Int. J. Epidemiol. Advance Access published September 16, 2008

Published by Oxford University Press on behalf of the International Epidemiological Association
International Journal of Epidemiology 2008;1–8
doi:10.1093/ije/dyn197

The intergenerational impact of the African orphans crisis: a cohort study from an HIV/AIDS affected area

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Accepted 27 August 2008

Background In sub-Saharan Africa, the prevalence of orphanhood among children has been greatly exacerbated by the HIV/AIDS pandemic. If orphanhood harms a child's development and these effects perpetuate into adult life, then the African orphan crisis could seriously jeopardize the continent's future generations. Whether or not there exists an adverse, causal and intergenerational effect of HIV/AIDS on development is of crucial importance for setting medical priorities. This study is the first to empirically investigate the impact of orphanhood on health and schooling using long-term longitudinal data following children into adulthood.

Methods We examined a cohort of 718 children interviewed in the early 1990s and again in 2004. Detailed survey questionnaires and anthropometric measurements were administered at baseline and during a follow-up survey. Final attained height and education (at adulthood) between children who lost a parent before the age of 15 and those who did not were compared.

Results On average, children who lose their mother before the age of 15 suffer a deficit of around 2 cm in final attained height (mean 1.96; 95% CI 0.06–3.77) and 1 year of final attained schooling (mean 1.01; 95% CI 0.39–1.81). This effect is permanent and the hypothesis that it is causal cannot be rejected by our study. Although father's death is a predictor of lower height and schooling as well, we reject the hypothesis of a causal link.

Conclusions The African orphan crisis, exacerbated by the HIV/AIDS epidemic will have important negative intergenerational effects.

Keywords Cohort studies, mortality, Africa, orphans, human capital

Background

In 2003, an estimated 12% of all sub-Saharan African children were orphans and there were 5.2 million newly orphaned children in the region in the course of 2003.[1] As the HIV/AIDS epidemic continues to affect countries in this region, prime-age adult mortality rates may continue to increase, producing greater numbers of young children with one or both parents deceased. It is often hypothesized that this orphan crisis is creating a future generation of Africans with seriously reduced education and worse health, which jeopardizes the future of the continent.

Despite the magnitude and importance of the issue, there remains a dearth of statistically rigorous research documenting the relation between adult

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deaths and human capital of their surviving children. Human capital outcomes reflect investments that occur during childhood and are expected to have life-long effects on the socio-economic welfare of children.[2,3] For school-age children who become orphaned, education retardation is an obvious potential consequence of parental death. Likewise, the health of children may be impacted. For the specific health measure we study, height, growth retardation for school-age children (say 6–15) has been documented in developed country contexts, although we are unaware of any study documenting growth retardation for this age-group in developing countries.[4–6] There are other outcomes of interest in understanding the consequences of orphanhood, such as migration and marriage transitions for young adults, but these are not the focus of this study.

Two imperative questions about the consequences of orphanhood are whether the impact is causal and whether it is persistent. The impact of parental death on observed differences in outcomes, or lack of a difference, between orphans and non-orphans in cross-sectional data may be misleading. For example, if poorer parents face higher mortality risks, then lower relative schooling observed for their orphans may capture an education gap that would exist regardless of the child becoming orphaned. Likewise, lack of observed differences in Africa between orphans and non-orphans may reflect higher HIV/AIDS prevalence among adults with higher socio-economic backgrounds.[7] This is particularly relevant since cross-country analysis using large-scale national surveys has shown that for many countries there are no observed orphan gaps with respect to schooling.[8] There is less evidence from national survey data comparisons of health outcomes for children in Africa. For children under age 5, Demographic Health Surveys can be used to examine malnutrition indicators (such as stunting and wasting). Analyses of these data did not reveal statistically significant patterns of malnutrition among orphans as compared with non-orphans. However, this may reflect the low frequency of orphanhood even in the most AIDS-affected countries (for example: Benin 1.6%; Mali 1.9%; Nigeria 1.6%; Tanzania 2.6%; Uganda 3.5%; Zimbabwe 5.9%) and, then, the difficulty of detecting significant differences across groups. In any case, finding no difference in health status between orphans and non-orphans is not evidence that orphanhood does not affect child health. Without some form of randomized design—an obviously impossibility for this research question—causality can never be considered 'proven'. Nevertheless, this study tried to assess whether this is a causal relation or not by testing a series of hypotheses that should hold under causal inference.

Even with evidence of a negative impact of an adult death on schooling or health status of a child, the question of the persistence of a short-run effect (in childhood) remains. Temporary withdrawal from school, for example, can be offset by re-entry to school and possible equal attainment between orphans and non-orphans.

If parental death is causally linked to decreased investments in children's health and education and these effects persist into the child's adult life, then the intergenerational effect of the orphan crisis is likely to have serious consequences for the development prospects of African countries. The importance of careful documentation of this relation is indispensable as the number of orphans increases due to HIV/AIDS and there currently exists strong political momentum to increase the number of people on antiretroviral therapy.[9] The scale-up effort has been particularly large in sub-Saharan Africa with the number of people on antiretroviral therapy having increased more than 8-fold over the past 2 year reporting period (from 100 000 to 810 000) and more than doubled in the past year.[10] Only if the effect of adult mortality on reduced investments in children's human capital is causal would we expect it to be impacted (directly) by this scale-up. If, on the other hand, other factors like poverty and lack of health knowledge are causing both adult mortality and reduced investments in children, then we would not expect an improvement on child health and education.

Methods

Data collection

The Kagera Health and Development Survey (KHDS) was a large-scale household survey implemented by the World Bank in 1991–93 in Kagera, Tanzania and again in 2004.[11] The Kagera region is particularly insightful when studying the impact of HIV/AIDS.[12–14] The first three cases of the disease were detected at Ndolage Hospital in 1983. Being one of the first regions in Africa to have been hit by the epidemic, it has a longer history of HIV/AIDS and, therefore, is one of the first places where one can attempt to analyse the intergenerational impact of the disease. Furthermore, Kagera had intensive socio-economic data collection efforts early on in the epidemic, providing the necessary baseline data to perform such studies.

The KHDS sample of more than 900 households included both orphaned and non-orphaned children. In the former group, at baseline, there were 1085 non-orphaned children aged 6–15 for whom full baseline socio-economic and anthropometric information was available and were at least 19-years old by 2004. Of these children, 822 (76%) were re-interviewed in 2004; 4% had died prior to 2004 and 20% were not located. Of these 822 tracked children, we have complete socio-economic and anthropometric data from baseline and follow-up for 718. Of these

718 children who at baseline had both parents alive, 133 lost either one or both parents before the age of 15. Fifty-two children lost their mother before the age of 15, 98 their father and 17 both parents. The higher rates of paternal orphanhood are observed in other data sets both for Tanzania and across the region. This is the case despite the slightly higher prevalence of HIV among women in Tanzania—8% among women and 6% among men.[15] The higher rates of paternal orphanhood is usually attributed to gender patterns in age-specific mortality and the age gap between husbands and wives.[8] Our research strategy was to compare those children who became orphaned before the age of 15 to those who did not in terms of the number of completed years of formal education and final attained stature at adulthood. By construction, then our analysis excludes the 4% of children who died before the follow-up round in 2004. So our results present lower bound estimates of the orphanhood effects if there is dependence between parental and child death. Since there are few deaths in the sample, we do not analyse mortality patterns among children.

Restricting our sample to children who were not orphaned at baseline was important as this ensured that they were equal in terms of their baseline position in so far as it is reflected in orphanhood status. Furthermore, this sample restriction allowed us to control for the socio-economic conditions that prevailed in the household before the death of the parent, as well as genetic factors as captured by the height of the child's mother and father.

Statistical methods

We used Stata version 9.2 for statistical analysis. We applied several statistical methods to asses the impact of orphanhood on final attained stature and years of formal schooling. Linear regression analysis [ordinary least squares (OLS)] allowed us to control for pre-orphanhood living conditions, such as household wealth. Of course, the socio-economic conditions in which a child resides will change with the death of a parent as the child is potentially fostered into new households within the extended family network.[16] We did not take into account that the socio-economic conditions of the households in which orphans resided after the death of a parent prior to reaching adulthood, in part because we do not have this information. But as well, it is not clear we would want to condition on these covariates. If orphans are strategically placed in wealthier households among the set of extended family households, then controlling for post-orphanhood household wealth would compare orphans with richer non-orphaned children.

As a robustness check to the OLS results, we applied a matching technique to measure impact. Each child is assigned a 'propensity score', which is the predicted likelihood of becoming orphaned by age 15. The propensity score, a number between 0 and 1, is based on the set of baseline characteristics of each child. Children with similar propensity scores had similar likelihoods of experiencing parental death, in so far as it could be predicted by their baseline characteristics. We excluded children in the sample of orphans (non-orphans) who did not have sufficiently similar non-orphans (orphans). We trimmed the samples to observations with propensity scores between 0.08 and 0.92 to estimate the paternal orphan effect and between 0.04 and 0.96 to estimate the maternal orphan effect.[17] We kept observations in the interval $(0.5 - \sqrt{0.25 - \gamma^{-1}}, 0.5 + \sqrt{0.25 - \gamma^{-1}})$ with s the propensity score and γ the solution to $\gamma = 2E\left[1/s(s-1)\middle|1/s(1-s) < \gamma\right]$. This reduced the sample to 364 (367) observations with 46 (86) children transitioning into maternal (paternal) orphanhood before the age of 15. We then captured efficient estimators of the average orphanhood effect using weighted regressions of the orphanhood dummy on the 2004 outcome variables.[18] Orphans (treatment observations) are weighed at unity, while non-orphans (control observations) get a weight of $s/(1-s)$, with s indicating the propensity score.

Finally, we used the data on baseline height and schooling to further test that results showed causal relationships between orphanhood and the outcomes of interest. First, we tested that the results remain robust to including the initial (baseline) outcome as a regressor. If baseline schooling (height) determines final schooling (height) and is at the same time correlated with future orphanhood then the orphanhood variable may be reflecting part of their effect. Furthermore, including the child's baseline height can control for genetic effects and nutritional history up to the baseline survey. The second hypothesis is similar and is built from the insight that if the regressors satisfactorily control for all characteristics that could jointly determine orphanhood and health and schooling outcomes then future orphanhood status should not be a predictor of baseline schooling (height), once these other factors are controlled for.

Results

Table 1 shows that, starting from a sample of non-orphaned children aged 6–15 years at baseline, those who subsequently lose a parent will, by adulthood, be on average 2 cm shorter ($P = 0.014$) and have 1 year less schooling ($P = 0.006$) than those who do not. Paternal and, especially, maternal orphanhood at childhood are powerful predictors of lower adult height, while only paternal orphanhood is statistically associated with lower education in adulthood. These associations, however, do not control for other socio-economic differences in these two groups of children, differences that could in part or in full explain the height and education levels observed.

Table 2 compares the baseline characteristics of the sample of children who lose a parent before the age of

Table 1 Average adult height and schooling attainment of orphans and non-orphans

	Mean final height non-orphans (cm)	Mean final height orphans (cms)	Difference in mean final height (cm)	*t*-stat of difference	*P*-value of difference (two sided)
Any parent died before age 15	162.8 (585)	160.9 (133)	1.9	2.47	0.014
Mother died before age 15	162.6 (666)	160.3 (52)	2.3	2.03	0.042
Father died before age 15	162.7 (620)	161.1 (98)	1.6	1.83	0.068
	Mean final schooling non-orphans (years)	**Mean final schooling orphans (years)**	**Difference in mean final schooling (years)**	***t*-stat of difference**	***P*-value of difference (two sided)**
Any parent died before age 15	6.2 (585)	5.4 (133)	0.8	2.82	0.005
Mother died before age 15	6.1 (666)	5.6 (52)	0.5	1.21	0.227
Father died before age 15	6.2 (620)	5.3 (98)	0.9	2.77	0.006

Number of observations are in brackets.

Table 2 Difference in baseline characteristics by future orphan status

	Remain non-orphan to age 15 $n=585$		Loses one or both parents by age 15 $n=133$		*P*-value of difference (two sided)
Baseline characteristic					
Height (cm)	133.64	(14.97)	126.61	(12.18)	0.000
Height for age *Z*-Score	−1.826	1.274)	−1.866	(1.072)	0.737
Schooling (years)	1.71	(2.06)	0.85	1.43	0.000
Age (years)	10.90	(2.74)	9.56	(2.38)	0.000
Male (proportion)	0.48	(0.50)	0.41	(0.49)	0.113
Living with mother (proportion)	0.78	(0.41)	0.65	(0.48)	0.001
Living with father (proportion)	0.78	(0.41)	0.64	(0.48)	0.000
Years of schooling of head	4.48	(2.84)	3.55	(2.78)	0.001
Male household head (proportion)	0.90	(0.29)	0.79	(0.41)	0.000
Age household head (years)	50.48	(13.43)	54.47	(13.75)	0.002
Household per capita expenditure (Log Tanzania shillings)	11.28	(2.39)	11.53	(1.84)	0.262
Dwelling has non-dirt flooring (proportion)	0.15	(0.35)	0.16	(0.37)	0.712
Height of father (cm)	167.88	(7.09)	166.52	(6.55)	0.104
Height of mother (cm)	157.65	(5.64)	158.16	(6.34)	0.435

Standard deviations are in parentheses.

15 years and compares it with the sample of children who will not. The very low levels of schooling among children 6–15 years at baseline reflect the degree of delayed enrolment, 2–3 years past the official age of entry for primary school.[19] The results indicate that inferring a causal link between orphanhood and low human capital investments on the basis of Table 1 is potentially erroneous, as orphans originate from different households than non-orphans. We see that before becoming orphaned these children are more likely to be living in female-headed households and in households with older and less-educated heads. They are also more likely to be living away from their father or mother. It is reasonable to assume that these same factors also contribute directly to human capital investments, irrespective of any effect they may have through parental death.

Table 3 controls for these conditions to investigate whether parental death predicts or causes lower human capital outcomes for the children. Height is expressed in its natural logarithm, although results are consistent with using height in levels.

Table 3 Impact of orphanhood on final attained height and schooling

	OLS controlling for the child's sex and age and village fixed effects		OLS controlling for pre-orphanhood socio-economic and genetic characteristics		Propensity score weighted regressions on trimmed sample	
	(1) Height (ln cm)	(2) Schooling (years)	(3) Height (ln cm)	(4) Schooling (years)	(5) Height (ln cm)	(6) Schooling (years)
Any parent died before age 15	−0.007 (0.004)	−0.705 (0.283)	−0.006 (0.004)	−0.680 (0.280)	−0.006 (0.006)	−0.645 (0.331)
Orphan (*N*)	133	133	133	133	123	123
Total (*N*)	718	718	718	718	501	501
Mother died before age 15	−0.013 (0.006)	−0.841 (0.390)	−0.012 (0.006)	−1.096 (0.362)	−0.011 (0.008)	−0.917 (0.452)
Maternal Orphan (*N*)	52	52	52	52	46	46
Total (*N*)	718	718	718	718	364	364
Father died before age 15	−0.003 (0.005)	−0.629 (0.336)	0.000 (0.005)	−0.491 (0.328)	−0.006 (0.006)	−0.402 (0.392)
Paternal orphan (*N*)	98	98	98	98	86	86
Total (*N*)	718	718	718	718	367	367
Mother died before age 15	−0.012 (0.006)	−0.750 (0.387)	−0.012 (0.006)	−1.039 (0.359)		
Father died before age 15	−0.001 (0.005)	−0.559 (0.333)	−0.001 (0.005)	−0.406 (0.323)		
Maternal orphan (*N*)	52	52	52	52		
Paternal orphan (*N*)	98	98	98	98		
Total (*N*)	718	718	718	718		

Schooling is measured in years of schooling completed. Height is converted into natural logarithm of height in centimetres. Standard deviations are in parentheses.

Columns 1 and 2 report on the results with controls for a very basic set of child characteristics (sex and a full set of age dummies indicating the child's age at baseline). Because the sample was drawn from 51 enumeration areas (administrative villages), we also include a set of village indicator variables that capture the impact of orphanhood on health and education from factors such as access to schools and health services. Columns 3 and 4 have further controls for the socio-economic environment prevailing in the household at baseline as reflected in the characteristics of its head (sex, age and years of education), whether or not the mother/father of the child was living in the household and two indicators of household wealth: whether or not the household had a cemented floor in the dwelling and the log value of per capita consumption expenditure in the household. Much effort was spent collecting the latter variable with respondents queried through an extensive itemized household budget module, capturing all consumption from home production, purchases, stocks and gifts. Monetary welfare in developing countries is more reliably measured through such consumption modules than through income modules and it is the indicator used to designate income poor households.[20] Furthermore, we controlled for the genetic background of the child by including the height of fathers and mothers as regressors. The first three rows of Table 3 include the effect of a single orphanhood variable defined, respectively, as the death of any parent, the mother and the father. Because in an area with high HIV/AIDS prevalence the death of one parent may increase the likelihood of the death of another parent, the regressions in the last row of Table 3 unbundle these effects by controlling for both simultaneously. As a further robustness check, we excluded the 17 double orphans from the sample and came to identical results, although their exclusion further weakened the link between paternal death and schooling.

The results from Table 3 columns 1–4 are enlightening: children who lose their mother lose, on average, 1.96 cm of height (95% CI 0.06–3.77) and 1.01 years of schooling (95% CI 0.39–1.81). This result remains robust across both specifications. Father's death, however, does not affect stature and is only weakly statistically associated with schooling. Table 3 columns 5 and 6 present results from the matching method described above. Again the evidence supports a causal link between maternal orphanhood and investments in health and education of the child, while we reject the hypothesis that paternal orphanhood results in lower height and schooling outcomes.

We did two additional sets of checks for the robustness of our result using information on schooling and height levels at baseline. First, including the initial condition as a regressor did not alter the main results. Second, we tested our causality assumption by examining whether future maternal and paternal orphanhood status predicts initial schooling and height years, controlling for all other covariates included in the regressions above. Future orphanhood status was not significantly associated with either initial schooling or height of children, results which further substantiate the causal interpretation of our findings.

In an attempt to further unpack the results, we interacted the orphanhood variable with the sex of the orphan and with baseline wealth. Exploring the gender dimensions further we also interacted the sex of the parent who died with the sex of the resulting orphan, hypothesizing that boys may suffer more from paternal death and girls from maternal death as they take over gender-specific roles in the household. We found none of these interaction effects to be significant. We also interacted the orphanhood shock with whether the child was living with the respective parent who subsequently died at the time of the baseline survey. While for height, we find no significantly different effect according to living arrangements, for education, we find that the entire impact of maternal death on schooling is confined to those children living with their mother at baseline. Finally, interactions with the age at which the child got orphaned also failed to yield any obvious patterns, although small sample sizes certainly plague interpretation of the coefficients here.

We exclude any controls measured in the follow-up survey (such as 2004 wealth or living arrangements) as they were measured *after* orphanhood and are likely to be endogenous to it, potentially biasing the regression coefficients. This implies that our results cannot inform on the role of *post*-orphanhood wealth changes in the causation chain leading to lower human capital outcomes of orphans. We do find that orphans do *not* live in households with statistically different 2004 consumption per capita compared with non-orphans. This indicates that orphanhood should be used with caution as a targeting characteristic in broad-based anti-poverty programmes (e.g. only if these households have a higher potential to move up in response to the programme).[21]

It is interesting to note that double orphanhood by definition results in fostering and becoming a one-parent orphan is highly correlated with being fostered (not residing with the surviving parent).[8] However, fostering itself is not itself clearly associated with worse outcomes for children, since motives for fostering can include improving the living standards of children.[22]

Conclusions

This article provides unique and robust evidence on the long-term effects of the loss of a parent on health and schooling outcomes of children. Controlling for a wide range of household and child conditions before orphanhood and for community effects, we find

evidence of persistent and plausibly causal impacts of becoming a maternal orphan before the age of 15. Maternal orphans are, on average, nearly 2 cm shorter (mean 1.96; 95% CI 0.06–3.77) and have 1 year less schooling (mean 1.01; 95% CI 0.39–1.81) than children who were not orphaned before the age of 15. Without some form of randomized design—an obviously impossibility for this research question—causality can never be considered 'proven'. Nevertheless, this study tried to assess whether this is a causal relation or not by testing a series of hypotheses that should hold under causal inference. Paternal orphanhood, while correlated with lower final height and years of schooling, was not found to causally affect either height or school attainment. Rather than directly affecting schooling and height, the death of a father captures other socio-economic disadvantages of orphans prior to becoming orphaned. Alternatively, it is plausible that future deaths are causal in that the illness itself affects baseline socio-economic status. We investigate this by examining the reported length of illnesses that preceded deaths of adults 25–50 years. It is just under 1 year (355 days). Furthermore, the gap between the baseline socio-economic measures and paternal deaths is up to 9 years, suggesting that this effect is likely to be small.

Of course, catch-up effects are possible for many human capital indicators. Even if a child drops out of school during a period of stress around the death of the parent, this does not necessarily imply that the child's education cannot reach the levels of his/her peers later. Similarly, catch-up growth after a period of stunting is relatively well documented.[23] Studies using short-term follow-up data on children cannot exclude this possibility. Because we analyse children who are at least 19-years old at the time of the follow-up survey we are sure to be investigating final attained height and, in a region with on average of 6 years of formal education, final attained schooling. Thus, any measured effects are ones that will persist throughout the child's adult life.

Our results suggest that reducing maternal mortality will increase investments in health and education of children thus mitigating the intergenerational effects of orphanhood on human development outcomes.

Funding

The KHDS 1991–94 data collection rounds were funded by the World Bank Research Committee, DANIDA and Economic and Social Research Council (UK) (grant RES 000-22-1060 to SD). The KHDS 2004 data collection round and analyses were funded by the Knowledge for Change Trust Fund at the World Bank, the World Bank Research Committee, DANIDA and Economic and Social Research Council (UK) (grant RES 000-22-1060 to S.D.).

Acknowledgements

We thank John Cockburn, Willy De Weerdt, Michelle Poulin and seminar participants at the AAEA annual meetings 2006, Child Health in Developing Countries Workshop (Bristol, UK), IFPRI, IUSSP seminar on HIV/AIDS and Poverty, Mini-conference on Development at the University of Laval, Oxford University Development Economics Conference, PAA annual meetings 2005, Research and Analysis Working Group (Dar es Salaam) and the World Bank for very useful comments. The sponsors had no role in the study design, data collection, data analysis, data interpretation or writing the report.

Conflict of interest: The views expressed here do not necessarily reflect those of the World Bank or its member countries.

KEY MESSAGES

- In a data set from rural Africa, the death of a parent is found to have serious adverse effects on the health and education of children; the impact is especially pronounced for a maternal death.
- Orphans are likely to live with this deficit in health and education throughout the rest of their lives; catch-up seems highly unlikely.
- The African orphan crisis, exacerbated by the HIV/AIDS epidemic will have important negative intergenerational effects.

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