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**Measuring the Impacts of the HIV Epidemic
on Household Structure and Gender Relations**

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For much of the 20th century, the global health transition brought reductions in adult mortality, as well as in the proportions of deaths due to infectious diseases with person-to-person transmission, thus lowering the risk to lose a spouse, a parent, and even more so both parents. The HIV/AIDS epidemic is unfortunately reversing these trends in some populations, leaving up to 19% of children under age 15 as paternal or maternal orphans in some sub-Saharan African countries (Bicego, Rutstein & Johnson 2003; Case, Paxson & Ableidinger 2004; Monasch & Boerma 2004) according to household survey data (which comparisons with model simulations suggest may underestimate orphans' number, see Grassly et al. 2004).

The disproportional loss of individuals in their most productive years raises concerns over the welfare of surviving members of affected families and social institutions. It may also impact gender relations in the affected countries because (a) the responsibility to care for sick individuals typically different by gender, and (b) the welfare of the survivors of AIDS victims might also be different by gender. Assessing the downward impact of the HIV epidemics on those who might not be infected but are clearly affected by the epidemic raises a number of measurement issues, which this article will discuss with a special emphasis on “bilateral” (often referred to as double) orphans. With the low infectivity of HIV and long duration from infection to full-blown AIDS, the prevalence of bilateral orphans has remained low (in the order of 2-3% in the worst-affected countries to date). As the epidemic matures, however, an increase in

bilateral-orphan prevalence appears inevitable, and NGOs, national and international agencies are gearing up for this most challenging aspect of the “AIDS-orphan crisis.”

Measuring the Demographic Impacts of the HIV Epidemic: An Overview

Understandably, the first impact of the HIV epidemic to be recognized was the resulting increase in mortality in countries where HIV prevalence was expected to reach a few percent nationally. Typical adult mortality rates in the sub-Saharan countries with the first generalized epidemics to be recognized were in the order of 10 to 20 deaths per thousand person-years. As an order of magnitude, one can estimate that a 1 to 2 percent adult prevalence would, in a steady state and with 10 years from infection to death, yield an additional 1 to 2 deaths per thousand person-years, that is, a 10% increase in adult mortality. This simplistic calculation suggests that a 5% prevalence could lead to a one-third increase in mortality—not a negligible change for the purpose of population forecasting for instance. Since national epidemics are not typically in a steady state, that one has to adjust for competing causes of deaths, and to account for vertical mother-to-child transmission at birth, the incorporation of the mortality impact of HIV epidemics in population forecasts is not as simple an affair as the above rule of thumb may erroneously suggest.

Incorporating deaths expected to result from HIV infection into population forecasts presents technical challenges, but it also requires a number of assumptions about how other factors affecting demographic behaviors might also be changing as a result of a generalized HIV epidemic. In the early demographic models, the assumptions were, implicitly, of no other impact than the premature deaths of HIV positives

individuals (Heuveline 1997). Some models now factor in some other non-behavioral impacts, such as the synergies between the prevalence of tuberculosis and of HIV, or the effect of HIV infection on conception and spontaneous abortion rates. A large array of other potential “downstream” effects of the epidemic remains ignored, however. Are the morbidity and mortality of HIV-negative individuals really unaffected by the HIV epidemic, in particular, among widows or widowers and orphans? For the foster parents of these orphans, are fertility preferences unchanged after having to care for additional children? For widows and widowers, are remarriage prospects unchanged by the understanding of HIV transmission between spouses? Is age at marriage affected by expectation of HIV status being associated with age?

The implicit assumption that there are no other impacts than those explicitly modeled reflects modelers’ agnosticism on many of these questions, as extant impressionistic accounts hardly amount to solid evidence that these other impacts are significant enough to warrant inclusion in reasonably-sized models. There are several empirical obstacles to the constitution of a compelling body of evidence on HIV’s downward impacts. First, any impact assessment requires a benchmark. The HIV epidemic has attracted attention and large data collection projects to populations that had been severely underserved in this respect. In assessing the mortality impact of the HIV epidemic, demographers had to rely on indirect estimates of mortality before the epidemic rather than on hard data. For many of the other behaviors that affect reproduction or family construction, precious few ethnographic studies provided detailed accounts of specific, small populations, but many large gaps in our understanding remain. Anthropological studies reveal great diversity in kinship systems within the vast expanses

of “sub-Saharan Africa” (Radcliffe-Brown and Foder 1950), and more recent survey data also confirm the complexity of contemporary living arrangements (McDaniel and Zulu 1996). A second, related difficulty is that the benchmark we would need to assess the impacts of the HIV epidemic is itself a moving target. A generalized HIV epidemic is about three decades old in a number of countries, which have in the meantime witnessed a number of deep macro-social transformations, arguably intertwined with the epidemic: massive internal or international migration, the spread of formal education, or even in some cases, prolonged warfare. Families systems and the institution of marriage were already changing at the outset of the epidemic (Parkin and Nyamwaya 1987; Weisner, Bradley, and Kilbride 1997), and even if we had a solid understanding of family systems and institutions then, we could not hold this past state to represent what would be in the absence of HIV.

Without good benchmark data available, evidence of HIV impacts has been sought primarily through analyses of cross-sectional survey data. Increasingly, the challenge to this analytical strategy is to define a comparison group for households directly impacted by the epidemic. As households with HIV-positive members adapt to the morbidity and mortality burden, they may draw on kinship or other networks by borrowing cash or services, and receiving or sending household members. This adaptive reallocation of resources and individuals diffuse the impacts of the epidemic across a larger number of households. For each household directly affected by the epidemic in the sense of a member being infected, there are thus several other households indirectly affected. A study in rural Uganda indicated that while nearly 20 percent of adults were infected, 31.3 percent of households had at least one HIV-infected resident adult

(Nalugoda et al. 1997). With this prevalence level, the majority of households is likely affected by the epidemic, and the whole community is impacted. In any event, data from surveys that typically sample on households as units of analysis are problematic for the assessment of the downward impacts because they collect data on the selected households in isolation from the network of households in which they operate. One may fear that impact assessments from this “atomistic” survey approach will repeat the failure of prevention-driven sex surveys that typically sampled individuals in isolation from their sexual networks. This approach led to reify the “number of sexual partners” as the key measure of risk, even though a simple probabilistic model suggests the risk of infection is higher for a monogamous person with an infected partner than for a polygamous person with a mix of infected and uninfected partners (Smith 1992)—which the growing prevalence among monogamous married woman painfully illustrates.

The coping processes through which affected households adapt to the impacts of the epidemic also argue strongly for longitudinal data collection. Following the HIV-infection of one of its member, a household experiences a sequence of events that may entail the infection of an adult partner, the birth of an uninfected baby, the birth of an infected baby, the death of that HIV-positive infant or child, the death of the first infected adult, the death of his or her partner, and eventually the household dissolution and fostering of the surviving children. The sequence in this example considers only HIV status and household membership, but in considering some of the impacts of HIV, the sequence of relevant events might be even more complex. The grouping of households in which one member is HIV-positive at a given point in time lumps together households at different stages of a sequence of shocks and responses. Depending on the stage, some

impacts might be weak or strong, some impacts might be transient while some other endure, and some might even be negative while some others might perhaps be positive. Estimating the impacts of the epidemic on a cross-section of households directly affected by the epidemic but caught at different stages may suggest only modest average effects.

The above discussion suggests a need for longitudinal rather than cross-sectional data collection that preferably started before the outset of the HIV epidemic in a given population. A few relatively small-scale longitudinal data collection projects (e.g., demographic surveillance systems) may meet all these criteria, but larger projects were typically launched in order to study the epidemic after it was evidently affecting a population already. As no particular data set is a panacea, what we can learn on the demographic impacts of the HIV epidemic comes from culling evidence from different projects with different strengths and weaknesses. This raises the question of how context-dependent these impacts might be, or in plainer words, how relevant what we can learn from a particular setting might be to another setting. This issue has generated substantial debate, unresolved to date, and it cannot be decisively settled here (if ever). It will simply be argued rather, than we have a better chance to generate relevant knowledge across settings by studying the processes or mechanisms through which households are affected by and try to cope with the epidemic, than by focusing merely on “outcomes,” that is, attempting to measure impact sizes in a given setting and at a given point in time. An understanding of processes is also critical to design successful interventions to maintain the welfare of affected individuals, households, and families.

The study of these processes requires conceptualizing the pathways through which the epidemic operates. Developing such a conceptual framework for each of the

potential downward impacts of the epidemic would require more space than allotted to this article. For the core of the paper, therefore, we illustrate the discussion by focusing on the impact the epidemic may have on orphans. While numerous studies document the negative consequences of becoming an orphan at a young age, establishing the mechanisms affecting or protecting orphans is perhaps more scientifically challenging than one may think at first. This is due in part to the conceptual diversity of the potential mechanisms, and in part to specific empirical challenges. We begin by developing an overall conceptual framework for articulating these potential mechanisms. We then discuss the relevant empirical findings and limitations.

Conceptual Framework: An Illustration

Children's wellbeing and successful development depend on physical and human "resources" and their "abilities" (to use resources efficiently). Children's access to many of those resources is indirect and mediated by a few privileged adult-child ties within a larger network of economic and cultural relationships. A child's wellbeing, development, and eventually, successful transition to adulthood depend both on these few adults' own standing in the larger network and on the strength of those ties, relative to other ties that may entail competing claims to the same resources. Within this general framework, we might expect orphans to be affected by a parental death through direct (e.g., psychological) effects on their abilities and indirect effects that reduce their access to resources. These indirect effects may originate in two different types of change. First, the adults to whom orphans are still connected may face economic and psychological hardships affecting their own access to resources. Second, orphans might be less strongly

connected to the adults primarily responsible for their welfare post-death than they were to the deceased biological parent. Effects linked to the first type of change should be household-level effects, while those linked to the second type of change might be termed *relational* in that they depend on an orphan's relation to the new head of the household. Families can be resilient and able to eventually cope with the hardships induced by an early adult death, but even transitory effects may have a lasting impact on children who are involved in age-specific developmental tasks. This impact should thus vary with the orphan's age at the time of parental death. Moreover, both types of change above should affect paternal and maternal orphans differently—depending on the gendered adult control over key resources and the structure of kinship—but be particularly strong for bilateral orphans.

With respect to household hardships, a seminal paper by Becker and Tomes (1979) illustrates the conditions under which investments in children's human capital may nonetheless remain optimal after a parental death. One of those conditions is that the household head faces no liquidity constraints. This may not be the case, however, in developing countries with no formal insurance markets. In a series of papers on India and Thailand, Townsend (e.g., 1995) reports evidence of smoothing of household consumption over time and across space, indicative of some risk sharing between neighbors and within extended families. These informal mechanisms only provide partial insurance though and insurance might be maintained partly by reciprocity expectations. Households with orphans that face chronic difficulties rather than temporary ones might appear less likely to reciprocate and less able to enter risk sharing networks.

Another condition is intergenerational altruism, and in particular, that the adult decision maker, caring equally about each child, bases her educational investments only on the expected returns for each child (effects on their future productivity). Under this condition, investments in orphans' education could still be impacted by parental death, but only if lower returns relative to other children in the household are expected (e.g., due to psychological effects of parental death on their learning abilities). The assumption of indiscriminate altruism should not be overlooked, however, as placing orphans with relatives is one of the strategies that families may use to adapt to an early adult death. In our above framework, such orphan placement can be thought of as a trade-off between household-level hardships, reduced by placing the orphan into a new household less directly affected by the death, and relational effects, potentially arising from the orphan's weaker tie to the new household head. Socio-biological theory emphasizes one aspect of these ties, genetic relatedness, which should have evolved as a key determinant of adult investments in children since natural selection on inclusive fitness should have favored cooperative behavior that benefits one's kin over indiscriminately altruistic behavior. The corresponding prediction, known as Hamilton's (1964) rule, is that for a given activity with an energy cost for ego and a fitness benefit for ego's kin, the higher the coefficient of genetic relatedness between ego and a particular kin, the stronger the selection pressure. Accordingly, children should be most likely to receive costly investments from their own biological parents. As for other relatives, cooperative rearing should be expressed to the greatest extent between the closest genetic relatives, which is amply confirmed in studies of bird species and mammals (Elmen 1995). While genetic relatedness is the same for a child's grand-parents and her aunts and uncles (full siblings

of either biological parent), grand-parents should invest equally in all their grand-children, while aunts and uncles should invest more in their own reproduction, caring for their own children first.

Superimposed to any genetic basis, social norms and institutions also affect cooperative child rearing. The near-universal institution of marriage and the family hence contributes to solidify children's ties to biological or social parents (Malinowski 1930). The diffusion beyond or concentration upon these parents of the rights and responsibilities toward children has been found to vary greatly, however, both over time (e.g., Aries 1962) and across societies (as illustrated by the variance in the prevalence of fosterage itself). Sociologists have linked these local and temporal variations to macro-level changes ever since Durkheim (1897) argued that the economic and social transformations of his time were weakening the family. Similar concerns over the decline of social solidarity norms thought to have a protective influence on individual wellbeing have continued to emerge from studies of modernization and, more recently, of globalization. While it may "take a village to raise a child," it appears plausible that the development of the market weakens the authority of community elders as social and economic success can increasingly be achieved outside of the community. In high-income countries, the Nation-State has taken over some forms of assistance, and can now be considered as jointly responsible, with the family, for youth's health and wellbeing (Furstenberg 1997). Even in these countries, parents continue to be essential in drawing the resources that children need from an increasingly complex institutional environment (McLanahan 2000), as shown by the voluminous body of research on family structure and youth outcomes. In poorer countries, moreover, the State might lack the means to

enforce universal programs such as compulsory schooling for instance, and the continued reliance on the cooperation of parents or legal guardians is likely even greater. “World-society” institutions (Meyer et al. 1997)—international agencies and non-governmental organizations (NGOs)—may there substitute for the State’s lack of resources with various assistance programs and at the same time become agents of further cultural changes.

Empirical Results and Limitations.

The theoretical perspectives above suggest several ways young orphans may suffer relative to non-orphans, but also several mechanisms that may alleviate potential disadvantages. Extant research includes relatively numerous studies of how several indicators of child wellbeing may differ between non-orphans and different orphan types, but precious few attempts to tease out the possible mechanisms. To begin with, in a review of several case studies from sub-Saharan Africa, Heuveline (2004) does report evidence that young fostered children presented more problems of malnutrition and were under-represented in hospital admissions, that orphans presented more mental health problems than non-orphans, but that orphanhood did not affect reported health and anthropometric measurements. Analyzing 18 national household surveys, Monasch & Boerma (2004) also did not find orphans more likely to be underweight than non-orphans among 1-4 year-olds. They did not find significant differences with respect to the working patterns of orphans and non-orphans either, but acknowledge that caretakers may under-report children’s work load and that children in the worst forms of child labor may not live in a household.

Educational outcomes are perhaps the most commonly studied indicators. Heuveline's (2004) review reveals conflicting evidence on school enrollment and school completion from sub-Saharan African case studies, varying by orphan type and gender, with possibly more evidence of orphan disadvantages in recent studies. Similar inconsistencies and trends emerge from analyses of national household surveys from the region. Lloyd and Blanc (1996) did not find differences in enrollment status among 6-14 year olds, nor in grade attainment among 10-14 year olds. Differences between orphans and non-orphans, especially strong for bilateral orphans, were later reported in the likelihood to be in school (Case et al. 2004; Monasch & Boerma 2004), and to be at the appropriate grade level for age (Bicego et al. 2003). In cross-sectional studies, however, attributing such differences to parental death is complicated by the possibility that orphanhood might be "endogenous," that is, that with respect to some of the characteristics thought to be affected by becoming an orphan, families that lose an adult parent early already differed from those who do not before that loss. Perhaps the only study to date with a longitudinal design allowing the authors to address this potential problem was recently reported on by Evans and Miguel (2007). They confirm the endogenous nature of orphanhood and that cross-sectional estimates of the differences between orphans and non-orphans would thus be biased. Other authors have derived statistical adjustments. Gertler, Levine & Ames (2002) for instance use a statistical procedure to match orphans and comparable non-orphans (propensity-score matching) in their study of Indonesian orphans still living with one biological parent, and still find that parental death has a strong net effect on a child's enrollment. Alternatively, Case and Ardington (2006) base their study in a South-African DSS in order to control for

households characteristics before parental death, and they also document significant effects of parental death on schooling outcomes. Interestingly, Evans and Miguel (2007) suggest gendered effects: (a) the impact of maternal death on schooling is larger than the effect of paternal death, and (b) the impact is larger on older girls.

To tease out disadvantage between and within household, Case et al. (2004) compare orphans and non-orphans in the same household (household-level fixed models). They find disadvantage for orphans at the individual level too, regardless of gender. No real consensus emerges, however, on any wealth differential between households with and without orphans. Using a simple-count index of household durables as a proxy for household wealth, Case et al. (2004) report that as a group orphans live in poorer households, although this can be attributed primarily to paternal orphans (no systematic difference for maternal or bilateral orphans). Using an index of household durables based on principal component analysis, Bicego et al. (2003) report that orphans do not appear disadvantaged compared to non-orphans. For Zimbabwe, where the proportion of orphans is among the highest worldwide and the sample of orphans is thus larger, the authors conducted further analysis suggesting that between the two most recent surveys the proportion of bilateral orphans increased in the lowest wealth quintile and decreased in the second and third quintile (no change in the top two quintiles). The authors reason that the findings may signal a strain in the way communities deal with these orphans as their proportion grows larger. Arguably, the strategic placement of orphans becomes more and more constrained as their prevalence increases.

Most studies of child placement come from West Africa, where child fosterage can be relatively common to allow parents to take better-paid but remote jobs, children to

study away from parental home, and families to cope with unforeseen crises (Isiugo-Abanihe 1985; Madhavan 2004). Studies in the region suggest that biological parents typically continue to interact with foster parents, and hence that the wellbeing of fostered children continues to depend on the wider social relation between biological parents and foster parents (Bledsoe 1990). The remedial effects of fosterage are thus more uncertain for bilateral orphans whose parents can no longer play this role and, depending on the kinship structure in a particular society, fosterage consequences might also differ for maternal and paternal orphans. With respect to specific placements, Case et al. (2004) find individual-level disadvantage to be lesser for orphans placed with grand-parents—a rather reassuring finding since grand-parents are the most common foster parents in sub-Saharan Africa, before aunts and uncles (Bicego et al. 2003). A qualitative study in Thailand reveals that in the event they were not able to care for their children themselves, parents there also express a clear preference for grand-parents as foster parents (Safman 2003). Just as orphanhood, however, placement decisions might be endogenous, and children who get placed with a given social parent may differ from those who do not with respect to factors that also affect specific child outcomes. Using another statistical correction to address the possibility of endogenous living arrangements (instrumental variables), Bishai et al. (2003) report that in rural Uganda not only the presence of both parents in the household increases the odds of survival, but the degree of biological relatedness of a child to the head of household is also positively associated with the child survival.

Discussion

Growing numbers of orphans are one of the foretold consequences of the HIV epidemic. Various theoretical perspectives converge in suggesting that this trend might be one of the least ambiguous, negative impacts of the epidemic. The empirical record for orphan disadvantages, however, is perhaps not as compelling as one might expect on these theoretical bases. In short, some authors have been able to attend to some of the analytical problems of studying orphans, but many aspects of our conceptual framework remain poorly understood. These shortcomings originate largely in the empirical limitations of the household surveys analysts must often resort to. These limitations were extensively discussed above, but for orphans a particularly important restriction is that those surveys, designed for other purposes, do not typically collect retrospective information on the conditions at the time of parental death and the larger environment in which households operate.

Even with the epidemic in its third decade, it might also be too early to observe the strongest effects of the epidemic in the case of orphans. There is clear evidence to date that the prevalence of single or widowed female-headed households is increasing, and so is the prevalence of children not living with both biological parents. Yet such households were not rare in Southern Africa for instance, where male work-related migration has long been quite common. But because many of these female heads of households are themselves infected, we can expect a growth in bilateral orphans. The fate of these bilateral orphans, more rare to date, is harder to anticipate precisely because their numbers might remain too small in population-based survey to allow for investigations of the multiple sources of between-orphan heterogeneity.

A more sanguine view is that family systems of the most affected populations have evolved confronting high adult mortality, and that families have been quite resilient and able to shelter their members from some of the foretold consequences of the epidemic (Caldwell 1997). While it is possible that certain cultural features, such as flexibility regarding kinship and living arrangements, have played a positive role in mediating the impacts of the epidemic, others may have contributed to the epidemic— asymmetrical gender relationships, typical age differences between sexual partners, or sexual violence against women, just to mention a few. To attempt to bring the epidemic under control, the dominant model has been unfortunately typical in being based on the external delivery of an elusive vaccine to affected populations rather than working with these populations towards moderating the cultural factors that potentially contribute to the epidemic.

Next to this external-delivery of medical expertise model, the burden of the disease has been left largely to the private sphere. As a result, the care for AIDS victims has fallen predominantly on women and reinforced traditional divisions of responsibilities within households. Similarly, in a context of scarce resources for HIV interventions, decisions about which to pursue are embedded in extant gender relationships. Widespread male circumcision, for instance, directly targets men, and may seem to leave out women and young children (Hankins 2007; Rennie et al. 2007). While modeling the impact of the intervention is reassuring with respect to their protective impact on adult women as well, they also show that interventions can have quite different impacts on different generations depending on the age at which boys and men are targeted (Clark and Eaton 2008). Nonetheless, one legitimate concern remains that until

they heal completely newly circumcised men may be more likely to infect their female partners (Altman 2008). A broader concern is that advocating the benefits of male circumcision may lead to confusion about and contribute to maintain some forms of female sexual mutilation which are controversially referred to as female circumcision and may appear to be the mere female equivalent of male circumcision (Hankins 2007). Male circumcision exemplifies that while HIV intervention policies maybe cast in objective and detached cost-and-benefit considerations, the potential success and eventual impacts of any intervention depends on a larger context of extant gender and intergenerational asymmetries.

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