SAJDem 9(1):49–66

Adult mortality in rural Malawi

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Abstract
This paper estimates adult mortality in rural Malawi between 1998 and 2001. The study was conducted as part of a longitudinal household survey in 2001. Mortality-induced sample attrition between 1998 and 2001 was 5 per cent and according to a World Health Organization clinical definition, most of the deaths were AIDS-related. Findings of this study are consistent with earlier studies in sub-Saharan Africa during the earlier stages of the AIDS epidemic. Large and well-conducted studies of adult mortality are urgently needed in Malawi as well as in other regions of Africa. Data from these studies will help to model epidemiological transition and execute relevant policy programmes to prevent future epidemics.

Key words
Malawi, mortality, sub-Saharan Africa, verbal autopsy

Introduction

Although the average level of adult mortality in sub-Saharan Africa is high compared to the rest of the world, the experience of different countries is very heterogeneous. By the late 1970s, adult mortality was at its lowest levels in some countries but remained high in other countries. The high level of adult mortality in some countries in the late 1980s and 1990s was depressing considering the substantial reductions that were achieved in Africa during the 1960s and 1970s. Many countries in sub-Saharan Africa entered the second half of the 20th

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century with extremely high adult mortality (Timæus 1993). The increase in adult mortality continued in some countries until around 1980 and has continued to do so during the 1990s and at the beginning of the 20th century.

One common index of measuring the pace of mortality change is the life table survivorship from exact age 15 years to exact age 60 years ($_{45}p_{15}$) which can be interpreted as the probability of surviving to old age, subject to surviving childhood, at the prevailing level of mortality. This index, which is a complement of the probability of dying between exact age 15 and 60 ($_{45}q_{15}$), has been adopted as the preferred index of adult mortality (Timæus 1998).

Timæus (1993) points out that some of the results on adult mortality based on data that have been subjected to smoothing and adjustment have shown that, for example around 1980, more than 75 per cent of those aged 15 would survive to age 60 in Benin and The Gambia. In Ghana, Mauritania, and Zimbabwe, the equivalent figure is more than 80 per cent. The increase from low to high mortality in some countries has been substantial. For example, Feeney (2001) reports that in Zimbabwe the value of $_{45}p_{15}$ decreased from about 80 per cent in 1982 to about 50 per cent in 1997. In Malawi, this value increased from 56 per cent in 1966 to 58 per cent in 1977 and further increased to 68 per cent in 1987 before declining to 52 per cent in 1998 (MNSO 1994, 2002).

In southern Africa, adult mortality levels in neighbouring countries quite often not only appear to be close but also have similar trends and patterns. In this region, adult mortality appears to have levelled off at high levels while that of children appear to have declined. Although much attention in the past has been paid to mortality and morbidity in adults and children living in the urban areas, little is known about the extent of mortality of adult populations in the rural areas of sub-Saharan Africa. Lack of such basic health data places health planners and policy makers at a disadvantage (Quigley *et al*. 2000). Adults, especially the economically active, provide the economic support for the whole population, and the emergence of the HIV/AIDS pandemic has increased our understanding of the effects of increased adult mortality and morbidity.

Study area and background characteristics of the population

The mortality study reported here was conducted as part of a longitudinal Malawi Diffusion and Ideational Change Project (1998 and 2001) (hereafter "MDICP 98" and "MDICP 01" respectively) in three rural areas of Malawi. The overall aim of the project is to examine the role of social networks in

changing attitudes and behaviour regarding family size, family planning, and HIV/AIDS in rural Malawi. The respondents of the MDICP are married and ever-married individuals[2] in three rural areas of Malawi. The first area is Balaka district in the southern region, which is dominated by mostly matrilocal and matrilineal Yao ethnic groups. The second area is Mchinji district in the central region which is inhabited by the predominantly patrilocal Chewa ethnic group. The third area is Rumphi district in the northern region which consists predominantly of the patrilineal and patrilocal Tumbuka.

The choice of the MDICP study sites was based on a previous survey in 1988 on Traditional Methods of Child Spacing in Malawi (TMCSM) (Miller, Zulu and Watkins 2001). Briefly, Rumphi and Mchinji districts were chosen in order to visit the same census enumeration areas covered by the 1988 TMCSM. This would enable an assessment of change over time. Balaka district was chosen instead of Chiradzulu district (in the same region; the district covered by the 1988 TMCSM) because of its higher proportion of Yao-speaking Muslims and also in order to examine the impact of a Community Based Distribution (CBD) initiative in the area. The researchers sought to visit part of the sample of a baseline survey that was administered in the area prior to the launching of the CBD program in the area[3].

Questions can be raised about the extent to which the MDICP sample is representative of the rural population of Malawi since it is not a random sample and the sampled population was rural and currently married and ever-married women. It is hard to establish how the non-random selection of the sites affects the results because the sites represent the diversity of Malawi communities on what are imagined to be salient dimensions: geographic location, religion, access to roads and other development infrastructure, lakeshore fishing and non-fishing communities, and proximity to trading centres (Doctor and Weinreb 2003). Specific regional mortality estimates show little heterogeneity in terms of respondents' socioeconomic and other

2 The mean age of men in 1998 was 37.3 years and ranged from 17 years to 75 years. Of these men, about 1 per cent were below the age of 20 and 10 per cent were above the age of 50. For females, their mean age was 30.7 years and ranged from 10 years to 78 years whereas 8 per cent of these women were less than 20 years and with the same frequency for those aged 50 and above. It should be noted that about 7 per cent and 18 per cent of men and women respectively did not know their ages (or year of birth) and their ages were estimated by the interviewers during the survey.

3 Further details about the sampling are available at the MDICP website, http://www.ssc.upenn.edu/Social_Networks/Level%203/Malawi/level3_malawi_sampling.htm

demographic characteristics, and possible sample selection biases may not have a significant effect on the findings if the AIDS epidemic is sweeping across all the communities. More specifically, in Malawi virtually all adults marry, and if they divorce, which many do, most remarry (Bracher, Santow and Watkins 2002). Thus, there is little possible "selection of deaths" (i.e. deaths occurring either among single adults or those that are married – since marriage is universal) resulting from the currently married and ever-married sample. In addition, comparisons have been made[4] between the MDICP, the Malawi Knowledge, Attitudes and Practices in Health Survey (MKAPH) (1996), and the Malawi Demographic and Health Survey (MDHS) (2000) rural data[5] for a number of variables, and it can be argued that even though the MDICP study sites were not chosen to be representative, the results for these variables are so close that we can consider the MDICP to be representative of the rural Malawian population.

Regional differences in adult survival estimates show that the northern region has significant lower mortality than the central and southern regions (Bicego 1997). This finding is consistent with the pattern of social development shown by education and employment levels, and differentials in childhood mortality. For example, Manda (1998) and Baker (1999) found regional differentials in infant and child mortality, with children in the northern region having higher survival rates than those in the central and southern regions.

Although there are no official and reliable estimates of HIV prevalence in the study areas, estimates for nearby areas are available. For example, in Machinga district which is the closest district to Balaka for which recent estimates exist, an estimated 14.9 per cent of pregnant women (n=114) who visited an antenatal clinic in a rural area were HIV+ in 1998. In the same year, 14.9 per cent (n=174) of pregnant women visiting an antenatal clinic in rural Chiradzulu district, to the south of Balaka, were HIV+ and 19.4 per cent of pregnant women (n=500) who utilised antenatal services at a hospital in a semi-urban part of Mangochi, to the northeast, were HIV+ (Malawi National AIDS Control Programme998).

4 Results of these comparisons are available from the author upon request.

5 These comparisons were made between (1) the MDICP 98 and the MKAPH 1996, and (2) the MDICP 01 and the MDHS 2000. The comparisons were made for the years that are closest to each other.

On the other hand, in a semi-urban part of Mchinji, 17 per cent of pregnant women (n=500) were HIV+ in 1998 and 17.7 per cent (n=350) were HIV+ in 1997. Similarly, in Rumphi, 12.5 per cent of pregnant women (n=400) receiving antenatal services at a clinic in a semi-urban area were HIV+ in 1998 (Malawi National AIDS Control Programme 1998); the figure was 18.5 per cent (n=400) in 1997. However, the Machinga data are from a rural clinic, whereas the Mchinji data are from a semi-urban clinic. In addition, Balaka is closer to a main road than is Mchinji which may increase its prevalence relative to the other two sites. Therefore, the prevalence in Balaka might be expected to be slightly higher than the other sites. Further, the estimates of HIV prevalence in these areas provide a sense of the expected level of AIDS-related mortality in the study sites, that is, it is reasonable to expect a considerable level of AIDS-related mortality in the study sites.

Data collection

The MDICP 01 re-interviewed married and ever-married women of reproductive age (n=1 600) and their husbands (n=1 500) who were originally interviewed in the MDICP 98. A total of 104 respondents (54 female, 50 male) passed away by 2001. Verbal autopsy (VA) interviews were conducted in the villages for 92 adult deaths since 1998 (i.e. 12 VAs were not conducted due to no contacts and other field problems). The VA is an alternative to clinical diagnosis and vital registration system to document cause of death profile in a population. This involves the use of VA questionnaires in which relatives or close friends of deceased people are asked questions pertaining to the illness that led to the death of the deceased. This method has been found to parallel systematically with clinical records on cause of death (Garenne and Fontaine 1990; Kalter *et al.* 1990; Kamali *et al.* 1996; Garenne *et al.* 2000; Kahn *et al.* 2000). The use of the VA technique is based on the assumption that most causes of death can be distinguished by their signs and symptoms, and that these can be accurately recognised, recalled, and reported by lay informants (Snow and Marsh 1992; Asuzu *et al.* 1996). Findings are determined in part by the causes of death in the community, and in part by the questionnaire, field procedures, and the analytic process used (Chandramohan *et al*. 1994).

Earlier VA studies have shown that despite the impact of differential field and analytic procedures, and of limitations in informants' knowledge or memory of the circumstances and symptoms surrounding death, VAs tend to

provide reliable data on the distribution of deaths by broad category (Chandramohan *et al*. 1994). In particular, several studies that have compared VAs of adult mortality to clinical reports or physician's assessments in sub-Saharan Africa settings have either found that VA data in general tend to have very high levels of specificity, with slightly lower scores on sensitivity indices (Chandramohan *et al.* 1998) or that they score high on both (Garenne *et al.* 2000; Pickering and Nunn 1997)[6].

In either case, the typical conclusion of such studies is twofold. First, because VAs lead to minimal misclassification of cause of death, VA data can be used to identify the most important health problems in a developing country. And second, VAs may even provide more dependable data on the overall distribution of cause of death than hospital or clinical data, since the latter are unlikely to represent all deaths in the community. It is worth noting that this overall reliability of VA data in relation to adult mortality is not as apparent in VA data on child mortality. Several studies have highlighted problems in distinguishing acute lower respiratory infection deaths (e.g. Kalter *et al.* (1990)), malaria (Todd *et al.* (1994); Snow *et al*. (1992)), and diarrhoeal deaths (Mobley *et al.* (1996)) among others.

In Malawi, the VAs were conducted using the local language by the interviewers who were collecting data for the main MDICP survey and they were mostly high school graduates. In the VA study, the information collected for each death includes specific symptoms the deceased experienced in the last few months of their lives, the relative timing and duration of those symptoms, and the type of medical treatment sought and received. Interviews were conducted by asking several open- and closed-ended questions. Responses to some open-ended questions on illness were used to check against closed questions, and most of them matched well.

Questionnaire design

A list of indigenous terminology for illnesses and their manifestations as recognised by lay people was constructed using information about common causes of deaths in the local communities. The VA questionnaire included the informant's account of the relationship with the deceased, year of death, the

6 Sensitivity and specificity vary across categories of disease (e.g. infectious, parasitic, non- communicable), by specific disease, and across other causes of death (e.g. accident and violence).

terminal illness, a list of signs and symptoms including their presence and duration (see Table 1).

Table 1 Selected items included in the verbal autopsy questionnaire, rural Malawi 2001

General	– relationship of informant to deceased respondent
	– year of death
	– duration of illness before death
	– informant's detailed account of illness
	– availability of death certificate
Circumstances of death	– diagnosis of deceased
	– place where medical treatment was sought
	– place of death
Signs, symptoms and their severity during the last illness	– severe fatigue
	– severe backache
	– pneumonia
	– chronic coughing
	– difficulty breathing
	– lack of appetite
	– vomiting
	– weight loss
	– bloody diarrhoea
	– pain/burning when urinating
	– surgery
Others	– source of help after death of respondent
	– problems faced by deceased relatives
	– changes in household composition

Results

Information was collected using the VA questionnaire and data are available on 104 deaths representing 5 per cent of the respondents (20–59) who were interviewed in 1998 (n=2 337). The socioeconomic and demographic characteristics of the deceased based on the MDICP 98 are reported elsewhere (Doctor 2002). In short, the results show that male deaths are highest in the

40–49 age group whereas female deaths are highest in the 30–39 age group. The average age for the deceased women was 33.5 years, while it was 38.4 years for men. The overall mean number of years of education completed is very low, with females having completed about 3 years and males about 3.6 years. The mean number of children ever born is 5.0 with males reporting 5.8 and females 4.2. Most people lived in houses with thatch or grass roof and in 1998 about two-thirds of the deceased respondents said they were very worried about catching AIDS.

Age-specific death rates, crude death rates, and the probabilities of dying are calculated using standard estimators (Preston, Heuveline and Guillot 2001). This involves (i) calculating a 3-year age-specific death rate (m_x) over these years for those who were initially interviewed in 1998 and then (ii) transforming the m_x into annual probabilities of dying q_x, within 10-year age groups[7]. The mid-year population multiplied by the length of the period, that is, three years, was used to estimate of person-years lived by the population[8]. These estimates are presented in Table 2. Cause of death was analysed as reported. Due to the small number of deaths in the sample, deaths rates have been calculated in four ten-year age groups, and specifically for the economically productive age group (20–59).

Table 2 shows that 104 people were reported dead by 2001 and this represents an annual crude death rate of 15 per 1 000 person years. Men and women had an annual crude death rate of 17 and 14 per 1 000 person years respectively. The annual probability of dying for the whole sample is 0.015 whereas for men and women it is 0.017 and 0.014. For men the probabilities are highest for the ages 40–59 years while for women they are highest in the 30–49 year age bands.

In order to assess the extent to which the mortality estimates in rural Malawi match with similar estimates at national level and also from other countries in southern Africa, the results from rural Malawi are compared with

7 Annual probabilities of dying are calculated in order to compare the estimates with those from the 1987 census as will be discussed later in this section. The m_x is interpreted as life table death rate in one year of time of everyone in a ten-year age range whereas the q_x is interpreted as the probability of dying in one-year of time of anyone in a ten-year age range.

8 Since some of the respondents were lost to follow up, the mortality estimates are based on the assumption that the mortality experience of those lost to follow up is similar to those who died, which might not be the case. Respondents who had moved to places very far from the study sites were not tracked down. Only respondents who had moved to places within a few kilometres away from the sampled villages were followed for interviews.

Table 2 Mortality rates by age and sex, rural Malawi, 1998–2001

Age interval (years)	*Deaths between 1998 and 2001*	*Person years lived (1998–2001)*	*Annual death rates (m_x)*	*Annual probability of dying (q_x)*
Total sample				
20–29	30	2 820	0.011	0.011
30–39	36	2 373	0.015	0.015
40–49	31	1 319	0.024	0.023
50–59	7	344	0.020	0.020
All ages (20–59)	104	6 855	0.015	0.015
Men				
20–29	11	875	0.013	0.012
30–39	11	998	0.011	0.011
40–49	21	833	0.025	0.025
50–59	7	290	0.024	0.024
All ages (20–59)	50	2 994	0.017	0.017
Women				
20–29	19	1 946	0.010	0.010
30–39	25	1 376	0.018	0.018
40–49	10	486	0.021	0.020
50–59	0	54	na	na
All ages (20–59)	54	3 861	0.014	0.014

Source: Calculated from the mortality data (MDICP 98 and MDICP 01).

Notes: "na" means not applicable; age is based on the MDICP 98; m_x= annual age-specific death rate for everyone in a ten-year age range; annual crude death rate (i.e. m_x multiplied by 1 000) is as follows: (a) total sample = 15 per 1 000; (b) men = 17 per 1 000; and (c) women = 14 per 1 000. The m_x was calculated as deaths/person years lived; q_x=probability of dying in one-year of time of anyone in a ten-year age range; $q_x = 1\text{-}e^{-m(x)}$. In this formula the assumption is that the death rate is constant in the age interval and in this case n=1. No deaths were observed for women in the 50–59 age group.

(i) the 1987 Malawi census data[9] for rural areas and (ii) those from Manhica Demographic Surveillance Site (DSS) in Mozambique for the period 1998–1999. The life table values from the census data are denoted as q_x^{CE}. From the resulting survivorship probabilities, an excess mortality factor (to quantify the magnitude) is also calculated, that is, the ratio of the q_x from the MDICP to the q_x^{CE} from Malawi census and the q_x from the Manhica DSS site.

For the purposes of this paper, the 1987 census is considered as the "pre-AIDS" period whereas the 1998–2001 as the "AIDS period". The meaning of the "pre-AIDS" period relates to the impact of the AIDS epidemic and not on the number of people living with HIV/AIDS since the first AIDS case in Malawi was reported in 1985 (Olsgard 1996). Cause of death was analysed as reported. Due to the small number of deaths in the sample, deaths rates have been calculated in four ten-year age groups, and specifically for the economically productive age group (20–59).

Although the choice of Mozambique (Manhica DSS site) is purely arbitrary, the two countries have some characteristics in common. For example, they share borders and Mozambique's life expectancy at 42 years is only slightly higher than that of Malawi at 40 years. HIV prevalence in Mozambique among adults (15–49) is 13 per cent which is somewhat lower than that of Malawi at 15 per cent (UNAIDS 2002a). Mozambique still ranks as one of the poorest countries in the world with an estimated per capita income of less than US$300 (INDEPTH Network 2002) whereas that of Malawi is even less than this at less than US$200.

The population of Manhica in mid-1999 reached 34 526 and about 44 per cent of the inhabitants were aged 15 and younger, 51 per cent were 15–64 years old, and 5 per cent were aged 65 and older. The Manhica population is peri-urban and rural, largely dominated by Muslims and Christians and the people are mostly subsistence farmers. Further details of the demography of Manhica have been reported in INDEPTH Network (2002).

Table 3 provides a comparison of estimates of mortality between MDCIP data and census data from rural Malawi; and between MDICP data and

9 The MNSO (1994) describes the Malawi 1987 census data in terms of overall methodology and analytical results as much better than the earlier censuses, that is, 1966 and 1977. The estimates are believed to have been arrived at with much more rigorous methods and subjected to consistency checks: "… the calculated indices [do] reflect that the age reporting was not as bad [compared to earlier censuses] implying that the age-sex data collected during the census [is] alright and can be used for further analysis" (MNSO 1994:12).

Table 3 Comparison of mortality rates between MDICP data and census data for rural Malawi; and between MDICP data and Manhica DSS site, Mozambique, 1998–1999.

Age interval (years)	*Annual probability of dying in Malawi census* $q(x)^{CE}$	*Annual death rates in Manhica* $(m_x)^{MZ}$	*Annual probability of dying in Manhica* $q(x)^{MZ}$	*Annual probability of dying in MDICP* $q(x)^{MD}$	*Ratio of* $q(x)^{MD}$ *to* $q(x)^{CE}$	*Ratio of* $q(x)^{MD}$ *to* $q(x)^{MZ}$
Total sample						
20–29	0.005	0.008	0.008	0.010	2.20	1.39
30–39	0.006	0.011	0.011	0.015	2.68	1.33
40–49	0.013	0.014	0.014	0.023	1.78	1.63
50–59	0.011	0.025	0.025	0.020	1.76	0.80
All ages (20–59)	0.008	0.014	0.014	0.015	1.95	1.04
Men						
20–29	0.003	0.007	0.007	0.012	3.61	1.67
30–39	0.004	0.020	0.020	0.011	2.72	0.56
40–49	0.005	0.022	0.022	0.025	4.51	1.11
50–59	0.009	0.035	0.034	0.024	2.57	0.70
All ages (20–59)	0.006	0.022	0.022	0.016	2.97	0.76
Women						
20–29	0.006	0.007	0.007	0.010	1.57	1.40
30–39	0.007	0.006	0.006	0.018	2.50	2.95
40–49	0.010	0.009	0.009	0.020	1.99	2.32
50–59	na	0.019	0.019	na	na	na
All ages (20–59)	0.010	0.009	0.009	0.014	1.41	1.51

Notes: $(m_x)^{MZ}$ is the annual age-specific death rate in Mozambique for everyone in the ten-year age range and is calculated from INDEPTH Network (2002), Table 6A.10, page 73; $q(x)^{MD}$ are reproduced from Table 2 of this paper (i.e. q_x values in column 5); "na" – means not applicable; annual crude death rate in Mozambique is as follows: (a) total sample = 14 per 1 000 person years; (b) men = 22 per 1 000 person years; and (c) women = 9 per 1 000 person years; $q(x)^{MZ}$ values are also calculated from INDEPTH Network (2002), Table 6A.10, page 73; No deaths were observed for women in the 50–59 age group in Malawi.

Manhica DSS (1998–1999) by age and sex. For both sexes, the 1998–2001 increase in mortality over the 1987 census shows that mortality almost doubled (ratio of 1.95) between the ages of 20 and 59. The ratios range from 1.76 for the eldest age group to 2.68 for the 30–39 age group. The biggest increase is in the age groups 20–29 and 30–39 with corresponding ratios of 2.19 and 2.68. For men, the ratio of observed mortality between the ages of 20 and 59 shows almost a three-fold increase in mortality over the 1987 census. The ratios range from 2.57 for the eldest age group to 4.51 in the 40–49 age group.

Women have a lower excess mortality factor of 1.41 between the ages of 20 and 49 than males at 2.97. There was no recorded female death in the 50–59 age group. The female excess mortality factor ranges from 1.57 (20–29 age group) to 2.50 (30–39 age group) in the discrete age groups. Overall, in all the age groups for the females, mortality increased by 41 per cent over the 1987 census compared to the almost triple increase in mortality by males.

The excess mortality factors for the MDICP–Manihca DSS data comparison are lower on average than the MDICP–Malawi census comparison. Overall, as was the case with the MDICP data, the death rates in Manhica increase with age. The crude death rate for the adult population as a whole is about 14 per 1 000 person years whereas for males and females it is 22 per 1 000 person years and 9 per 1 000 person years respectively. Although the crude death rate for the whole population in the MDICP data is higher by about 0.8 points than that for Mozambique, the difference in death rates between males and females in Manhica is greater than that of males and females in the MDICP (Table 2). In order to make the comparison clear, the excess mortality factor for Malawians compared with Mozambicans is calculated. The results in Table 3 (last column) show that for the adult population as a whole, mortality in the MDICP was higher than in Mozambique by 4 per cent. The highest increase occurred in the age group 40–49 where mortality was higher by 63 per cent. However, the sex-specific estimates show that, overall, mortality among males was lower in the MDICP than in Mozambique by 24 per cent (ratio is 0.76) whereas among Malawian females, mortality was higher by 51 per cent than their counterparts. In summary, these results suggest that mortality among rural Malawians in the MDICP was higher than their counterparts in Mozambique. More importantly, the mortality analysis conducted in Malawi seems to match (in the aggregate) with estimates from Mozambique, a country with similar demographic and socioeconomic characteristics. Clear differences are observed by sex as well as by age.

In the Malawi study the most frequently reported illnesses or diseases associated with terminal death were cough (42.9 per cent), malaria (37.4 per cent), difficulty breathing (34.1 per cent), diarrhoea (30 per cent), very thin or weight loss (27.7 per cent), pneumonia (27.5 per cent), fever (23.1 per cent), and rapid breathing (11 per cent). AIDS was given as a "cause" in 10 per cent of the deaths. The reported percentages here do not add up 100 per cent because multiple causes were recorded. In addition, the low AIDS deaths reported in this paper is consistent with similar studies in other parts of sub-Saharan Africa. For example, in rural communities of Mwanza region in Tanzania, Todd *et al*. (1997) found that HIV/AIDS was mentioned during the VA interview as a cause of death in 7 per cent (n=178) of the deaths. On the other hand, it is possible that HIV/AIDS may have been associated with stigma and shame among the relatives and that they did not want to talk about it.

Discussion and conclusion

The results of this study indicate a high level of adult mortality in rural Malawi during the 1998–2001 period compared to adult mortality level during an earlier period before the impact of HIV/AIDS. In addition, adult mortality in rural Malawi is also higher than that documented in other parts of sub-Saharan Africa, specifically the Manhica DSS site in Mozambique. The mortality estimates from rural Malawi using the MDICP are clearly approximate because of the relatively small sample of the longitudinal survey compared to other studies that have examined similar issues such as those reported in Kelly *et al.* (1998) and Cooper *et al.* (1998a). However, these estimates provide a sense of the level of adult mortality in areas where majority of deaths occur at home and consequently data on cause-specific mortality are scarce. As HIV prevalence in rural Malawi is estimated to be around 15 per cent (UNAIDS 2002b), and given the unusual prominence of diseases such as diarrhoea, and pneumonia, and weight loss as causes of death, it is reasonable to expect that HIV infection may be responsible for the observed death rates.

These results also seem to be consistent with those from a Lusaka 1995 study on adult mortality (Kelly *et al*. 1998) where it was found that among young adults, death rates were 20 times higher than in another study in rural and urban Nigeria (Cooper *et al.* 1998a). The Lusaka study comprised poor urban neighbourhoods where a total of 2 258 households (representing 6 440 adults and 5 073 children) were initially interviewed in 1995 and followed after two years. It was found that 29 per cent of all households reported one or

more deaths within two years, a total of 392 adult deaths (202 men and 190 women). In the Lusaka study, the most frequent causes of death were diarrhoea (20 per cent), malaria or fever (9 per cent), witchcraft (7 per cent), tuberculosis (7 per cent), and cough (6 per cent). AIDS was given as a cause in 3 per cent of deaths and the same frequency was reported for accidental or violent deaths (Kelly *et al*. 1998:883).

The Nigerian study (Cooper *et al*. 1998b), which was conducted in 1995, followed 7 628 adults over the age of 15 years in an urban cohort of Ibadan and 4 205 adults over the age of 25 years in the nearby rural district of Igbo-Ora. A follow-up was done every three months to see if a death had occurred. The only difference in this study with the Malawi and Lusaka study is the use of a panel of physicians to assign a cause of death in cases where sufficient information to do so was available. A total of 216 deaths occurred and they found that the crude death rate in Lusaka was 2.5 times higher than the Nigerian cohorts. The cause of death profile in Nigeria was: infection, 23 per cent; cardiovascular, 17 per cent; accidents, 7 per cent; cancer, 3 per cent; and other unknown, 50 per cent. The authors note that the difference with the Lusaka study is the absence of diarrhoea as an important cause, and the prominence of cardiovascular diseases (Cooper *et al*. 1998b:1740).

The World Health Organization (WHO) developed a provisional clinical case definition for AIDS in Africa where sophisticated diagnostic equipment may not be available (Quinn *et al*. 1986). The WHO reports that AIDS is defined with at least two of the major signs[10] associated with at least one minor sign[11]. This definition fits well with the reported terminal diseases or signs in rural Malawi. Although there is no measure of loss of body weight in the VA data, it was very clear reading through the VA reports, especially the descriptions of the weight loss, that loss of weight might have been more than the 10 per cent WHO lower limit. Quinn *et al*. (2001) further report that in a 1996 survey of 178 hospitalised patients in Kinshasa, Zaire (now the Democratic Republic of Congo), the WHO definition of AIDS was found to be

10 (a) Weight loss >10 per cent of body weight, (b) chronic diarrhoea >1 month, and (c) prolonged fever (intermittent or constant).

11 (a) Persistent cough for >1 month, (b) generalised pruritic dermatitis, (c) recurrent herpes zoster, (d) orophangeal candidiasis, (e) chronic progressive and disseminated herpes simplex infection and (f) generalised lymphadenopathy. The presence of generalized Kaposi's sarcoma or cryptococcal meningitis are sufficient by themselves for the diagnosis of AIDS (Quinn *et al*. 1986).

highly specific (93 per cent) with a positive predictive value of 82 per cent for seropositivity.

There are some limitations with these estimates of mortality in rural Malawi. The most important of these is the lack of corroboration of VA data with hospital records. It might be possible that because of the emergence of HIV/AIDS as a prominent health issue in society, informants may attribute almost all adult deaths to HIV/AIDS or other AIDS-related illnesses. The patterns of diseases for adults dying at a health facility might be different from those dying at a home. The validity of these results may also be affected by the length of the recall period. Deaths which occurred in 1998 soon after the first wave of the MDICP, may affect reporting of the informants. In addition, informants who received at least some medical information during an adult's hospitalisation, may provide information different from those who never come to a health facility (Nykanen 1995).

Although data are not available on a larger scale to provide enough evidence on the association of AIDS with adult mortality in Malawi, longitudinal studies such as the MDICP provides a leverage for us to make the claim that most of the adult deaths are AIDS-related. Neither all-cause nor cause-specific mortality rates derived from real data are available for any of the poor countries of southern Africa (Cooper *et al.* 1998a) as is the case in other parts of East Africa such as Tanzania and Uganda. Therefore, large and well-conducted studies of adult mortality are urgently needed in Malawi as well as in other parts of Africa. These data would be very useful in helping to model the epidemiological transition and execution of relevant policy programmes to prevent future epidemics.

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