AIDS Care. Author manuscript; available in PMC 2019 April 26.

Published in final edited form as:
AIDS Care. 2007 July ; 19(6): 781–790. doi:10.1080/09540120601163227.

The social and economic impact of parental HIV on children in northern Malawi: retrospective population-based cohort study

Sian Floyd, MSc [Lecturer in Statistics and Epidemiology],
London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK

Amelia C Crampin, MSc MBChB MFPHM [Senior Clinical Lecturer in Infectious Disease Epidemiology],
Karonga Prevention Study, PO Box 46, Chilumba, Karonga, Malawi

Judith R Glynn, PhD FRCP [Reader in Infectious Disease Epidemiology],
London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK

Nyovani Madise, PhD [Reader in Social Statistics],
University of Southampton, UK

Michael Mwenebabu [Interviewer],
Karonga Prevention Study, PO Box 46, Chilumba, Karonga, Malawi

Stancelaus Mnkhondia [Interviewer],
Karonga Prevention Study, PO Box 46, Chilumba, Karonga, Malawi

Bagrey Ngwira, PhD MBBS [Assistant Field Director],
Karonga Prevention Study, PO Box 46, Chilumba, Karonga, Malawi

Basia Zaba, MSc [Reader in Medical Demography], and
London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK

Paul EM Fine, PhD [Professor in Infectious Disease Epidemiology]
London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK

Abstract

From population-based surveys in the 1980s in Karonga district, northern Malawi, 197 “index individuals” were identified as HIV-positive. 396 HIV-negative “index individuals” were selected as a comparison group. These individuals, and their spouses and children, were followed up in 1998-2000. 582 of 593 index individuals were traced. 487 children of HIV-positive, and 1493 children of HIV-negative, parents were included in analyses. Rates of paternal, maternal, and double orphanhood among children with one or both parents HIV-positive were respectively 6, 8, and 17 times higher than for children with HIV-negative parents. Around 50% of children living apart from both parents had a grandparent as their guardian; for most of the rest the guardian was an aunt, uncle, or sibling. There were no child-headed households. Almost all children aged 6-14 were attending primary school. There was no evidence that parental HIV affected primary school attainment among children <15 years old. Children of HIV-positive parents were less likely to

Correspondence to: Sian Floyd Tel: 44-207-6127888 Fax: 44-207-6368739 sian.floyd@lshtm.ac.uk.

Europe PMC Funders Author Manuscripts

have attended secondary school than those of HIV-negative parents. The extended family has mitigated the impact of orphanhood on children, but interventions to reduce the incidence of orphanhood, and/or which strengthen society's ability to support orphans, are essential, especially as the HIV epidemic matures and its full impact is felt.

Keywords

HIV; children; household; impact; Africa; orphanhood; education; living arrangements; socio-economic

Introduction

HIV is the leading cause of death among individuals aged 15-50 in many sub-Saharan African countries(Mulder et al. 1994; Todd et al. 1997; Urassa et al. 2001), and the vast majority of these individuals have children. A major recent international report by UNICEF, UNAIDS and USAID has argued that the "challenge of ensuring the well-being of children affected by HIV/AIDS is unprecedented", that there is a need to respond with increased urgency, and that "a fundamental step in building a supportive environment for children includes increased awareness of the impacts of HIV/AIDS on children and families among policy makers, community leaders, organizations and the public"(UNAIDS/UNICEF/USAID, 2004).

To date, the evidence about how parental HIV affects children is limited. It is known that maternal HIV has a large impact on child mortality, mostly due to vertical transmission(Crampin et al. 2003(a); Zaba et al. 2005). One study found that parental HIV did not affect the physical well-being of children(Crampin et al. 2003(a)). Not surprisingly, it has been found that parental HIV has a large impact on the incidence of orphanhood(Makumbi et al. 2005; Watts et al. 2005), and that at the population level the prevalence of orphanhood is associated with adult HIV prevalence(Monasch & Boerma 2004). However, there are no published data about age-specific orphan incidence rates among children with HIV-positive parents, and their implications for the prevalence of orphanhood among children affected by parental HIV. The impact of parental HIV on the incidence of double orphanhood, and on the time from the loss of the first parent to becoming a double orphan, is unknown. While several studies have considered the impact of orphanhood on children's living arrangements and education in sub-Saharan Africa(Ainsworth & Filmer 2002; Beegle et al. 2005; Bicego et al. 2003; Case et al. 2004; Evans & Miguel 2005; Foster et al. 1995; Foster 1998; Hosegood et al. 2003; Lloyd & Blanc 1996; Monasch & Boerma 2004; Mutangadura 2001; Nyamukapa et al. 2003; Nyamukapa & Gregson 2005), only one has been able to classify these impacts by parental HIV status(Urassa et al. 1997). Just three of these studies investigated the impact of orphanhood on children's educational achievement, as opposed to school enrolment rates(Beegle et al. 2005; Bicego et al. 2003; Nyamukapa & Gregson 2005), and none have considered its impact on secondary school attendance.

The Karonga Prevention study in Malawi began in the early 1980s, and has included population-based surveys that allow health and socio-economic outcomes to be directly

Europe PMC Funders Author Manuscripts

linked to an individual's HIV status. This paper reports how children are affected by parental HIV in terms of the incidence of orphanhood, the time to become a double orphan after the loss of the first parent, living arrangements including household assets, and educational enrolment and achievement.

Methods

Karonga is a rural district with a population consisting predominantly of subsistence farmers, fishermen and small traders. There is no major industry or single large employer in the district, with the exception of a hydro-electric power station and an army garrison. There are two "urban" areas. One is the district capital, Karonga boma, in the north of the district, with administrative offices, the district hospital and small businesses. The second is Chilumba in the south, which is a port and truck depot. There are three other main trading centres. The population are mainly Tumbuka in the south (the area of our southern cohort) and Nkhonde (the area of our northern cohort) in the north of the district. Both these groups are patriarchal and patrilineal, but intermarriage and the presence of other groups (for example Chewa from the south of Malawi, and Swahili-speaking people from further north) are not uncommon. Polygamy is common but other cultural practices such as widow-inheritance by brothers are less common than in the past. The majority of the population are Christian, from a large number of denominations (40% Presbyterian or Roman Catholic), with a small minority (2%) of Muslims. A high percentage of people attend church regularly, although we have not collected data on this. Strong beliefs in witchcraft are widely held, particularly in rural areas, and local healers (both herbalists and spiritualists) are well-frequented. HIV prevalence in adults was 2% in the late 1980s and 13% in the late 1990s(Crampin et al. 2003(b)).

Data were collected through a retrospective cohort study, described in detail elsewhere(Crampin et al. 2003(a)). From population-based surveys in the 1980s, 197 "index individuals" were identified as HIV-positive, and 396 HIV-negative "index individuals" were selected as a comparison group, individually matched to the HIV-positive individuals on age, sex, area of residence at the time of the baseline survey, interview date, and household structure. Two-thirds of the index individuals were from an area in the south of Karonga district, and one-third from an area in the north of the district. These individuals, plus their spouses and children of all ages, were followed up in 1998-2000.

An interview was conducted with each individual, or a guardian, or an informant (for individuals reported to be living outside the district, or those who had died), in the local language. Thus information was collected on children who had left the district, as well as those who were living in the district at the time of follow-up. Interviewers were blinded to the HIV status of the index individual. Households of individuals found living within the district were visited. A household was defined as a group of people living together who recognised the same household head.

For all individuals, data on mortality and education were collected. For children <15 years old at follow-up, data were collected on whether and when they had ever lived apart from both parents, and if appropriate their relationship to the guardian. For individuals living in

the district at follow-up, data on household composition, housing quality, and household assets were collected. Housing quality was assessed by interviewers, by observation of house construction, and household assets were reported by the interviewee. Household assets were scored according to their relative values, and scores for individual items were summed to obtain a total score. Consenting adults (≥15 years old) were counselled and HIV tested, and post-test counselling given to those who wanted to know their results.

Data were double-entered using Foxpro and analysed using STATA 8.2 (Stata Corporation, College Station, TX). All analyses compared children of HIV-positive indexes with those of HIV-negative indexes. Only children who were dependents (<18 years old) at the time of the baseline survey, or born after it, were included. Regression analysis was used, with robust standard errors to allow for the clustering of children with the same parents. Logistic regression was used for binary outcomes (such as secondary school attendance yes/no) and linear regression for quantitative outcomes (such as educational grade).

Ethical approval for the study was granted by the National Health Sciences Research Committee of Malawi and the Ethics Committee of the London School of Hygiene and Tropical Medicine.

Results

Of 593 index individuals, 582 were traced, identifying 2525 children. Of these, 545 were >18 years old at the time of the baseline survey or died before it. Thus 487 children of an HIV-positive index, and 1493 children of an HIV-negative index, were included in analyses.

Information was obtained from a parent for 1206, from the child for 353, from a relative for 348, and from another informant for 73 children. Of surviving children, the most recent information was from ≥10 years after the baseline survey for 86% of children of HIV-positive, and 94% of children of HIV-negative, individuals.

(i) Incidence of orphanhood

Orphanhood rates were much higher for children of HIV-positive than children of HIV-negative parents (Table 1). For children with one or both parents HIV-positive for at least part of the child's life, these rates predict that 70% of surviving children aged 15 years old will be paternal, 50% maternal, and 29% double orphans. The corresponding figures for children of HIV-negative parents were much lower, at 18%, 9%, and 3% respectively ($p<0.001$ all comparisons).

For children who lost their father first, 28% of children of HIV-positive indexes were double orphans within 5 years, compared to 7% for children of HIV-negative parents ($p<0.001$). For children who lost their mother first, the corresponding figures were 41% and 8% (Table 2).

(ii) Child migration

Among surviving children, 33% (138/422) of children of HIV-positive, and 20% (275/1341) of children of HIV-negative, parents had migrated out of the district by the time of follow-up. Migration rates out of Karonga district were higher among children of HIV-positive than

among children of HIV-negative indexes (HR=1.6, 95% CI (1.2-2.1) for children <15 years old, and HR=3.3, 95% CI (1.9-5.8) for 15-18 year olds). Child migration rates were higher among those whose parents migrated, and higher in those whose parents died. However, these associations explained only a small part of the positive association between parental HIV and child migration.

(iii) Living arrangements

The percentage of children who had lived apart from both parents was much higher for those of HIV-positive than those of HIV-negative parents (21% vs 4% among children <5 years old, 32% vs 12% among 5-9 year olds, and 48% vs 19% among 10-14 year olds). This was explained by the higher incidence of orphanhood among children of HIV-positive parents. Around 20% of orphaned children lived away from their parents before the first parental death; this did not vary according to parental HIV status. Among children living apart from both parents, for half a grandparent was the guardian; most of the rest had an aunt, uncle, or sibling as their guardian (Table 3). Only 5 children, all double orphans, were reported to have lived in >1 household other than that of their parents.

Compared to children of an HIV-negative index individual, a much lower percentage of children of an HIV-positive individual had their father as their household head. Correspondingly, a much higher percentage had their mother or grandparent as the household head (Table 4). For almost all, the household head was a close relative. There were no child-headed households.

Overall, the percentage of children living in a household with ≥1 male, or ≥1 female, aged 18-49 (a proxy for the economically active age group) varied little according to parental HIV status. However, around 80% of non-orphans and double orphans lived in a household with ≥1 male aged 18-49, compared to just 45% of paternal and 68% of maternal orphans. Almost all non-orphans, and 90% of paternal orphans, lived in a household with ≥1 female aged 18-49, compared to around 80% for maternal and double orphans.

Overall, household wealth varied little according to parental HIV status (Table 4). However, among children of an HIV-positive index individual, households headed by their mothers had relatively few household assets (27%, 6/22 children, with a possessions score >3), households headed by an uncle or male sibling were relatively wealthy (94%, 17/18 children, with score >3), and households headed by the father or a grandparent were intermediate (64%, 36/56 children, and 52%, 14/27 children, respectively with score >3).

(iv) Education

Around 90% of children of all ages had attended primary school at some time; this varied little according to parental HIV or orphanhood status. Among children who had ever attended primary school, almost all of those aged 6-14 years old were currently attending school. There was no evidence that mean grade was lower among children of an HIV-positive individual (Table 5), for both girls and boys. Single maternal, single paternal, and double orphans aged 19-28 years had a mean grade 0.7, 0.9, and 0.6 respectively below that of non-orphans, although the differences were not statistically significant.

The differences between children of HIV-positive and HIV-negative parents, presented in Table 5, are adjusted for mother's education. This was necessary because maternal education is both a strong predictor of child educational achievement and also associated with HIV prevalence early in the epidemic in this area (with HIV prevalence higher among the better-educated). Paternal education was also a strong predictor of child educational achievement, but was not controlled for in the analysis for two reasons. First, among children for whom both parents' educational achievement was known, the estimated effect of parental HIV was similar whether maternal education alone was controlled for, or both maternal and paternal education (i.e. paternal education no longer had an effect as a confounder after controlling for maternal education). Second, for a non-trivial percentage of children (9%) data on paternal education were unavailable, and these children would have been excluded from an analysis that controlled for father's education. There was no evidence that the effect of parental HIV on educational grade varied with parental education or area of residence of the index individual at the time of the baseline survey, but these tests for interaction had low power.

Current household socio-economic status, as measured by housing quality, was associated with educational achievement, but was not controlled for in the analysis because it is a consequence of parental HIV (rather than something that preceded it).

As adverse family circumstances may have a severe effect on one particular child, for each family the "worst-performing" child was identified, by comparing each child's grade to the standard predicted by their age, sex, area of residence and mother's education and then selecting the one who was most behind. There was no evidence of an effect of parental HIV on the achievement of these children, or of an effect on either the eldest boy or eldest girl.

Secondary school attendance is not common in northern Malawi, and consequently among 15-28 year olds an analysis of attendance at this level (yes or no) was likely to be more illuminating than an analysis of mean grade. There was weak overall evidence that parental HIV has an adverse effect on secondary school attendance (Table 5). The robustness of this finding is increased by the fact that it was seen in three of four strata defined by child age and maternal education (Table 5) and also that the effect was of similar magnitude in boys and girls (data not shown). Secondary school attendance was lower in single maternal and single paternal orphans, but not double orphans. There was no statistical evidence that the effect of parental HIV on secondary school attendance varied with child's sex or parental education level. There was a suggestion that the effect might be greater in the south of the district than the north (data not shown).

Discussion

Principal findings

The impact of parental HIV on the incidence of orphanhood is substantial in northern Malawi, consistent with findings from Zimbabwe and Uganda(Makumbi et al. 2005; Watts et al. 2005). Most children with one or both parents HIV-positive for part of the child's life are predicted to be orphaned by age 15, with 29% double orphans. The time to become a double orphan after the first parental death is much shorter for children of HIV-positive

parents than those of HIV-negative parents, an important finding as children who lose two parents in quick succession may be particularly vulnerable.

However, to date the extended family appears to have mitigated most of the negative social and economic consequences of orphanhood in this population. Among children <15 years old, educational achievement among children of HIV-positive and HIV-negative parents was similar, almost all children were living in a household headed by a close relative, and there were no child-headed households. This has likely been achieved through reciprocity and redistribution of resources among the extended family, mechanisms which help to confer “social immunity". A study in the mid-1990s in northern Malawi found these principles were still observed(Mtika 2001), although it was also found that some individuals providing support to relatives in difficulty were beginning to find the obligation to provide assistance a liability. Nevertheless, there was a suggestion that parental HIV had an adverse effect on secondary school attendance, and that “final” educational achievement (as assessed among 19-28 year olds) might be lower among orphans than non-orphans.

Living arrangements

For almost all children who were living apart from both parents, the guardian was a close relative, consistent with other studies(Foster 1998; Hosegood et al. 2003; Monasch & Boerma 2004; Mutangadura 2001; Nyambedha et al. 2003; Nyamukapa et al. 2003; Urassa et al. 1997). It is not uncommon in this society for non-orphans to live away from their parents, with close relatives, and the impact of parental HIV has been managed by expanding this system. Around 50% of children living apart from both parents had a grandparent as their guardian, also consistent with other studies(Bicego et al. 2003; Monasch & Boerma 2004; Nyamukapa et al. 2003; Urassa et al. 1997). That only 20% of orphans had lived apart from both parents prior to the first parental death suggests that “planned” fostering is not the norm.

The percentage of children living in a household headed by their mother was much higher for children of an HIV-positive than children of an HIV-negative index. These children were relatively poor in household assets, consistent with a Zimbabwean study which found that the households of paternal orphans were relatively poor(Nyamukapa et al. 2003). Northern Malawi has a patrilineal society, so it is expected that children would be supported by paternal relatives after their father’s death.

Education

There was little evidence of an adverse effect of parental HIV on primary school achievement among children <15 years old. This is in contrast to a study in eastern Zimbabwe, which found that maternal orphans were less likely to have completed primary school than other children(Nyamukapa et al. 2003), and analyses of DHS data from Zimbabwe, Kenya, and Tanzania, which have found that maternal, paternal, and double orphans were less likely to be at their appropriate grade level than were non-orphans(Bicego et al. 2003). Multi-country analyses of DHS data show that the impact of orphanhood on primary school enrolment varies among countries(Ainsworth & Filmer 2002; Case et al. 2004), and it has been commented elsewhere that generalizations across countries about

whether orphans are disadvantaged in terms of education are not possible(Ainsworth et al. 2005; Beegle et al. 2005). The HIV epidemic was not severe in northern Malawi during most of the follow-up period, although it was by 1998-2000, and education was measured throughout the follow-up period. Also, primary schooling was free from 1994. These two things probably explain why we did not find evidence of an adverse effect of parental HIV or orphanhood on the educational achievement of children aged <15 years old.

Our findings hint that parental HIV has an adverse effect on secondary school attendance, however. The finding is plausible, especially as secondary school is fee-paying. Orphanhood status did not explain the effect of parental HIV on secondary school attendance, which could mean that HIV-related illness and death have more severe consequences for children than death from other causes. The suggestion of a larger adverse effect of parental HIV in the south than the north of the district, if real, might be because the HIV epidemic emerged earlier in the south of the district, or it might reflect cultural differences between the two areas.

Among individuals aged 19-28 at the time of follow-up, mean educational grade (equivalent to years of schooling completed) was lower among maternal, paternal, and double orphans than among non-orphans. Although these differences did not reach statistical significance, the size of the effects are similar to those found in a cohort study in Kagera, Tanzania(Beegle et al. 2005). The consistency with the Kagera study suggests that these differences are real.

Study strengths and weaknesses

The study followed a cohort over a ten-year period, allowing us to capture the child's experience from the time from when a parent was recently HIV-infected until about ten years later. The cohort was constructed on the basis of total-population surveys, with HIV-positive individuals matched to HIV-negative individuals at baseline, including on household structure, so that findings should be representative of the included areas within Karonga district. Household socio-economic status was not measured at baseline, but data on parental education provided a measure of parental socio-economic status and was available for virtually all mothers, and most fathers, allowing us to control for it in the analysis. In contrast, most published studies of the impact of orphanhood on children have been cross-sectional, and the analyses have not controlled for parental or household characteristics that preceded parental death; exceptions are analyses of data from a study in Kagera district, Tanzania(Ainsworth et al. 2005; Beegle et al. 2005) and a study of factors affecting the regularity of school attendance in Kenya(Evans & Miguel 2005). The matching at baseline, together with controlling for parental education in the analysis, means that observed differences between children of HIV-positive and HIV-negative individuals should be attributable to parental HIV. Information was sought, and in the vast majority of cases obtained, on children who had left the district, so that analyses were in general not restricted to children living in the district at the time of follow-up. Almost all informants were close relatives of the child, suggesting the data are reliable. The percentage of children for whom the most recent information was at least ten years after the baseline survey was high, so the study captured well the impact of parental HIV ten years after it was first identified.

Study limitations include that households of children who had left the district were not visited, so such children could not be included in analyses of current household characteristics, including the head of the household and socio-economic status. It is possible that these outcomes are worse among children who have left the district than among those who remained. Also, a comparison between children of HIV-positive and children of HIV-negative individuals may underestimate the impact at community level (since families in which HIV infection is absent will be indirectly affected, for example through the fostering of orphans). Further, future studies should consider not only the impact of parental mortality on children, but also the mortality of other relatives, for example aunts/uncles, grandparents, and siblings. This is because in Southern and East Africa it is fairly common for children to live away from their parents, whether they are orphaned or not.

Generalisability of findings

The HIV epidemic was at an early stage at the time of the baseline survey, so the impacts on children reported here represent the situation about 10 years after a parent was first infected, and during the 10 years in which the epidemic escalated in the community. Our findings should have broad relevance to other rural areas of sub-Saharan Africa at a comparable stage of the HIV epidemic.

The impact on children in Karonga may be increasingly severe over time, especially when grandparents have also been lost due to HIV infection. Studies in areas where the HIV epidemic is advanced and adult HIV prevalence high have found that the extended family was finding it difficult to cope(Hunter 1990; Mutangadura 2001; Nyambedha et al. 2003). However, the roll-out of anti-retroviral therapy provision has the potential to delay parental/guardian death, and thus reduce its impact on children.

Policy implications

Provision of support to community-based initiatives designed to mitigate the socio-economic impact of HIV has previously been advocated(Foster 2002; Nyambedha et al. 2001; Nyambedha et al. 2003; Shetty & Powell 2003; UNAIDS/UNICEF/USAID, 2004). Grandparents are major providers of care to orphaned grandchildren, and interventions to assist them may be warranted, as suggested elsewhere(Bicego et al. 2003; Foster et al. 1995; Mutangadura 2001). Our study found that children of HIV-positive parents who were living in a household headed by a grandparent were, on average, living in households with fewer household assets than children of HIV-negative parents. This, together with the fact that grandparents may be physically frail, less economically active than younger individuals, the death of their son/daughter may have resulted in a loss of economic support, and they may be the guardians to grandchildren from more than one son or daughter, could mean they are more “vulnerable” than other households. On the other hand, some grandparents are relatively young, and no less able to care for children than other relatives such as surviving parents, aunts, uncles, brothers and sisters. It could be argued that foster carers should be supported irrespective of their age and relationship to the child, to counter any disincentives to child fostering such as the need to pay school fees and other costs associated with schooling such as books and uniforms.

Our data also indicate that children living in households headed by their mother would benefit from interventions designed to improve their economic status. The rarity of child-headed households in rural areas of sub-Saharan Africa shows that policies should not give disproportionate attention to such households. Interventions which facilitate the planning of fostering in advance of parental death would be useful.

Interventions that facilitate secondary school attendance are required, in line with recent reports (Nyambedha et al. 2001; Sachs & Sachs 2004). It has been commented elsewhere that “improvements in school quality and better access to secondary education would help to improve schooling outcomes for all children, including those affected by adult mortality"(Ainsworth et al. 2005). The use of anti-retroviral therapy to delay orphanhood has been advocated(Monasch & Boerma 2004; Sachs & Sachs 2004; Shetty & Powell 2003), and our findings show this could substantially reduce the percentage of children who are orphaned before age 15.

Conclusions

The impact of parental HIV on the incidence of orphanhood among children in northern Malawi is substantial. Although the extended family has mitigated its social and economic impact, interventions to reduce the incidence of orphanhood and to strengthen society’s ability to support orphans are essential, especially as the HIV epidemic matures and its full impact is felt.

Acknowledgements

We thank the Government of the Republic of Malawi for their interest in and support of the Karonga Prevention Study (KPS) and the National Health Sciences Research Committee of Malawi for permission to conduct the study and to present these data. We thank Dr Jörg Pönnighaus for organizing and implementing the original field surveys which made this study possible.

Funding Until 1996 the KPS was funded primarily by LEPRA (The British Leprosy Relief Association) and ILEP (The International Federation of Anti-Leprosy Organizations) with contributions from the WHO/UNDP/World Bank Special Programme for Research and Training in Tropical Diseases. Since 1996 the Wellcome Trust has been the principal funder. BN was supported by the British High Commission in Malawi. JRG was partially supported by the British Department for International Development and is now supported by the Department of Health (Public Health Career Scientist Award).

References

1. Ainsworth, M; Filmer, D; Poverty, AIDS, and Children’s Schooling. A targetting dilemma. World Bank Policy Research Working paper 2885. 2002.
2. Ainsworth M, Beegle K, Koda G. The Impact of Adult Mortality and Parental Deaths on Schooling in Northwestern Tanzania. Journal of Development Studies. 2005; 41(3):412–439.
3. Beegle, K; De Weerdt, J; Dercon, S. Orphanhood and the long-run impact on children. World Bank Working Paper. 2005.
4. Bicego G, Rutstein S, Johnson K. Dimensions of the emerging orphan crisis in sub-Saharan Africa. Social Science in Medicine. 2003; 56(6):1235–47.
5. Case A, Paxson C, Ableidinger J. Orphans in Africa: parental death, poverty, and school enrollment. Demography. 2004; 41(3):483–508. [PubMed: 15461011]
6. Crampin AC, Floyd S, Glynn JR, Madise N, Nyondo A, Khondowe MM, et al. The long-term impact of HIV and orphanhood on the mortality and physical well-being of children in rural Malawi. Aids. (2003)(a); 17(3):389–97. [PubMed: 12556693]

7. Crampin AC, Glynn JR, Ngwira BM, Mwaungulu FD, Ponnighaus JM, Warndorff DK, et al. Trends and measurement of HIV prevalence in northern Malawi. Aids. (2003)(b); 17(12):1817–25. [PubMed: 12891068]
8. Evans, D, Miguel, E. Orphans and Schooling in Africa: A Longitudinal Analysis. University of California; mimeo: 2005.
9. Foster G, Shakespeare R, Chinemana F, Jackson H, Gregson S, Marange C, et al. Orphan prevalence and extended family care in a peri-urban community in Zimbabwe. AIDS Care. 1995; 7(1):3–17. [PubMed: 7748908]
10. Foster G. Today's children - challenges to child health promotion in countries with severe AIDS epidemics. AIDS Care. 1998; 10(Suppl 1):S17–23. [PubMed: 9625891]
11. Foster G. Supporting community efforts to assist orphans in Africa. New England Journal of Medicine. 2002; 346(24):1907–10. [PubMed: 12063378]
12. Hosegood, V; Herbst, K; Timaeus, I. The impact of adult AIDS deaths on households and children's living arrangements in rural South Africa. Paper presented at conference on the empirical evidence for the socio-economic impact of AIDS; Durban. 2003.
13. Hunter SS. Orphans as a window on the AIDS epidemic in Sub-Saharan Africa: initial results and implications of a study in Uganda. Social Science in Medicine. 1990; 31(6):681–90.
14. Lloyd CB, Blanc AK. Children's Schooling in Sub-Saharan Africa: The Role of Fathers, Mothers, and Others. Population and Development Review. 1996; 22:265–298.
15. Makumbi FE, Gray RH, Serwadda D, Nalugoda F, Kiddugavu M, Sewankambo NK, et al. Aids. 2005; 19(15):1669–76. [PubMed: 16184037]
16. Monasch R, Boerma JT. Orphanhood and childcare patterns in sub-Saharan Africa: an analysis of national surveys from 40 countries. Aids. 2004; 18(Suppl 2):S55–65.
17. Mtika M. The AIDS epidemic in Malawi and its threat to household food security. Human Organization. 2001; 60:178–188.
18. Mulder DW, Nunn AJ, Wagner HU, Kamali A, Kengeya-Kayondo JF. HIV-1 incidence and HIV-1-associated mortality in a rural Ugandan population cohort. Aids. 1994; 8(1):87–92. [PubMed: 8011241]
19. Mutangadura G. Women and AIDS in Southern Africa: The case of Zimbabwe and Its Policy Implications. Jenda: A Journal of Culture and African Women Studies: 1,2. 2001
20. Nyambedha EO, Wandibba S, Aagaard-Hansen J. Policy implications of the inadequate support systems for orphans in western Kenya. Health Policy. 2001; 58(1):83–96. [PubMed: 11518603]
21. Nyambedha EO, Wandibba S, Aagaard-Hansen J. Changing patterns of orphan care due to the HIV epidemic in western Kenya. Social Science in Medicine. 2003; 57(2):301–11.
22. Nyamukapa CA, Foster G, Gregson S. Orphans' household circumstances and access to education in a maturing HIV epidemic in eastern Zimbabwe. Journal of Social Development in Africa. 2003; 18(2):7–32.
23. Nyamukapa CA, Gregson S. Extended family's and women's roles in safeguarding orphans' education in AIDS-afflicted rural Zimbabwe. Social Science in Medicine. 2005; 60(10):2155–67.
24. Sachs SE, Sachs JD. Africa's children orphaned by AIDS. Lancet. 2004; 364(9443):1404. [PubMed: 15488214]
25. Shetty AK, Powell G. Children orphaned by AIDS: a global perspective. Semin Pediatrics and Infectious Diseases. 2003; 14(1):25–31.
26. Todd J, Balira R, Grosskurth H, Mayaud P, Mosha F, ka-Gina G, et al. HIV-associated adult mortality in a rural Tanzanian population. Aids. 1997; 11(6):801–7. [PubMed: 9143613]
27. UNAIDS/UNICEF/USAID. Children on the Brink. 2004.
28. Urassa M, Boerma JT, Japheth ZL, Ng'weshemi J, Isingo R, Schapink D, et al. Orphanhood, child fostering and the AIDS epidemic in rural Tanzania. Health Transition Review. 1997; 7(Supplement 2):141–153.
29. Urassa M, Boerma JT, Isingo R, Ngalula J, Ng'weshemi J, Mwaluko G, et al. The impact of HIV/AIDS on mortality and household mobility in rural Tanzania. Aids. 2001; 15(15):2017–23. [PubMed: 11600831]

30. Watts H, Lopman B, Nyamukapa C, Gregson S. Rising incidence and prevalence of orphanhood in Manicaland, Zimbabwe, 1998 to 2003. Aids. 2005; 19(7):717–25. [PubMed: 15821398]

31. Zaba B, Whitworth J, Marston M, Nakiyingi J, Ruberantwari A, Urassa M, et al. HIV and mortality of mothers and children: evidence from cohort studies in Uganda, Tanzania, and Malawi. Epidemiology. 2005; 16(3):275–80. [PubMed: 15824540]

Europe PMC Funders Author Manuscripts

Europe PMC Funders Author Manuscripts

AIDS Care. Author manuscript; available in PMC 2019 April 26.

Table 1

Rate at which children are orphaned, and predicted percentage of surviving children who are orphans given these rates, by HIV status of index individual

	Paternal orphan						Maternal orphan						Double orphan					
	HIV+ index (132 fathers)		HIV− index (364 fathers)		Rate ratio		HIV+ index (177 mothers)		HIV− index (371 mothers)		Rate ratio		HIV+ index (130 indexes)		HIV− index (319 indexes)		Rate ratio	
age band		424[1]		1419[1]				472[2]		1460[2]				434[3]		1419[3]		
(years)	o/years[4]	rate	o/years	rate	RR[5]	95% CI	o/years	rate	o/years	rate	RR	95% CI	o/years	rate	o/years	rate	RR	95% CI
<1	7/152	46.0	6/658	9.1	5.0	(1.7-14.9)	5/158	31.6	2/671	3.0	10.6	(2.1-54.5)	1/153	6.5	0/658	0	/	
1-4	34/551	61.7	21/2485	8.5	7.3	(3.9-13.6)	15/605	24.8	6/2593	2.3	10.7	(3.6-31.5)	4/596	6.7	0/2508	0	/	
5-9	47/654	71.9	32/2673	12.0	6.0	(3.5-10.3)	42/801	52.4	20/2845	7.0	7.5	(3.7-14.8)	17/787	21.6	5/2779	1.8	12.0	(4.1-34.9)
10-14	59/534	110.4	35/1995	17.5	6.3	(3.6-11.0)	43/725	59.3	20/2155	9.3	6.4	(3.3-12.3)	29/738	39.3	7/2128	3.3	11.9	(4.2-33.9)
15-17	26/213	122.3	18/918	19.6	6.2	(3.0-12.9)	27/307	88.0	10/1019	9.8	9.0	(3.7-21.8)	19/320	59.3	3/1014	3.0	20.0	(5.6-71.5)
0-17	173/2104	82.2	112/8728	12.8	**6.0**[6]	(3.7-9.7)	132/2596	50.9	58/9283	6.2	**8.2**[6]	(4.8-14.2)	70/2595	27.0	15/9087	1.7	**16.6**[6]	(6.7-41.2)
						p<0.001[7]						p<0.001[7]						p<0.001[7]
	Predicted percentage of surviving children who are orphans, for children of ages 1, 5, 10, 15, and 18 years old																	
Age	%	95% CI	%	95% CI			%	95% CI	%	95% CI			%	95% CI	%	95% CI		
1	4	(2-9)	0.9	(0.4-2)			3	(1-7)	0.3	(0-1)			0.6	(0-5)	0			
5	25	(19-33)	4	(3-6)			12	(8-18)	1	(1-2)			3	(1-8)	0			
10	48	(41-55)	10	(8-13)			32	(26-39)	5	(3-7)			13	(9-19)	0.6	(0.4-2)		
15	70[8]	(64-76)	**18**	(15-21)			**50**	(44-57)	**9**	(7-12)			**29**	(23-37)	**3**	(1-5)		
18	79	(74-84)	22	(19-26)			62	(55-68)	12	(9-15)			41	(34-49)	3	(2-6)		

[1] Includes all children for whom the identity of their father, and the year when the father died or was last seen or reported to be alive, were known, and the father was alive at the time of the baseline survey.

[2] Includes all children for whom the identity of their mother, and the year when the mother died or was last seen or reported to be alive, were known, and the mother was alive at the time of the baseline survey

[3] Includes all children for whom the identity of both their mother and father, the year when the mother died or was last seen or reported to be alive, and the year when the father died or was last seen or reported to be alive, were known, and one or both parents were alive at the time of the baseline survey

[4] o/years = number of children orphaned / person-years of observation

[5] Rate ratio, comparing orphanhood rate among children of HIV-positive indexes with that among children of HIV-negative indexes

Europe PMC Funders Author Manuscripts

[6] Rate ratio, comparing orphanhood rate among children of HIV-positive indexes with that among children of HIV-negative indexes, controlled for age of child, mother’s education, and area of residence of index individual at time of baseline survey

[7] p value for evidence that rate ratio, controlled for age of child, mother’s education, and area of residence of index individual at time of baseline survey, is different to 1

[8] Figures in bold are referred to in the text

Europe PMC Funders Author Manuscripts

Table 2

Time between losing first and second parent, among children who lost a parent when aged <18 years old

	Lost father first				Lost mother first			
	HIV+ index (65 mothers)		**HIV− index (42 mothers)**		**HIV+ index (33 fathers)**		**HIV− index (22 fathers)**	
number of children	137[1]		103		67		50	
Double orphan by 1 year later (%)	6	(3-12)	0	/	20	(12-32)	6	(2-18)
Double orphan by 2 years later (%)	10	(6-17)	1	(0.2-9)	25	(16-38)	8	(3-21)
Double orphan by 3 years later (%)	18	(12-26)	1	(0.2-9)	25	(16-38)	8	(3-21)
Double orphan by 4 years later (%)	23	(16-32)	7	(3-17)	41	(28-56)	8	(3-21)
Double orphan by 5 years later (%)	**28**[2]	(20-38)	**7**	(3-17)	**41**	(28-56)	**8**	(3-21)
Crude hazard ratio[3]	4.3	(1.1-17.0)			6.5	(1.4-29.2)		
Adjusted hazard ratio[4]	2.9	(0.9-9.7)			11.6	(1.9-69.8)		

[1] Forty-nine percent of children of an HIV-positive index experienced the loss of a parent during the follow-up period and were <18 years old at the time of the first parental death, compared to 11% of children of an HIV-negative index.

[2] Figures in bold are referred to in the text

[3] Rate ratio, comparing rate at which child becomes a double orphan after first parental loss among children of HIV-positive indexes with children of HIV-negative indexes

[4] Rate ratio, adjusted for mother's education, and area of residence of index individual at time of baseline survey

Europe PMC Funders Author Manuscripts

Table 3

Guardian of children living apart from both parents, among children <15 years old

	HIV status of index individual			
	HIV+		HIV−	
Guardian	%	(n)	%	(n)
Grandparent	52	(33)	52	(47)
Aunt/uncle	37	(23)	20	(18)
Sibling	8	(5)	13	(12)
Other relative	1.5	(1)	10	(9)
Not specified	1.5	(1)	4	(4)
		(63)		(90)

Europe PMC Funders Author Manuscripts

AIDS Care. Author manuscript; available in PMC 2019 April 26.

Table 4

Household composition and socio-economic status, among children <15 years old and living in the district at the time of follow-up

	HIV status of index individual				
	HIV+		HIV−		p value
Living with parents	%	(n)	%	(n)	
Both parents	**34** [1]	(46)	**77**	(509)	
Mother only	28	(38)	12	(79)	
Father only	9	(12)	6	(40)	
Neither parent	28	(38)	5	(37)	
		(134)		(665)	<0.001
Household head [2]					
Father	**42**	(56)	**83**	(547)	
Mother	**16**	(22)	**4**	(24)	
Grandparent	**20**	(27)	**6**	(40)	
Aunt/uncle	**12**	(16)	**2**	(14)	
Sibling/Sibling-in-law	**1.5**	(2)	**1**	(8)	
Other relation	**2**	(3)	**4**	(29)	
Not blood relative	**6**	(8)	**0**	(0)	
		(134)		(662)	<0.001
Age of household head (years)					
19-29	1	(2)	3	(20)	
30-39	30	(40)	32	(215)	
40-49	31	(41)	33	(221)	
50-59	18	(24)	19	(129)	
60-82	20	(27)	12	(77)	
		(134)		(662)	0.10
Sex of household head					
Male	78	(104)	93	(616)	
Female	22	(30)	7	(46)	
		(134)		(662)	<0.001
Household head female >60 years old					

Europe PMC Funders Author Manuscripts

	HIV status of index individual				
No	96	(128)	98	(650)	
Yes	4	(6)	2	(12)	
		(134)		(662)	0.06
Male adult aged 18-49 in household					
No	25	(34)	23	(149)	
Yes	**75**	(100)	**77**	(513)	
		(134)		(662)	0.47
Female adult aged 18-49 in household					
No	8	(11)	4	(25)	
Yes	**92**	(123)	**96**	(637)	
		(134)		(662)	0.02
Household assets [3]					
Score ≤3	39	(52)	38	(245)	
Score >3	**61**	(82)	**62**	(405)	
		(134)		(650)	0.81
Housing quality [4]					
Score ≤2	50	(62)	58	(371)	
Score >2	**50**	(61)	**42**	(273)	
		(123)		(644)	0.14

[1] Figures in bold are referred to in the text;

[2] Household head not identified for 3 children of an HIV-negative index individual;

[3] Higher scores imply more and/or more valuable possessions;

[4] The construction of walls, roof, floor and windows were scored according to building materials and the component scores were summed. Higher scores imply more solid/expensive constructions

Europe PMC Funders Author Manuscripts

Table 5

Mean educational achievement, and secondary school attendance, by HIV status of index individual, and child age at follow-up

Education grade								
Age at follow-up (years)[1]		**HIV status of index**	**n**	**Mean grade**[2]	**95% CI**	**Mean difference**	**Adjusted mean difference**[3]	**95% CI for adjusted difference**
6-11		HIV−	311	1.9	(1.7-2.1)			
		HIV+	69	2.3	(2.0-2.7)	0.4	0.3	(−0.1,0.7)
12-14		HIV−	109	4.3	(4.0-4.7)			
		HIV+	38	4.4	(3.7,5.1)	0.1	0	(−0.8,0.8)
15-18		HIV−	181	6.4	(6.0-6.7)			
		HIV+	92	6.5	(5.9,7.1)	0.1	−0.3	(−1.0,0.4)
19-28		HIV−	272	6.8	(6.2-7.4)			
		HIV+	102	7.1	(6.4-7.9)	0.3	−0.2	(−1.1,0.7)
Secondary school								
Age at follow-up (years)	**Mother's education**	**HIV status of index**	**n**	**s**[4]	**%**	**Crude odds ratio (OR)**	**Adjusted OR**[3]	**95% CI for adjusted OR**
15-18	≤5 yrs primary	HIV−	111	6	5			
		HIV+	31	2	6	1.2	1.3	(0.2-8.4)
	>5 yrs primary	HIV−	70	14	20			
		HIV+	61	8	13	0.6	0.4	(0.1-1.4)
19-28	≤5 yrs primary	HIV−	213	46	22			
		HIV+	52	6	12	0.5	0.6	(0.2-1.5)
	>5 yrs primary	HIV−	59	34	58			
		HIV+	50	20	40	0.5	0.4	(0.1-1.2)
15-28	Overall	HIV−	453	100	22			
		HIV+	194	36	19	0.8	**0.6**[5]	**(0.3-1.1)**

[1] Analysis was restricted to children who were 6-28 years old at the time of follow-up (1387/1980 children), and for whom information was available for the period 9-13 years after the baseline survey (87%, 1204/1387).

[2] In Karonga, primary school has 8 grades, and secondary school 4 grades (total of 12 grades). Here education grade is recorded as between 1 and 12, and represents the highest grade a child has attended.

[3] adjusted for age in 2-year bands, sex of child, area of residence of index individual at time of baseline survey, and mother's education

Europe PMC Funders Author Manuscripts

[4] s = number of children who had attended secondary school

[5] Figures in bold are referred to in the text