HIV-infected women and age-specific fertility rates. The age-distribution for HIV-infected women is derived from reported AIDS cases, while the age-specific fertility rate is based on projections made by the National Economic and Social Development Board Working Group (1995) and the Survey of Population Change undertaken by the National Statistical Office (1997). These data are used, together with estimates of prevalence among women and the rate of vertical transmission, to produce the number of infected children and AIDS orphans.

The assumption about the percentage reduction in fertility for HIV-infected women is related to the impact of HIV/AIDS on children. Recent studies in Africa have shown a reduction in fertility among HIV-infected women, but no data are available for Thailand. Data from the sero-surveillance system collected among women attending ANC clinics, provide information showing that the proportion of infected women with 1-2 children is parallel with those women who were primigravida (Division of Epidemiology, 1999). This information suggests that the expected reduction in fertility among infected women in the Thai setting, where low fertility is the norm, should be less limited. Therefore, we assume that the fertility of HIV-infected women will be 10 per cent lower than that of non-infected women.

To estimate the impact of AIDS on the infant mortality rate requires information about the proportion of infants with AIDS that die in the first year of life. This information is used to calculate the number of infected infants who have developed AIDS in their first year and will die before their first birthday.

Figure 4. Number of people living with HIV/AIDS in Thailand, 1985-2010



The proportion of children who will develop AIDS and die in that year is set at approximately 0.67. Such a value is used as the best estimate, based on international literature, and is applicable to any country (Stover, 1997 and 1999).

Results

The results of the two scenarios are presented in figures 4-6. A comparison of the estimates and projections for the with- and without-AIDS scenarios shows that the disease has already affected the Thai population.

Figure 5. Annual number of AIDS deaths in Thailand, 1985-2010

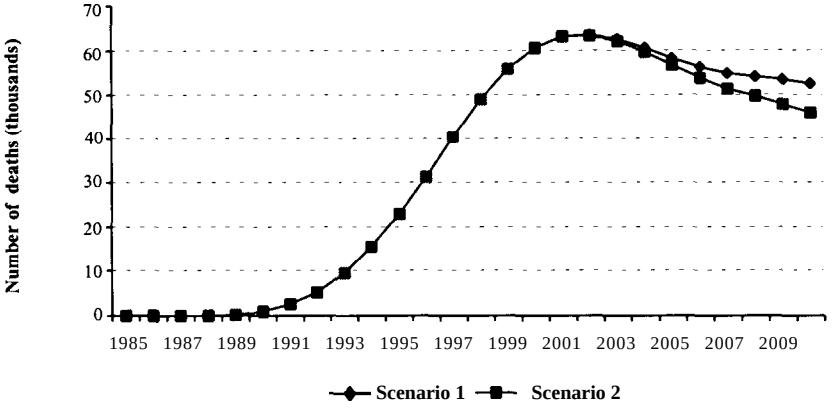
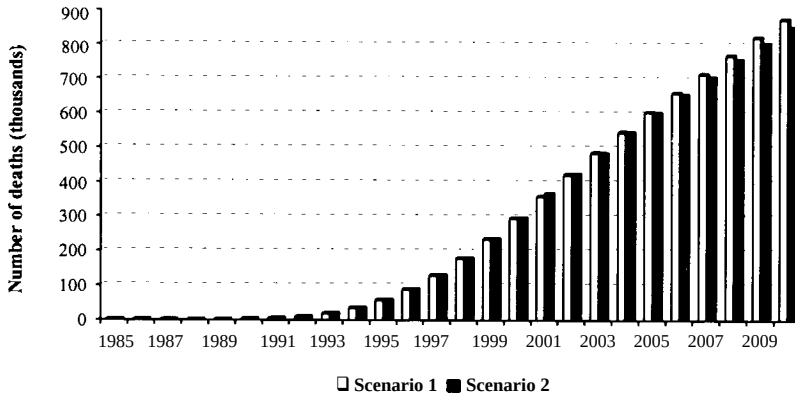


Figure 6. Cumulative AIDS deaths in Thailand, 1985-2010



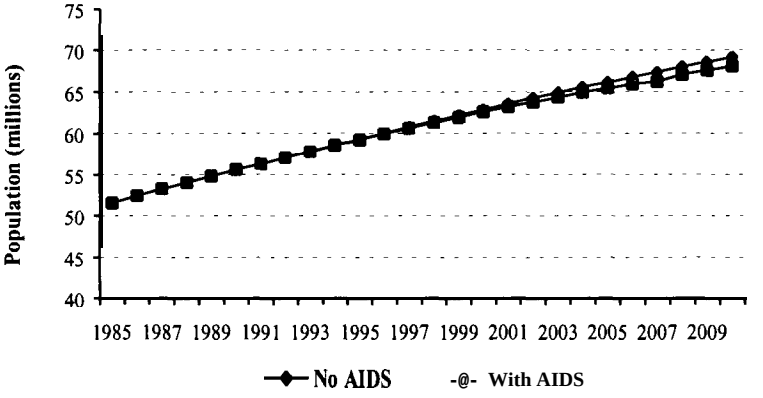
In the fist scenario, the number of people living with HIV/AIDS in Thailand climbed rapidly from 1987 to 1995, reaching a peak of more than 600,000, or around 1 per cent of the population during 1996 and 1997. Subsequently, the number of infected persons is projected to gradually decline to less than 600,000 by 2005 and to just over 500,000 by 2010.

In the second scenario, the projected number of infected persons is lower after 2000 because the prevalence is assumed to fall more rapidly than in the first scenario. This scenario produces approximately 100,000 fewer infected persons by 2010 (figure 4).

The projected number of AIDS deaths is shown in figure 5. In the first scenario, the number is projected to increase rapidly to approximately 60,000 per year from 2000 to 2005, then decline slightly to approximately 50,000 by 2010. The second scenario produces some 6,000 fewer AIDS deaths by 2010.

According to data on cumulative AIDS deaths in Thailand (figure 6), there were approximately 300,000 AIDS-related deaths from the beginning of the epidemic until the end of 2000. More deaths occurred among males than females, with the ratio being around 2.5:1. It is projected that this ratio will decrease to approximately 1.6:1 by 2010. The cumulative number of AIDS deaths among the Thai population is projected to reach nearly 900,000 by the end of the projection period. If the prevalence falls more rapidly as in the second scenario, that number will be reduced to approximately 25,000 by 2010.

Figure 7. Population size in with- and without-AIDS scenarios for Thailand, 1985-2010



Demographic impact of AIDS

The impact of AIDS on the demographic process in Thailand can be illustrated by population size, annual growth rates and mortality indicators such as the crude death rate, age-specific death rate, infant mortality rate, child mortality rate and the life expectancy at birth. These parameters are projected through a comparison of scenarios for absence of AIDS and with AIDS.

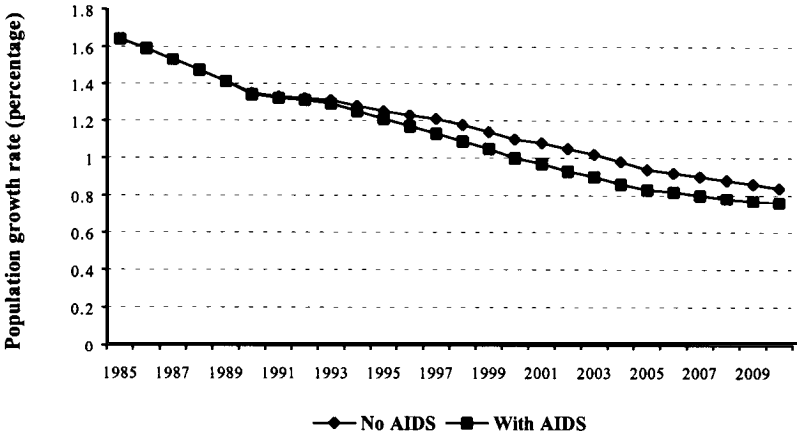
It is now clear that the mortality impact of the AIDS epidemic on the Thai population has been substantial. However, comparisons of the estimates and projections of with- and without-AIDS show that the disease has had a more limited effect on Thai population dynamics.

Population size and annual growth rate

Figures 7 and 8 present the projected population sizes and annual growth rates for the with- and without-AIDS scenarios for 1985-2010. The difference between the projections indicates that by 2010 the cumulative impact of AIDS will result in the population size being 1-2 per cent lower than it would have been in the absence of AIDS. Although the impact of AIDS on population size does not appear large when examining the total population, the effect on the increase over the period 2000-2010 is, in fact, substantial. This can be seen from an examination of population growth-rate projections.

The data shown in figure 8 indicate that the with-AIDS scenario results in a growth rate that is substantially displaced by approximately three years compared with the scenario without AIDS. For example, in the presence of AIDS, the growth rate in 2000 was approximately equal to the expected growth rate in 2003 without AIDS.

Figure 8. Annual population growth rate for with- and without-AIDS scenarios, in Thailand, 1985-2010



Number of deaths

The impact of AIDS is projected to be most severe in Thailand when the focus shifts to mortality. The total annual number of deaths in 2010 is projected to be 17 per cent higher under the AIDS scenario compared with the non-AIDS scenario. By the end of the projection period, AIDS is projected to result in approximately 50,000 more deaths per year than would have occurred in the absence of AIDS (figure 9).

Figure 9. Total deaths in the with- and without-AIDS scenarios in Thailand, 1985-2010

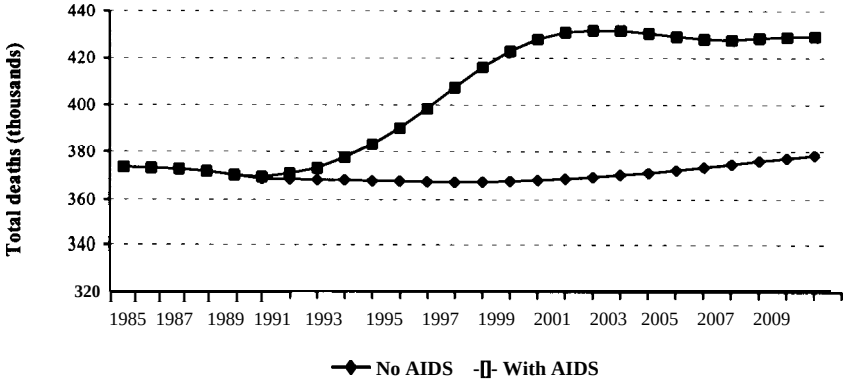
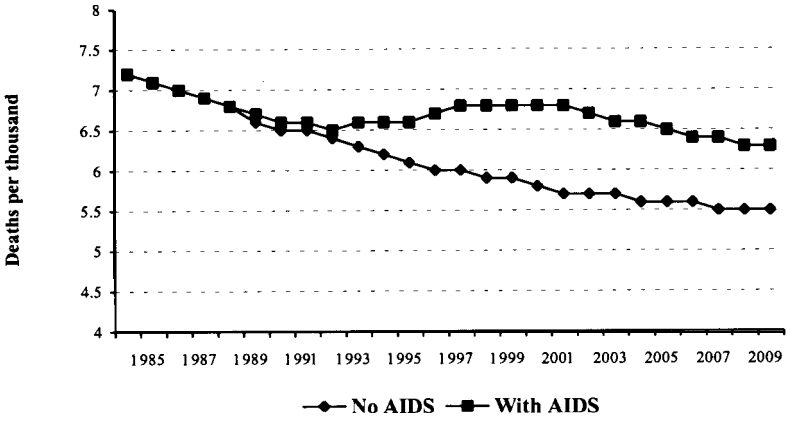


Figure 10. Crude death rate in with- and without-AIDS scenarios in Thailand, 1985-2010



Crude death rate

In the absence of AIDS, the crude death rate is expected to decline from 7 deaths per 1,000 during 1985-1990 to 5.5 per 1,000 at the end of the projection period. AIDS will result in the crude death rate remaining at approximately seven deaths until 2000. The percentage difference of the crude death rate according to the with- and without-AIDS projections will peak during 2000-2005, when AIDS will be responsible for an increase of approximately 17 per cent in the crude death rate. At that point, the crude death rate is projected to be around 7 deaths per 1,000 with AIDS, instead of 6 deaths per 1,000 without AIDS (figure 10).

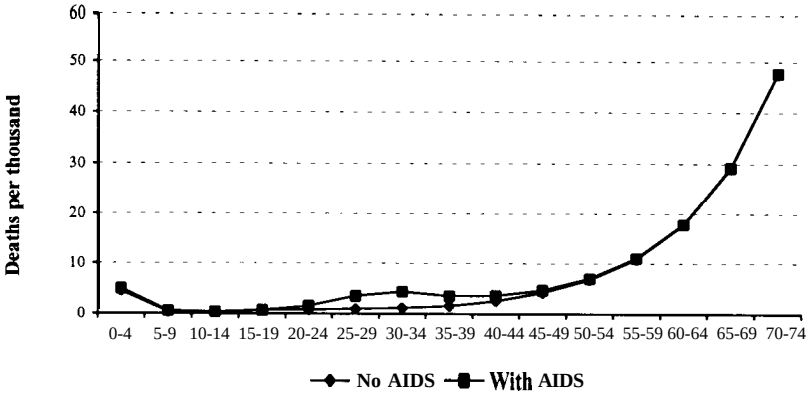
Age-specific mortality rate

The impact of AIDS on the age-specific mortality rates in Thailand is shown in figure 11. The greatest impact is in the group of highest sexual activity, aged between 25 and 39 years. The increase in mortality rates in that group is quite large, with a peak between the ages of 30 and 34 years.

Life expectancy at birth

Life expectancy at birth is a measure for indicating the average number of years that a newborn child can expect to live. Even in the presence of AIDS, life expectancy is projected to increase until the end of the projection period. However, for the years 2000-2005, life expectancy is estimated at 71 years, or three years less than without AIDS. In addition, levels are expected to remain unchanged until the end of the projection period (figure 12).

Figure 11. Age-specific mortality rates with and without AIDS in Thailand, 2000



Infant and child mortality

Approximately 25 to 33 per cent of children born to HIV-positive women are likely to acquire the infection from their mothers. Paediatric HIV infection is expected to have a substantial impact on mortality during infancy and childhood, particularly among children aged 1-5 years.

Even in the presence of AIDS, infant mortality is projected to decline from 39 deaths among infants aged less than 1 year per 1,000 live births

Figure 12. Life expectancy at birth with and without AIDS in Thailand, 1985-2010

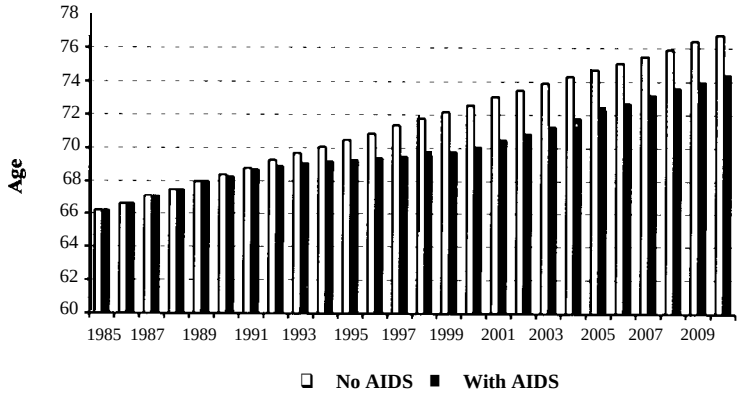
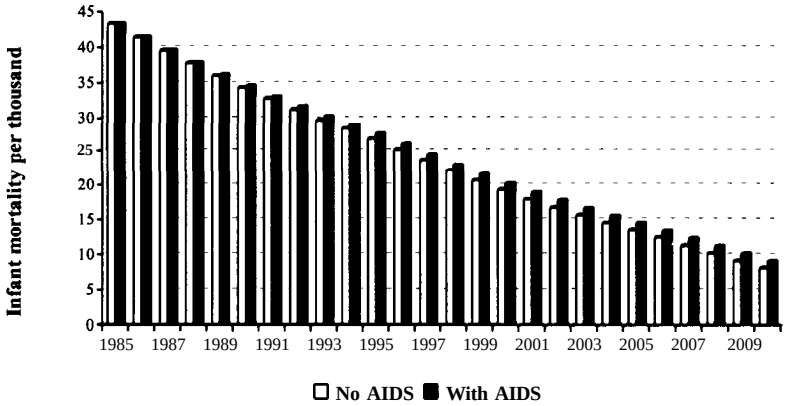


Figure 13. Infant mortality rate with and without AIDS in Thailand, 1985-2010



between 1985 and 1990 to 12 per 1,000 live births from 2005 to 2010. Even in the absence of AIDS, a similar decline to 11 per 1000 is expected by the end of the projection period (figure 13).

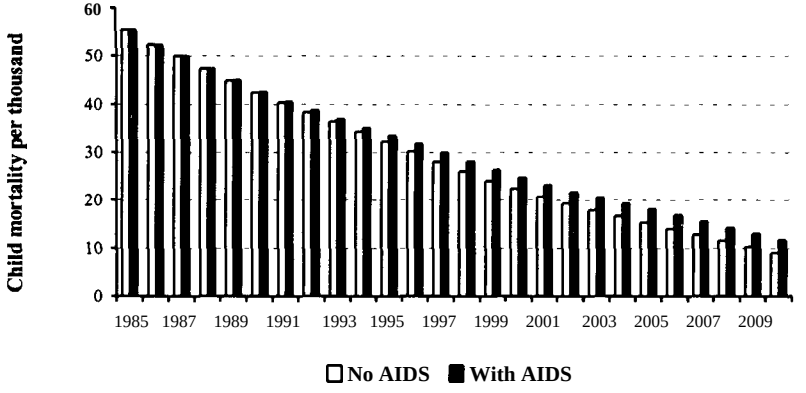
Child mortality rate is defined as the probability of dying between the ages of 1 and 5 years. In the presence of AIDS, the child mortality rate will be affected more than the infant mortality rate, as most infected children will survive their first year of life only to die before they reach their fifth birthday. The projections show that AIDS can be expected to result in child mortality rates that are 14 per cent higher than they would have been in the absence of AIDS between 2000-2005, and 30 per cent higher in 2010 (figure 14).

AIDS orphans

HIV/AIDS will have a serious impact on children, both directly and indirectly. Some children of infected mothers will be infected with HIV and will die from AIDS; the remainder will not be infected, but will be at risk of becoming orphans when their mothers die from AIDS. With anti-retroviral intervention for preventing mother-to-child HIV transmission, these relationships will change. A positive impact is that a large portion of children will be protected from HIV infection; only about 10 per cent of children born to HIV-infected mothers will be infected. However, those surviving children will become orphans, because the same anti-retroviral therapy will not benefit their mothers.

The number of orphans resulting from AIDS mortality is already large and is expected to increase rapidly in the near future. The projection shows that the cumulative total number of AIDS orphans in Thailand is expected to climb

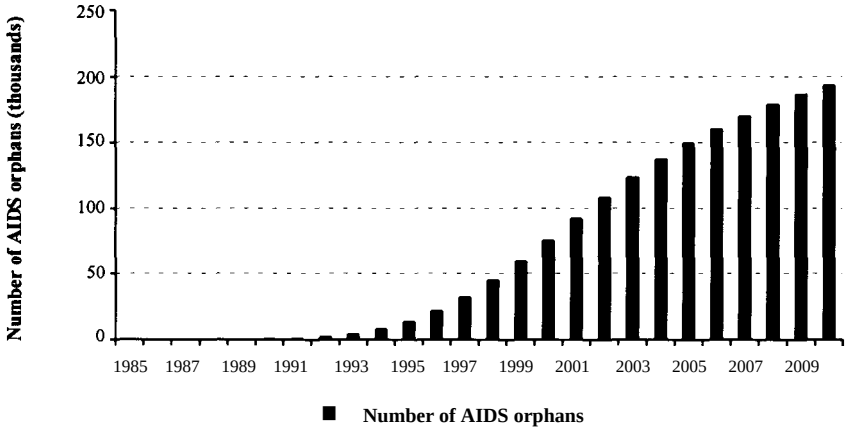
Figure 14. Child mortality rate with and without AIDS in Thailand, 1985-2010



to 60,000 by 2000, then to double by 2005. The projection also shows that the number of AIDS orphans in Thailand is expected to reach nearly 200,000 by the end of the projection period (figure 15).

The seriousness of the dramatic increase in orphans due to the AIDS epidemic has not been fully appreciated nor planned for. Some studies in Thailand show that AIDS orphans are brought up by extended families, for example, by grandfathers and mothers (Brown and others, 1995; Thamathikul, 1997; Yoktri, 1996). However, those children are mostly in resource-poor

Figure 15. Number of AIDS orphans in Thailand, 1985-2010



families that need social and financial support. They also face discrimination and social exclusion by neighbours and the community. This translates into the denial of access to playing, joining activities and schooling within the community. Any help or support for children orphaned by AIDS within the family network or community should therefore be aimed at reducing discrimination in society and at providing necessary financial subsidies in terms of nutrition and school fees for such children.

Discussion and conclusion

The results of the projections presented in this paper may differ from projections given elsewhere, owing to varying assumptions about past and current adult HIV prevalence as well as future prevalence. Differences may also result from the assumed length of the incubation period and the rate of perinatal transmission. Median prevalence, which is derived from ANC data, is used instead of mean prevalence in this paper as it is more representative of adult prevalence at the national level. Therefore, the projected numbers of those who will be affected are somewhat lower than those found in other studies. However, considerable effort was devoted during this study to examining the accuracy of ANC data and adjusting those data so that they could best represent the level of prevalence in adult Thais.

HIV prevalence in Thailand is declining. Furthermore, current levels of prevalence are low when compared to African countries. However, even with this low level of HIV prevalence (not more than 2 per cent), the impact is large, partly because most of those infected are within the reproductive age group. Although the AIDS epidemic in Thailand is not expected to reduce population size and growth rate, it will substantially reduce the amount by which the population would have grown in the absence of AIDS. The projections suggest a decline in total population size of about 1-2 per cent. The decline in the population growth rate as a result of HIV/AIDS mortality will be about 0.1 percentage point.

The long-standing nature of the AIDS epidemic in Thailand means that the cumulative impact of mortality will have a significant impact on some demographic parameters. Since the increase in mortality as a result of AIDS has occurred mainly in adults of reproductive age, it inevitably has an impact on child survival. Both adult and child mortality indicators show AIDS is having a large impact. The social, economic, emotional and health costs of this impact will be enormous. By 2010, AIDS is projected to result in 50,000 additional deaths, or a 17 per cent increase in the number of annual deaths that would have occurred in the absence of AIDS. The effect on child mortality is projected to be even greater.

The economic impact of AIDS derives, in part, from its demographic impact. AIDS kills prime-age adults, many of whom are at the peak of their economic productivity. Thus, it affects the productivity and efficiency of low- and semi-skilled workers, creates labour shortages as a result of sickness and strains the effectiveness of both formal and informal insurance mechanisms. That may encourage the replacement of sick or deceased workers with migrant labour from neighbouring countries. However, that approach could further emphasize any problems created by those migrants.

Although the macroeconomic effect of AIDS is likely to be small in Thailand, the effect on the health sector and the poor will be severe. Among the households that suffer AIDS deaths, lower income will mean that those households will be less able to cope with the medical expenses and loss of incomes. Therefore, AIDS will tend to worsen poverty and increase equality among the poor households.

One of the most tragic effects of the AIDS epidemic is the increase in the number of orphans who have lost one or both parents. AIDS is the cause not only of orphanhood but also of a decrease in human resource development in children, in terms of both physical and psychosocial aspects, as well as a decline in nutritional status, a reduction in schooling and an increase in the numbers of street children. These aspects form only the measurable impact. There remains the immeasurable impact of grief and phychological pain that is experienced by children who lose a parent. These effects are likely to be greatest among the poor, since they are more likely to become infected with HIV.

The projections presented in this paper have one core message. The human and social costs of AIDS are enormous, even at relatively low levels of prevalence. Prevention is straightforward and is much cheaper than treatment. Small decreases in prevalence can have significant effects in reducing the demographic impact of AIDS and, therefore, the economic and social costs that society has to face.

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