Chapter 4

The influence of HIV/AIDS on demography and demographic research

Simon Gregson

Introduction

HIV and AIDS are having devastating effects on the demographic landscape particularly in sub-Saharan Africa (UNAIDS, 2002). Equally, recognition of the terrifying scale of the demographic impact of HIV epidemics has been crucial in the mobilisation of the – albeit still grossly inadequate – global response. Initially, the proposition that HIV epidemics had the potential, on their own, to reduce the high rates of population growth (3-4% per annum) seen in sub-Saharan African countries during the 1970s and 1980s to below zero within a time scale of 2-3 decades (Anderson et al., 1987) proved predictably controversial but awakened international and local concern at the possible severity of these epidemics. Subsequently, data directly linking positive HIV infection status to heightened mortality risk (Mulder et al., 1994) and verifying the enormous scale of the impact of HIV/AIDS on death rates in badly affected populations (Caraël & Schwartländer, 1998; UNAIDS, 2000) provided empirical basis for and thereby much-needed impetus to efforts to control the pandemic.

In this chapter, we show that HIV and AIDS are also leaving an indelible mark on the academic discipline of demography. The nature and scale of the effects of HIV/AIDS epidemics have been so profound that they have come to dominate the demographic agenda, particularly within Africa. As a consequence, new methods of study design, data collection, data analysis and demographic projection have been developed that reflect this new priority. However, the influence on demographic methodology goes deeper than this since the patterns of spread and impact of HIV/AIDS are such that the assumptions implicit in many previously standard demographic procedures commonly utilised in resource-poor settings are no longer valid. Thus, HIV/AIDS epidemics have undermined our ability to measure core demographic characteristics including key indicators of mortality and fertility within seriously affected populations and, in so doing, have made it increasingly difficult to establish their own true effects. In this chapter, we summarise the impact of HIV/AIDS on global and regional

1 Department of Infectious Disease Epidemiology, Faculty of Medicine, Imperial College of Science, Technology and Medicine, University of London, London W2 1PG, UK.
2 In this chapter we focus on demography (the study of births, deaths and migration within human populations and the changes brought about by the interplay between these phenomena (Wilson, 1985)) rather than the wider field of population studies.
demographic trends and discuss the influence of the pandemic on the demographic research agenda and on methods used in demographic studies in developing country settings.

The influence of HIV/AIDS on demographic trends

The World’s population reached 6.1 billion in the year 2000 at which time the rate of growth was 1.2% per annum (UNPD, 2001). However, the growth rate has been declining in recent years and is thought likely to fall further in the 21st century. Recent projections based on a probabilistic approach suggest that World population is unlikely to double in the new century (Lutz et al., 1997) but will reach a peak around 2070 at approximately 9 billion people (Lutz et al., 2001). Even allowing for the effects of HIV/AIDS epidemics, the population of sub-Saharan Africa probably will double between 2000 and 2050 (Lutz et al., 2001) due to continuing high fertility. Beyond Africa, HIV/AIDS is thought unlikely to have a significant demographic impact (Lutz et al., 2001; UNPD, 2001; Bongaarts 1996). In one detailed study, in Thailand - until now, one of the most affected countries outside of Africa – it was estimated that the HIV/AIDS epidemic could reduce population growth by only 0.1% per annum even at the peak of HIV-associated mortality (Surasiengsunk et al., 1997). However, HIV infection rates have recently been rising in India, China, Eastern Europe and, albeit more slowly, in some Western countries (UNAIDS, 2002) so caution is warranted. Furthermore, whilst the impact on population growth has been negligible at the national level in Western countries, the death rate in some sub-populations has been substantial (Selik & Chu, 1997; Nylen et al., 1999). Indeed, HIV has been the leading cause of death among young adults in at least one American city during the late 1980s (Mann et al., 1992).

Within Africa, the demographic impact of HIV/AIDS epidemics has been huge. The United Nations estimated that by the year 2000 expectation of life at birth had already been reduced by an average of nearly 3 years in the 45 most affected countries and that, by 2015, life expectancy would be 5 years lower than would otherwise have been the case (UNPD, 2001). However, the effect in several individual countries has been far greater. Initially, the largest effects have been in those countries that experienced substantial early epidemics - e.g. Côte D'Ivoire (De Cock et al., 1990; Garenne et al., 1996), Uganda (Mulder et al., 1994; Sewankambo et al., 2000) and Tanzania (Urassa et al., 2001). Those countries in southern Africa that are currently at the epicentre of the HIV pandemic are experiencing even more severe epidemics (UNAIDS, 2002) and are beginning to suffer unprecedented high mortality and socio-demographic consequences (Timæus, 1998; Feeney, 2001). Life expectation at birth in some of these countries may be reduced to close to 30 years (Gregson et al., 1994a).

To date, negative population growth has not been recorded in a sub-Saharan African country but this may be due as much to the paucity of good quality demographic data as to the absence of such an
The HIV prevalence rates of 30% and above currently seen in southern African countries such as Botswana, Zimbabwe, Swaziland and Lesotho (UNAIDS, 2002) seem highly likely to translate into modest if temporary declines in population numbers (Anderson et al., 1991; Gregson et al., 1994b) - especially given the concurrent declines in fertility that are occurring in these countries (Gregson et al., 1997; Kirk & Pillet 1998).

HIV itself has been found to be associated with sub-fertility (Widy-Wirski et al., 1988; Ryder & Temmerman 1991; Ryder et al., 1991; Carpenter et al., 1997; Gray et al., 1998). In a study of low contraceptive use populations, lower fertility amongst HIV-positive women was found to be associated with a population attributable decline in total fertility of the order of 0.4% for each percentage point HIV prevalence in the general female population (Zaba & Gregson, 1998). The effect is somewhat smaller in populations where contraceptive use is more common (Terceira et al., 2002). The precise mechanisms for HIV-associated sub-fertility in African settings are not well understood but probably include more frequent periods of widowhood and divorce, reduced coital frequency and more common amenorrhoea and miscarriage. Increased use of contraception among women with HIV infection, common in western countries (Thackway et al., 1997), is not currently a significant factor in sub-Saharan Africa (Setel, 1995). However, it may become so as voluntary counselling and testing and HIV/AIDS treatment services become more widely available within the region and HIV-positive women seek to avoid mother-to-child-transmission and/or leaving orphans. At the population level, the effects of the HIV epidemic on fertility are more pervasive and more complex: some measures taken to limit the risk of HIV transmission (e.g. delayed sexual debut or condom use) can result in lower birth rates but others (e.g. reduced breastfeeding) may heighten fertility (Gregson, 1994; Zaba & Gregson, 1998).

Of at least as much significance as their impact on population growth, are the effects of HIV/AIDS on the composition of severely affected populations. Early mathematical model simulations generated the superficially counter-intuitive prediction that even large-scale HIV epidemics would have little effect on the dependency ratio (Anderson et al., 1987). This was because high mortality amongst infants born to infected women tends to counter-balance the high death rates in the economically-active populations. However, closer inspection indicated that substantial changes in the age and sex-distribution of the economically-active population could nevertheless occur: a trend towards younger and more male-dominated working age populations seemed likely in most instances (Gregson et al., 1994b). Empirical

---

3 In one careful study in the Rakai District of south-west Uganda, the rates of natural increase in trading centres, trading villages and rural villages with HIV prevalence of 35%, 23% and 12%, respectively, declined from 4.2% to 1.1%, 3.0% to 1.5%, and 2.4% to 1.8%, respectively (Sewankambo et al., 1994).
validation of such predictions is problematic in community studies due to the effects of selective urban-rural and rural-urban migration (Low-Beer et al., 1997) and rarely has been attempted at the national level in the most affected countries. Even so, the effects in individual households will frequently be severe (Barnett & Blaikie, 1990) and recent population projections continue to predict dramatic changes in population structure as the effects of HIV/AIDS accumulate in these countries (USBC, 1997).

The effects of HIV/AIDS on population structure are unlikely to be limited to changes in age and sex-distributions. Because HIV typically spreads more rapidly in some population sub-groups than in others, its mortality effects are also likely to be disproportionately great within these sub-groups resulting, over time, in decreases in the size of these groups relative to other groups. Thus, for example, the proportion of the population who have high numbers of sexual partners may reduce over the course of an HIV epidemic because these people tend to become infected and die at a faster rate than the rest of the population (Boily et al., 2002). Data from serial cross-sectional surveys could therefore give a misleading impression of behaviour change. Similarly ceteris paribus other sexually transmitted infections (STIs) may decline due to selective infection and mortality among STI patients (Garnett & Gregson, 2000). Further changes in population composition could occur as a result of more rapid behaviour change in some groups than in others (e.g. more educated people may alter their behaviour more quickly: Gregson et al., 2001)).

Finally, major HIV/AIDS epidemics have been projected to cause dramatic increases in the proportions of children who become orphaned (Preble, 1990; Palloni & Lee, 1992). Model projections indicated that these increases would be gradual with the peak in maternal orphanhood, for example, being reached several years after the peak in female HIV prevalence (Gregson et al., 1994b). Early community studies (Hunter, 1990; Foster et al., 1995) followed by data from successive rounds of national Demographic and Health surveys (Gregson et al., 1999) have provided empirical confirmation for the emergence of a steady upward trend in orphans.

The influence of HIV/AIDS on the demographic research agenda

As might be expected given the relatively small scale of HIV epidemics in Western countries to date, HIV/AIDS has had little impact on the demographic research agenda within these countries. Here, issues such as population ageing, population decline, international migration, nuptiality and single parent families, and the length of the human life span are currently pre-eminent concerns. For demographic research in less developed countries, the United Nations population conference held in Cairo in September 1994 (United Nations, 1995) marked a watershed between an extended period over
which demographers had maintained a rather narrow focus on issues of global population growth and control (Ehrlich, 1968; Simon, 1981), often discussed by reference to models of demographic transition (Chesnais, 1992), and a period in which the agenda was broadened to embrace “an individual-level model with women’s health, rights, status, and empowerment at its heart” (McIntosh & Finkle, 1995; United Nations, 1999). Whilst the programme adopted at Cairo has been attributed largely to “an extraordinarily effective campaign undertaken by the international women’s movement” (McIntosh & Finkle, 1995), the new focus on reproductive health has certainly been given added impetus and, to some degree, new direction by the continued spread of HIV infection and the realisation of its socio-demographic and economic consequences (United Nations, 1999).

This said, the initial reaction of the demographic community to the emergence of HIV/AIDS epidemics – in common with that of many others - was principally one of scepticism regarding the possibility that such epidemics might have serious demographic consequences at the national and regional levels (e.g. Nicoll et al., 1993). This scepticism was lent weight by demographic model projections done at the time which suggested more modest changes in key demographic indicators (Bongaarts, 1989; Meredith John, 1991) than those projected by some epidemiologists (see, for example, Palloni & Lee, 1991). Partly for this reason and despite its gaining the early attention of leading internationally-renowned demographers including the Caldwells, Bongaarts, Dyson and Cleland, the profession, as a whole, was rather slow to incorporate HIV/AIDS within its mainstream agenda. This in turn may have contributed to a situation whereby epidemiologists working on small-scale community studies, rather than demographers, took the lead in empirical description of the early demographic effects of HIV and AIDS (De Cock et al., 1990; Mulder et al., 1994; Hira et al., 1989; Ryder et al., 1991; Sewankambo et al., 1994). However, this was probably inevitable since it was always going to be some time before the demographic impact of HIV epidemics became visible at the national and global levels typically studied by demographers especially given the limitations of the demographic data sources that prevail in most developing countries (Timæus, 1991).

The first formal response of the International Union for the Scientific Study of Populations (IUSSP) was to organise a scientific meeting on sexual behaviour and networking in Sonnerborg, Denmark in 1991 (Dyson, 1992). This was followed by a further meeting in Annecy, France in 1993 (Cleland & Way, 1994) after which an IUSSP Committee on AIDS was established chaired by Basia Zaba from the London School of Hygiene and Tropical Medicine. The committee was extremely active, organising a series of international meetings covering a wide range of aspects of the spread, socio-demographic impact and control of HIV (Awusabo-Asare et al., 1997; Artuzzi, 2000; Velyvis 2000). In particular, it was instrumental in mobilising the World Bank to recognise the significance of HIV/AIDS epidemics as a major threat to development (Caraël & Schwartländer, 1998; World Bank, 1997) and, through the
participation of some of its members in the UNAIDS Reference Group on Estimates, Modelling and Projections (RGEMP), has played a major part in the development of more rigorous methods for monitoring the spread and demographic impact of HIV at the country and global levels (UNAIDS RGEMP, 2002). These efforts together with parallel revisions in the funding priorities of major donor agencies contributed to a significant broadening in the research agenda of developing country demographers during the latter half of the 1990s.

International bodies such as the United Nations Population Division and the World Bank have also taken time to incorporate fully the effects of HIV/AIDS within their official population projections. Even quite recently, these effects were reflected by presenting parallel “with AIDS” and “without AIDS” scenarios for those countries known to be subject to major epidemics. The reason for this is that, whilst “without AIDS” scenarios were clearly unrealistic, consensus was slow to emerge on how HIV/AIDS should be accounted for within these projections - particularly over the longer term for which the effects of unknown patterns of behaviour change would be substantial. Furthermore, given that this was the case, the emphasis tended to be on providing indications of the possible scale of impact of HIV/AIDS in a manner that would not compromise the overall integrity of the global projections.

Whilst the primary focus of this chapter is on the narrower, more technical and statistical discipline of demography, it is important to recognise that the emergence of HIV/AIDS as a major determinant of demographic trends has also stimulated considerable interest and relatively early activity amongst anthropological demographers. Much of this activity focussed on description and on developing understanding of patterns and determinants of sexual behaviour (Bledsoe, 1991; Dyson, 1992; Cleland & Ferry, 1995; Velyvis 2000). This was prompted largely by findings from epidemiological models that pointed to patterns of sexual behaviour and sexual mixing as key influences in the course and scale of HIV epidemics (Jacquez et al., 1988; Gupta et al., 1989). For example *ceteris paribus* populations characterised by a heterogeneous distribution of sexual behaviour and extensive mixing between those with high and low numbers of sexual partners (Anderson, 1992) and populations in which concurrent sexual partnerships are common (Watts & May, 1992; Morris & Kretzschmar, 1995) were identified as being especially vulnerable to widespread dissemination of HIV infection. There has also been keen interest in identifying and describing geographical differences in underlying cultural systems, beliefs and norms (Caldwell et al., 1989; Larson, 1989) and in specific social practices – e.g. male circumcision (Moses et al., 1990) - that might help to explain the observed spatial distribution of HIV infection (Carael & Holmes, 2001).
The prior preoccupation of demographers with fertility trends and the effectiveness of family planning programmes has already been mentioned. Also, the fact that HIV has significant implications for fertility trends in populations subject to major epidemics. Not surprisingly, the merits and demerits of integrating HIV/AIDS and STI treatment services within family planning services have been debated widely and this continues to be a subject of some controversy (Zaba et al., 1998; Lush et al., 1999; Caldwell & Caldwell, 2002). At a technical level, demographers have investigated and developed methods to correct for the bias in HIV surveillance estimates derived from women attending antenatal clinics due to HIV-associated sub-fertility (Zaba et al., 2000).

Beyond this, demographers’ extensive prior experience and ongoing work on the behavioural determinants of fertility (e.g. Bongaarts & Potter, 1983) and on their underlying socio-economic and structural determinants (e.g. Cleland & Wilson, 1987) together with the broad overlap between these and the determinants of HIV transmission (Zaba & Gregson, 1998) have led to their being heavily involved in research on the latter. Established programmes of nationally representative demographic and health surveys have provided baseline and longitudinal data on sexual behaviour (Blanc & Way, 1998; Blanc, 2000) and were extended quickly to include questions on knowledge, attitudes, beliefs and practices in relation to HIV. The possibility of adding bio-markers, including tests for HIV infection status, to these surveys also is being explored (Boerma et al., 2001a). In addition, demographers have been closely involved in the design and conduct of national sex surveys in both developing (Cleland & Ferry, 1995) and developed countries (Leridon & Bozon, 1993).

Demographers’ prior experience had been that surprisingly reliable aggregate level data can be obtained on aspects of sexual behaviour within the context of fertility and child health surveys in developing countries (e.g. Blanc & Rutenburg, 1990; Dare & Cleland, 1995). This experience has emboldened researchers and others to collect more detailed sexual behaviour data in HIV and reproductive health surveys (e.g. Cleland & Ferry, 1995; Buvé et al., 2001) However, the absence of clear differences in behaviour patterns between countries with contrasting HIV epidemics together with erratic correlations between behavioural indicators such as age at first sex and number of lifetime sexual partners and HIV infection status point to the likelihood that considerable inconsistencies in reporting frequently exist.

A further difficulty has been that understanding of the transmission dynamics of HIV infection - unlike measurement of behavioural determinants of fertility - requires detailed data on sexual networks as well as data on individual behaviour. A few helpful insights have been obtained from large-scale population surveys that incorporate small numbers of additional questions on local network structure - e.g. on the role of bridge populations in Thailand (Morris et al., 1996); condom use among travellers in Uganda (Morris et al., 2000), and age-differences between sexual partners in Zimbabwe (Gregson et al., 2002).
Data on partial and, preferably, complete sexual networks could aid identification of further aspects of sexual network structure that influence on patterns of HIV transmission. However, such data are highly complex to collect (Velyvis, 2000) and, to some degree, similar investigations can be carried out using mathematical model simulations (Anderson et al., 1990). The study in Zimbabwe also is an example of a situation in which population scientists have become involved in research on what might be termed demographic determinants of HIV transmission. Other examples include studies on the roles of migration (e.g. Pison et al., 1993), infertility (Boerma et al., 2001b) and marital breakdown (Caraël, 1994), and age of partner (Aaby et al., 1996) in the spread of HIV.

In Africa, in particular, social demographers have sought to utilise insights gained during research on cultural and socio-economic obstacles to rapid and widespread adoption of modern methods of contraception in the development of understanding of what some perceive to be a similarly protracted response to the spread of HIV (e.g. Caldwell & Caldwell, 1987; Caldwell et al., 1989; Caldwell, 2000).

The influence of HIV/AIDS on methods used in demography

The spread of HIV has had a significant influence on the methods used to measure the demographic characteristics of populations in developing countries subject to major epidemics. In these populations, HIV and AIDS have: (i) challenged demographers’ ability to measure and forecast vital rates; (ii) created a need to measure demographic features not previously considered to be of high priority in their own right (e.g. adult mortality and orphans); and (iii) created a new need to estimate the actual and future demographic impact of HIV. This section comprises a brief discussion of these different types of effect in relation to the measurement and forecasting of demographic indicators and trends.

Measurement of vital rates

Perhaps the most significant implication of the HIV and AIDS epidemics for demography as a discipline has been the challenge that these epidemics have posed to measurement of the demographic characteristics of populations where they have taken a hold. Since these are invariably developing countries, coverage of vital events such as births and deaths within national registration systems is low. Furthermore, national censuses and surveys in these countries are prone to high levels of omission and mis-reporting. To cope with these problems, demographers had previously developed a variety of “indirect” estimation techniques that could be applied where small numbers of additional questions are asked in censuses and surveys (e.g. United Nations, 1983). In addition, they have made use of the fact that certain regularities typically exist within the demographic characteristics of human populations. Unfortunately, aspects of HIV transmission render some of the assumptions implicit within these
methods (e.g. assumptions regarding the independence of events) invalid, especially in badly afflicted populations (and sub-populations).

Taking the case of mortality as an example: death rates are estimated using census and survey data on deaths within the previous twelve months in enumerated households and on children ever-born and children surviving. Where empirical data are considered to be incomplete or unreliable, empirical (United Nations, 1982; Coale & Demeny, 1983) and relational model life tables that reflect age-patterns of mortality typically observed in human populations are fitted to the data so that standard mortality indicators such as life expectation at birth can be estimated. A number of different sets of these model life tables have been developed to reflect the relatively small variations in age-patterns of mortality observed between countries and over time. For example, the widely-used Coale-Demeny system comprises four sets (“North”, “South”, “East” and “West”) of model life tables. In each set, estimates of age-specific mortality rates were constructed for different overall levels of mortality.

The widespread presence of HIV and AIDS invalidates this approach. First, even in the absence of HIV, mortality rates derived from data collected from households can be under-estimated due to household dissolution following the death of a key member (e.g. household head or his/her spouse). However, high rates of HIV transmission within marriage (Carpenter et al., 1999) mean that, in a population subject to an HIV epidemic, there is a significantly greater likelihood that, if one partner in a spousal relationship has died recently, the other partner will also have died. Thus, many of the households in which deaths have occurred within the past twelve months will no longer exist and deaths that have occurred in these households will not be recorded (Timæus & Nunn, 1997). Second, the age-patterns of mortality encapsulated in model life tables differ substantially from that typically observed in populations subject to severe HIV epidemics. In the former, age-specific death rates are low between early childhood and old age. In the latter, mortality is generally very high from the early twenties onwards (Gregson et al., 1994a). Application of existing model life tables can lead to gross over-estimation of life expectation at birth because most of the adult deaths enumerated are assumed to occur at old ages and insufficient weight is given to deaths occurring within the central years of the life span.

Some of the assumptions required when other “indirect” methods commonly used to estimate mortality levels and trends in developing country settings also are invalidated when HIV prevalence is high. For example, the “orphanhood method” uses data on the survival status of fathers and mothers of individuals of different ages to estimate past levels of male and female adult mortality (Brass & Hill,
However, the standard method entails an assumption that the survival chances of parents and children are independent. This clearly is not the case in populations subject to HIV epidemics due to the high rate of mother-to-child transmission.

Problems also are faced in measurement of infant and early childhood mortality and fertility. For example, in developing countries, these indicators are most commonly estimated from birth history data collected in representative national surveys. In the presence of HIV and AIDS, early childhood mortality generally will be under-estimated due to the exclusion of children of women who have died of AIDS who themselves are subject to higher levels of mortality than children of women who are still alive. Similarly, women who have died of AIDS can have different levels of fertility to those who remain alive at the data of survey enumeration. Thus, fertility levels and trends estimated from retrospective birth histories also can be subject to bias in populations where HIV prevalence is high.

Some progress has been made in addressing these difficulties. Indirect methods for which the required assumptions remain essentially valid (e.g. the sibling survival method) are being used (e.g. Timæus, 1998). A revised version of the orphanhood method has been developed that incorporates a correction for selection bias in reports of orphanhood and a revised procedure for estimating life table survivorship for use in populations with significant AIDS mortality (Timæus & Nunn, 1997). An updated version of the United Nations manual on methods of indirect estimation has been prepared that includes procedures for use in populations subject to large-scale HIV epidemics (Feeney, 2001) and new mortality models are being developed that are able to reflect the age-patterns of mortality characteristic of such populations. However, much still remains to be done.

Prior to the spread of HIV/AIDS, demographers had studied patterns of child care and fostering (Page, 1989) but little importance had been attached to quantifying orphan rates per se except in so far as these could be used to estimate trends in adult mortality (Brass & Hill, 1973). This situation has changed markedly as concern has grown about the rising numbers of children orphaned due to HIV-related mortality. Even so, direct empirical national estimates still are only obtained periodically in censuses and surveys, largely for reasons of cost. Instead, mathematical models (Gregson et al., 1994b) fitted to past trends in HIV prevalence are used to generate the required international estimates of contemporary numbers of orphans and proportions of children orphaned (e.g. UNAIDS et al., 2002). Until recently, these official figures were confined to estimates of maternal orphans because of the additional complexity of generating plausible estimates of paternal and double orphans. These difficulties now have been addressed (Timæus & Grassly, 2001; United Nations RGEMP, 2002) and

---

4 i.e. generated using simple mathematical functions that can reflect the age-patterns of mortality most
the most recent United Nations reports include separate and combined estimates for the different forms of orphanhood (UNAIDS et al., 2002; UNAIDS, 2002).

One final difficulty that can afflict demographic estimates in developing countries is the problem of political interference. For example, census figures are frequently used as the basis for resource allocation and there are instances where it is suspected that population numbers have been manipulated so that particular areas or population sub-groups receive higher allocations. Similarly, the stigma associated with HIV and AIDS, including fears that reports of high mortality may have an adverse effect on international tourism, could lead to incorrect official estimates of death rates, population growth and so on.

The demographic impact of HIV cannot be measured directly at the national population level because of uncertainty as to what demographic trends would have pertained in the absence of HIV. For example, mortality rates had been declining in most countries prior to the onset of HIV epidemics following improvements in health services, sanitary systems, personal hygiene, and so on, and this trend might have been expected to continue. Nonetheless, estimates have been obtained by making comparisons with mortality levels for periods prior to the spread of HIV and by using the indirect estimation methods referred to above with the appropriate adjustments where necessary (Timæus, 1998). In addition, it has proved possible to obtain localised estimates of the impact of HIV infections by following cohorts of HIV-infected and uninfected individuals prospectively in community studies and by assuming that mortality among the HIV-infected would have been the same as that of the uninfected in the absence of the HIV/AIDS epidemics (Boerma et al., 1998). Similarly, methods have been developed for estimating the impact of HIV on fertility rates using data from localised community and antenatal clinic-based studies (Zaba & Gregson, 1998).

**Forecasting of demographic indicators and trends**

The slow progress in incorporating the effects of HIV/AIDS epidemics within the demographic projections published by the major international institutions has already been mentioned together with the underlying difficulty in establishing a consensus on the modelling methods that should be applied for this purpose. The latter was not due to a shortage of models but was because those that did exist either required input data that were unavailable in most low-development countries or did not incorporate the age structure needed for demographic projections (Palloni & Glicklich, 1991). A further problem has been the need to develop methods suitable for generating internally-consistent short-term
and longer term estimates as required by UNAIDS and the United Nations Population Division, respectively. In recent meetings, the UNAIDS Reference Group has been working to develop such methods (United Nations RGEMP, 2002) and these are now being applied. These methods utilise the same mathematical procedures to project future trends in orphanhood as are used in the derivation of contemporary estimates (see previous section).

Population projections had a chequered history even before the advent of HIV/AIDS. However, the HIV/AIDS pandemic inevitably further reduces their reliability - particularly for long time horizons - due to: (i) lack of precision in the HIV prevalence estimates upon which they are based; (ii) uncertainty about the extent of behaviour change in countries currently subject to major HIV/AIDS epidemics; and (iii) uncertainty as to the future scale of HIV/AIDS epidemics in countries not currently subject to major epidemics.

Finally, the spread of HIV has created a new requirement for projections that distinguish the demographic impact of epidemics from underlying trends. These projections are needed for advocacy purposes, for use in evaluation of alternative prevention strategies, and for assessing the implications of HIV/AIDS mortality for health, social and economic systems. Broadly speaking, similar methods are used to those developed for use in population projections. In addition, simple models have been developed to estimate the cumulative lifetime chances of acquiring HIV infection (Gregson et al., 1996) and of dying from AIDS (Blacker & Zaba, 1997) under stable population conditions.

Conclusion

HIV and AIDS have had only a limited effect on demographic trends globally but a substantial effect in parts of sub-Saharan Africa. Their effect on the demographic research agenda reflects this pattern. However, the presence of major HIV epidemics within Africa has prompted a reorientation and expansion of research activity within the region. In particular, the spread of HIV has necessitated revision of a number of the methods previously used by demographers to measure and forecast demographic indicators.

In the future, the demographic effects of HIV/AIDS and their impact on demographic research seem likely to extend beyond Africa given recent increases in HIV prevalence in areas of Asia and eastern Europe (UNAIDS, 2002). The nature of the demographic effects of HIV and AIDS could be modified as voluntary counselling and testing services (Weinhardt et al., 1999) and antiretroviral treatment become more widely available. For example, nevirapine is being used increasingly in Zimbabwe and elsewhere to reduce the risk of mother-to-child transmission (MTCT). On its own, this might be
expected to reduce early childhood mortality but increase numbers of orphans. However, “MTCT+” programmes that extend the treatment protocol to include provision of antiretroviral drugs to pregnant women and their spouses now are being promoted. Even now, antiretroviral drugs are being accessed by urban elites in some African countries and are being made available through the health system in Botswana. Many practical problems exist (Garnett et al., 2002), but, to the extent that these and other strategies succeed in increasing the availability of treatment to reduce disease progression, the overall mortality impact of HIV/AIDS will be reduced.

These changes will pose new challenges in demographic measurement. For example, temporal changes in rates of vertical transmission of HIV infection will complicate adaptation of the orphanhood method of adult mortality estimation; increasing durations of HIV infection will require revision of demographic projection methods based on extrapolation from trends in HIV prevalence; and so on. Nevertheless, such challenges will be more than welcome!

References


Gregson


Gregson


