Deaths in the family: AIDS, demography and poverty in Africa

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I was surprised when the invitations to this lecture went out how many senior professors responded by offering me some advice on how to go about tackling the occasion. Some of them, rather worryingly, appear to be still suffering from some kind of post-traumatic stress-related condition caused by their own Inaugural Lecture. The first advice that I got was that it was important that I start my lecture with a really good joke. This advice evidently came from someone who had never had the misfortune to hear what happens to a really good joke when I get my hands on it. So, I thought that I should probably ignore this idea. Someone else suggested to me that I should regard my Inaugural Lecture as an opportunity to review what I have accomplished in my career and thank some of the other people who have contributed to it. This seemed to be a helpful principle that I could use, but then the next person to offer me advice told me, "whatever you do don't give one of those lectures where you summarise your career and spend the whole lecture thanking everyone you have ever worked with - those are *so* boring". Another Professor told me that my best strategy was to make half of the lecture so utterly simple that anyone should be able to understand it; but the other half so specialised and technical that nobody in the audience would grasp what I was saying. That way, he said, they will think that you are both accessible *and* brilliant.

Anyway, what I plan to do is to hedge my bets. The lecture has two halves. The first half reviews some of the research I have been involved in over the last 20 years that was aimed at improving our understanding of the demographic impact of the AIDS epidemic in sub-Saharan Africa. In essence, this research seeks to establish how many people are dying of AIDS in Africa and who they are. The second half of the lecture, on the other hand, is concerned with research that I have been involved in recently that is trying to learn a bit more about the socioeconomic impact of the AIDS epidemic in sub-Saharan Africa. In essence, this research aims to learn a bit more about the impact of the AIDS epidemic on poverty and on the development

process. One thing I want to do in the lecture is explain why I think we will never be able to answer these questions very adequately. But I also go on to consider what we may be able to achieve. If you don't understand some parts of the lecture, don't worry about that – it is just me being brilliant.

Data on adult mortality in Africa

My interest in adult mortality in Africa dates back to early 1980s. It was John Blacker who first made me aware that adult mortality is a largely neglected topic in comparison with the huge interest that existed then and still does now in monitoring child survival, in understanding the determinants of death at young ages, and in developing and implementing interventions to improve child health. When I expressed an interest in the topic, John made it possible for me to get involved in the research project that he was setting up on the estimation of adult mortality using World Fertility Survey data from the developing world. I assume that he, like myself, had no idea that this was the first step on an intellectual journey would end up with my standing in front of you today.

Back at the beginning of the 1980s, the basic statistical information available on adult mortality in sub-Saharan Africa was both patchy and unreliable. In particular, throughout Africa the routine registration of deaths and production of statistics based on these death certificates was either very incomplete or not being attempted at all. Some countries had asked questions about adult deaths in censuses and surveys. Unfortunately, it was clear that respondents were not always providing accurate answers to these questions and that calculating conventional life table indices of mortality from the data that was obtained was far from straightforward.

That was the situation 25 to 30 years ago. How have things changed? Well the answer is hardly at all. Even today, South Africa and, for a period, Zimbabwe are the only countries in mainland sub-Saharan Africa that have produced useful routine vital statistics on mortality. Moreover, even in these countries, the quality of the data has remained far from perfect. A few countries continue to ask questions about adult deaths in their census. Most though, did not do so in their 2000 round censuses despite the explosive growth in AIDS deaths that took place during the 1990s.

The fact that only limited hard data on adult mortality in sub-Saharan Africa exist, does not discourage both international agencies and national governments from routinely publishing statistics on adult mortality for every country in Africa, indeed in the world. These statistics are then adopted by other researchers, journalists, politicians and lobbyists. For example, Barnett and Whiteside (2006) quote these statistics from UNAIDS on the devastating impact that the epidemic has had on life expectancy in eastern and southern Africa in their excellent book, *AIDS in the Twenty-First Century:*

> "Life expectancy at birth has dropped below 40 years in nine African countries – Botswana, Central African Republic, Lesotho, Malawi, Mozambique, Rwanda, Swaziland, Zambia and Zimbabwe. AIDS is the single most important reason for this fall. In Zimbabwe, life expectancy at birth was 34 years in 2003, compared with 52 years in 1990".

Alternately, one can go to volumes such the World Health Organization's *World Health Report 2006* to look up estimates of life expectancy and of the probability of dying between ages 15 and 60 in every country of the world. This tells us, for example, that WHO believes that life expectancy at birth in Zimbabwe in 2004 lay somewhere between the 33 year figure adopted by Barnett and Whiteside (2006) and 39 years. Equally, we learn, the probability that a 15 –year-old young man in Zambia will die before his 60th birthday is somewhere between 58 per cent and 78 per cent. For a young woman the estimates are marginally lower at 55 to 77 per cent.

If they are accurate, these are shocking numbers. But, as few data exist on adult mortality in Zambia, what are they based on? The answer in most African countries is a combination of census and survey data on child mortality and surveillance statistics on the HIV infection rates among pregnant women attending antenatal clinics. All the agencies use much the same procedure. They start by estimating what child mortality would be in the absence of the AIDS epidemic (see, for example, Figure 1). Then, having projected an estimate of childhood mortality forward to the desired date, they extrapolate from child mortality to the death rates at all other ages using a typical age pattern of mortality (Figure 2). Finally, they add back in estimates of AIDS deaths by age in both adulthood and childhood. The former numbers are estimated not from data on AIDS deaths, but using an epidemiologic model that

combines data on the prevalence of HIV infection with assumptions about how long infected individuals survive on average.

To summarize then, trying merely to describe adult mortality patterns in Africa is like trying to identify the scene portrayed in a jigsaw puzzle from which most of the pieces are missing, into which a few pieces from a completely different jigsaw have been introduced, and where the picture has partly worn off most of the pieces that one does have.

Levels and trends in adult mortality before AIDS

In order to understand the impact of AIDS on adult mortality in Africa, it is vital to understand the background mortality conditions that existed in Africa at the outset of the HIV epidemic. Figure 3 comes from a paper on mortality in Africa that I prepared for the UN Population Division (Timæus, 1999). It presents estimates of adult mortality based on all the different source of data that exist. In the main these are questions in national censuses or large-scale household surveys about deaths in the household in the previous year or about the survival of the mothers and fathers of each household member. Figure 3 plots trends over time in the probability of dying prematurely in adulthood, defined conservatively as the probability of dying between ages 15 and 60. It covers the period between 1960 and the mid-1990s.

These estimates confirm that Africa is a high mortality region. Throughout these decades, women's probability of dying prematurely in adulthood remained more than 20 per cent almost everywhere. Men's mortality was even higher (not shown). The estimates also show that Africa is characterised by large differences in mortality conditions between countries, making it difficult to summarize the situation in the continent. Many of these countries benefited from rapid declines in adult mortality over a period of several decades. In other countries, mortality stagnated. For example, all three Middle African countries on which we have data are characterised by high adult mortality but relatively low child mortality. At least until the onset of the AIDS epidemic, they were experiencing rapid mortality decline. A contrasting pattern is seen in Southern Africa, This region has some of the lowest levels of child mortality in Africa and moderate mortality among adult women, but rather high mortality among adult men. Moreover the rate of decline in mortality during the

1960s to 1990s was slow, allowing some countries in other parts of the region to catch up.

These results also suggest that mortality decline slowed or stopped in a number of African countries during the 1980s, albeit mainly those with fairly low mortality. War was not a factor in most of these countries and adverse trends developed too early in several of them for AIDS deaths to be the full explanation. Then, beginning in the late 1980s, adult mortality began to rise rapidly in several Eastern African countries.

Figure 4 is based on records of burials abstracted from the parish registers of the Evangelical Lutheran Church in Namibia for the period 1930 and 1990 (Notkola, Timæus and Siiskonen, 2000). These registers provide a unique longer-term perspective on mortality transition in sub-Saharan Africa that stretches back well before census and survey data became available. Figure 4 plots the evolution of child mortality, plotted on the horizontal axis, against the evolution of adult mortality, plotted on the vertical axis. In this case though, because the deaths of children who died without being baptised are missing from the church records, we look at child mortality at ages 1 to 9.

The estimates show that mortality of this population fluctuated somewhat in the 1930s and 1940s but remained high throughout these decades. The transition to low mortality was largely concentrated in a period of just 10 years from the early-1950s to the early-1960s. From then till 1990, mortality continued to fluctuate but remained low. Thus, the really important and striking changes in mortality in this population occurred at a time for which we know almost nothing about mortality trends elsewhere in Africa. It is also striking that adults contributed more to the overall decline in mortality than existing model life tables would predict. The lighter lines on Figure 4 represent average trajectories of mortality decline based on historical data from Western populations. The trajectory in Namibia is steeper, crossing the lines representing Western experience. Thus, during the transition to low mortality, a pattern of relatively high child compared to adult mortality (or low adult compared to child mortality) developed in Namibia.

There are other fragmentary mortality data for Africa in the 1950s that also suggest adult mortality was rather high. Moreover, except in the Middle African countries that I have already mentioned, almost all the estimates for the 1980s and 1990s suggest that low adult, compared with child, mortality had become typical of the African region. Thus, although the rate of mortality decline was probably slower in most other countries, the Namibian experience may be of more general significance. This is important for two reasons.

First, something rather dramatic and poorly understood happened to adult mortality in Namibia and probably other parts of Africa. Our research show that a range of developments contributed to the mortality transition in Namibia. The most important of these factors was the early establishment of an effective system of Western health care. What we do not know is why this benefited adults so much. We do not know which diseases were brought under control or what were the crucial interventions. Nobody thought to investigate this – the attention of the few health researchers who were working in Africa in the late 1950s and early 1960s was concentrated firmly on children.

The second reason why this sudden change in the age pattern of mortality is important is because, as I have explained, most official estimates of adult mortality in Africa are extrapolated from data on child mortality. Based on the fragmentary data for the 1950s that I mentioned, the UN Population Division started at that time to make adult mortality estimates using models that assume that adult mortality is high compared with child mortality. Inertia, and the messy and uncertain nature of the evidence that I have been able to assemble, mean that they, and more recently WHO and UNAIDS, mostly continue to do the same. I believe that the world has spent decades operating on the basis of overestimates of adult mortality in Africa and underestimates of life expectancy at birth.

What is certain is that the AIDS epidemic in sub-Saharan Africa has been unfolding in a diverse continent with a complex demographic history. Countries have very different levels of background mortality. Moreover, while adult mortality from cause other than AIDS was falling rapidly in many parts of Africa in the 1980s, other

countries had stagnating or even rising mortality even before the AIDS epidemic broke out.

Impact of AIDS on mortality patterns

Two new sources of data on adult mortality have become much more common in recent years that offer some hope of documenting the impact of the AIDS epidemic in Africa. Unfortunately, both have their limitations as well as potential. First, many African countries have included questions in one or more Demographic and Health Surveys about the survival of the siblings of respondents. Second, a number of demographic surveillance systems have been set up in Africa that aim to monitor all the birth and deaths occurring in the population of a limited geographical area. Such studies can only tell us, of course, about the mortality of these particular areas, not mortality in national populations.

The sibling histories that have been collected from women aged 15 to 49 in many of the Demographic and Health Surveys conducted in Africa ask women about the dates of birth and death of each of their brothers and sisters in turn. This provides all the data we need to calculate death rates. The analysis in Figure 5 uses data collected during the 1990s in 23 African countries. The problem with these sibling history data is that each DHS is too small to provide useful estimates of adult mortality for single calendar years and five-year age groups. To extract useful information from them, requires some rather energetic statistical gymnastics to smooth the data using a regression model. In particular, we combined the data from all the surveys to estimate the typical age-sex pattern of mortality increase due to AIDS rather than estimating this for each country (Timæus and Jasseh, 2004).

These DHS sibling histories confirm that adult mortality has risen sharply in Africa since HIV became prevalent. Countries differ markedly in the timing and speed of the rise in mortality. By the late 1990s the probability of dying between ages 15 and 60 exceeded 40% for women and 50% for men in several countries. The greatest increases in mortality have occurred among women aged 25-39 and men aged 30-44. The sibling histories suggest that the rise in mortality slowed by the late-1990s in some of the worst affected countries, such as Uganda and Zambia, but not in others, such as Malawi and Zimbabwe.

These estimates are mainly reassuring in that they are mostly in line with what is suggested by the HIV data that has been collected in clinics and surveys. However, some of the findings are unexpected and suggest that UNAIDS may be getting its estimates of ether background adult mortality or AIDS mortality wrong. Figure 6a compares estimates that UNAIDS produced a few years ago of adult mortality in Kenya using Spectrum with the empirical estimates from the sibling histories. They do not match at all. However, as Figure 6b shows, if one halves the level of background mortality assumed by UNAIDS without changing their estimates of AIDS mortality greatly, one can obtain a near perfect match. Having seen these results and others like them, UNAIDS decided to change the model life tables that it uses to estimate background adult mortality in Africa.

It is undoubtedly the case that some of the empirical mortality estimates are wrong – the very low estimates for Nigeria in Figure 5 are an evident example. Equally, they undoubtedly do contain genuine information on the mortality impact of AIDS in sub-Saharan Africa. To my mind, this demographic evidence should be incorporated systematically into the procedures used to produce estimates of the global HIV and AIDS epidemic. It is somewhat perverse to estimate AIDS deaths from data on HIV infections without routinely checking the estimates obtained against the empirical data on adult mortality. This is particularly the case when most HIV prevalence data refer only to pregnant women, but we have measured the mortality of adult men directly.

The last piece of research on increasing mortality due to AIDS that I want to mention aims to examine the increase in adult mortality associated with the spread of HIV/AIDS in Southern Africa (Timæus, 2007). It assesses the extent to which estimates for several populations in the region share common features. They comprise the civil registration data for South Africa for 1990, 1996, 1999/2000 (Timæus, Dorrington, *et al*., 2001) and for Zimbabwe in 1986, 1992, 1995 (Feeney, 2001), surveillance data for 2000 from the Africa Centre Demographic Information System at Hlabisa, KwaZulu-Natal, South Africa (Hosegood, Vaneste and Timæus, 2004), and the Evangelical Lutheran Church parish registers for the North-Western Namibia in 1980-2000 (Notkola, Timæus and Siiskonen, 2004). In particular, I wanted

to check the estimates coming out of the national civil registration systems in South Africa and Zimbabwe against estimates from surveillance sites. I also wanted compare the impact of AIDS on mortality by age in Southern Africa with a model pattern of AIDS mortality derived from surveillance data from Tanzania.

It turns out that age patterns of mortality increase are similar in the different Southern African populations (Figures 7). No obvious discrepancies exist between the national estimates and those based on surveillance data. Adult AIDS deaths occur between ages 25 and 65 for men, peaking at about 40, and between ages 20 and 60 for women, peaking at about 35, although the increase in women's mortality may be occurring at slightly older ages in Namibia than in the other two countries. The age pattern of mortality from AIDS in Southern Africa is also similar to that in for Tanzania, though more women aged 40+ and men aged 50+ may be dying of AIDS in Southern Africa than in Tanzania (see Figure 8). The lack of variability in the age pattern of mortality increase due to AIDS suggests that a 1-parameter model of AIDS mortality would be adequate for most projection and modelling purposes.

Socioeconomic impact of AIDS: the short-term v. the longer run

Let me now turn to consider the socio-economic impact of this huge rise in the mortality of young adults in Africa. What happens to the survivors? As a starting point we can usefully distinguish between the immediate micro-level impact of AIDS cases and deaths on people and activities linked directly to the index person and longer-term, macro-level or systemic effects.

I am not going to say much in this lecture about the macro-level systemic or structural impact of the AIDS. Even in the fairly short-term, a massive rise adult death rate may tend to disrupt the economy, produce de-urbanization, and diminish the effectiveness of institutions throughout society. However, these effects are probably modest. Population will not decline in most of Africa, but grow more slowly. Moreover, even before AIDS epidemic hit, the region was characterised by extensive chronic poverty, a surplus of low-skilled labour, extremely rapid turnover of skilled staff in the public sector, and bureaucracies that were sometimes achieving almost nothing. In the longer-term though, as Bell, Devarajan and Gersbach (2006) have argued, the most worrying effect of AIDS is likely to be that a generation of

young people is now growing up whose family life and education has been disrupted by AIDS and the orphanhood of many of their number. Quite what the effect of this will be is uncertain – in part because it depends on decisions and actions that have yet to take place. However, one has to be concerned not just about literacy and formal educational qualifications. For example, who will teach the orphans to farm or how to care for their own children in the future?

The KwaZulu-Natal Income Dynamics Study (KIDS) is a household panel based on 1354 households first interviewed in 1993 (May, Agüero, *et al*., 2007). They were revisited in 1998 and again in 2004 after I joined the scientific team responsible for the study. When adults with children move out of panel households we attempt to interview their new household and in 2004 we also followed up the children who had been fostered out. Each wave of KIDS has collected detailed information on household income, expenditures and wealth. The study also collects full demographic information on both resident and non-resident members of the households, including details of all deaths.

Table 1 uses household fixed-effects regression to examine the determinants of the proportion of the children in KIDS households who have completed at least two grades fewer than expected for their year of birth (Timæus and Boler, 2007). In particular, it examines whether orphans were more likely to have dropped behind at school between 1998 and 2004 than unorphaned children living in the same households. By 2004 about a quarter of school-aged children were paternal orphans and about an eighth maternal orphans. Late enrolments, grade repetition and dropout combine to leave about half the children 2+ grades behind at school by their late teens.

We find no evidence that death of the mother affects progress at school. This probably reflects the small sample of maternal deaths rather than the absence of an effect. In contrast, paternal orphanhood and children with father in a different household are much more likely to drop seriously behind at school. Almost none of the beneficial effect of living with fathers arises because such families are less poor than others. Poor children do worse at school than better-off children but orphans are not particularly poor. Moreover, given that children with absent fathers are

doing just as badly at school with those whose fathers that have died, it is probably the lack of fathering, rather than the shock of bereavement, that is of importance. I find these findings very worrying. If the problems of orphans were largely financial, one could imagine intervening successfully to support them. For example conditional cash grants are very popular with the development agencies currently and might be of assistance. However, I find it very hard to imagine how we might attempt to maintain educational levels in Africa by addressing the consequences for children of not being fathered.

Repugnant conclusions and comparisons

Turning to the more narrowly economic consequences of AIDS, the household of a person living with AIDS is likely to lose the income of the sick person and anyone else who is unable to work because they are involved in providing care. It will incur expenses in accessing health care and medicines and is eventually likely to have to pay for a funeral. For employers the main direct consequences of the AIDS epidemic are increased levels of absenteeism and higher rates of staff turnover. For small-scale farmers in Africa, of course, the domestic group and the agricultural enterprise are essentially the same entity and their households have to deal with all these issues.

Whether or not they receive ART, the impact on any household of one of its members developing AIDS can only be adverse. The economic consequences of that person's death are less clear cut. Certainly, death removes the burden of time and money costs associated with providing health care. Moreover, if the person who died had never been a net economic contributor to the household, his or her death may leave the household better off than it was originally, in at least economic terms. We should accept that the AIDS epidemic in Africa is benefiting some directly-affected households and even some whole communities. As has been observed before, the death of poor people reduces the prevalence of poverty just as killing off the sick would reduce the burden of disease. Making this point recently in a recent paper, Cogneau and Grimm (2005) describe this as a 'repugnant conclusion'.

The term "repugnant conclusion" is one coined by the Oxford-based philosopher Derek Parfit (1984). Ironically, it is precisely the utilitarian logic that leads to Parfit's

"repugnant conclusion" that explains why the AIDS epidemic would remain a bad thing even if its effect was to reduce the prevalence of poverty in Africa. Let me explain. Parfit postulates the following situation. Imagine a population that enjoys a high standard of living. If we add some extra people to the population at a lower but still high standard of living, have we not increased total human welfare (Figure 9)? Now eliminate inequalities: are not things even better? OK, repeat indefinitely – one ends up with the repugnant conclusion that the total welfare of a huge population living in misery must be higher than that of a much smaller population living in affluence. Parfit's argument is that he finds this conclusion repugnant and yet all the ways he can think of side-stepping the logic of his argument lead to either even more morally repugnant or absurd implications.

The most obvious counter to Parfit's argument is to suggest that we should not be concerned with total welfare, but with the average welfare of the population. In fact, I doubt that any of you would wish to claim this. Why? Return to the issue of AIDS deaths. In effect these run the process that led to the repugnant conclusion in reverse. It is because you agree with Parfit's utilitarian logic, that you find it unacceptable to solve the problem of poverty by killing off poor people. The lost welfare of someone who dies does matter and this is something that we must never forget. It is entirely possible that the impact of the AIDS epidemic may be to leave some individuals or groups better off. However, most of the welfare costs of the AIDS epidemic are incurred by the people that die of AIDS. Viewed in reverse, Parfit's logic seems far less repugnant. Unlike Kanbur and Mukherjee (2005), I personally do not see any great need to devise a method for putting a value on welfare lost by people who die prematurely. However, though it is important to investigate the impact of AIDS on the welfare of survivors, we should always remember that such impacts constitute only a small part of the total costs of the AIDS epidemic.

Let me push this point a little bit further. To my mind the most convincing objection to Parfit's logic has been proposed by Partha Dasgupta (1989, 2005). Dasgupta argues that when considering optimal population size it is important to distinguish real people and potential or non-existent people. Births that couples may or may not

choose to have in the future do not currently have zero welfare; they have non-existent welfare, which is a very different thing. If we prevent population increase by restricting fertility, there is no loss of welfare to the people who are never born as a result. So long as we avoid induced abortions and perhaps use well-timed abstinence to do this, not contraception, even the US administration and the Vatican would not judge it to be a sin. The situation is quite different from one in which population shrinks because of the death of real people.

Consider this passage from a paper in *The Lancet* by John Cleland and Steve Sinding (2005). They are arguing that excess fertility is a bigger brake on economic growth than AIDS mortality in most of Africa:

> "we believe that AIDS is not yet, as is so often claimed, the main threat to development in most countries. Continued high fertility rates and rapid population growth could prove to be more serious obstacles to poverty reduction than AIDS in most, although not all, African countries".

The evidence may or may not support this conclusion. However, Cleland and Sinding are not making a fair comparison. To be provocative, one might even call it a repugnant comparison. This is because they consider only the benefits to average welfare that might result from intervening to reduce either fertility or AIDS mortality. However, as I have argued, the problem with focusing on average welfare is that, while it is perfectly reasonable to ignore the non-existent welfare of people who are never born, it is quite wrong to ignore the longer lives that millions of people would live if we intervened successfully to prevent AIDS deaths.

Death and the African family

For those of us with some training in epidemiology, it is tempting to think about the impact of AIDS in terms of relative risk or population-attributable risk. In other words, to quantify the impact of AIDS on poverty we might compare the prevalence of poverty among those households exposed to AIDS deaths with the prevalence of poverty in other households. I want to argue that we need to extremely cautious about how we interpret such comparisons. One obvious issue is that the households in which someone dies of AIDS are not a random sample of all households but distinctive in all sorts of ways. In addition, households that are not directly affected

by the epidemic are unlikely to remain unchanged by it. Indeed, unaffected households may actually benefit from the AIDS epidemic because their members gain access to the jobs, land, housing and other resources of individuals who die. In other words, the major consequence of the AIDS epidemic may not be a reduction in average incomes but a large rise in inequality. The AIDS epidemic may operate like a mortal lottery or sweepstake in which those lucky enough to remain uninfected with HIV win all.

Households where nobody dies may also be affected indirectly by the AIDS epidemic because they are inter-linked with directly-affected households in more benign ways. I think it fair enough to say that a lot of economic theory is based on what one might call a billiard ball theory of the household. Households are considered as internally undifferentiated units that present a common interface to the outside world and relate to each other solely through the market. Such simplified models have their uses but are inappropriate in the present context. In contrast to the billiard ball model, African families tend to have blurred and overlapping boundaries and are bound together by complex networks of mutual support and obligation involving an extended network of kin and affines. Sometimes this network of relationships can be exploitative; usually it is supportive.

Of course, one must be cautious about making generalisations about the African family. Families in, say, Senegal differ from those in South Africa just as families in Greece differ from those in England. Moreover, even within a particular cultural context, families differ from one another and some individuals quarrel with their relatives and become estranged from them. Nevertheless, African families do tend to share a series of features that distinguish them from Eurasian families. These features include aspects of the marriage system such as exogamy (usually), polygyny (potentially), bridewealth, and large age gaps between spouse. They also include the importance of resource sharing by extended family groups defined by shared descent; the tendency of members of these extended families to live together in what can become very large households; the ongoing interest of the family's ancestors in its everyday life; and the gerontocratic nature of authority relationships within the family. Finally, labour migration and dual residence are common in many parts of

Africa. Often it can make sense in many ways to regard people living large distances apart from each other as members of the same household. These features of African family systems are crucial to understanding how the impact of AIDS plays itself out at the level of the household.

If households did not respond to an AIDS death, the economic impact on the household of such deaths would equal the net contribution of the dead person. Most young adults will be net contributors to the household. Often they will be the principal breadwinners. Some of them however, notably the unemployed, might be dependents. Whatever the emotional distress it causes, the death of a dependent individual may be of economic benefit to the surviving members of the household.

In reality, households do respond when their income changes as a result of the illness or death of one of their members. The responses that might seem most obvious to the Western members of the audience include reducing consumption, borrowing money from a bank, and finding alternative sources of income. These are the only responses that would be available to a billiard ball household. In addition, the costs of disease and deaths can be shared by households. Once again though, there is more than one way of achieving this. The first possibility is to transfer resources between households. This is the more obvious strategy to the Western mind. However, a second possibility exists. It is to transfer people between households. For example, it is generally recognised that sick individuals often move back to their parents' households in order to obtain care. In addition though, households affected by AIDS may either transfer out dependent members, for example by fostering children with relatives, or they may pull in economically-active adults to provide replacement (productive and reproductive) labour (for example, by remarriage).

Of course, other researchers have noticed that households mount demographic responses to shocks. For example, young men may migrate to urban areas if a household experiences crop failure. My argument is that we need to consider "push migration", fostering, and other specific forms of inter-household mobility as instances of a more general phenomenon. To understand how households respond to the AIDS epidemic, we need a comprehensive typology of the ways in which

households can respond. I have suggested that our research needs to identify the inter-linkages between households in an extended family as well as the responses that the surviving members of a household can mount on their own. In addition, we need to consider how households manipulate not just income and expenditure, that is the numerators of our measures of poverty and welfare indices, but their denominators, which is to say household memberships. One of the most important responses to the death of a household member in Africa is to adjust further the demographic composition of the household.

The statistics in Table 2 also come from the KIDS study. They document just how much demographic turnover goes on in South African households. Even in the absence of AIDS a huge amount of mobility would occur at the household level in Africa. Much of this is stochastic in nature. For example, someone gets a job. Other inter-household moves are linked to the unfolding of the life course and developmental cycle of domestic groups. Moreover, AIDS is only one of many developments of economic importance that will influence the standards of living of individual households. Nevertheless, households in which adults have died are clearly less stable than other households.

KIDS also shows that the households in which adults have died tend to be poorer than other households. However, because it is a longitudinal study, we know that this is because such households were already relatively poor before that adult died. These descriptive statistics provide little evidence that death leads to falls in households' standard of living. Moreover, in a sophisticated econometric analysis, Carter, May *et al*. (2007) demonstrate that the impact on standards of living of deaths from disease of adult household members is limited to the better-off households who would otherwise have improved their economic status yet further (Figure 10). The impact of adult deaths on the incomes of the poor is limited. Does that mean that AIDS is having no economic impact on poor households? No, of course not! Households where adults have died lose some of their assets and savings, whereas other households have tended to accumulate wealth between the waves of KIDS. The fixed-effects conditional regression in Table 3 shows that, in this respect, adult deaths have a serious impact on households whatever their initial level of income or

wealth. They end up with about 30% less savings and assets than other households. Poor households are hit hard by the AIDS epidemic. In South Africa though, their demographic and economic responses and the assistance provided by the social grants available in that country enable them to maintain the minimal standard of living required to survive.

My general point is that microeconomic analysis usually treats demographic change as exogenous, or even ignores it entirely. Most demographic analyses treat socioeconomic status as an exogenous explanation of demographic phenomena that is unaffected by them. The challenge to welfare posed by the HIV/AIDS epidemic in Africa highlights the limitations of these analytic traditions. A case of AIDS is a phenomenon that has both demographic and economic dimensions. The ways in which households can respond are also both economic and demographic. And over and beyond this, the demographic characteristics of the household are built into the measures of the outcomes, such as poverty and average incomes, that we wish them to explain. A more sophisticated conceptualisation of the inter-relationships between demographic and poverty dynamics is essential if we are to hope to understand the impact of AIDS.

Of course, my propositions have worrying implications for our ability to empirically assess the impact of AIDS on African households. Insofar as households are successful at persuading members of their extended families to share the burden of AIDS cases and deaths with them, most households are likely to be either directly or indirectly affected. The impact of the epidemic will become diffuse and pervasive, and will be almost impossible to identify. Moreover, to the extent that those households that are lucky or selfish enough to insulate themselves from the adverse impacts of the AIDS epidemic then manage to benefit from opportunities that it creates, it becomes even more difficult to imagine that a control group or counterfactual exists against which we can measure impact.

Conclusions

1. In his Inaugural Lecture to LSHTM in January of this year, John Whittaker explained that much of his previous work in genetic epidemiology has already become obsolescent because rapid advances in laboratory technology and our

understanding of human genetics were constantly redefining the statistical challenges faced by the field. The worrying thing about my research over the past 25 years is how little of it has become obsolescent. Obviously, I would love to believe that this reflects my brilliance, but it does not. Instead, the problem is that the data remain limited and inadequate, demographic methods have not advanced greatly, and our empirical and theoretical understanding of how African households to respond AIDS and other adult deaths and the outcomes that they achieve remains rudimentary.

2. Nevertheless, although the evidence as to levels, trends and patterns of adult mortality in Africa is limited, it is not as weak as many researchers and agency staff believe. It general terms, it supports the picture of the scale of the AIDS epidemic in Africa that we have built up during the last decade or so. In some instances though, it throws out a challenge to conventional wisdom that has not been given the attention that it deserves. In particular, I have argued that strong evidence exists that the model life tables usually used in African populations tend to overestimate adult mortality in comparison to child mortality and thus bias downward estimates of life expectancy made from data on children.

3. Barnett and Whiteside (2006) point out that it is much easier to measure the immediate shock of someone developing AIDS and dying than it is to determine the impact on the various sectors of national economies or on countries as a whole or to assess the long-term implications of these deaths for the next generation. I have argued that it is also nearly impossible to measure impact at the micro level during the few years surrounding an AIDS death.

4. The evidence tends to support the commonsense view that AIDS deaths usually have a negative impact on the households of the individuals who die. Effects on inter-household inequality are likely to be large, with at least some unaffected households benefiting from the AIDS epidemic. In South Africa, most of the benefits of the establishment of democratic rule in 1994 have gone to those households that combine high levels of human capital with the good fortune that none of their adult members have yet developed AIDS.

5. Notwithstanding this, African extended families are acting to greatly reduce the divergence in the fortunes of directly hit and other households. I have suggested that African family systems can be considered as a sophisticated mechanism for responding to adversity by sharing out the impact of household shocks. AIDS is merely one novel, though horrifyingly common, such shock. African families survive by extending social obligations for mutual support across an extended network of kin.

6. Lastly, I have argued that in addition to pooling resources, African households respond demographically to economic shocks far more often than households in most other parts of the world. They make flexible use of an "alternative economic strategy" of moving people between households so as to maintain both those individuals' well-being and that of other family members. To understand the impact of the AIDS epidemic in Africa, is going to require more demographically sophisticated economic theory and more economically sophisticated demographic theory.

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Table 1: Odds of being 2+ grades behind at school, Kwa-Zulu Natal, children aged 9 to 14 in 1998 and 15-20 in 2004. (Source: Timæus and Boler, 2007)

Variable	Coding	Odds ratio	95% CI
Sex of child	girls v boys	0.44	(0.37 - 0.53)
Household expenditure per head (relative to poverty line)	ln(poverty score)	0.84	(0.71 - 1.00)
Father's residence and survival	non-resident member	1.24	(0.83 - 1.87)
	not a household member	1.72	(1.31 - 2.27)
(Reference: resident)	father dead	1.71	(1.27 - 2.32)
Number of children			4190

Table 2: Demographic and economic dynamics of KIDS households.

	No adult deaths 1998-2004	1+ adult deaths 1998-2004
Number of households, 1998	605	258
Average size in 1998	6.4	9.2
% that died out by 2004	8	6
% that split into 2+ households	34	47
% that fostered out children	25	36
Of unsplit households, % by 2004 with:		
1+ adult women moving in	25	25
1+ adult women moving out	37	44
1+ adult men moving in	26	30
1+ adult men moving out	34	35
Median expenditure per head, 1998 (as % of a poverty line of R322 per month)	99	63
% change in expenditure by 2004	26	35
Median net wealth per head, 1998 (Rand, 2000)	30200	28300
% change in net wealth by 2004	+5	-26

Table 3: Impact of adult deaths on net household wealth, KIDS 1993-2004.

Variable	Coefficient	s.e.
Any adult deaths, *t*-1 to *t*	-0.351	0.118
ln(net wealth) at *t*-1	-0.0316	0.0875
ln(net wealth)^2 at *t*-1	-0.0182	0.0061
Household size at *t*-1	0.0282	0.0182
1998-2004 versus 1993-98	0.261	0.080
Constant	11.888	0.382

Household fixed-effects model; 2150 observations on 841 households.

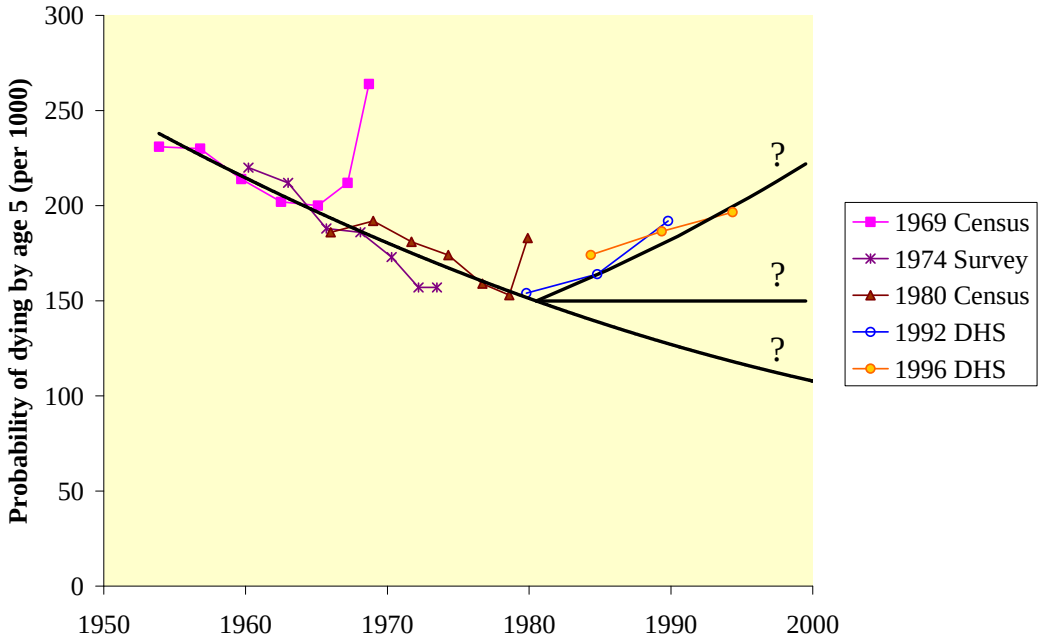

Figure 1: Trends in childhood mortality in Zambia, 1950s-1990s, and possible extrapolated trends in non-AIDS mortality. (Source: UNICEF database)

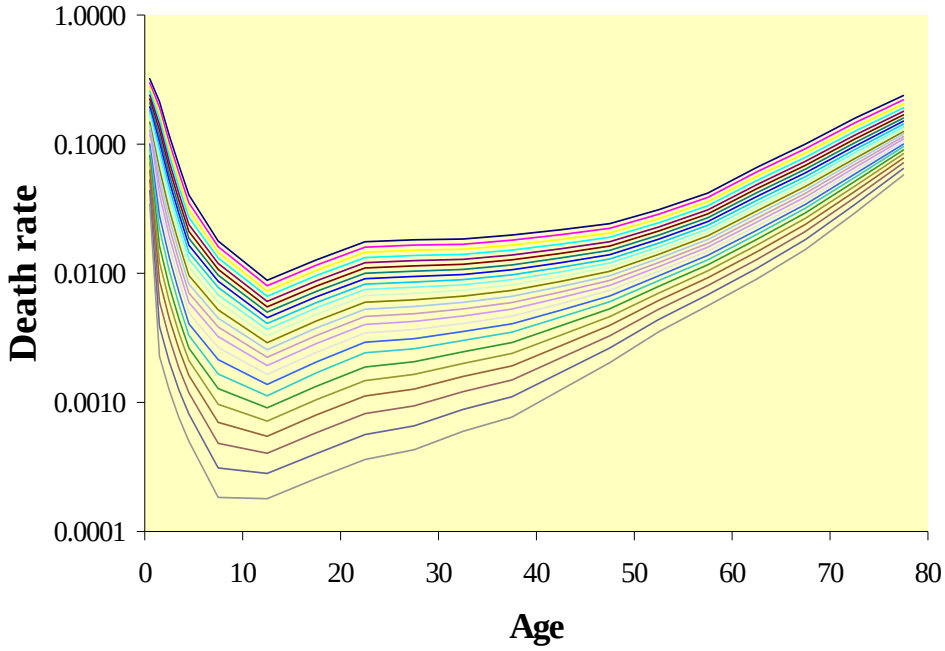

Figure 2: Death rates by age at different levels of mortality. (Source: Princeton South model life tables)

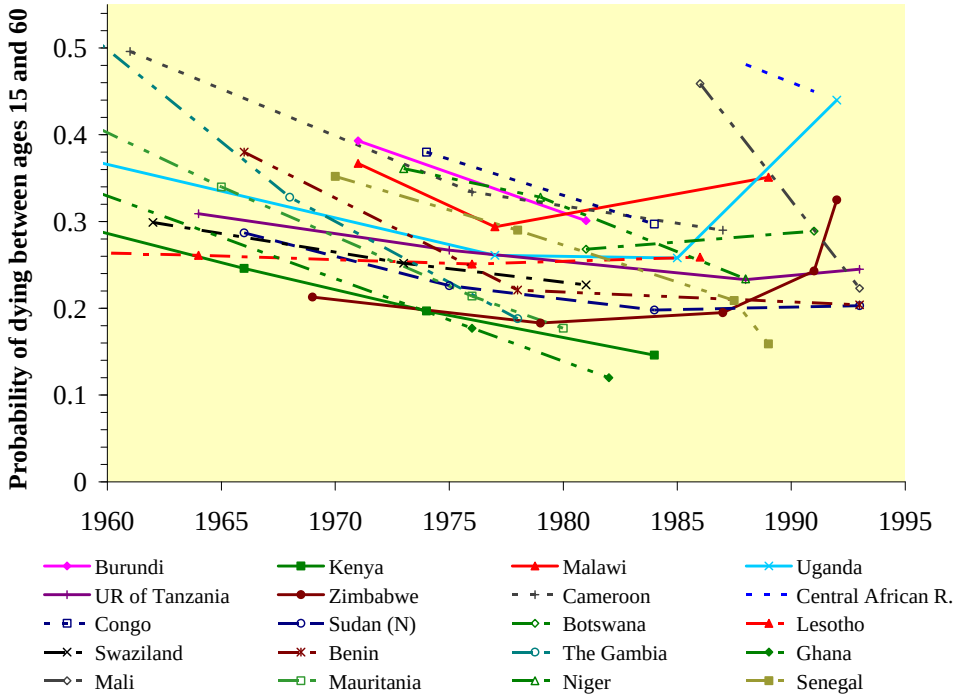

Figure 3: Trends in mortality between ages 15 and 60, women. (Source: Timæus, 1999)

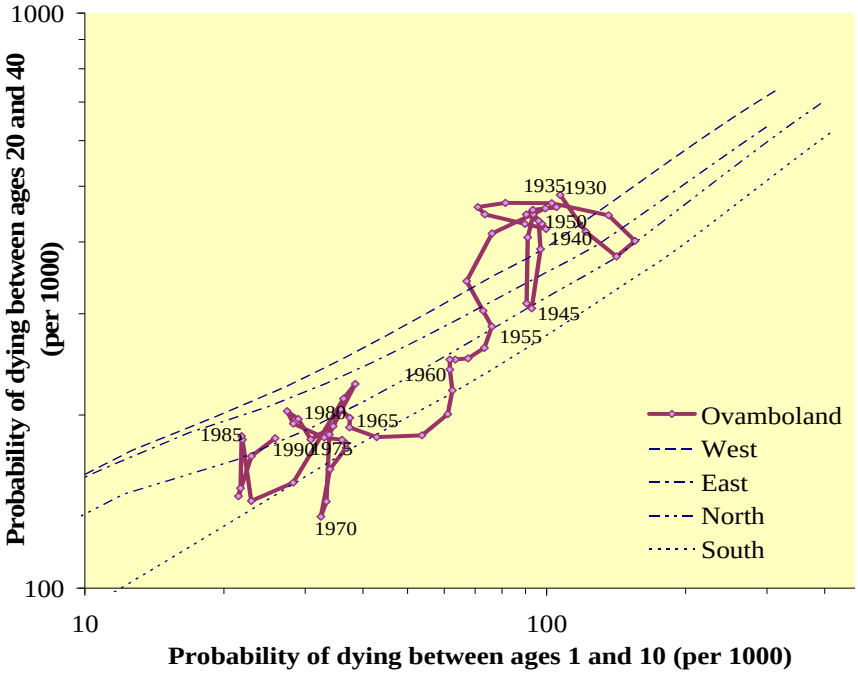

Figure 4: Evolution of mortality in Ovamboland, Namibia, 1930-90. (Source: Notkola, Timæus and Siiskonen, 2000)

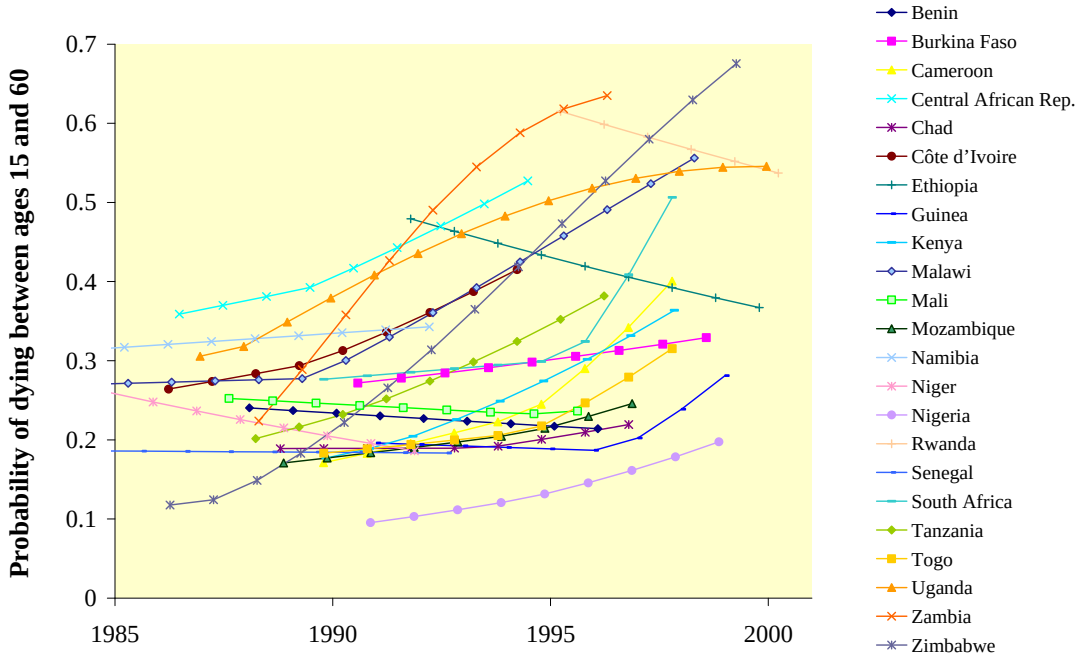

Figure 5: Trends in men's mortality between ages 15 and 60. (Source: Timæus and Jasseh, 2004)

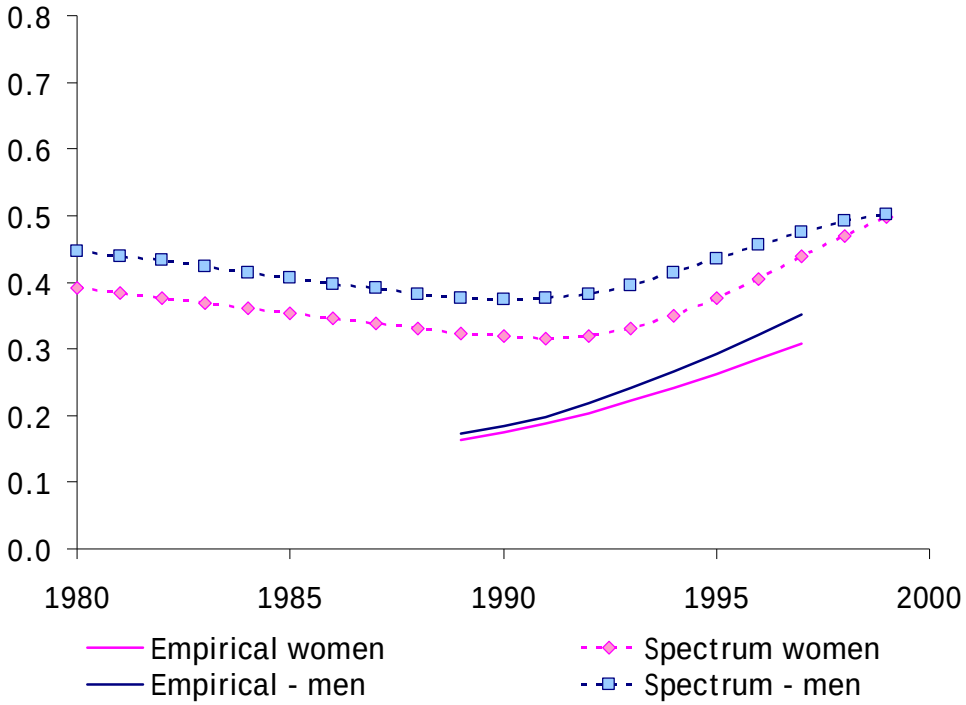

Figure 6a: Empirical and UNAIDS' estimates of mortality at ages 15 to 60, Kenya. (Source: Timaeus and Dorrington, unpublished presentation, 2005)

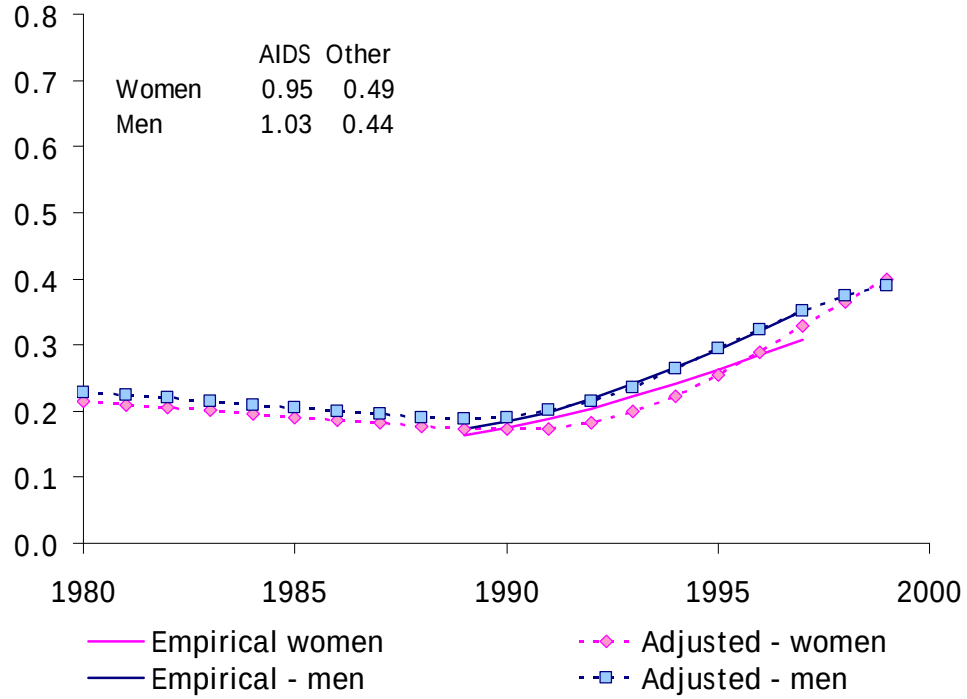

Figure 6b: Empirical and adjusted UNAIDS' estimates of mortality at ages 15 to 60, Kenya. (Source: Timaeus and Dorrington, unpublished presentation, 2005)

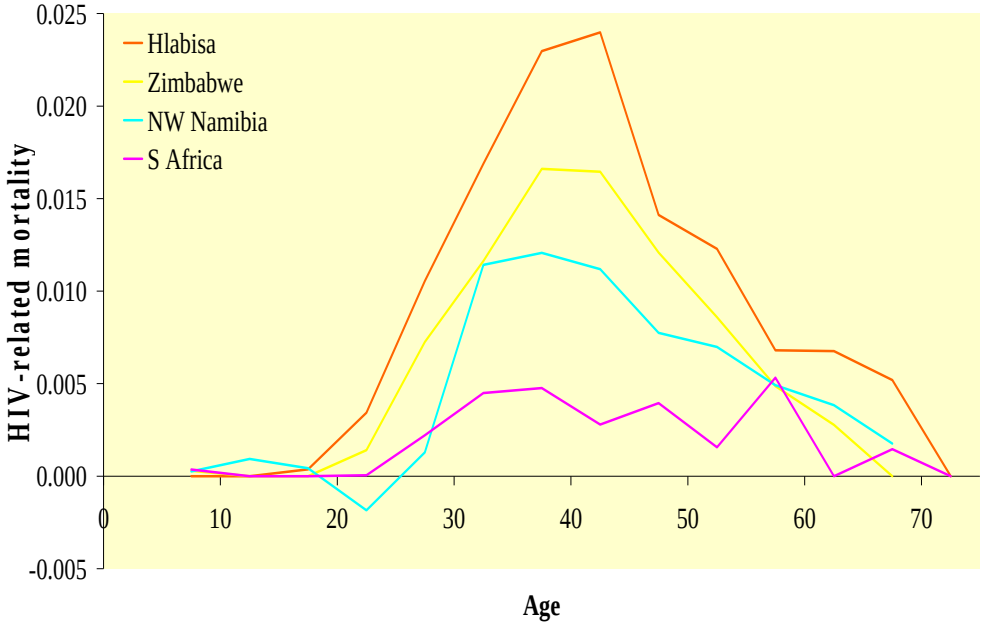

Figure 7a: AIDS mortality in four Southern African populations, men. (Source: Timæus, 2007)

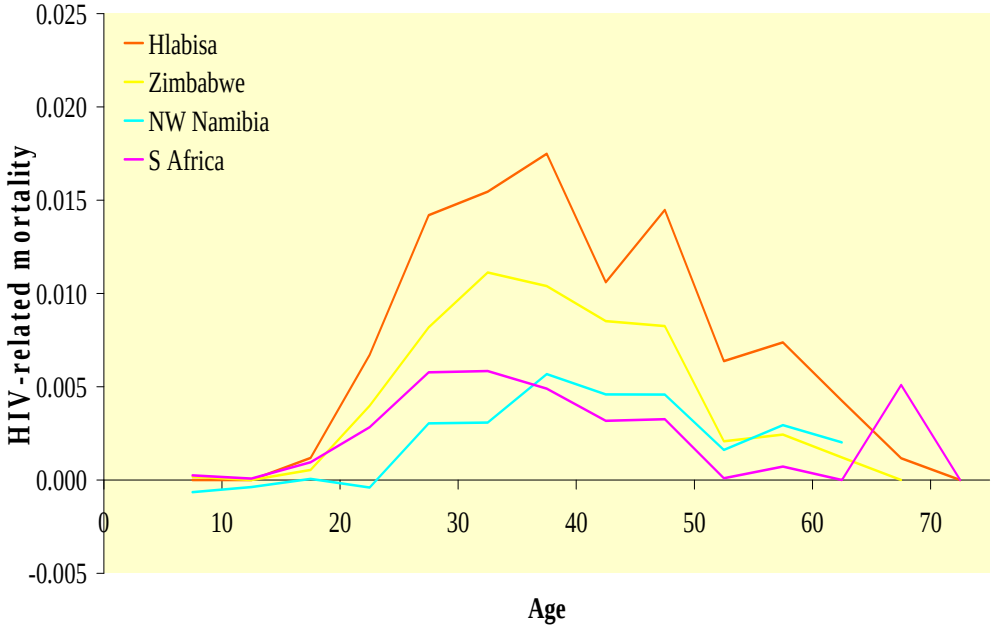

Figure 7b: AIDS mortality in four Southern African populations, women. (Source: Timæus, 2007).

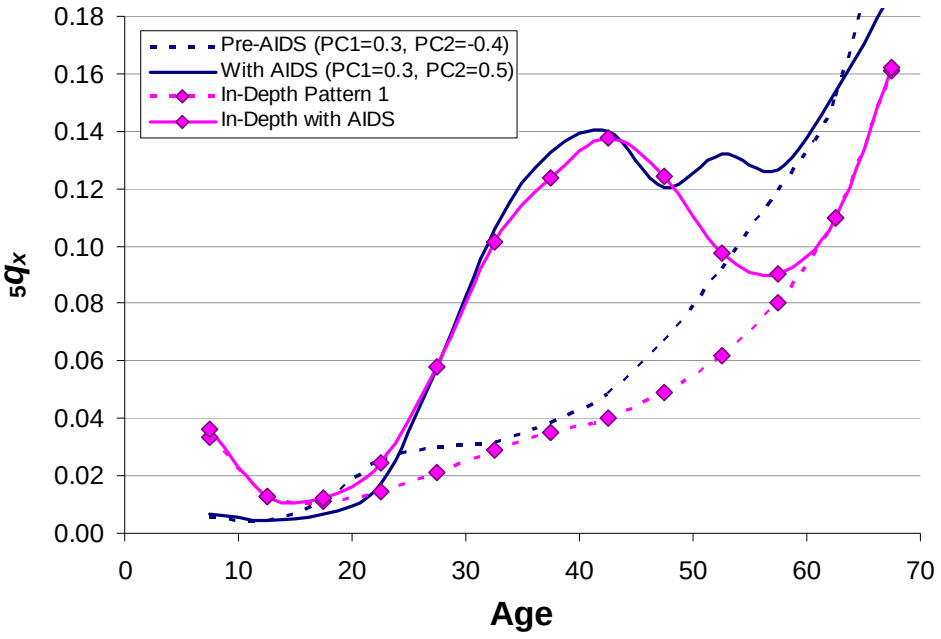

Figure 8a: Comparison of the Southern African principal component (PC) and INDEPTH models of the probability of dying by age ($_5q_x$) in populations with and without AIDS mortality – men. (Source: Timæus, 2007).

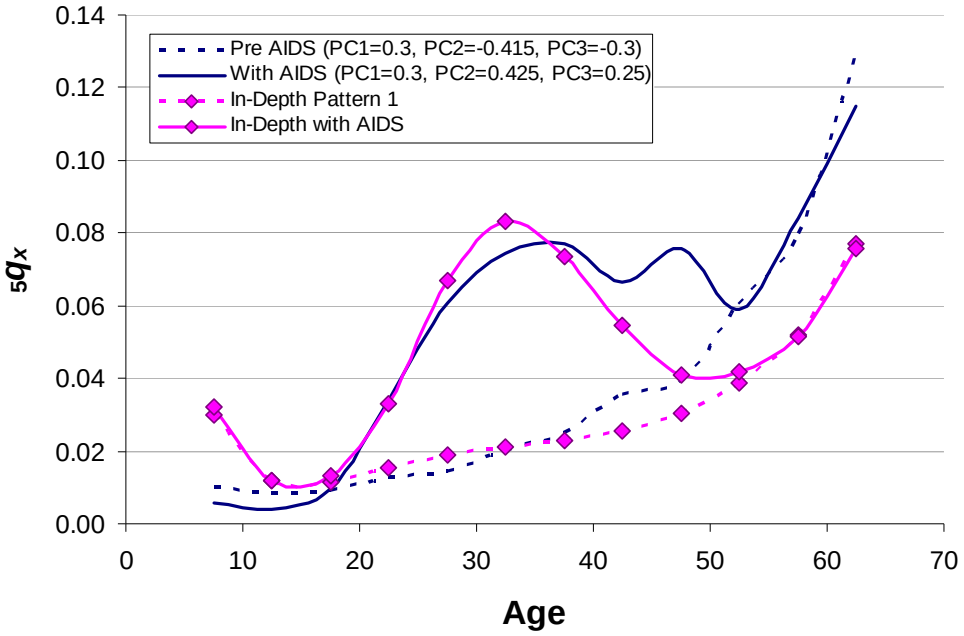

Figure 8b: Comparison of the Southern African principal component (PC) and INDEPTH models of the probability of dying by age ($_5q_x$) in populations with and without AIDS mortality – women. (Source: Timæus, 2007).

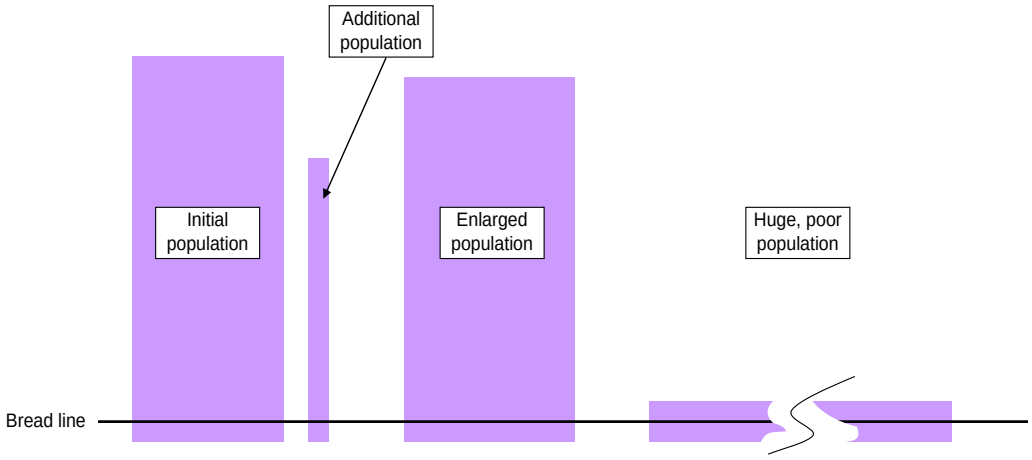

Figure 9: Arriving at Parfit's (1984) "repugnant conclusion".

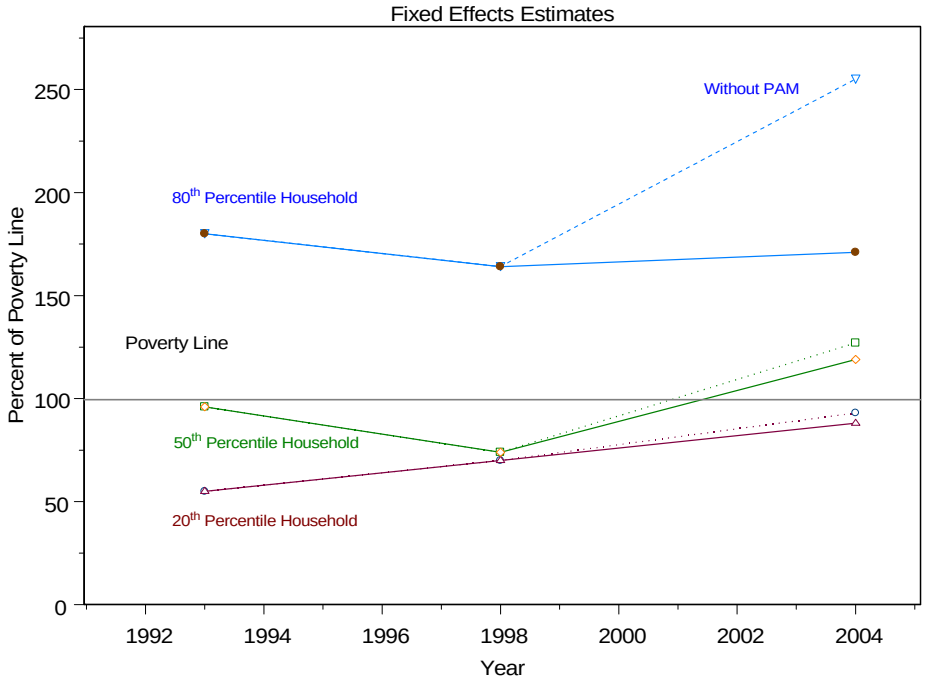

Figure 10: Impact of premature adult deaths (PAM) on income trajectories relative to the poverty line by level of initial income, KwaZulu-Natal. (Source: Carter, May *et al*., 2007)

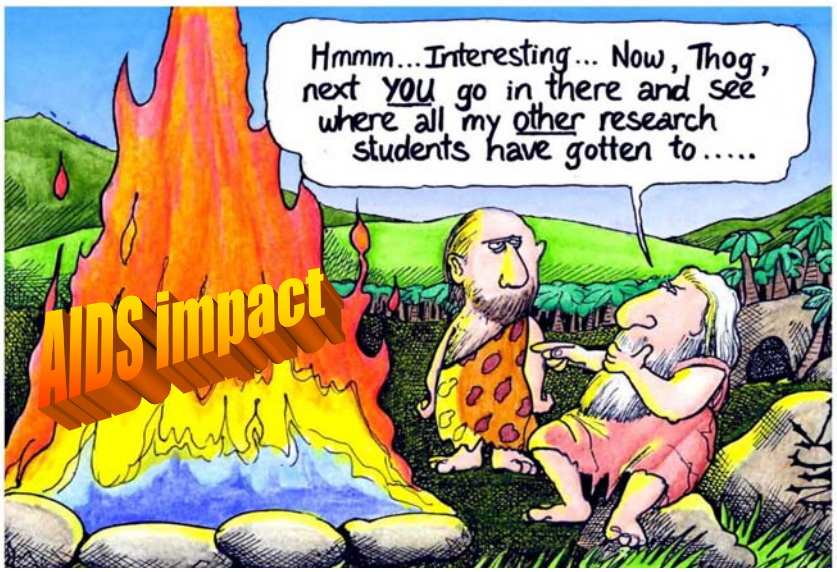

Figure 11: Early in the history of universities, professors found out that some research students want to do fieldwork.