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HIV/AIDS AND FERTILITY IN SUB-SAHARAN AFRICA: A REVIEW OF THE RESEARCH LITERATURE

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PREFACE

The Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat is responsible for providing the international community with up-to-date and scientifically objective information on population and development. The Population Division provides guidance to the United Nations General Assembly, Economic and Social Council and the Commission on Population and Development on population and development issues and undertakes regular studies on population levels and trends, population estimates and projections, population policies and population and development interrelationships.

Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) has been a concern of the United Nations for many years, and in June 2001, the United Nations General Assembly held a special session to review and address the problem of HIV/AIDS in all its aspects.[1] The session highlighted the need to intensify international action and to mobilize the resources needed to fight the epidemic.

As part of its regular work programme, the Division assesses the demographic impacts of the AIDS epidemic. Since 1992, the mortality effects of the AIDS epidemic in the most affected countries have been explicitly taken into account in each biennial set of population estimates and projections. As a backdrop to the United Nations General Assembly special session on HIV/AIDS, the United Nations Population Division published in English and French the most recent data on population and policies relating to HIV/AIDS in the form of a wall chart, entitled "HIV/AIDS: Population Impact and Policies 2001". The recently released publication "HIV/AIDS: Awareness and Behaviour"[2] highlights findings from a series of national demographic and health surveys that are directly relevant to the AIDS epidemic.

This report reviews the theoretical frameworks for the analysis of the impact of the AIDS epidemic on reproductive behaviour and fertility trends and a wide array of empirical data. It also suggests a further research agenda in this domain. Acknowledgement is due to Mr. John B. Casterline for working with the Population Division in the preparation of this report.

Comments and suggestions on this report are welcome and may be addressed to the Director, Population Division, Department of Economic and Social Affairs, United Nations Secretariat, New York, N.Y. 10017, USA.

NOTES

[1] *HIV/AIDS: Population Impact and Policies, 2001* (United Nations Wall Chart, 2001).
[2] United Nations, forthcoming.

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A. INTRODUCTION

There are several distinct facets to the association between HIV/AIDS and fertility. To begin with, the causality underlying the association can run in either direction – HIV/AIDS can affect fertility desires and outcomes, and fertility can affect the risk of HIV/AIDS. The two may also share common causes that induce an association between HIV/AIDS and fertility. Indeed, the major proximate determinants of HIV infection and pregnancy are virtually the same – sexual exposure (through socially recognized unions or otherwise), contraceptive practice, reproductive tract infection, breastfeeding practices – and for this reason an empirical association between the two seems almost unavoidable.

This report focuses on the effect of HIV/AIDS on fertility. This effect, in turn, operates at the *population level* or at the *individual level.* In one of those paradoxes that demographers, because of their sensitivity to compositional effects, ought to be well equipped to analyze, the population-level and individual-level effects can differ not only in size but also in direction. For example, seropositive status may reduce fertility (i.e. have a negative effect at the individual level) and, moreover, seropositive status may be selective of lower fertility women because of the presence of other STIs. In this case, the relatively higher rates of adult mortality among these lower-fertility seropositive women will, everything else being equal, result in an increase in the level of fertility in the population as a whole. At the individual level, effects on the fertility of *infected* and *uninfected* individuals should be considered separately. Among the infected, the many various mechanisms through which HIV/AIDS might affect fertility can be classified as *biological* or *behavioural*, whereas among the uninfected only behavioural mechanisms operate.

The report is organized in terms of these basic distinctions: effects of HIV/AIDS on fertility among the infected (biological and behavioural mechanisms), among the uninfected (behavioural mechanisms), and at the population level (compositional effects). The aim is to summarize the existing research literature for developing countries, with only passing reference to research in developed countries. The reviewed studies were conducted in sub-Saharan Africa, primarily in Eastern and Southern Africa. This is entirely appropriate, because the rates of infection in those regions are so much higher than in any other regions of the world. In theory, there is scope for substantial effects on the fertility of uninfected individuals in other less developed regions where the prevalence of HIV/AIDS is low but concern about infection is high. However, to date there have been very little research conducted in these countries that attempts to assess the degree to which fear of HIV/AIDS has changed sexual behaviour, contraceptive practice, and so forth.

B. INDIVIDUAL-LEVEL EFFECTS: PERSONS INFECTED WITH HIV

At present, the effect of HIV/AIDS on fertility among those persons infected with HIV is far better understood, and with more precision, than the corresponding effect for uninfected persons. Zaba and Gregson (1998) synthesize evidence from six African studies conducted in the early and mid-1990s: three in Uganda, two in Zambia, and one in Tanzania[1]. From these studies, one can conclude that the overall fertility[2] of HIV-positive women is 25 per cent -- 40 per cent lower than that of HIV-negative women. Studies in Rwanda (Allen and others, 1993) and Zaire (Ryder and others, 1991) not included in Zaba and Gregson's synthesis also yield differentials that fall within the 25 per cent -- 40 per cent range. Lower fertility of HIV-positive women translates into impacts on the fertility of the entire population that generally do not exceed 10 per cent, as follows: if the "population-attributable" decline in the total fertility rate is of the order of 0.4 per cent for each 1 per cent of HIV prevalence among females of reproductive age, as Zaba and Gregson (1998) propose, then the population impact is a 4 per cent reduction in the TFR when the HIV prevalence is 10 per cent and a 10 per cent reduction in the TFR

when the HIV prevalence is 25 per cent, the latter being at the higher end of the national adult prevalences currently observed in the AIDS-belt stretching from Uganda south to South Africa.[3]

The factors that account for this quite substantial depressing effect of HIV/AIDS on reproductive performance are thought to be largely biological, although behavioural mechanisms cannot be ruled out.

Biological mechanisms

Seropositive status is thought to be associated with both reduced fecundability (likelihood of conceiving) and increased foetal loss. The reduced fecundability has several sources.

1. Coital frequency

Coital frequency is probably lower among HIV-positive individuals who have progressed to AIDS – to be sure, this is a behavioural source of lower fecundability, but reduced sexual activity is an almost inevitable consequence of debilitating illnesses such as AIDS.

2. Production of spermatozoa

Even prior to HIV infection progressing to AIDS (a relatively brief stage for most infected individuals in low-income societies), HIV infection may lead to decreased production of spermatozoa in men (Martin and others, 1991, Crittenden and others, 1992). However, Gray and others (1998) argue that semen quality hardly declines until men progress to clinical AIDS.

3. Gonorrhoea and other sexually transmitted infections (STIs)

A far more important explanation for reduced fecundability is co-infection with other STIs (gonorrhoea, syphilis, chlamydia). Both gonorrhoea and chlamydia cause pelvic inflammatory disease (with probability 0.4 in the case of gonorrhoea), thereby sharply reducing the ability to conceive (Cates and others, 1993). On average 20 per cent of women are infecund after two episodes of pelvic inflammatory disease (Bracher and Santow, 2001). Infection with one STI increases the risk of infection with another, creating an "epidemiological synergy". Bracher and Santow (2001) report, without clear attribution of source, that transmission rates for both gonorrhoea and syphilis double in the presence of HIV. Even more dramatic are the effects of gonorrhoea and syphilis on the transmission of HIV – an estimated ten-fold inflation of transmission probabilities (Bracher and Santow, 2001). Hence, HIV-positive women are disproportionately likely to have another STI – in most instances not as a direct consequence of their HIV status, but nevertheless a factor contributing to their lower fertility.

4. Foetal loss

There is now good empirical evidence of higher rates of both early and late foetal loss among women who are seropositive (see review of evidence in Zaba and Gregson 1998[4]; see also Langston and others, 1995 and Gregson and others, 1997).[5] A principal reason for this pattern is the substantially higher prevalence of syphilis among seropositive women due both to the doubling of syphilis transmission rates in the presence of HIV and the ten-fold higher transmission rates of HIV in the presence of syphilis. Syphilis is known to increase the risk of stillbirth by roughly 25 per cent, and early foetal loss by a smaller but still significant amount (Bracher and Santow, 2001). In addition, HIV infection itself may increase the likelihood of foetal loss. One analysis of the Rakai data from Uganda controls for syphilis (plus some other covariates) and nevertheless calculates a roughly 50 per cent higher risk of foetal loss among HIV-positive women (Gray and others, 1998). Bracher and Santow (2001) assert that HIV triples

the risk of foetal loss, but they do not explicitly identify the empirical studies from which they infer such an enormous effect.

Therefore, the several confirmed biological mechanisms by which HIV infection can suppress fertility would appear to be sufficient to account for the observed 25 per cent -- 40 per cent reduction in fertility among seropositive women. Co-infection with other STIs (most notably gonorrhoea and syphilis) may well account for most of this differential. If so, one might posit that HIV-positive status is far less of a fertility suppressant in populations where co-infection rates are lower than the rates commonly found in Eastern and Southern Africa. A further implication is that antibiotic treatment of STIs has the potential to reduce the seropositive–seronegative differential, raising fertility among the seropositive and thereby the fertility of the population as a whole (Gregson and others, 1997). This would continue an historical process, extending back many decades, of medical interventions having a pronatalist effect in the Africa regions with high prevalence of infertility.

Behavioural mechanisms

The consensus in the research literature is that HIV-positive status does not lead to behavioural changes that would have any noticeable impact – negative or positive -- on fertility. In Africa, most seropositive individuals are unaware of their status until the infection expresses itself in overt physical symptoms such as weakness, weight loss, opportunistic infections (Setel, 1995), and even then some uncertainty may remain. Women often learn of their seropositive status through an antenatal check-up, i.e. after they have already added a pregnancy.

The first issue is whether seropositive status changes fertility desires. On this question, the evidence is mixed. One conclusion that emerges from a review of recent empirical studies is that African women are themselves deeply conflicted about the proper reproductive response to AIDS. One indication of this is the contradictory themes -- both pronatalist and antinatalist – expressed by the same set of respondents. An insightful qualitative study conducted in Abidjan, Côte d'Ivoire among women who had been informed of their seropositive status (Aka-Dago-Akribi and others, 1999) reveals that the desire to continue childbearing continue to be paramount. Among women who had not yet attained their desired number of births, to curtail reproduction was viewed as a denial of the future. A further pregnancy, in contrast, would confirm her health and fecundity to her friends, relatives and to herself. Continued reproduction, therefore, was considered a means of denying death, of redeeming her relationship with her husband and in-laws and, equivalently, of protecting her against the risk of rejection and abandonment and of maintaining recognized status as a wife and mother. All of these considerations overwhelm concerns about how another pregnancy might harm the woman's health and any fears she might have of passing the infection to her child. Adherence to the social obligations and rewards of reproduction has also been observed in studies conducted in Kenya (Temmerman and others, 1990a) and Uganda (Lutalo and others, 2000). Similar themes surface in qualitative interviews in Zambia (Rutenberg and others, 2000), in which the respondents were uninformed about their HIV status, but given the relatively high HIV prevalence hypothetical questions about reactions to acquiring HIV/AIDS had a powerful relevance. There is also scattered evidence of the view that it would be prudent for seropositive individuals to produce more children to ensure that some survive (Temmerman and others, 1994), and perhaps produce them more quickly (Setel, 1995).

But these positive effects on fertility desires appear to be the exception rather than the norm. A more common finding in recent studies is the emergence of doubts about continuing reproduction after HIV infection is confirmed (Setel, 1995, Gregson and others, 1997, Ntozi and Kirunga, 1998, Rutenberg and others, 2000). These doubts are fuelled by three distinct concerns (Rutenberg and others, 2000). The first is that further pregnancies will exacerbate the disease – "bring out" the HIV infection, as respondents

say in Zambia (Rutenberg and others, 2000). A second concern is that the infection will be transmitted to the prospective child, increasing the risk of death and the attendant emotional costs, burial expenses, and so forth. A third concern is for the welfare of existing children -- school fees, housing, fostering arrangements, and so forth (Setel, 1995). A focus on investment in these children, with the looming threat of the mother's premature death, becomes an argument against continued childbearing. In survey data collected in Zimbabwe, 83 per cent of seropositive and seronegative respondents, most unaware of their status, indicate that HIV-positive women should cease childbearing because of the risk of vertical transmission to the prospective child and of adding to the number of future orphans (Gregson and others, 1997). Similar views that HIV-positive women should bear no further children are expressed by some of the respondents in qualitative interviews in Côte d'Ivoire (Aka-Dago-Akribi and others, 1999) and Zambia (Rutenberg and others, 2000).

Similarly to fertility desires, studies of actual reproductive behaviours contain no solid body of evidence that seropositive individuals change key behaviours in response to recognition of their HIV status, while it has to be reiterated that in most developing countries a small fraction of seropositive individuals are aware of their status.

1. Sexual behaviour.

Because of the difficulties in collecting valid and precise data on sexual behaviour, changes in sexual behaviour are not easy to detect. Hence, it is not surprising that some studies of seropositive individuals (e.g. Temmerman and others, 1990a) make no effort to assess changes in sexual activity in response to knowledge of their status. In their qualitative study in Abidjan, Côte d'Ivoire, Aka-Dago-Akribi and others (1999) observe no intention among HIV-positive women to modify their sexual behaviour. In contrast, a comparable qualitative study of men and women conducted in Bulawayo, Zimbabwe finds that, after notification of their seropositive status, some individuals stopped having sex, others reported a reduction in multiple partners, and some men indicated that they had stopped casual sex (Meursing and Sibindi, 1995). These changes are not quantified, and, furthermore, those individuals who stopped having sex found this difficult to sustain for emotional reasons.

2. Contraceptive behaviour

Condoms and other contraceptives should be distinguished, although this has little bearing on the conclusions. Condoms can be used to prevent infection of sexual partners, to prevent pregnancy, or both, whereas other contraceptives presumably are used only for pregnancy prevention, although erroneous notions about the HIV-prevention attributes of other contraceptives should not be discounted. With respect to condoms, the usual finding is that knowledge of HIV-positive status does not lead to increased condom use. This is the conclusion from studies in Kenya (Temmerman and others, 1990a), Rwanda (Allen and others, 1993), Côte d'Ivoire (Aka-Dago-Akribi and others, 1999) and Uganda (Lutalo and others, 2000). In the studies in Rwanda and Uganda, condom use in fact is more likely among the seropositive, but the differential is small and not statistically significant. The lone exception appears to be the study by Ryder and others (1991) in Kinshasa, Zaire: in this 36-month follow-up, in the third year condom use is distinctly higher among the seropositive individuals. With respect to other contraceptive methods, which in sub-Saharan Africa are primarily hormonal methods (i.e. oral contraceptives and injectables), no studies reveal an increase in use in response to awareness of seropositive status. Indeed, in two studies – Ryder and others (1991) in Zaire and Allen and others (1993) in Rwanda – use of hormonal contraceptive methods actually declines in response to awareness of seropositive status. To some extent, this decline can be accounted for by a switch to condoms. There may also be a tendency for women to regard the health side effects of hormonal methods as no longer tolerable given the added stress created by HIV infection.

3. Breastfeeding and post-partum abstinence.

Post-partum behaviours are extremely important means of fertility regulation in sub-Saharan Africa. Any shortening of durations of breastfeeding and abstinence, if not replaced by contraception, has the potential to increase levels of fertility substantially (Stecklov, 1999). Breastfeeding is one channel for vertical transmission of HIV infection, a fact that is increasingly widely known and is the rationale for recommendations that HIV-positive women (or, more broadly, all women in communities characterized by high HIV prevalence) refrain from breastfeeding. The period of post-partum abstinence might be curtailed in order to decrease the incentive for male partners to seek other sexual partners (Gregson 1994, Carael, 1995), a rationale far more compelling for the uninfected segment of the population (see discussion in section II). There is virtually no empirical data on whether either of these hypothesized behavioural trends is occurring. In some countries, trends in breastfeeding can be determined through comparison of successive DHS surveys, but it is not straightforward to attribute any reduction in breastfeeding that is observed to concerns about HIV transmission. In the Rakai data from Uganda, HIV-positive women are significantly less likely to be breastfeeding at the follow-up interview (roughly 10 per cent less likely), without adjustment for other confounding variables. How post-partum behaviour responds to HIV-status is a topic that requires further empirical research.

There is a further non-volitional mechanism that hypothetically could link HIV status and post-partum behaviours. If seropositive status increases infant and early childhood mortality, in most African populations this will truncate breastfeeding and abstinence, thereby reducing their fertility-suppressing effects. Under the assumption that the increase in infant and child mortality amounts to 25 per cent, Palloni and Lee (1992) calculate that this would translate into a 9 per cent increase in fertility, everything else being equal.

Summing up this review of the behavioural mechanisms through which HIV-positive status might affect fertility, the balance of the empirical research to date suggests limited and non-consequential behavioural responses to knowledge of HIV-positive status. Moreover, the potential demographic effect of this response is further reduced because only a minority of the seropositive persons in developing countries knows that they are infected. There is some evidence that, as the pandemic matures, a view is beginning to take hold that the wise and responsible decision (for the well-being of the reproductive-age couple, and for the well-being of their children) is to curtail further reproduction. But to date there is little evidence that seropositive individuals are acting in accordance with this view. With a few exceptions, empirical studies detect no significant responses to HIV infection through either sexual behaviour or contraceptive behaviour.

C. INDIVIDUAL-LEVEL EFFECTS: PERSONS NOT INFECTED WITH HIV

According to estimates for 1999 provided by UNAIDS (2000), at present the maximum national prevalence of HIV among reproductive-age women is 36 per cent (Botswana), and the prevalence does not yet exceed 25 per cent in the other high prevalence countries of Eastern and Southern Africa (Swaziland and Zimbabwe at 25 per cent, Lesotho at 24 per cent, Namibia, South Africa and Zambia at 20 per cent). It seems unlikely that the adult prevalence will exceed 20 per cent in many other African countries during the next few decades, and it is unlikely to exceed 10 per cent outside of Africa. Moreover, a substantial fraction of the infected are unaware of their seropositive status; when the objective is to understand behavioural responses to the pandemic, these individuals are for all intents and purposes uninfected. There is far greater potential for the pandemic to affect national fertility levels by stimulating reductions in fertility among the non-infected segment of these populations (actual or self-perceived) than among the infected segment. This is particularly true for populous Asian and Latin American countries (China, Brazil, India) where prevalence is only 1 per cent and even Western Africa

(e.g. in Nigeria with a prevalence of roughly 5 per cent). This is one reason, and arguably the lesser reason, for assessing the effects of awareness of HIV/AIDS on the reproductive behaviour of those not infected. The other, more important reason is that certain fertility-related behaviours – sexual behaviour, contraceptive behaviour – will be the primary determinants of the future trajectory of the pandemic.

It is very difficult to design empirical studies that yield valid estimates of the independent effect of the HIV/AIDS pandemic on the fertility of the seronegative population. Many other forces can be simultaneously acting to decrease, or increase, levels of fertility and each of its proximate determinants. More than a decade ago, Caldwell and co-authors speculated that HIV/AIDS might contribute significantly to the transformation of reproductive regimes in Africa, indeed might be the key catalytic force in the onset of fertility transition in many countries in the region (Caldwell and others, 1989). A decade later, Caldwell is far less confident that consciousness of the AIDS pandemic has affected reproductive behaviour (Caldwell 1999, Caldwell 2000), despite the fact that the 1990s witnessed the onset of fertility decline in many countries in the region (Cohen 1998). Caldwell now fears that the AIDS pandemic, by retarding mortality decline and reinforcing perceptions that mortality risks remain high, might even work against fertility decline in some parts of Africa, such as Nigeria (Caldwell and others, 1999; see also Gregson, 1994). In fact, there is little in the way of rigorous empirical research from which one might determine whether Caldwell's early optimism or more recent pessimism is closer to the truth. Gregson (1994) suggests that the greatest analytical leverage on this problem will be obtained by thorough exploration of individual intentions and motivations through in-depth KABP (Knowledge, Attitudes, Beliefs, Practices) studies and ethnographic studies. In making this recommendation, Gregson by implication concedes the impossibility that rigorous quantitative research might partial out the independent effect of HIV/AIDS on fertility change. If we are to make some headway on this problem, there is a clear need for the development of some imaginative research designs (see section V of this report).

The responses to HIV/AIDS among the non-infected are assessed below by considering, in turn, possible effects on fertility desires, sexual exposure, contraceptive behaviour and induced abortion, and post-partum behaviours.

Fertility desires

Two types of empirical evidence have been brought to bear on the question of whether awareness of HIV/AIDS has affected fertility desires: in-depth qualitative research, some of it ethnographic, and survey data. Both types of evidence are scanty, and neither suggests a marked effect on fertility desires, although there is some suggestion that this is beginning to emerge.

The major conclusion is that fertility desires are driven by social and economic considerations that are surprisingly robust in the face of the AIDS pandemic. Setel (1995), reviewing research from central and eastern Africa, concludes that reproductive responses are not based primarily on personal assessments of HIV risk to self, partner or child. Rather, the main factor is the continued importance of reproduction for both women and men in marginal socio-economic circumstances. Setel also concludes that, in formulating their fertility desires, individuals feel compelled to respect the existing structure of reproductive decision-making power along the dimensions of generation and gender. In a similar vein, Aka-Dago-Akribi and others (1999) conclude from in-depth interviews in Côte d'Ivoire that for most individuals, health considerations are secondary to the meeting of social and familial obligations. With these fundamental factors underlying fertility desires, there is limited scope for concerns about HIV/AIDS to exercise any influence. For instance, Rutenberg and others (2000) report that respondents in qualitative interviews in Zambia are perplexed by the question of how HIV/AIDS might change views about childbearing; they find it difficult to comprehend the logic of awareness of HIV/AIDS changing

reproductive goals, except for the minority of individuals who know themselves to be HIV-positive. Essentially the same point is made implicitly by focus group participants in Kenya (Bauni and Jarabi, 2000): while views are mixed about the risk of HIV infection, there is unanimity that unwanted pregnancies are a serious problem, especially among young unmarried individuals. That is, the problematic outcome of sexual activity is unwanted pregnancy, not HIV infection.

Some effects of HIV/AIDS on fertility desires are nevertheless evident. Even within the existing reproductive calculus, the surge in the number of orphans in the highest prevalence areas of Eastern and Southern Africa is causing some individuals to re-think their personal childbearing as their responsibility of caring for other children is forced on themselves or on near kin and neighbours (Rutenberg and others, 2000). Economic costs of children have long been recognized and acknowledged as a valid reason for curtailing reproduction in African (and most) societies. The Zambian respondents perceive that fertility desires are on the decline, but attribute this mostly to increasing economic distress, to which the burden of caring for orphans makes a small, albeit distinct, contribution (Rutenberg and others, 2000). Moreover, there is one line of thinking revealed by the Zambian in-depth interviews that does constitute a causal effect of concern about HIV/AIDS on fertility desires. The respondents reason that a large number of children contributes to household poverty, which in turn can lead to risky sex, which in turn increases the likelihood of acquiring AIDS; hence, by this logic, concern about HIV/AIDS is an argument for restricting fertility. Survey data from rural Zimbabwe provide some quantitative support for a conscious reduction in fertility desires in response to the AIDS pandemic (Gregson and others, 1997): one-half of respondents, when asked directly, indicated that they desired fewer children because of AIDS. However, this is self-assessment from a cross-sectional survey, not longitudinal observation of changing fertility desires.

Speculation abounds that awareness of HIV/AIDS might lead to an increase in family size desires, as individuals conclude that they must have extra births to ensure that a sufficient number survive (e.g. Ntozi and Kirunga, 1998). However, empirical verification that this logic actually operates is lacking. Presumably, this logic would operate most powerfully among the HIV-positive, but as noted in section I, the existing empirical evidence indicates that knowledge of seropositive status if anything reduces the desire for further children. A positive response to HIV/AIDS that is perhaps more plausible would be a decision to increase the pace of childbearing (i.e. shorter birth-spacing), in order to achieve the desired family size at the earliest age and prior to acquiring AIDS (Gregson 1994, Setel, 1995). This possibility would seem worthy of investigation, given the prominence of conscious birth spacing in African reproductive regimes. But Gregson and others (1997) found that, contrary to the hypothesis, a very small percentage of the Zimbabwean respondents recognized accelerated childbearing as a sensible response to the threat of AIDS, while 46 per cent indicated that they would prefer to delay the next child because of the threat of AIDS in order to permit the body to recover even more fully from the last pregnancy, and to monitor their economic situation.

With the exceptions of studies by Rutenberg and others (2000) and Lyons (2001) there are few rigorous empirical investigations – qualitative or quantitative – of the extent to which awareness of HIV/AIDS has changed childbearing aspirations. Instead, research attention has focused primarily on behaviours, in particular sexual activity and contraceptive use. While these behaviours are clearly of great importance because of their influence on the spread of HIV, they are but two components of the larger reproductive regime. There is a need for further research on the ways in which consciousness of the AIDS pandemic is, or is not, transforming reproductive strategies.

Sexual exposure

There are different sources of sexual exposure that should be distinguished, because they may respond differently to concern about HIV/AIDS: entry into stable sexual union and the duration of such unions; sexual activity within stable unions; and sexual activity outside of stable unions (whether pre-union, extra-union, or post-union).

1. Entry into marital unions

One of the debates about the impact of the AIDS pandemic on reproductive behaviour in Africa concerns its possible effect on union formation and dissolution. Contradictory effects have been posited. Gregson (1994), without empirical data, speculates that the pandemic might place downward pressure on the age at entry to sexual unions, among women in particular, for three reasons: first, a desire on the part of women to secure a long-term relationship as soon as possible, with a reduction in the number of pre-union partners an unintended consequence; second, an effort by men to reduce the likelihood that their partner is infected with HIV by choosing a younger (and hence less sexually experienced) woman; and, third, female orphans' need for the financial support that a stable union can provide. Earlier entry into unions will of course exert upward pressure on fertility, everything else being equal.

The more common hypothesis is that fear of AIDS leads to postponement, or even avoidance altogether, of engagement in sexual unions. Two studies conducted in Uganda report just such a change in female nuptiality (Mukiza-Gapere and Ntozi, 1995, Asiimwe-Okiror and others, 1997). These studies describe how the fear of AIDS has resulted in a generalized reluctance to become married and a far more careful choice of partner, with the latter typically resulting in delayed union formation. More fundamentally, Mukiza-Gapere and Ntozi sense a societal shift towards much greater tolerance of young adults delaying marriage, reflecting parents' respect for the children's concerns about the risk of HIV infection. However, there are no data from other parts of Africa that document similar nuptiality changes. The Kenyan focus group discussions analysed by Bauni and Jarabi (2000) give some hint of a shift towards more committed (and monogamous) unions among young adults, but this is not clearly articulated. More dramatically, commentators on South Africa society describe a younger generation that is abandoning the institution of marriage, under the dual pressures of the AIDS pandemic and economic stress; but empirical research that confirms such a cultural transformation is actually underway seems to be lacking.

There are potential effects of HIV/AIDS on the dissolution of unions and the entry into higher-order unions. Clearly the pandemic, by increasing levels of adult mortality, increases the probability of becoming widowed. Whether the pandemic also changes the probability of divorce/separation is another question, as yet largely unexplored in empirical research. Mukiza-Gapere and Ntozi (1995) derive what appear to be contradictory conclusions from analysis of focus group discussions in Uganda. On one hand, there was an increase in the rate of divorce and separation (accompanied by increased acceptance of divorce or separation as sensible choices) reflecting an unwillingness to remain with unfaithful partners. On the other hand, a trend emerged towards more fidelity and stability of unions due to the threat of HIV infection. There seems to be more agreement among researches despite a limited empirical foundation, that the AIDS pandemic is reducing the probability of remarriage (Caldwell 1997), as the stigma attached to a former partner having acquired AIDS (whether confirmed or suspected) sharply reduces widows' attractiveness in the marriage market. Gregson and others (1997) conclude from analysis of cross-sectional survey data from rural Zimbabwe that AIDS is reducing the likelihood that widows remarry but may increase the likelihood of divorcees remarrying. Mukiza-Gapere and Ntozi (1995) detect a decline in widow remarriage in Uganda.

It has to be noted that a decline in rates of remarriage will affect fertility rates only to the extent that individuals who might have remarried have many post-union fecund years remaining. If instead these individuals are at the older end of the reproductive lifespan or die relatively soon after the dissolution of the union, then the impact on fertility of reduced rates of remarriage may be rather modest.

2. Sexual activity within stable unions

Within stable unions, one conceivable response to the threat of AIDS is a reduction in marital coital frequency. Participants in qualitative interviews in Zambia, when asked how to avoid HIV infection, often responded "avoid sex in the home", i.e. practice abstinence (Rutenberg and others, 2000). Whether in fact there has been a trend towards reduced sexual activity within marital unions is a question for which empirical data are lacking. Ng'weshemi and others (1996) found no change over a two-year period in the early 1990s in the coital frequency within the primary unions of male factory workers in Tanzania. The post-partum behaviours are considered below.

3. Sexual activity outside of stable unions

Sexual activity outside of stable unions has received the most attention in the literature, for the very good reason that the prevalence of multiple sexual partners is a key factor determining the rate of spread of HIV. The study that has drawn the most attention is the study by Ng'weshemi and others (1996) on male factory workers in Tanzania. Over a two-year period in the early 1990s, the likelihood of having multiple partners declined from 22 per cent to 12 per cent (referring to the previous month) and the likelihood of a "casual sex partner" also declined from 10 per cent to 5 per cent. Several qualitative studies conducted in Uganda reveal attitudes and sentiments consistent with similar behavioural changes, but these studies do not offer quantitative evidence that behavioural change has actually occurred (Mukiza-Gapere and Ntozi, 1995, Ayiga and others, 1999, Ntozi and others, 2000, Ntozi and others, 2001). Evidence on stability or change in sexual activity outside of stable unions should be available from two different data sources: successive KABP surveys (including DHS surveys that contain HIV/AIDS modules) and successive sample surveys of adolescents. Thus far, however, there were no published studies that use these data sources to analyse trends in extra-union sexual activity.

To conclude, there is some evidence that various aspects of sexual behaviour are undergoing change in African societies under the many pressures imposed by the AIDS pandemic. The data suggest that entry into stable unions is being postponed, remarriage following union dissolution is on the decline and sexual activity outside of such unions may be on the decline. However, the empirical evidence supporting this view is very limited. Varga (1997) and Caldwell (1999) come to an entirely different conclusion arguing that the changes in sexual behaviour in sub-Saharan Africa in fact have been quite modest both in high HIV prevalence countries such as South Africa (Varga, 1997) and low prevalence countries such as Nigeria (Caldwell and others, 1999). In other words, it largely remains unclear whether the threat of AIDS is changing sexual behaviour.

A final point: once it is ascertained whether or not sexual behaviour is changing (and in which aspects), the net impact on fertility remains a separate issue. The changes that have been posited – delayed entry to stable unions, reduced likelihood of remarriage after union dissolution, fewer extra-union liaisons – typically would have the effect of reducing fertility. But more intense investment in one union conceivably could have the effect of increasing fertility within that union. A reduction of the period of post-partum abstinence, for example, could certainly have this effect.

Contraceptive behaviour

Of the various components of reproduction, it is probably contraceptive behaviour that has the most realistic potential for causing substantial changes in levels of fertility in Africa in response to the AIDS pandemic. This is the case simply because levels of contraceptive use are, with few exceptions, low throughout the region. Changes in sexual exposure and/or post-partum behaviours could induce substantial change in fertility. But the changes in these components of reproductive behaviour in a magnitude required to match the fertility impact of rather plausible changes in contraceptive practice are unlikely. The amount of change in contraceptive use that can be attributed to HIV/AIDS *per se* remains highly uncertain. Indeed, as Zaba and Gregson (1998) point out, it is a considerable challenge to decompose trends in contraceptive use (preferably method-specific trends) into a portion attributable to awareness and concern about HIV/AIDS and portions attributable to other causes. An accurate accounting also requires subtracting out that fraction of use apparently motivated by HIV/AIDS that would occur in its absence, i.e. method switching and method substitution.

The two contraceptive methods most protective against HIV infection are the condom and abstinence. Condom use is clearly on the rise in Africa. For example, DHS data (Demographic and Health Surveys, 2002) show substantial increases in reported ever use of the condom in Cameroon (from 9 per cent in 1991 to 22 per cent in 1998), Côte d'Ivoire (from 14 per cent in 1994 to 23 per cent in 1999), Ghana (from 4 per cent in 1988 to 14 per in 1998), Togo (from 4 per cent in 1988 to 16 per cent in 1998), Zambia (from 9 per cent in 1992 to 17 per cent in 1996) and Zimbabwe (from 13 per cent in 1988 to 18 per cent in 1998). Smaller increases are evident in Burkina Faso, Kenya, Madagascar, Malawi, Mali, Nigeria, Senegal, Tanzania, and Uganda. More revealing of the possible determining effect of HIV/AIDS are associations between the increased use of condoms and various indicators of HIV/AIDS knowledge and attitudes. In Zimbabwe, those individuals with greater AIDS knowledge and awareness are more likely to use condoms (Gregson and others, 1997). In the Rakai data from Uganda, where use of the condom increased from 10 per cent to 17 per cent from 1995 to 1998 (making the major contribution to an increase from 11 per cent to 20 per cent in the prevalence of any modern contraceptive), condom use is associated with self-perception of HIV risk and condom use is higher among those with multiple partners -- for example, the young and unmarried (Lutalo and others, 2000). The authors conclude that in Rakai district the primary motivation for condom use is protection against HIV infection. More generally, a cross-sectional association between self-perceived risk of HIV and condom use has been observed in many other settings (Mehryar, 1995, Agha, 1998, Meekers and others, 2001). Suggestive of a conscious response to perceived risk of HIV, condom use is higher in those circumstances where risk is higher: among individuals with multiple partners and in extra-marital sexual encounters (Gardner and others, 1999).

From the standpoint of fertility impact, however, undoubtedly some of this increased condom use is method switching and therefore should be discounted. Gregson and others (1997) find that 6 per cent of respondents in Zimbabwe report a change in contraceptive method after hearing about AIDS, virtually all of this a switch from another method to the condom. Furthermore, if the abandoned methods are more efficacious than the condom in preventing pregnancy (condoms have relative low use-effectiveness), then the increase in condom use might have a fertility-enhancing effect.

HIV/AIDS can also motivate contraceptive use for pregnancy prevention, i.e. declines in fertility demand that are a response to the various social, economic, and health repercussions of the AIDS pandemic (see sub-section on fertility desires above). However, both quantitative effort to calculate the magnitude of this particular contribution of HIV/AIDS to changing contraceptive practices in Africa and qualitative research that offers systematic treatment of this topic are missing.

While a strict accounting of the causal contribution of heightened consciousness of HIV/AIDS to trends in contraceptive use has not yet been achieved, it seems clear that the contribution is of some significance – it is the most plausible explanation for the marked increased in the prevalence of condoms. As Caldwell and others (1999) note with reference to Nigeria, the acceptance of the condom in many African societies is impressive – abhorred just one decade ago, now common practice at least when engaging in high risk sex. Yet, use of the condom remains rare in stable and not so stable sexual unions -- rare in relation to those times when it would be advised for either or both STD prevention and pregnancy prevention. This reflects the continued strength of the several social and psychological obstacles to condom use in most types of heterosexual relationships in African societies (Meursing and Sibindi, 1995; Varga, 1997; Rutenberg and others, 2000, Agha and others, 2002).

Induced abortion

Some researchers, seconding the view of public health officials, believe that rates of induced abortion have increased in sub-Saharan Africa. For example, there is suspicion that induced abortion has become a principal means of fertility regulation in West Africa, especially among the young and unmarried (Caldwell and Caldwell, forthcoming). Yet, there have been no efforts to attribute any of this increase to HIV/AIDS. Were there to be an effect on rates of induced abortion, this would reflect AIDS-induced changes in fertility desires, since presumably very few persons would perceive induced abortion to be HIV-preventive. There have been some calls for legalizing induced abortion for those women who are HIV-positive (see Setel, 1995). This would have the effect of reducing fertility in direct response to HIV.

Post-partum behaviours

In section I, were discussed changes in post-partum behaviours among those infected with HIV, in particular reductions in breastfeeding in an effort to avoid passing the virus to the child. This same concern can motivate reductions in breastfeeding among the non-infected segment of the population, to the extent that women are uncertain about their sero-status or incorrectly suspect that they are seropositive. In rural Zimbabwe, Gregson and others (1997) find that breastfeeding is less likely among those women who perceive their risk of HIV infection to be higher. Undoubtedly many of these women who perceive themselves to be at higher risk are in fact uninfected. Decreases in breastfeeding will lead to increases in fertility, everything else being equal. Because average breastfeeding durations are relatively long in most African societies, the potential increase in fertility is surprisingly large (Stecklov, 1999).

Perhaps more likely is that adherence to the long periods of post-partum abstinence that are normative for many ethnic groups in the region (Lesthaeghe, 1989; Lesthaeghe and Eelens, 1989) will weaken. There is anecdotal evidence, confirmed by focus group discussions (Gregson and others, 1997), that post-partum abstinence is a significant factor motivating men to engage in extra-marital sex (Cleland and others, 1999, Ali and Cleland, 2001). Hence, women may be prepared to abbreviate the period of post-partum abstinence in order to decrease the risk that their male partners will become HIV-infected through extra-marital sexual liaisons during this period (Gregson, 1994, Carael, 1995). The logic is relatively simple and straightforward, and it reinforces tensions about post-partum abstinence that long precede the AIDS pandemic. While this scenario is entirely plausible, rigorous research – either quantitative or qualitative -- that examines the prevalence of this behavioural response to the threat of HIV/AIDS is missing.

D. POPULATION-LEVEL EFFECTS

In this discussion, "population-level effects" refer to changes in societal structures that affect the level of fertility in the population. Changes in both demographic and socio-economic structures can affect fertility. These effects have not yet been the subjects of empirical investigation, rather simply a matter of speculation, and therefore this discussion will be brief.

Adult mortality due to AIDS can create several distinct population-level effects on fertility. Probably the most important population-level effect is the loss of substantial reproductive potential due to adult female mortality (Gregson, 1994). AIDS mortality occurs primarily in the adult reproductive ages. Were fertility rates in the reproductive ages to be unaffected by AIDS mortality (which, as will be discussed momentarily, is not likely to be the case), then the selective loss of reproductive-age adults can be expected to reduce the crude birth rate (CBR) -- the ratio of total births to total population – because the death of reproductive-age adults would have a larger proportionate impact on the numerator than the denominator of this ratio. The general fertility rate (GFR) is also sensitive to the impact of AIDS mortality on age-structure, in this instance the age-structure of women of reproductive age. Zaba and Gregson (1998) propose that the mortality from a mature AIDS epidemic might act to increase the GFR, due to higher AIDS mortality at the older reproductive ages where fertility rates are relatively lower. This assumes an age-pattern of HIV infection and a distribution for the elapsed time from infection to death that jointly produce disproportionate rates of AIDS mortality at the older reproductive ages.

Further complicating this analysis, the assumption that fertility rates in the reproductive ages are unaffected by AIDS mortality is clearly untenable, judging from the evidence reviewed in section I above. HIV infection is on balance selective of lower fertility women, primarily because infection by other STIs, which themselves depress fertility, is a strong risk factor for HIV infection. The positive association between coital frequency and risk of HIV infection induces a selectivity in the opposite direction, but this is thought to be more than offset by the negative selection on fertility due to other STIs. Excess mortality of the sub-fertile will lead to a positive impact of AIDS mortality on fertility rates, everything else being equal (Zaba and Gregson, 1998). The same selectivity distorts cohort fertility, which the period TFR mimics as a synthetic cohort measure. Bracher and Santow (2001) show that the completed fertility of a cohort subject to AIDS mortality will be higher than the sum of the age-specific fertility rates of that cohort because the calculation of fertility rates at younger ages includes lower-fertility women who die before completing the reproductive years, which in turn will be higher than the potential/expected fertility of the cohort at the beginning of the reproductive years. Once age-structure changes are controlled, this positive effect of AIDS mortality on fertility rates should dominate. The widely used total fertility rate (TFR), because it is confined to the reproductive-age population and is age-standardized, should show such positive effects of AIDS mortality.

The effects just described are the result of adult female mortality. Another set of effects operate through the structure of the marriage market, which is altered by either male or female mortality. It should first be noted that postponement of entry into stable sexual unions, an individual-level response to the pandemic discussed in section II, can dampen period fertility rates through so-called "tempo" effects (Bongaarts and Feeney, 1998). Other transformations of the marriage market can exert subtle, and difficult to predict, influences on fertility rates by modifying the amount of sexual exposure experienced in the population. Most fundamentally, to the extent that AIDS mortality is sex-selective, this will result in imbalances in the marriage market that should increase the fraction of the reproductive-age population outside stable sexual unions (an excess number of females may be less consequential because polygyny is an established institution in African societies). More specifically, increased widowhood during the reproductive ages, accompanied by a growing aversion to widow remarriage, will increase the fraction of the reproductive-age population that is sexually inactive, thereby reducing population-level fertility rates.

AIDS mortality, and more generalized reactions to the AIDS pandemic, might also alter the normative acceptability of polygynous unions. A common expectation is that polygyny will become less accepted as the pandemic persists (Gregson, 1994), although in fact there is little basis expecting changes in one direction or the other. Polygyny on balance probably increases population-level fertility rates, and hence a reduction in the prevalence of polygynous unions would place downward pressure on fertility, but this effect almost certainly would be small in magnitude. Moreover, there is continuing debate on the issue of the overall impact of polygyny on fertility levels, and one generalization may not be valid for all African societies (Pebley and Mbugua, 1989).

In short, HIV/AIDS may have subtle and complex effects on the marriage market (and thereby on fertility), and whether the overall net effect is positive or negative is difficult to determine *a priori*. More thought and investigation should be devoted to the possible impact of HIV/AIDS on nuptiality patterns (Zaba and Collumbien, 1996, Ntozi, 1997).

An entirely different set of population-effects might occur in response to changes in socio-economic structures. Almost a boundless number of such changes can be envisioned and only few are briefly reviewed here. To the extent AIDS morbidity and mortality causes macro-economic damage (UNAIDS 2001), this may alter the economic cost-benefit calculus concerning childbearing. The prevailing view is that increased economic strain is a strong incentive for fertility reduction in contemporary African societies (Lesthaeghe, 1989b, Working Group on Demographic Effects of Economic and Social Reversals 1993). This is the view expressed in focus group discussions in Zambia, for example (Rutenberg and others, 2000).

An alternative view would posit that macro-economic struggles close off opportunities in the modern sector of the economy, and that the financial distress of governments and households results in lower average school attainment as recent evidence from Africa indicates is already occurring (Lloyd and Hewett, 2002). Given the cross-sectional fertility differentials that have characterized Africa societies in recent decades, these types of economic changes should act to increase fertility (Gregson, 1994).

Other types of social changes that might occur in response to the AIDS pandemic could have fertility implications. Gregson (1994) surmises that AIDS will force a profound change in the character of adult heterosexual relationships: far more discussion, deliberation, and negotiation (about contraception, about childbearing) than heretofore and, perhaps more importantly, far greater endorsement of women challenging male domination of sexual and reproductive decision-making. Clearly the social transformation Gregson portrays has not yet occurred on a widespread scale (judging from Varga, 1997 and Rutenberg and others, 2000, to select two examples), but in social historical time the pandemic is still a very recent development. We should not under-estimate the capacity of exogenous shocks of this magnitude to undermine established social practices.

E. THE RESEARCH AGENDA

In the attached table, the high priority research problems uncovered by this review are listed.

An increasing number of African countries have carried out more than one national demographic survey (e.g. DHS surveys). These appear to have been under-utilised for the purpose of examining the impact of HIV/AIDS on trends in reproductive behaviour. The problem for the analyst is determining what portion of any observed change in reproductive behaviour can be attributed to HIV/AIDS knowledge and attitudes. Increase in condom use, for example, might be motivated in part by an intention to regulate fertility absent any concern about HIV infection. Two analytical strategies are possible. First, one can examine at the aggregate-level (e.g. regions within countries) the association between HIV/AIDS

prevalence and changes in reproductive behaviours. To what extent is the increase in condom use sharper in high prevalence areas? Through multivariate analyses, the portion of change that can be attributed to HIV/AIDS might be extracted. Second, one can examine at the individual-level the association between HIV/AIDS knowledge/attitudes and changes in reproductive behaviour. To what extent is the increase in condom use more rapid among those who perceive themselves to be at high risk of HIV infection?

F. CONCLUSION

There is much debate about the likely future course of fertility in the high fertility countries of the developing world, especially sub-Saharan Africa. Far more certain is that this region will experience substantial increases in adult mortality during the next two decades due to the AIDS pandemic. The possible linkages between these two major demographic phenomena – fertility trends and the AIDS pandemic – has been the subject of this literature review. At present, the nature and magnitude of the impact of HIV/AIDS on reproductive behaviour cannot be quantified with any precision. To be sure, it can be stated with some confidence that the fertility of those infected with HIV is markedly lower than the uninfected – a differential on the order of 25 per cent - 40 per cent. This differential is probably due primarily to non-volitional factors, in particular the depressing effect of STIs on fecundability. An intentional behavioural response to HIV infection is not yet clearly evident, but may well emerge as the pandemic matures. Obviously the potential population-level impact of such behavioural responses will increase with the increase in the fraction of the population that is infected with HIV.

Even so, behavioural responses by those who are uninfected (actual or self-perceived) has a far greater potential impact on fertility levels and trends – this is certainly true in the near future, and in all likelihood will continue to be true when the pandemic reaches its peak. For this reason, it is distressing that the existing research literature is seriously deficient on this topic, i.e. whether, and to what extent, those persons who live in societies where the risk of HIV infection is high but who do not perceive themselves to be infected are modifying their reproductive aspirations and behaviours in response to a recognition of HIV risk. The plausible responses include changes in fertility desires, changes in sexual and marriage patterns, and changes in contraceptive practice. Changes in one or more of these reproductive domains could significantly shift the trajectory of fertility change in Africa. Equally, whether or not such changes occur will have substantial bearing on the future path of the AIDS pandemic.

HIV/AIDS and Fertility: Priority Research

RESEARCH PROBLEM	RESEARCH DESIGN
1. *Changes in reproductive motivation*: • incentives for having children • costs of childbearing and childrearing	*In-depth qualitative interviews*: cross-sectional, with retrospective assessment Explore views of the costs and benefits of children, with emphasis on changes prompted by AIDS
2. *Changes in reproductive strategies*: • total number of births desired • pace of childbearing	*Demographic surveys*: trends via comparison of successive surveys (total births desired) (But how to determine unique causal contribution of HIV/AIDS?) *In-depth qualitative interviews* (pace of fertility) Examine whether AIDS motivates an accelerated pace of childbearing
3. *Changes in the value of marriage*: • desirability of ever-marrying • optimal timing of first marriage	*In-depth qualitative interviews*: cross-sectional, with retrospective assessment Explore views of costs and benefits of marriage, with emphasis on changes caused by AIDS
4. *Changes in sexual activity*: • extra-marital sex • within-marriage sex, including post-partum abstinence	*Demographic surveys*: trends via comparison of successive surveys (But how to determine unique causal contribution of HIV/AIDS?)
5. *Changes in contraceptive practice*: • increased use of condom • increased use of other methods	*Demographic surveys*: trends via comparison of successive surveys (But how to determine unique causal contribution of HIV/AIDS?)
6. *Changes in post-partum abstinence*	*Demographic surveys*: trends via comparison of successive surveys (How to determine unique causal contribution of HIV/AIDS?)

NOTES

[1] The studies are Carpenter and others. (1997) and Gray and others (1998) on Uganda, Fylkesnes and others (1998) on Zambia and Kigadye and others. (1993) on Tanzania.

[2] As measured by the total fertility rate (TFR), which standardizes fertility levels for age and can be translated into lifetime loss of births.

[3] Botswana with the adult prevalence of 36 per cent is an outlier (UNAIDS 2000).

[4] DeCock and others (1994) for Côte d'Ivoire, Temmerman and others. (1990b) for Kenya, Miotti and others (1990) for Malawi, Gray and others (1998) for Uganda.

[5] An exception is the study of Ryder and others (1991) on Zaire, which finds no statistically significant difference in rates of spontaneous abortion and stillbirth.

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