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Working-Age Adult Mortality, Orphan Status, and Child Schooling in Rural Mozambique

by

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EXECUTIVE SUMMARY

There is growing concern that the AIDS epidemic may reduce long-term human capital development through reductions in child schooling, thus severely limiting the long-term ability of orphans and their extended families to escape poverty. This concern has led to an empirical debate regarding whether to target orphans or poor children (or both) with schooling subsidies. This paper contributes to this on-going debate by using a large panel dataset from 2002-2005 from rural Mozambique to measure the impact of working-age (WA) adult mortality, morbidity and orphan status on child primary schooling.

The results demonstrate that, for rural Mozambique, a homogenous conceptualization of WA adult mortality and morbidity shocks are not by themselves a reliable indicator of poor child schooling outcomes, but rather depend upon the pre-death wealth level of the household and the gender of the deceased or ill adult. For example, a WA male death within the past three years reduces attendance of children from poor households by 21%, while the presence of chronically ill WA male adult in the household reduces attendance by 25%. While negative mortality effects are more often found from male deaths, we do find that a recent WA female death reduces school advancement by 10% among children from poor households and reduces attendance by 21% for children from less poor households. These results are consistent with other research using this panel dataset that found that significant reductions in household size, income, and assets are more likely found in the event of a WA male death rather than a WA female death (Mather and Donovan 2007). One potential explanation for the gender differential in mortality impacts is that on average, three out of four households with a WA female death are able to attract a new WA adult to the household, whereas, on average, no households with a WA male death are able to attract new adults (*ibid.* 2007).

The results also indicate that negative effects of WA mortality/morbidity shocks are more likely to occur for children from poorer households, which suggests that the opportunity costs of children in such households become high during the illness or following the death of a WA adult. Yet, the fact that we also find some significant negative effects of adult mortality among children from less poor households, as well as significant negative schooling effects for orphans from less poor households, suggests that even those Mozambican households in the top half of the distribution of rural household income per adult equivalent adjust to mortality/morbidity shocks by reducing child schooling. This may be due to the fact that quite a few of these 'less poor' households are technically at or below the rural poverty line (i.e., while they are relatively wealthier than other rural households are, they are not wealthy enough to be able to withstand a mortality/morbidity shock without having to reduce child schooling).

Analysis of the effects of orphan status on child schooling finds 12% lower attendance for maternal orphans from poor households (relative to non-orphans from poor households), 17% lower attendance for paternal orphans from less poor households, and 28% lower attendance for double-orphans from both poor and less poor households. Analysis also finds slower school advancement among maternal orphans (especially girls), paternal orphans from less poor households, and double-orphan boys from less poor households. Both the attendance and school advancement analyses find lower schooling among female maternal orphans. These results suggest that maternal orphans from poorer households and double-orphans are likely to have lower schooling on average, relative to non-orphans. They also suggest that paternal orphans in less poor households are also not immune from lower schooling.

The analysis does not evidence of systematic bias against boys or girls in how households that suffer a WA death or illness respond to this shock. Nevertheless, girls in rural Mozambique continue to face schooling bias in that they are less likely to attend school: 62% of girls age 10-18 in 2005 yet to complete primary school attended school in 2005 compared with 70% of boys.

There are several policy implications from these results. First, because the extent to which children's schooling outcomes are affected by adult mortality or morbidity is specific to the gender of the child, the household's wealth level, characteristics of the deceased or ill adult, and the timing of the adult death, it is inappropriate to categorize all children in Mozambique who are directly or indirectly affected by HIV/AIDS-related morbidity and mortality as being especially vulnerable and in need of targeted school subsidies. The results demonstrate that social protection and education policymakers concerned with primary school under-enrollment in Mozambique need to tailor mitigation measures to the specific needs and situation of children in rural Mozambique. The evidence in this paper suggests that both boys and girls from households with either a recently deceased WA male adult or a currently ill male adult – especially those from poorer households – are most likely to face losses in school attendance and advancement. Mitigation measures appropriate for rural Mozambique may, therefore, include conditional cash transfers targeted to children that have incurred these mortality/morbidity shocks.

Third, although Mozambique abolished primary school fees in 2005, there may still be barriers to enrollment such as continued household demand for child labor, additional educational expenses for transport, school uniforms and books, and declining school quality if enrollment outpaces new school construction and teacher hiring. These additional barriers to enrollment may explain why we have found evidence of negative effects of adult mortality and morbidity on child schooling, even in a time period after the government had abolished primary school fees. In addition, targeted schooling subsidies alone may not reduce schooling deficits of some orphans, in the event that their poor schooling progress is due to the emotional and psychological trauma of losing one or both parents or a lack of interest by their adult guardians in their schooling. This may help explain why we found evidence of schooling deficits among orphans in both poor and non-poor households.

Fourth, Mozambique should continue to provide universal free primary schooling, as this policy has been found in a number of countries to improve the enrollment and schooling progress of those children most likely to suffer from poor schooling – namely children from poorer households, both orphan and non-orphan alike. For example, evidence from Malawi and Uganda suggest that improvements in enrollments among the poor through universal abolition of primary school fees can substantially raise the enrollment of orphans, even to the point of eradicating orphan schooling deficits (Ainsworth and Filmer 2006). Finally, it should be noted that because of the well-established positive correlation between educational attainment and safer sexual behavior (World Bank 1999), Education for All is itself an important policy that can help reduce the spread of HIV/AIDS.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

AE	Adult Equivalent
ASE	Acção Social Escolar
BFS	Bureau of Food Security
CRE	correlated random effects
DFID	UK Department for International Development
EGAT	(USAID) Economic Growth, Agriculture, and Trade
FE	Fixed Effects
IAF	National Household Consumption Survey (Inquérito aos Agregados Familiares)
INE	National Statistics Institute
IPW	Inverse Probability Weighting
MEC	Ministry of Education and Culture
MINAG	Ministry of Agriculture
MSU	Michigan State University
OLS	Ordinary Least Squares
SSA	Sub-Saharan Africa
TIA	Trabalho do Inquérito Agrícola
USAID	United States Agency for International Development
WA	Working Age
WHO	World Health Organization

1. INTRODUCTION

Many of the African countries hardest hit by the AIDS epidemic of the past two decades also suffer from low levels of human capital development. There is growing concern that the AIDS epidemic may reduce long-term human capital development through reductions in child schooling, thus severely limiting the long-term ability of orphans and their extended families to escape poverty. This prompted calls a decade ago for governments and donors to subsidize the schooling of orphans (USAID 2000; World Bank 2002). A multi-country study by Case, Paxson, and Ableidinger (2004) lends empirical support to this argument, reporting evidence of orphan schooling deficits and arguing that targeting of subsidies to orphans is justified because such deficits exist even after controlling for household wealth. By contrast, a larger multi-country study found so much diversity in their results that they concluded that the extent to which orphans are under-enrolled in Sub-Saharan Africa (SSA) relative to other children – if at all in some cases – is country-specific and cannot be assumed (Ainsworth and Filmer 2006). Ainsworth and Filmer's (2006) results also question whether the schooling progress of orphans is on average worse than that of children from the poor households - therefore requiring a targeted intervention linked to their special needs - or whether the impact of becoming an orphan is to further increase the already large group of poor children currently under-enrolled in many SSA countries. In the latter case, one might argue for policies that will raise the levels of schooling of the under-enrolled poor, reaching the most vulnerable children, whether orphan or non-orphan. This paper contributes to this on-going empirical debate by using a large panel dataset from rural Mozambique to measure the impact of working-age adult mortality, morbidity, and orphan status on child primary schooling.

One of the main challenges of measuring the effects of adult mortality on child schooling is that mortality from AIDS is not a random event. Most studies in the earlier years of the epidemic in SSA have found higher HIV incidence rates among individuals with higher income, higher education, and more mobility (Ainsworth and Semali 1998; Gregson, Waddell, and Chandiwana 2001).[1] If those with higher socioeconomic status also tend to invest more in child schooling, then orphans and children in households with an adult death may actually have higher school enrollment than children in other households. Failure to control for initial household characteristics may therefore generate biased estimates of the impact of adult mortality on schooling outcomes. We address this challenge by using panel data that enables us to control for pre-death household characteristics.

While there are various studies which have used panel data from SSA to measure the impacts of adult mortality on child education in SSA (Deininger, Garcia, and Subbarao 2003; Evans and Miguel 2007; Beegle, de Weerdt, and Dercon 2006; Ainsworth, Beegle, and Koda 2005; Yamano and Jayne 2005; Case and Ardington 2006; Yamano, Shimamura, and Sserunkuuma 2006; Yamauchi, Buthelezi, and Velia 2006; Ueyama 2007), these studies represent findings from only five different countries. Yet, a recent review of this literature as well as the literature on orphan schooling based on cross-sectional Demographic and Health Survey data demonstrates that the impacts of adult mortality or orphan status on child schooling vary considerably across countries and by household wealth level (Mather, 2011a). For example, the studies by Ainsworth, Beegle, and Koda (2005) and Yamano and Jayne (2005) use household data from Kagera, Tanzania, and rural Kenya, respectively, both areas with relatively high population density. Households in these areas may not face the same labor constraints following an adult death as rural Mozambique, which has a considerably lower

[1] This pattern may be changing in some countries, as research using more recent data from west and east Africa finds that although adults with more education are still more likely to be HIV-positive, associations between wealth and HIV status vary considerably across countries (Fortson 2008).

population density. In addition, while several of the panel studies have tested for whether the effects of adult mortality on child schooling vary by pre-death household wealth levels, only one of them (Mather 2011b) has tested whether the effects vary by gender or household position of the deceased or ill adult. The relatively large household sample in the panel survey dataset used in this paper enables us to estimate such effects both by household wealth level and by gender of the deceased or ill adult.

This paper is organized as follows. We first discuss the data sources used in this paper. Second, we develop a conceptual framework with which we investigate potential pathways by which adult mortality may affect child schooling. Third, we estimate reinterview models to assess the potential for non-random sample attrition, and run regression-based tests for attrition bias with our schooling models. Fourth, we estimate various regression models to measure the effect of adult mortality, adult morbidity, and orphan status on child schooling outcomes. We then repeat the analyses after stratifying the sampled households by initial household wealth, by gender of the child, and by gender of the deceased or ill adult.

2. DATA

2.1. Sampling

This study uses a three year panel of rural household-level surveys known as the TIA (Trabalho do Inquérito Agrícola), implemented in 2002 and 2005 by Ministry of Agriculture (MINAG) staff from the Directorate of Economics in collaboration with colleagues from Michigan State University (Ministério da Agricultura 2005). Employing standards from the National Statistics Institute (INE) and based on the Agricultural Census sample, TIA in 2002 (TIA02) used a stratified, clustered sample design[2] that is representative of rural small- and medium-holders[3] at the provincial and national levels, and includes 4,908 households from 80 districts (out of 128) across the country. The TIA05 sample includes 4,104 TIA02 households that could be re-interviewed from the 80 TIA02 districts (i.e., the panel households), replacement households for attrited TIA02 households, as well as households from 16 additional districts that were not sampled in TIA02. The sampling design is thus representative of current conditions while also having the panel component. Not all TIA02 households were re-interviewed; attrition issues are discussed in detail below. Given the stratification and clustering of the sample, survey weights are used in estimations and the corrected standard errors calculated using StataCorp (2009) software.

Some researchers have sought to increase the probability of having sufficient sample numbers of households suffering adult mortality by targeting areas known to have high HIV prevalence (Petty et al. 2005), or by over-sampling households likely to have experienced an adult illness or death (Beegle, de Weerdt, and Dercon 2006). The sampling for the TIA survey was designed to meet the primary purpose of measuring rural agricultural production and incomes, thus there were no modifications to the sampling for the purposes of morbidity- and mortality-related research. Nevertheless, the rather large size of the household survey resulted in a sample with a reasonable number of cases of adult death or illness between 2002 and 2005.

This study also uses secondary data on HIV prevalence rates that are reported at the provincial level and based on ante-natal clinic data (Ministério da Saúde 2005). The data are used to help estimate the probability of reinterview, which we use to help alleviate potential panel attrition bias. In addition, secondary data on the kilometers of all primary and secondary roads at the district level is used along with data on district-level population (estimated from the CAP 2000?).

2.2. Working-age Adult Mortality and Morbidity

The TIA02 and TIA05 survey instruments were very similar and covered a range of aspects: agricultural and livestock production, land use, and income sources and services. The survey instruments also included several demographic sections, to capture the characteristics of each current member of the household, and to document new arrivals, departures, deaths, and chronic illness of household members.

[2] The TIA02 sample was drawn from the sampling frame prepared for the year 2000 agricultural *census* (covering approximately 22,000 households) with the intention that TIA02 data can be analyzed at the provincial level and by agro-ecological zone.

[3] Medium scale farmers (based on criteria using land and livestock holdings and horticultural production) were expressly over-sampled, to ensure sufficient observations for analysis.

When enumerators revisited the 2002 sampled households in 2005, they asked about each individual in the demographic roster of the 2002 survey, including their whereabouts. For individuals which had left the household, further information was sought from respondents concerning why that individual left. For example, for members reported as deceased, respondents were asked to identify the cause of death. Among working-age adults, defined below, approximately 87% of WA deaths were caused by disease. Enumerators also asked about new members who may have joined the households since the previous survey, thus this survey captures deaths of individuals who may have returned home for terminal care. The surveys also recorded whether any individual in the household had suffered illness in the previous 12 months, and the number of months of illness. We define chronic illness as those that are reported to have lasted three or more months in duration.

Our analysis focuses on the deaths and chronic illness of working-age adults, defined as ages 15-59 for both men and women, because these correspond to the age ranges hardest hit by HIV/AIDS. Following earlier studies (Donovan et al. 2003; Yamano and Jayne 2004; Mather et al. 2004; Chapoto and Jayne 2008), we use demographic information from the TIA panel on the 'disease-related' death of a WA household member as a rough proxy for an HIV/AIDS-related death. In this research, we recognize that not all the WA illness-related deaths are due to HIV/AIDS, yet it is generally accepted that the epidemic has played a large role in the rapid increase in WA mortality rates in countries with increasing HIV prevalence (Ngom and Clark 2003). Opportunistic diseases such as tuberculosis and malaria are present in Mozambique and are more likely to occur or to be more severe when adults have a compromised immune system. Such diseases confound any simple diagnosis as to cause of illness or death and are responsible for numerous deaths even in the absence of HIV/AIDS. However, chronic illness and/or death of WA adults, whether HIV-related or not, is clearly an increasingly important development problem. This paper therefore aims to quantify the effects of illness-related WA death on child schooling in the interest of informing the design of policies and programs intended to mitigate the adverse effects of adult mortality.

2.3. Primary School-Age Children Included in the Analyses

The national education system of general education program is divided into two levels: primary and secondary. Primary education consists of seven years of schooling divided into two levels, the first level comprising: grades 1–5 (escola primária do primeiro grãu, or EP1) level, grades 6 and 7 (escola primária do segundo grãu, or EP2). While the entrance age for primary school in Mozambique is seven, given that many children do not begin school until age 9-10, most children will not complete primary school and begin secondary education by the earliest entrance age of 14.

While the TIA surveys collected data on all children in the observed households, they only collected information on years of schooling completed for children age 10 and older. In TIA05, additional child-specific questions were asked including whether the child was currently attending school as well as the vital status of the parents of each child under age 15. The TIA panel surveys therefore provides longitudinal data on children's years of schooling, age, gender of children age 10 and over for 2002 and 2005, while TIA05 alone provides data on children's years of schooling, attendance, and orphan status. Given that our interest is primary school education and the fact that the TIA instrument only records schooling information from children age 10 and over, we therefore restrict our analysis to children who are age 10 or older and who have not yet completed primary school.

3. PRIMARY EDUCATION AND WORKING-AGE ADULT MORTALITY

3.1. Primary Education in Mozambique

The Government of Mozambique has dramatically increased its investment in basic education since the mid-1990s. For example, Ministry of Education data show that the number of primary schools in rural areas almost doubled from 1996 to 2005 (including an increase of 16% in the number of schools from 2002 to 2005) (World Bank 2007). Gross and net enrollment rates for primary school grades 1-2 (EP1) have subsequently improved from 40% in 1996 to 83% in 2006, according to the Ministry data (*ibid.* 2007). [4] Enrollment data from the nationally-representative Inquérito aos Agregados Familiares (IAF) household expenditure surveys in Mozambique confirm that there has been a large increase in primary school enrollment in rural areas between 1996/97 and 2002/03 (*ibid.* 2007). While a significant gender gap in schooling in rural Mozambique still exists, this too has improved remarkably over time. For example, the IAF survey in 1996/97 found that school attendance of children age 12-17 in rural areas was 51.5% for boys and 33.2% for girls, while the TIA survey of 2005 found average attendance rates of 72.9% for boys age 12-17 and 61.8% for girls (Mather, Cunguara, and Boughton 2008).

The Mozambican government issued a ministerial decree in 2004 abolishing the *Acção Social Escolar* (ASE) and all other fees and levies in primary education, beginning in the 2005 school year. While public primary schools charged a matriculation fee of about $5/year per child (prior to 2005), this amount still represented a serious constraint for many rural households, as 38% of communities in the 1996/97 IAF survey with a school in their village reported that some children did not attend school because it was too expensive (Handa, Simler, and Harrower 2004). Thus, the removal of the matriculation fee may well have improved school attendance as observed in TIA05.

3.2. Conceptual Framework

The factors that affect parents' decisions to send their children to school include the financial costs of schooling, opportunity costs of children's time in other activities, and the expected returns from schooling. The potential effects of WA mortality or morbidity on child schooling depends on how such events affects these factors (World Bank 1999). First, medical expenses during the pre-death illness period may make it difficult for parents to afford school fees, and such fees could be prohibitive in the post-death period if the deceased was a key cash-earner for the household. While there were no primary school fees in rural Mozambique in 2005, there may have been additional educational-related expenses for transport, school uniforms, and books.

Second, the opportunity costs of children's time, which increase with age, may also increase based on demands for care-giving (during the pre-death period) and family labor (during both the pre- and post-death periods). We expect that households with higher initial asset holdings would be less likely to pull children from school because such households may have sufficient income to hire additional labor to meet their labor demand or to attract new adults to the household (Ainsworth, Ghosh, and Semali 1995; Mather and Donovan 2007). Third, expected returns from schooling may decline if life expectancy and/or non-farm employment opportunities are eroded in the event of widespread HIV incidence in the community. In

[4] As reported by World Bank (2007), these data are from the Ministry of Education and Culture (MEC) administrative data base.

addition, the value of returns from education of a child may be lower for the guardians of two-parent orphans, who may well be less interested in investing in the long-term welfare of children who are not their own.

While we lack suitable instruments with which to distinguish empirically the impacts of one of these potential factors from the others, this conceptual framework suggests various ways by which adult mortality might affect child schooling. We consider three hypotheses in particular. First, if girls are more likely to become caregivers when an adult in their household becomes ill, then we would expect to find larger effects of adult morbidity on girls' schooling outcomes. Second, we would expect effects of adult mortality to be larger for children from households with lower initial asset holdings given that the opportunity costs of children of such households may be quite high, and that such households are less likely to be able to hire labor or attract new members. Third, a few studies have found that impacts of adult mortality on household income or assets are larger when the deceased was a household head or spouse relative to a non-head or spouse (Yamano and Jayne 2004; Mather and Donovan 2007); research which used this same panel data from Mozambique found larger mortality effects from male relative to female deaths (Mather and Donovan 2007). Thus, we expect to find larger negative effects on schooling following the deaths of a head or spouse relative to the death of other household members, and from males relative to females. However, due to a small number of cases of head/spouse deaths, we only test the latter hypothesis.

4. ESTIMATION STRATEGIES AND VARIABLES

4.1. Panel Attrition and Sampling

For some of the panel econometric analysis in this paper, we only use children from households that were initially interviewed in 2002, and then re-interviewed in 2005. Given that over time, some households move away from a village and others dissolve as part of a typical household life-cycle (or perhaps due to adult mortality), panel household surveys typically have to contend with at least some sample attrition over time. If the characteristics of households that are not re-interviewed are systematically different from those that are, then using the re-interviewed households to estimate the means or partial effects of variables during one of the later panel time periods may result in biased estimates. In the three-year TIA panel, of the n=4,908 households interviewed in TIA 2002, n=4,104 households were re-interviewed in 2005 (a re-interview rate of 83.6% for 2005). Overall, the rate of attrition in this sample is relatively low, as compared to other African country surveys described in Alderman et al. (2001) and elsewhere (Chapoto and Jayne 2008, for rural Zambia).

To test for household-level attrition bias in our individual-level regressions, we follow the approach described in Wooldridge (2002) and define a selection indicator variable, $attrite_{i,t+1}$. This is equal to one if the child belongs to household that was not re-interviewed in the next wave of the panel survey, and equal to zero if the individual belongs to a household that was successfully re-interviewed. The binary variable $attrite_{i,t+1}$ is then included as an additional explanatory variable in each of our schooling regression models. If the coefficient on $attrite_{i,t+1}$ is statistically different from zero, this indicates the presence of attrition bias. Given that there are two waves of panel data on child schooling available, only the first wave (2004) is used in this test.

Given that our panel household survey data is based upon a complex, stratified sampling design, we apply Stata's options for complex sampling weights to estimate standard errors used in the econometric analysis in this paper. When this option is not available in Stata for a given regression model, we use the population weights. For regression models that appear to be significantly affected by attrition bias, we use sampling weights that are adjusted for panel attrition bias using the Inverse Probability Weighting (IPW) method (Wooldridge 2002), as discussed in the next section.

Information was not collected by the supplemental surveys concerning children who may have left households since the 2002 survey, either with their entire households or by themselves. We therefore lose some children due to attrition. While we test for attrition at the household level, we are not able to test for potential bias that may arise in the event that there is non-random child attrition (beyond that which we can control for at the household level).

4.2. Reinterview Model

Wooldridge (2002) proposes Inverse Probability Weights (IPW) as a method to evaluate and address this possible source of selection bias. IPW methods have been applied in HIV/AIDS impact analysis by Yamano and Jayne (2005), Chapoto and Jayne (2008), and Mather and Donovan (2007), and this study follows the same approach. A key assumption is that the observable characteristics of the household adequately explain re-interview status, and that unobservables are not strong predictors of re-interview.

Alderman et al. (2001) notes that while selective attrition on unobservables potentially remains a problem even after the analyses account for selection on observables, the possibilities for detecting selective attrition on unobservables using datasets from developing countries is very limited, given that such tests require comparisons with similar datasets which contain the same key variables yet no (or little) attrition. In addition, they argue that "using as much information as possible about selection on observables in the panel helps to reduce the amount of residual, unexplained variation in the data due to attrition. Controlling for selection on observables thus will likely reduce any biases due to selection on unobservables (*ibid.* 2001)." Following Alderman et al. (2001), we, therefore, rely upon observable characteristics to help explain attrition.

In our study, we use initial household and village characteristics, lagged HIV prevalence rates from the nearest sentinel site, and binary variables for provinces and different enumerator teams to predict reinterview. In short, we write our 2005 reinterview model as:

$$Pr(R_{ht} = 1) = f(HIV_{2001}, X_{bt}, T_{bt}, P). \qquad (1)$$

where R_{ht} equals one if a household b is re-interviewed at time t, conditional on being interviewed in the previous survey, and zero otherwise; HIV_{2001} is the average lagged district-level HIV prevalence rate from 2001; X_{bt} is a set of household characteristics observed in the 2002 TIA survey; T_{bt} is a set of enumeration team dummies; and P is a set of eight provincial dummies. Note that all of the variables are observable even for households that were not reinterviewed in 2005. Because of the 6-10 year average lag time between HIV seroconversion and AIDS-related death, it would be ideal to use HIV prevalence information from 6-10 years prior to 2002. However, we use HIV prevalence information from 2001 as this was the first year that an expanded set of sentinel sites were included by the Ministry of Health to produce provincial-level estimates of HIV prevalence (Ministério da Saúde 2005). If these regressors are a good predictor of re-interview, then we will be able to use the inverse of the predicted probability as a weight in the outcome estimations to control for panel attrition bias.

Using these characteristics observed for all 4,908 households in the original TIA02 sample, we estimate equation (1) with probit to determine the probability of being re-interviewed, φ_{2005}. For observations in both the 2002 and 2005 survey, the inverse probability weight is $1/\varphi_{2005}$. We then multiply the IPW by the household-specific population weights and apply them to the models that are found to exhibit significant panel attrition bias.

4.3. School Attendance Model

4.3.1. Measuring the Effects of Mortality/Morbidity Shocks on Child School Attendance

The economic theory and estimation models on schooling have been discussed elsewhere by Strauss and Thomas (1995) and Glewwe (2002). Our first educational outcome of interest is primary school attendance (A_{it}), which is measured as a binary variable which equals one if the child is enrolled in school at the time of the survey, and zero otherwise. Child school attendance provides a good indicator of the household's current investment in a child's schooling. We restrict our analysis to children who have not yet completed primary school for several reasons: the household decision with respect to secondary school attendance may involve different financial and opportunity-cost constraints, given that primary school fees were abolished in Mozambique in 2005 (but not fees for secondary schools); and the nearest secondary school may be further than the nearest primary school. In practice, this means that we use a sample of 5,650 children who were age 10 to 18 in 2005 and who had not yet completed primary school.

As discussed in Section 3.2, the impact of WA adult mortality on a child's schooling may start prior to the death due to the demand for caregivers for the sick member(s) and to medical costs. In addition, adult mortality may affect child schooling for a long time after the death because of reduced financial resources and labor. To measure the total impact of adult mortality, we disaggregate instances of adult mortality into those that occurred 3-6 years prior to time t, and those which occurred within 0-3 years of time t. This Past period WA death binary variable PPD_{bt} equals one for each child which experienced a WA adult death in their household in the 3-6 years prior to year t, while the Recent WA death binary variable RD_{bt} equals one for each child which experienced a WA adult death in their household from 0-3 years prior to time t. Finally, to capture the potentially negative effects of adult mortality that occur during the illness period, we include the binary variable I_{bt} which equals one for any child which lives in a household with an adult who was reported to be chronically ill for 3 of the past 12 months, and zero otherwise. Thus, a base model for our analysis of child school attendance is:

$$Pr(A_{it} = 1) = f(PPD_{it}, RD_{it}, I_{it}, HIV_{t-j}, C_{it}, X_{i2002}, V_{k2002}, DR_{kt}, PROV_{im})) \qquad (2)$$

where C_{it} represent child-specific variables for the child's age, age-squared and gender; X_{i2002} represent household characteristics observed in 2002, V_{k2002} are village-level characteristics (some observed in both years, and some only observed in 2002), DR_{kt} is a vector of district-level variables; and $PROV_{im}$ is a vector of binary variables for m=1 to 9 of the 10 provinces in Mozambique.

Household characteristics (observed in 2002) include: total household landholding, total farm asset value (which includes farm equipment and livestock), the age of the household head, the education level of the household head, the maximum education level of adults age 18 and over in the household, the maximum education level of female adults age 18 and over in the household, and a binary variable which =1 if the head is polygamous. District-level variables include the number of drought-days during the main growing season, the kilometers of primary and secondary roads per 1,000 residents (in 2002), and the lagged HIV prevalence rate at the nearest surveillance site (HIV_{t-j}).

Village-level characteristics include: travel time from the village to the nearest town of 10,000 or more residents (in 2002); distance from the village to nearest public transport (in 2002); a binary variable which =1 if there is a mill in the village or nearby village (in 2002); a binary variable which =1 if the village has a well or borehole (in 2002); and the percentage of village residents who reported significant maize yield losses. These village-level characteristics are included primarily because the household survey did not record a measure of the distance or travel time from the village to the nearest primary school. We assume that if most schools are built on or near a feeder road (or nearest administrative town), then distance to the nearest vehicular transport, feeder road, or administrative town may well proxy for distance to the nearest primary school. We also include these distance variables because they may serve as proxies for market access, under the assumption that market access may affect the household's demand for schooling (given higher relative returns to education in the production and marketing of higher-value crops as well as non-farm wage or own business activities, relative to the returns to education in semi-subsistence farming). We also include three additional village-level binary variables which indicate whether the household was interviewed in October, November, or December, in the event that the timing of the survey influenced the household's response regarding the child's highest grade completed (given that the public school year for a given region goes from January-October or February/November).

Several points should be clarified about this equation. First, we use household characteristics as observed in 2002 instead of contemporary household characteristics in year t, because contemporary values of X_i for the years 2005 may well be affected by mortality shocks. For example, when a male household head dies, it is possible that his household transitions from being relatively wealthy to relatively poor. To measure the full impact of his death on his children's schooling, we need to compare the schooling outcomes of his children with children who resided in relatively wealthy households, not in poorer households. Therefore, we hold the household characteristics at the levels observed prior to the mortality shocks. Technically, the past period mortality shocks for the year 2005 occurred in 1999-2002, and thus may affect household characteristics from 2002. Thus, if mortality shocks tend to reduce household wealth and asset levels, this means that we may underestimate the negative effect of past-period mortality shocks.

Second, we include the lagged HIV prevalence rate at the nearest surveillance site expecting that it may pick up broader community effects of the AIDS epidemic on child school attendance (separate from the direct effect via afflicted households) (Yamano and Jayne 2005). However, it should be noted that the lagged HIV prevalence rate could be correlated with various district or provincial-level characteristics that are unobserved in our model. For example, we know from previous studies that HIV prevalence rates tend to be high in areas with major trunk roads where there is a steady influx of outsiders. Thus, we need to be cautious in interpreting the partial effect of this variable on schooling outcomes.

We first estimate equation (2) with Probit. However, if unobservable characteristics such as household social status, mobility, and parents' preferences for schooling are correlated with the mortality/morbidity binary variables, this can lead to biased estimation of the effects of such shocks on child schooling. While a Fixed Effects (FE) estimator is usually the most practical way to control for unobserved household-level heterogeneity that can be assumed to be time-constant, the FE Probit estimator has been shown to be inconsistent (Wooldridge 2002). An alternative is to use pooled correlated random effects (CRE) Probit (Mundlak 1978; Chamberlain 1984), which explicitly accounts for unobserved heterogeneity and its correlation with observables, while yielding a fixed-effects-like interpretation.

In contrast to traditional random effects, the CRE estimator allows for correlation between unobserved heterogeneity (*ci*) and the vector of explanatory variables across all time periods (X_{it}) by assuming that the correlation takes the form of: $c_i = \tau + Xi\text{-}bar\,\xi + a_i$, where *Xi-bar* is the time-average of X_{it}, with $t = 1, \ldots, T$; τ and ξ are constants, and a_i is the error term with a normal distribution, $a_i \mid Xi \sim \text{Normal}(0, \sigma^2_a)$. However, because the household time-average CRE terms most likely to be correlated with household-level unobserved heterogeneity – such as head's age, head's education, spouse's education, maximum adult education, total landholding and asset values – may be affected by mortality shocks, we instead use household characteristics as observed in 2002 (i.e., prior to recent mortality shocks for 2005). While the measure of each of these household characteristics in 2002 is not the 'long-term time-average', all of them except for total landholding and asset values are essentially constant over time (in the absence of the death or departure of the head or spouse). We further assume that these variables are likely to be correlated with unobserved time-constant factors such as the household's schooling preference.

We estimate a reduced form of the Probit CRE model in which τ is absorbed into the intercept term and the X_{i2002} terms are added to the set of explanatory variables. Using the full sample with the pooled CRE probit, we perform an adjusted Wald test and reject the hypothesis of zero correlation ($\xi = 0$) between unobserved heterogeneity and the X_{i2002} terms (p=0.000), indicating that the CRE approach is superior to the traditional pooled or random effects estimators. To facilitate interpretation of the results, we compute average partial effects[5] (APE) for each regressor using Stata's margins command. We use survey sampling weights in each regression in accordance with the complex survey design of the Mozambique rural household surveys.

Because the TIA surveys only began recording child school attendance in 2005, our analysis of the effects of adult morbidity/mortality on attendance uses a sample of children from 2005 who are age 10 to 18 and who have not yet completed primary school (we drop n=162 children who had begun secondary school in 2005). In order to control for pre-death (2002) household wealth levels and other characteristics, we only use children from panel households.

After running the Probit on the sample of children age 10-18 in 2005 from panel households, we then rank the sample by the household's total gross income per Adult Equivalent[6] in 2002, and stratify the households into two groups; households that are in the bottom half of total income/ Adult Equivalent (AE) (i.e., poor) and those that are in the top half (i.e., less poor). We define wealth status by income rather than assets because households in rural Mozambique have few farm equipment assets and large livestock in the upper half of the country is limited by the tsetse fly. We then run separate regressions by wealth category to see if mortality effects vary by the household's initial wealth level.

Next, we stratify the sample by gender of the child and run separate regressions by gender to see if mortality and morbidity shocks affect girls differently than boys. Information on the number of cases (children) in each of these separate regressions is presented in Appendix Table 2. Finally, we estimate equation (2) but we disaggregate the mortality and morbidity dummies by the gender of the deceased or ill adult.

4.3.2. Measuring the Effects of Orphan Status on Child School Attendance

To measure the effect of orphan status on child attendance, we also estimate equation (2) in which we drop the mortality/morbidity shock information and add three separate binary variables: the first =1 if the child is a paternal orphan in time t (and zero otherwise), the second =1 if the child is a maternal orphan in time t, and the third =1 if the child is a double-parent orphan in time t. Previous research has demonstrated the importance of differentiating between single- and two-parent orphans, as a study using nationally-representative survey

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[5] Because the effect of an explanatory variable in a nonlinear equation depends on the level of all explanatory variables, not just its own coefficient, analysts typically compute the marginal effects for a given variable using the mean of all regressors. By contrast, we compute the partial effect for each household, and then take the average partial effect across the entire sample (or subsample), and compute bootstrapped standard errors for inference (Wooldridge 2002).

[6] Adult equivalent is a measure that adjusts the size of a household to reflect its caloric consumption needs based on the age and gender or each individual in the household (WHO 1985).

data from 34 SSA countries found that orphans who have lost both parents are considerably more likely to have statistically significant schooling deficits (and of larger magnitude) than single-parent orphans (Ainsworth and Filmer 2006).

Among single-parent orphans, we might expect to find larger schooling effects from a maternal death given evidence from intra-household expenditure surveys showing that female-headed households spend a larger percentage of the household budget on children than male-headed households do (Bruce and Lloyd 1997). In addition, single-parent orphans who lose their mother are more likely to be moved to a different household, where they may face discrimination due to the absence of their surviving parent (their father) (Ueyama 2007). This is consistent with empirical results from Ainsworth and Filmer (2006), who find that schooling deficits of maternal orphans tend to be larger than those of paternal orphans in east and southern Africa, which is also found in most of the panel-based studies from these regions (Mather 2011b).

On the other hand, the loss of a male household head or male adult may well result in a larger loss of cash income for the surviving family members, given that men are more likely than women to have higher-wage employment or manage cash crops in many SSA countries. Likewise, research from Kenya and Mozambique found that the loss of a household head or spouse resulted in a larger loss of farm assets and cash income for the surviving family members, relative to the loss of a non-head/spouse (Yamano and Jayne 2005; Mather and Donovan 2007). In addition, this Mozambique paper by Mather and Donovan (2007) – which used the same panel data set used in this paper – found significant reductions in household size, income, and assets are more likely found in the event of a WA male death rather than a WA female death. Therefore, it is difficult to predict *a priori* whether maternal orphans in rural Mozambique will be more likely to face schooling deficits relative to paternal orphans.

Our analysis of the effects of orphan status on attendance uses a sample of 5,236 children from 2005 who are age 10 to 14 and who have not yet completed primary school. Because information on a child's orphan status does not tell us the timing of the death of the child's parent, using household characteristics from 2002 may or may not control for pre-death household wealth. We also do not know for certain that the orphan resides in the same household where his/her parent(s) died, although literature from other countries has typically found that paternal orphans are very likely to stay in the same household after their father's death. We therefore household characteristics observed in 2005 so as to make use of the larger TIA 2005 full sample of households, which provides for more individual cases of orphans (Appendix Table 3).

4.4. School Advancement Model

We next undertake an additional set of analyses focusing on schooling or grade advancement, that is, the successful progression of children from one grade to the next. This analysis provides an alternative measure of the effects of working-age adult mortality on child schooling, as it is possible that the effects of mortality/morbidity shocks could be better captured in school advancement than in school attendance, in the event that such shocks result in grade repetition and/or late enrollment. If we find any negative impacts of WA mortality/morbidity shocks on school attendance, then we should find similar results in the school advance model because the negative impacts on school attendance should delay the school advancement. However, the reverse does not necessarily hold: even if we do not find any negative mortality/morbidity impacts on school attendance, we may still find negative impacts on school advancement. Thus, school advancement is likely to be a better measure of a child's cumulative school-based learning, while attendance is a better measure of a household's current (short-term) investment in child schooling.

One measure of school advancement is the ratio of the child's grade actually achieved over the grade that would be achieved under normal grade progression without repetition and assuming the child begins primary school at age 7. We measure school advancement as SA_{it} = (the highest grade attained) / (age - 6).

While not attending school at all results in a SP score of zero, less than 10% of our sample of cases have school advancement of zero (in large part because our sample of children begins with age 10). Given that the mean of SP is 0.378 and the skewness is not large, we estimate the following school advancement model using OLS:

$$SA_{it} = f(PPD_{it}, RD_{it}, I_{it}, HIV_{t-j}, C_{it}, X_{i2000}, V_{k2000}, DR_{kt}, DIST_{im}, YEAR_t) \quad (3)$$

This model uses the same regressors as in equation (3), including household characteristics measured in 2002 which we assume should control for time-invariant unobserved household heterogeneity as correlated random effect (CRE) terms (described above). We add a dummy variable for the year 2005 to control for the abolition of primary school fees beginning with the 2005 school year (our age variable captures the change in schooling outcomes by child's age).

As with our attendance analysis, we restrict analysis of school advancement to children who have either not started school or who have not yet completed primary school. In order to maximize the number of children in our analysis while also controlling for pre-death household characteristics, we use a sample of 9,016 children who had not yet completed primary school, which includes a) children age 10-18 in 2002 from all TIA02 households; and b) children age 10-18 in 2005 from panel households. If we find any negative impacts of WA adult mortality on school attendance, then we would anticipate finding similar results on school advancement, assuming that lower school attendance leads to delayed school advancement. The reverse does not necessarily hold: even if we do not find any negative impacts on school attendance, we may still find negative impacts in schooling progress.

$$SA_{it} = f(PPD_{it}, RD_{it}, I_{it}, HIV_{t-j}, C_{it}, YEAR) \quad (4)$$

To check the robustness of our results, we also estimate equation (4) on longitudinal observations using OLS with household fixed effects, which causes the time-constant household, village, and district-level variables to drop out of the school advancement model. While this allows us to more effectively control for household-level time-constant unobservable factors – which may be correlated with adult morbidity/mortality – the disadvantage of this approach is that it restricts our analysis to longitudinal child observations, which reduces the sample by about half to n=4,690 (i.e., 2,345 children).

5. RESULTS

5.1. Determinants of Reinterview

We first discuss results of the reinterview model (Appendix Table 1). The joint tests for significance of all household characteristics show these variables to be highly significant, thus indicating that attrited households appear to differ from non-attrited households with respect to several observable attributes. For example, households with higher probability of reinterview are those with larger numbers of female adults, elderly adults, and children, whose house has a good quality roof, or who have a household head or spouse native to the village. By contrast, households with a working-age (WA) male adult death in the past four years or a current chronically ill male adult are less likely to be reinterviewed in 2005. These results suggest that households with ties to the local leadership, larger household sizes, and higher-quality housing are more likely to stay together as a family and stay in the village. By contrast, those with smaller household size and a recent adult male death are more likely to dissolve the household and/or migrate. In addition, households from areas with higher district-level HIV prevalence in 2001 are also less likely to be reinterviewed (though this effect may be picking up unobserved district-level attributes that are conducive to household migration).

However, this evidence alone does not mean that there is necessarily significant attrition bias with respect to the dependent and independent variables in our child schooling regressions. We therefore run regression-based attrition tests (described above) on our various child-level regressions, using children from all households household interviewed in 2002. We find that there is evidence of attrition bias in approximately half of these regressions, most notably in those that are run on the full sample of children (Table 1). We therefore present results in the next few sections from models which apply attrition corrections to the sampling weights (with the exception of the school advancement models using the sub-sample of girls), and note that use or not of these correction factors have a minimal effect on our results.

Table 1. Attrition Bias Test Results

Dependent variable	Estimator	p-value for test of H_0: $\beta_{reinterview i,t+1} = 0$ vs H_1: $\beta_{reinterview i,t+1} = 1$
Years of schooling achieved (children in grades 0-7, age 10-17)		
All children	Neg Binomial	0.068
children from poor households	Neg Binomial	0.002
children from less poor households	Neg Binomial	0.456
girls	Neg Binomial	0.124
boys	Neg Binomial	0.285
Grade progress of children (children in grades 0-7, age 10-17)		
All children	Tobit	0.076
children from poor households	Tobit	0.005
children from less poor households	Tobit	0.565
girls	Tobit	0.119
boys	Tobit	0.338

Notes: Neg Binomial = Negative Binomial
Source: Author's calculations using TIA02 and TIA05.

5.2. Descriptive Statistics

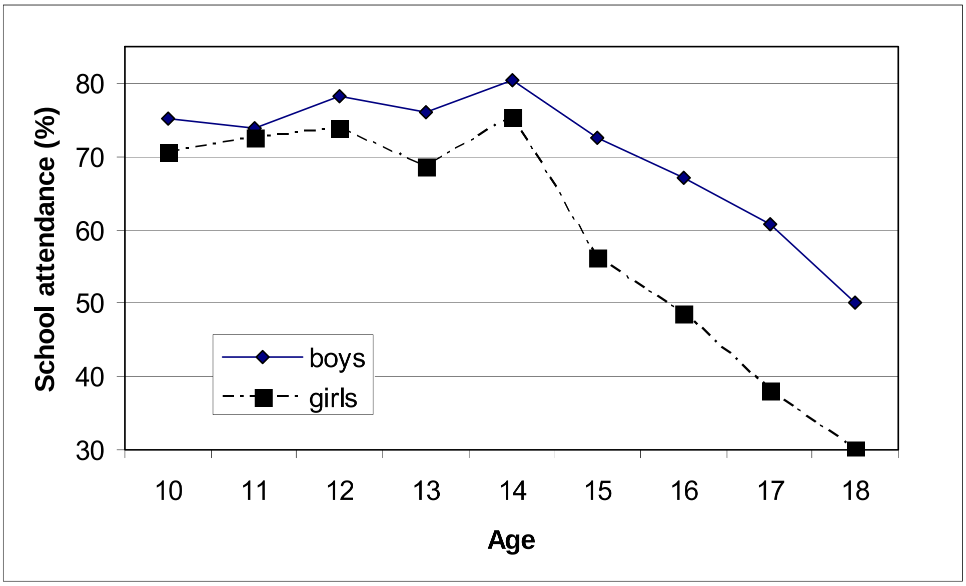
The means and standard deviations of the variables used in our regressions that measure the effect of adult mortality and morbidity on child school attendance and school advancement are shown in Table 2 and Appendix Tables 4 and 5. Mean school advancement of children age 10-18 is 0.409 in 2005 (Table 2), which implies that many children do not start school at age 7 and/or complete grades on schedule. For example, if a child starts school on time (at the age of 7), stays in school, and advances one grade for each year, their school advancement ratio would consistently be 1.0 from one year to the next.

Three key descriptive statistics indicate the necessity of controlling for various household and child-level factors when testing for differentials in child schooling. First, school attendance and grade progression differ considerably by age of the child, thus any comparison of schooling outcomes across different categories of children must first control for the child's age (Figure 1).

Second, average school attendance differs considerably by the wealth level of the household. For example, 63% of children age 10-18 from poorer households attended school in 2005, compared with 70% of children in the same age range from wealthier households (Table 2). This pattern is also clear from Figure 2, which shows that mean attendance of children age 10-18 is higher among children from wealthier households for 8 of the 9 age groups represented. Higher probability of attendance among children from wealthier households translates into faster grade progression, as we see that the mean years of schooling achieved and school advancement for less poor children (3.15 and 0.44) are higher than those for children from poor households (2.74 and 0.39) (Table 2). Together, these schooling results suggest that children from poorer households start school later than those from wealthier households, progress more slowly from one grade to the next, and/or drop out of school at an earlier age.

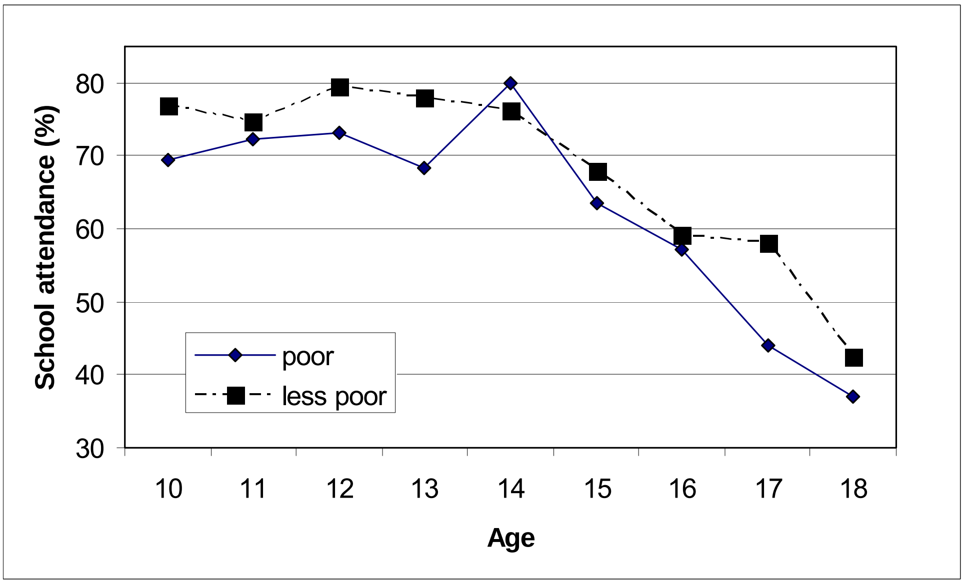
Third, school attendance and grade completion differ by the gender of the child, as the mean attendance of boys age 10 to 18 in 2005 was 70.4%, as compared with 61.7% for girls in the same age range (Table 2). This pattern is also shown by age group in Figure 1, as girls have consistently lower attendance than boys between the ages of 10 to 14, and drop out of school faster than boys from ages 15-18 do. We next move to multivariate regression analysis, which enables us to measure the effect of adult mortality or orphan status on child schooling while controlling for the various child- and household-specific attributes which influence child school attendance and grade completion.

Figure 1. Child School Attendance by Age and Gender, Rural Mozambique, 2005



Source: TIA05

Figure 2. Child School Attendance by Age and Household Income Category, Rural Mozambique, 2005



Source: TIA05

Table 2. Summary Statistics of Children Age 10-18 Yet to Complete Primary School, by Gender and Wealth Category, 2005

	All		Poor[1]		Less Poor[1]		Girls		Boys	
	2005		2005		2005		2005		2005	
	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE
Dependent variables										
Primary school attendance (=1)	0.663	0.008	0.633	0.011	0.701	0.011	0.617	0.012	0.704	0.010
School advancement	0.409	0.005	0.385	0.006	0.440	0.007	0.384	0.007	0.433	0.007
Highest grade achieved	2.921	0.034	2.737	0.045	3.148	0.052	2.697	0.048	3.123	0.047
Explanatory Variables										
Lagged HIV prevalence rate	10.077	0.102	9.964	0.139	10.218	0.149	10.205	0.149	9.961	0.139
Household-level adult mortality/morbidity shocks										
Past WA adult mortality (3-6 years ago)	0.040	0.003	0.047	0.005	0.033	0.004	0.039	0.005	0.042	0.005
Recent WA adult mortality (0-3 years ago)	0.066	0.004	0.068	0.006	0.064	0.006	0.064	0.006	0.068	0.006
Chronically ill adult	0.059	0.004	0.064	0.005	0.053	0.005	0.065	0.006	0.053	0.005
Child characteristics										
Age	13.389	0.043	13.359	0.058	13.427	0.065	13.364	0.063	13.412	0.059
Age squared	185.839	1.199	185.012	1.607	186.867	1.799	185.274	1.757	186.352	1.639
Girl (= 1)	0.476	0.008	0.473	0.011	0.480	0.012				
Household characteristics (in 2002)										
ln(Total landholding)	2.320	0.028	2.091	0.037	2.605	0.043	2.322	0.042	2.318	0.038
ln(Total farm asset value)	6.299	0.043	5.914	0.059	6.778	0.059	6.266	0.061	6.328	0.060
Head's years of education	2.397	0.039	1.903	0.045	3.012	0.065	2.375	0.057	2.417	0.054
Maximum years of education (of female adults in HH)	1.602	0.034	1.301	0.042	1.977	0.055	1.610	0.050	1.595	0.047
Maximum years of education (of all adults in HH)	3.389	0.044	2.869	0.053	4.036	0.070	3.427	0.065	3.354	0.060
Head's age	43.778	0.214	43.932	0.285	43.586	0.325	43.552	0.314	43.982	0.293
Head is polygamous (= 1)	0.072	0.004	0.076	0.005	0.068	0.006	0.068	0.005	0.076	0.005
Village and district characteristics (in 2002)*										
Travel time to nearest town of 10,000+ residents (hrs)*	7.645	0.100	7.667	0.128	7.617	0.157	7.483	0.144	7.792	0.139
Distance to nearest public transport*	26.526	0.476	28.198	0.657	24.445	0.687	26.561	0.713	26.493	0.638
Mill in the village (or nearby village) (= 1)*	0.398	0.008	0.358	0.011	0.447	0.012	0.397	0.012	0.399	0.011
Village has well or borehole (= 1)*	0.710	0.008	0.698	0.010	0.725	0.011	0.715	0.011	0.706	0.011
% of village hhs reporting significant crop yield loss	0.722	0.005	0.716	0.007	0.729	0.007	0.719	0.007	0.725	0.007
# of district-level drought-days	47.198	0.453	47.093	0.601	47.327	0.687	46.925	0.651	47.445	0.629
district-level road density (kms of roads/1000 people)*	2.099	0.027	2.091	0.036	2.109	0.041	2.106	0.039	2.092	0.037
1=HH interviewed in October	0.351	0.008	0.350	0.011	0.352	0.012	0.339	0.011	0.361	0.011
1=HH interviewed in November	0.510	0.008	0.515	0.011	0.504	0.012	0.526	0.012	0.495	0.012
1=HH interviewed in December	0.087	0.005	0.087	0.007	0.087	0.007	0.084	0.007	0.089	0.007
No. of children	5,650		2,843		2,702		2,685		2,965	

Notes: 1) Poor HHs defined as those in the bottom 50% of total gross HH income/AE in 2002; Less poor are in the top 50% of total gross HH income/AE

Source: Author's calculations using TIA05.

5.3. School Attendance and Adult Mortality/Morbidity Shocks

We estimate a probit regression of primary school attendance and find that children experiencing working-age (WA) adult mortality and morbidity are not less likely to attend school than other children (Table 3). We then stratify the sample by the upper and lower 50% of households by total household income per AE in 2002, run separate regressions for children from poor and less-poor households, and find that WA mortality and morbidity shocks do not have significant negative effects on child schooling for children in either poor or less poor households (Table 3). Next, we stratify the sample by gender of the child (to consider whether mortality/morbidity shocks affect girls and boys differently) and find no significant negative effects of WA mortality or morbidity on the attendance of boys or girls (Table 3). There are also no significant effects of chronic adult illness on attendance, using either the full sample or the samples stratified by wealth or child's gender. Community-level effects of high HIV prevalence are also not significant for any of the regressions (Tables 3 and 4).

As we would expect, both the level of household assets and the education levels of adults in the household have positive and significant effects on child school attendance. While the magnitude of the effect of household assets on attendance is quite small, those for adult education are relatively larger (Table 3, Column A). For example, a one-year increase in either head's education level or maximum education of female adults in the household increases child attendance by 1.6 points (i.e., 2.4%), while a one-year increase in the maximum adult education in the household increases attendance by 1.8 points (2.7%). Contrary to what we might expect, children from households with larger landholding have lower attendance, as a 1% increase in landholding reduces attendance by 0.3 points (or 0.4%). This may indicate that households with larger landholding expect low returns to schooling for their children and that they subsequently prefer that their children help with farm production activities rather than attend school.

Access to road infrastructure and distance from the nearest administrative town also have significant effects on child school attendance. For example, reducing the travel time from the village to the nearest town of 10,000 or more residents by one hour increases the probability of attendance by 0.2% (Table 3). In addition, an additional kilometer of district-level road density per capita increases attendance by 0.8%. Assuming that primary schools are built near roads, these results are consistent with the literature on schooling demand in developing countries, which has consistently found a negative relationship between distance to the nearest school and probability of attendance. Presence in the village of a well/borehole or of a mill (in the village or nearby) both have large and significant positive effects on school attendance, which suggests that wealthier villages are more likely to have a primary school nearby.

Table 3. Determinants of Primary School Attendance (Probit), by Wealth Category, 2005

Covariates	All (A)	Poor (B)	Less Poor (B)
HIV prevalence rate at nearest sentinel site, 2001	-0.000	0.001	-0.002
	(-0.211)	(0.458)	(-0.752)
Household-level adult mortality/morbidity shocks			
Past WA adult mortality (3-6 years ago)	-0.024	-0.053	0.023
	(-0.584)	(-0.997)	(0.320)
Recent WA adult mortality (0-3 years ago)	-0.024	-0.019	-0.020
	(-0.675)	(-0.379)	(-0.423)
Chronically ill adult (3 months in past year)	-0.006	-0.048	0.073
	(-0.156)	(-0.965)	(1.330)
Child characteristics			
Age	0.187**	0.231**	0.144**
	(5.759)	(5.215)	(3.080)
Age squared	-0.008**	-0.010**	-0.007**
	(-6.986)	(-6.105)	(-3.941)
Girl (= 1)	-0.085**	-0.087**	-0.085**
	(-5.634)	(-4.254)	(-3.879)
Household characteristics (in 2002)			
ln(Total landholding)	-0.002	-0.008	-0.002
	(-1.321)	(-1.042)	(-1.019)
ln(Total farm asset value)	0.012**	0.014**	0.009
	(2.914)	(2.730)	(1.361)
Head's years of education	0.016**	0.012	0.020*
	(2.816)	(1.457)	(2.540)
Maximum years of education (of female adults in HH)	0.015**	0.008	0.022**
	(2.696)	(0.881)	(3.027)
Maximum years of education (of all adults in HH)	0.018**	0.029**	0.008
	(3.105)	(3.660)	(1.003)
Head's age	0.002**	0.001	0.003**
	(2.710)	(0.631)	(3.284)
Head is polygamous (= 1)	-0.070*	-0.110**	-0.021
	(-2.232)	(-2.724)	(-0.438)
*Village or district-level characteristics (in 2002)**			
Travel time to nearest town of 10,000+ residents (hrs)*	-0.002	-0.003+	-0.000
	(-1.477)	(-1.874)	(-0.239)
Distance to nearest public transport*	-0.000	-0.000	-0.001
	(-1.038)	(-0.066)	(-1.265)
Mill in the village (or nearby village) (= 1)*	0.058**	0.070*	0.047+
	(2.873)	(2.485)	(1.676)
Village has well or borehole (= 1)*	0.065**	0.028	0.100**
	(3.135)	(1.031)	(3.294)
% of village hhs reporting significant crop yield loss	-0.062	-0.067	-0.057
	(-1.605)	(-1.245)	(-1.029)
# of district-level drought-days	0.001	0.001	0.002
	(1.075)	(0.545)	(1.119)
district-level road density (kms of roads/1000 people)*	0.008*	0.008+	0.008
	(2.252)	(1.894)	(1.406)
Dummies for province and month of interview	Yes	Yes	Yes
No. of children	5,650	2,843	2,807

Notes: Regressions use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 4. Determinants of Primary School Attendance (Probit), by Gender and Wealth Category, 2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
HIV prevalence rate at nearest sentinel site, 2001	-0.003	0.001	-0.002	0.003	-0.003	-0.001
	(-0.984)	(0.521)	(-0.481)	(0.857)	(-0.814)	(-0.199)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 years ago)	-0.030	-0.013	-0.086	-0.018	0.070	-0.017
	(-0.546)	(-0.246)	(-1.163)	(-0.266)	(0.778)	(-0.172)
Recent WA adult mortality (0-3 years ago)	0.005	-0.044	-0.012	-0.001	0.039	-0.079
	(0.115)	(-1.073)	(-0.180)	(-0.018)	(0.606)	(-1.409)
Chronically ill adult (3 months in past year)	-0.033	0.038	-0.080	0.003	0.041	0.115+
	(-0.675)	(0.811)	(-1.334)	(0.046)	(0.509)	(1.861)
Child characteristics						
Age	0.204**	0.160**	0.286**	0.185**	0.130+	0.137*
	(4.202)	(3.483)	(4.382)	(2.821)	(1.889)	(2.193)
Age squared	-0.009**	-0.007**	-0.012**	-0.008**	-0.007**	-0.006**
	(-5.331)	(-4.046)	(-5.219)	(-3.211)	(-2.673)	(-2.609)
Household characteristics (in 2002)						
ln(Total landholding)	-0.000	-0.005	-0.005	-0.007	0.002	-0.004
	(-0.126)	(-1.487)	(-0.487)	(-0.780)	(0.240)	(-1.387)
ln(Total farm asset value)	0.019**	0.006	0.022**	0.006	0.011	0.007
	(3.237)	(1.281)	(3.458)	(0.870)	(1.060)	(1.033)
Head's years of education	0.016*	0.016*	0.010	0.018	0.025*	0.013
	(2.168)	(2.275)	(0.865)	(1.604)	(2.545)	(1.367)
Maximum years of education (of female adults)	0.025**	0.007	0.018	-0.002	0.032**	0.016+
	(3.347)	(0.997)	(1.608)	(-0.201)	(3.354)	(1.803)
Maximum years of education (of all adults)	0.015*	0.021**	0.028**	0.029**	0.004	0.013
	(2.023)	(2.839)	(2.832)	(2.737)	(0.326)	(1.386)
Head's age	0.002*	0.002+	0.001	0.000	0.004**	0.003*
	(2.394)	(1.776)	(0.866)	(0.238)	(2.758)	(2.211)
Head is polygamous (= 1)	-0.118**	-0.027	-0.135*	-0.082	-0.096	0.046
	(-3.010)	(-0.697)	(-2.554)	(-1.613)	(-1.618)	(0.732)
*Village or district-level characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.000	-0.003+	-0.002	-0.004*	0.002	-0.002
	(-0.234)	(-1.857)	(-0.909)	(-1.995)	(0.582)	(-0.875)
Distance to nearest public transport*	-0.001	-0.000	-0.000	0.000	-0.001+	0.000
	(-1.268)	(-0.375)	(-0.017)	(0.015)	(-1.891)	(0.107)
Mill in the village (or nearby village) (= 1)*	0.040	0.078**	0.065+	0.079*	0.010	0.081*
	(1.430)	(3.170)	(1.768)	(2.230)	(0.261)	(2.424)
Village has well or borehole (= 1)*	0.074**	0.054*	0.028	0.022	0.127**	0.080*
	(2.736)	(2.094)	(0.820)	(0.604)	(3.064)	(2.182)
% of village HHs reporting significant crop loss	-0.045	-0.064	-0.055	-0.070	-0.067	-0.050
	(-0.911)	(-1.294)	(-0.827)	(-0.976)	(-0.895)	(-0.717)
# of district-level drought-days	-0.001	0.003*	-0.001	0.002	-0.001	0.005*
	(-0.927)	(2.241)	(-0.716)	(0.989)	(-0.591)	(2.489)
District road density (kms roads/1000 people)*	0.007	0.006	0.004	0.011+	0.012	0.001
	(1.640)	(1.372)	(0.709)	(1.830)	(1.620)	(0.145)
Dummies for province and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,685	2,965	1,348	1,495	1,337	1,470

Notes: Regressions use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

We next disaggregate the adult mortality and morbidity shock variables to test for potential differences in household responses by gender of the ill or deceased adult. We find that a recent WA male death reduces attendance of children from poor households by 14 points (Table 5, Column D). Given that average attendance over the two survey waves is 66%, this means that a recent WA male death reduces the probability of attendance of children from poor households by approximately 21%. We also find that the presence of a chronically ill WA male in the household reduces the probability of child school attendance by 16.9 points (or 25%) (Table 5, Column B). This effect is significant for children in both poor and less poor households, and is somewhat stronger among children from less poor households, where it reduces attendance by 19 points (28%) (Table 5, Column D). We also note that the regression results in Columns A, C, and E – for which we did not apply attrition correction factors to our sampling weights – are quite similar to the results from regressions that use the correction factors. While most of the significant effects on attendance appear to be due to deceased or ill WA males, we also find that a recent WA female death reduces the attendance of children from less poor households by 0.14 (21%) (Table 5, Column F).

These gender-specific results are consistent with those from other analyses using this same panel dataset, which found that significant reductions in household size, income, and assets are more likely found in the event of a WA male death rather than a WA female death, and that such effects tend to be larger with the death of a male household head (Mather and Donovan 2007). One explanation for the gender differential in mortality impacts in rural Mozambique appears to be found in gender-differentiated demographic responses to WA mortality. For example, on average, three out of four households with a WA female death are able to attract a new WA adult to the household (usually another female), whereas, on average, no households with a WA male death are able to attract new adults (*ibid.* 2007). If the number of adults is a reasonable proxy of labor available to the household, then this gender disparity in demographic adjustment to WA mortality helps to explain why households with a WA male death are more likely than those with a WA female death to experience reductions in crop income, non-farm income, and child schooling. A complementary explanation for the gender disparity in mortality impacts on household income, assets and child schooling is that WA males (especially male household heads) in rural Mozambique are more likely than women to manage high-return crops such as cotton or tobacco, and are more likely to have the required education or social connections required for higher-return non-farm wage or self-employment. Thus, a household that loses a WA male is more likely to lose human capital, specific work experience, and/or social contacts that enable access to higher-return activities, yet which are not easily substitutable by surviving adult members (*ibid.* 2007).

We also find two results that are counter-intuitive: the presence of an ill WA female adult *increases* the probability of attendance by 14.8 points (22%) (Table 5), and recent WA male death is associated with a 10 point increase (15%) in the probability of attendance (Table 5).

Table 5. Determinants of Primary School Attendance (Probit), by Wealth Category, 2005

	All		Poor		Less Poor	
		Corrected for attrition		Corrected for attrition		Corrected for attrition
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
HIV prevalence rate at nearest sentinel site, 2001	-0.000	-0.000	0.001	0.002	-0.002	-0.002
	(-0.157)	(-0.156)	(0.415)	(0.523)	(-0.688)	(-0.766)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 yrs ago) - MALE	-0.000	0.001	-0.019	-0.024	0.017	0.031
	(-0.005)	(0.016)	(-0.295)	(-0.369)	(0.179)	(0.326)
Past WA adult mortality (3-6 yrs ago) - FEMALE	-0.029	-0.035	-0.094	-0.088	0.057	0.040
	(-0.506)	(-0.591)	(-1.252)	(-1.137)	(0.600)	(0.412)
Recent WA adult mortality (0-3 yrs ago) - MALE	-0.037	-0.036	-0.138*	-0.140*	0.095	0.101+
	(-0.859)	(-0.820)	(-2.441)	(-2.472)	(1.607)	(1.757)
Recent WA adult mortality (0-3 yrs ago) - FEMALE	-0.044	-0.046	0.067	0.064	-0.140*	-0.137*
	(-0.906)	(-0.933)	(0.945)	(0.903)	(-2.409)	(-2.351)
Chronically ill adult (3 months in last 12) - MALE	-0.169**	-0.178**	-0.178*	-0.191*	-0.113	-0.113
	(-3.004)	(-3.216)	(-2.347)	(-2.568)	(-1.513)	(-1.524)
Chronically ill adult (3 months in last 12) - FEMALE	0.068	0.062	0.009	0.012	0.168**	0.148*
	(1.513)	(1.427)	(0.149)	(0.202)	(2.601)	(2.431)
Child characteristics						
Age	0.185**	0.185**	0.225**	0.231**	0.149**	0.142**
	(5.714)	(5.837)	(5.088)	(5.239)	(3.213)	(3.169)
Age squared	-0.008**	-0.008**	-0.010**	-0.010**	-0.007**	-0.007**
	(-6.949)	(-7.100)	(-5.973)	(-6.126)	(-4.096)	(-4.088)
Girl (= 1)	-0.086**	-0.083**	-0.088**	-0.087**	-0.089**	-0.084**
	(-5.733)	(-5.651)	(-4.333)	(-4.293)	(-4.055)	(-3.931)
Household characteristics (in 2002)						
ln(Total landholding)	-0.002	-0.002	-0.007	-0.008	-0.002	-0.002
	(-1.326)	(-1.368)	(-0.930)	(-1.083)	(-1.141)	(-1.117)
ln(Total farm asset value)	0.012**	0.011**	0.013*	0.013*	0.010	0.008
	(2.992)	(2.891)	(2.552)	(2.528)	(1.460)	(1.271)
Head's years of education	0.016**	0.016**	0.013	0.015+	0.019*	0.017*
	(2.779)	(2.779)	(1.530)	(1.733)	(2.481)	(2.361)
Maximum years of education (of female adults)	0.016**	0.015**	0.007	0.007	0.024**	0.023**
	(2.770)	(2.697)	(0.828)	(0.783)	(3.260)	(3.310)
Maximum years of education (of all adults)	0.018**	0.019**	0.029**	0.028**	0.008	0.010
	(3.117)	(3.366)	(3.674)	(3.589)	(0.996)	(1.269)
Head's age	0.002**	0.002**	0.001	0.000	0.003**	0.003**
	(2.634)	(2.594)	(0.539)	(0.493)	(3.086)	(3.128)
Head is polygamous (= 1)	-0.069*	-0.068*	-0.105**	-0.097*	-0.020	-0.028
	(-2.221)	(-2.268)	(-2.615)	(-2.476)	(-0.407)	(-0.595)
*Village or district-level characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.002	-0.002	-0.003+	-0.003+	-0.001	-0.001
	(-1.443)	(-1.467)	(-1.723)	(-1.661)	(-0.391)	(-0.478)
Distance to nearest public transport*	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001
	(-0.978)	(-0.951)	(-0.041)	(-0.019)	(-1.214)	(-1.226)
Mill in the village (or nearby village) (= 1)*	0.059**	0.059**	0.072**	0.072**	0.049+	0.048+
	(2.903)	(2.945)	(2.594)	(2.604)	(1.777)	(1.754)
Village has well or borehole (= 1)*	0.067**	0.067**	0.031	0.031	0.097**	0.096**
	(3.247)	(3.287)	(1.127)	(1.155)	(3.238)	(3.256)
% of village HHs reporting significant crop loss	-0.068+	-0.069+	-0.069	-0.069	-0.057	-0.062
	(-1.781)	(-1.822)	(-1.282)	(-1.287)	(-1.050)	(-1.154)
# of district-level drought-days	0.001	0.001	0.001	0.001	0.002	0.002
	(1.101)	(1.059)	(0.421)	(0.415)	(1.166)	(1.095)
District road density (kms roads/1000 people)*	0.008*	0.008*	0.008+	0.008+	0.008	0.009
	(2.203)	(2.318)	(1.769)	(1.804)	(1.413)	(1.613)
Dummies for province and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	5,650	5,650	2,843	2,843	2,807	2,807

Notes: Regressions use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 6. Determinants of Primary School Attendance (Probit), by Gender and Wealth Category, 2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
HIV prevalence rate at nearest sentinel site, 2001	-0.003	0.001	-0.002	0.002	-0.003	-0.001
	(-0.917)	(0.435)	(-0.460)	(0.634)	(-0.708)	(-0.254)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 yrs ago) - MALE	-0.062	0.051	-0.089	0.077	0.033	-0.023
	(-0.889)	(0.615)	(-0.999)	(0.756)	(0.275)	(-0.179)
Past WA adult mortality (3-6 yrs ago) - FEMALE	0.036	-0.056	-0.044	-0.110	0.124	0.036
	(0.437)	(-0.863)	(-0.378)	(-1.416)	(1.038)	(0.260)
Recent WA adult mortality (0-3 yrs ago) - MALE	0.020	-0.077	-0.065	-0.173**	0.129	0.039
	(0.329)	(-1.572)	(-0.744)	(-2.617)	(1.600)	(0.530)
Recent WA adult mortality (0-3 yrs ago) - FEMALE	-0.064	-0.032	-0.026	0.161*	-0.083	-0.192**
	(-0.938)	(-0.562)	(-0.258)	(1.986)	(-1.008)	(-2.613)
Chronically ill adult (3 months in last 12) - MALE	-0.155*	-0.161*	-0.145	-0.192	-0.184	-0.060
	(-1.980)	(-2.177)	(-1.521)	(-1.643)	(-1.505)	(-0.766)
Chronically ill adult (3 months in last 12) - FEMALE	0.011	0.156**	-0.056	0.102	0.109	0.317**
	(0.190)	(2.675)	(-0.756)	(1.272)	(1.154)	(3.215)
Child characteristics						
Age	0.204**	0.155**	0.283**	0.176**	0.133+	0.143*
	(4.216)	(3.362)	(4.331)	(2.686)	(1.945)	(2.291)
Age squared	-0.009**	-0.006**	-0.012**	-0.007**	-0.007**	-0.006**
	(-5.355)	(-3.922)	(-5.162)	(-3.080)	(-2.749)	(-2.704)
Household characteristics (in 2002)						
ln(Total landholding)	-0.000	-0.005	-0.004	-0.007	0.001	-0.004
	(-0.151)	(-1.490)	(-0.442)	(-0.776)	(0.201)	(-1.441)
ln(Total farm asset value)	0.019**	0.007	0.022**	0.005	0.011	0.008
	(3.325)	(1.363)	(3.366)	(0.810)	(1.154)	(1.088)
Head's years of education	0.016*	0.016*	0.009	0.018	0.025*	0.012
	(2.083)	(2.193)	(0.846)	(1.640)	(2.548)	(1.254)
Maximum years of education (of female adults)	0.026**	0.007	0.018	-0.003	0.034**	0.016+
	(3.494)	(1.055)	(1.629)	(-0.234)	(3.618)	(1.878)
Maximum years of education (of all adults)	0.016*	0.020**	0.028**	0.029**	0.003	0.013
	(2.033)	(2.809)	(2.846)	(2.756)	(0.309)	(1.364)
Head's age	0.002*	0.002+	0.001	0.000	0.004**	0.003*
	(2.315)	(1.652)	(0.828)	(0.029)	(2.668)	(1.981)
Head is polygamous (= 1)	-0.117**	-0.027	-0.131*	-0.075	-0.095	0.049
	(-2.962)	(-0.691)	(-2.482)	(-1.494)	(-1.614)	(0.783)
*Village or district-level characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.000	-0.003+	-0.002	-0.004*	0.001	-0.002
	(-0.216)	(-1.917)	(-0.853)	(-1.999)	(0.506)	(-0.917)
Distance to nearest public transport*	-0.001	-0.000	0.000	0.000	-0.001+	0.000
	(-1.266)	(-0.303)	(0.001)	(0.020)	(-1.903)	(0.154)
Mill in the village (or nearby village) (= 1)*	0.040	0.079**	0.063+	0.086*	0.011	0.083*
	(1.413)	(3.249)	(1.712)	(2.462)	(0.276)	(2.550)
Village has well or borehole (= 1)*	0.075**	0.056*	0.030	0.025	0.125**	0.075*
	(2.776)	(2.186)	(0.864)	(0.699)	(3.036)	(2.071)
% of village HHs reporting significant crop loss	-0.050	-0.072	-0.059	-0.065	-0.067	-0.051
	(-1.015)	(-1.437)	(-0.896)	(-0.914)	(-0.898)	(-0.753)
# of district-level drought-days	-0.001	0.003*	-0.001	0.002	-0.001	0.004*
	(-0.838)	(2.173)	(-0.712)	(0.861)	(-0.496)	(2.420)
District road density (kms roads/1000 people)*	0.007	0.006	0.003	0.010+	0.012	0.001
	(1.575)	(1.295)	(0.663)	(1.651)	(1.585)	(0.088)
Dummies for province and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,685	2,965	1,348	1,495	1,337	1,470

Notes: Regressions use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Rather than being causal, this positive effect of a chronically ill WA female on attendance might instead be due to an association between household wealth and chronically ill adults who return to their rural home for care-giving. For example, given that recent research finds that temporary migrant laborers in neighboring rural Zambia have higher disease-related adult mortality rates (Chapoto et al. 2009), these ill female adults in rural Mozambique may well be migrants who have returned home to relatively wealthy households for care-giving. Because the households receiving such migrants tend to be relatively wealthy, this may explain why we do not find adverse effects on child schooling. This potential explanation is consistent with the fact that we find a positive association between ill female adults and child schooling among households with higher farm assets and not among poorer ones (Table 5, columns B and C). This same rationale may also explain the association between a recent WA male death and higher attendance among children from less poor households, if the deceased male was a young adult who returned home for care-giving and passed away soon thereafter. There are no other significant negative effects of adult mortality or morbidity on child schooling, although we note that sign of the effects of past period male and female deaths are negative and relatively large for poor households while they are positive for less poor households.

Finally, we stratify the sample by the gender of the child and find that the negative effect of recent WA male death on attendance appears to be borne primarily by boys from poor households (Table 6, Column D), whose attendance falls 17 points (25%), while the negative effect of a chronically ill male adult on school attendance is borne by both boys and girls (Table 6, Columns A and B), whose attendance falls 15-16 points (24%). We also find that a recent WA female death reduces attendance by 19 points (28%) for boys from less poor households, yet it *increases* attendance by 16 points (24%) for boys from poor households (Table 6). This latter result is difficult to explain and demands further inquiry. There are no other significant negative effects of adult mortality or morbidity on attendance by child's gender. While there appears to be evidence of household bias against boys in response to the recent death of a WA male adult, one should keep in mind that girls in non-afflicted households face systematic gender bias in that they are less likely to attend school in the first place.

5.4. School Advancement and Adult Mortality/Morbidity Shocks

Given that we have found negative effects of WA adult mortality and morbidity on school attendance (primarily due to illness or death of a WA male adult), we would expect to find similar results in the school advancement model, assuming that lower school attendance results in delayed grade progression. The results suggest that mortality and morbidity shocks are more likely to cause observable differences in school advancement relative to attendance.

First, we find that a recent WA death reduces school advancement by 0.029 (Table 7). Because average school advancement for the sample is 0.38, this means that a recent WA death reduces school advancement by approximately 8%. We then stratify the sample by total household income/AE in 2002 and find that a recent WA death (0-3 years ago) reduces school advancement by 0.036 (i.e., by 9.5%) among children from poor households (Table 7). In addition, a past period WA death (3-6 years ago) reduces school advancement by 0.095 (24%) among children from less poor households.

Table 7. Determinants of School Advancement (OLS), by Wealth Category, 2002-2005

Covariates	All (A)	Poor (B)	Less Poor (B)
HIV prevalence rate at nearest sentinel site, 2001	0.011**	0.014**	0.001
	(4.377)	(3.387)	(0.124)
Household-level adult mortality/morbidity shocks			
Past WA adult mortality (3-6 years ago)	-0.021	0.019	-0.105**
	(-0.808)	(0.583)	(-2.954)
Recent WA adult mortality (0-3 years ago)	-0.029*	-0.036*	-0.025
	(-2.081)	(-2.097)	(-1.130)
Chronically ill adult (3 months in past year)	-0.003	-0.016	0.009
	(-0.161)	(-0.687)	(0.373)
Child characteristics			
Age	0.058**	0.051**	0.071**
	(4.348)	(2.792)	(3.807)
Age squared	-0.003**	-0.002**	-0.003**
	(-5.790)	(-3.641)	(-5.047)
Girl (= 1)	-0.058**	-0.061**	-0.055**
	(-8.219)	(-6.553)	(-5.397)
Household characteristics (in 2002)			
ln(Total landholding)	-0.000	-0.004	-0.000
	(-0.359)	(-1.148)	(-0.056)
ln(Total farm asset value)	0.008**	0.009**	0.007*
	(4.609)	(4.001)	(2.032)
Head's years of education	0.005*	0.001	0.008*
	(2.147)	(0.241)	(2.300)
Maximum years of education (of female adults in HH)	0.018**	0.015**	0.018**
	(6.691)	(3.716)	(5.218)
Maximum years of education (of all adults in HH)	0.015**	0.019**	0.012**
	(5.554)	(5.000)	(3.162)
Head's age	0.002**	0.001*	0.002**
	(5.142)	(2.149)	(4.859)
Head is polygamous (= 1)	-0.062**	-0.057**	-0.065**
	(-4.195)	(-2.807)	(-3.230)
*Village or district-level characteristics (in 2002)**			
Travel time to nearest town of 10,000+ residents (hrs)*	-0.002*	-0.002*	-0.001
	(-2.440)	(-2.066)	(-1.133)
Distance to nearest public transport*	-0.000*	-0.000	-0.000
	(-2.200)	(-1.519)	(-1.134)
Mill in the village (or nearby village) (= 1)*	0.017	0.015	0.020
	(1.564)	(1.038)	(1.202)
Village has well or borehole (= 1)*	0.019+	0.003	0.034*
	(1.813)	(0.187)	(2.265)
% of village hhs reporting significant crop yield loss	0.000	0.003	-0.006
	(0.028)	(0.143)	(-0.235)
# of district-level drought-days	0.000	-0.000	0.001
	(0.255)	(-0.753)	(1.559)
district-level road density (kms of roads/1000 people)*	0.001	0.001	0.001
	(0.283)	(0.510)	(0.410)
Dummies for district, time and month of interview	Yes	Yes	Yes
No. of children	9,016	4,729	4,287

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 8. Determinants of School Advancement (OLS), by Gender and Wealth Category, 2002-2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
HIV prevalence rate at nearest sentinel site, 2001	0.009*	0.012**	0.008	0.024**	0.005	0.001
	(2.522)	(3.691)	(1.516)	(2.735)	(0.778)	(0.120)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 years ago)	-0.052+	0.023	-0.045	0.076	-0.097*	-0.102+
	(-1.686)	(0.628)	(-1.131)	(1.570)	(-2.211)	(-1.848)
Recent WA adult mortality (0-3 years ago)	-0.022	-0.032+	-0.010	-0.048*	-0.045	-0.002
	(-1.226)	(-1.755)	(-0.444)	(-2.154)	(-1.526)	(-0.067)
Chronically ill adult (3 months in past year)	-0.026	0.028	-0.035	0.009	-0.008	0.023
	(-1.228)	(1.158)	(-1.254)	(0.246)	(-0.262)	(0.669)
Child characteristics						
Age	0.068**	0.042*	0.055*	0.049+	0.081**	0.043+
	(3.673)	(2.267)	(2.144)	(1.902)	(3.225)	(1.664)
Age squared	-0.003**	-0.002**	-0.003**	-0.002*	-0.004**	-0.002*
	(-4.926)	(-3.019)	(-2.879)	(-2.304)	(-4.281)	(-2.367)
Household characteristics (in 2002)						
ln(Total landholding)	-0.001	0.001	-0.010+	0.002	0.000	-0.001
	(-0.801)	(0.461)	(-1.895)	(0.349)	(0.367)	(-0.411)
ln(Total farm asset value)	0.008**	0.009**	0.010**	0.008*	0.004	0.010*
	(3.246)	(3.947)	(3.389)	(2.550)	(0.858)	(2.473)
Head's years of education	0.003	0.009**	-0.002	0.005	0.008+	0.010*
	(0.774)	(2.956)	(-0.300)	(1.012)	(1.653)	(2.246)
Maximum years of education (of female adults)	0.025**	0.012**	0.020**	0.012*	0.025**	0.012**
	(7.410)	(3.582)	(3.855)	(2.577)	(5.698)	(2.621)
Maximum years of education (of all adults)	0.016**	0.012**	0.022**	0.013**	0.010+	0.013**
	(3.965)	(3.758)	(4.038)	(2.906)	(1.835)	(2.739)
Head's age	0.002**	0.001*	0.001*	0.001	0.003**	0.002*
	(4.628)	(2.476)	(2.167)	(0.859)	(4.471)	(2.432)
Head is polygamous (= 1)	-0.083**	-0.044*	-0.069**	-0.049*	-0.097**	-0.035
	(-4.033)	(-2.499)	(-2.677)	(-2.070)	(-3.057)	(-1.364)
*Village or district-level characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.001	-0.003*	-0.000	-0.004**	-0.001	-0.001
	(-1.125)	(-2.503)	(-0.130)	(-3.132)	(-0.891)	(-0.541)
Distance to nearest public transport*	-0.000	-0.001**	-0.000	-0.000+	-0.000	-0.001+
	(-0.535)	(-2.665)	(-0.401)	(-1.768)	(-0.135)	(-1.820)
Mill in the village (or nearby village) (= 1)*	0.014	0.013	0.027	-0.003	-0.003	0.026
	(0.985)	(0.929)	(1.523)	(-0.138)	(-0.150)	(1.306)
Village has well or borehole (= 1)*	0.019	0.020	0.008	-0.001	0.017	0.046*
	(1.453)	(1.444)	(0.421)	(-0.033)	(0.864)	(2.375)
% of village HHs reporting significant crop loss	0.009	-0.005	0.028	-0.010	-0.017	0.006
	(0.411)	(-0.212)	(0.895)	(-0.339)	(-0.528)	(0.179)
# of district-level drought-days	-0.001	0.001	-0.001	0.000	0.000	0.001+
	(-1.189)	(1.559)	(-1.111)	(0.205)	(0.089)	(1.883)
District road density (kms roads/1000 people)*	0.004	-0.003	0.003	-0.003	0.007*	-0.005
	(1.384)	(-1.326)	(0.703)	(-0.755)	(1.971)	(-0.949)
Dummies for district, time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	4,291	4,725	2,243	2,486	2,048	2,239

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** $p<0.01$; * $p<0.05$; + $p<0.10$

We then stratify the sample by gender and find that the school advancement of both boys and girls are negatively affected by WA mortality shocks. For example, a past period WA death reduces the school advancement of girls by 0.052 (14%), and that of less poor girls and boys by 0.09 (24%) (Table 8). In addition, recent WA death reduces the school advancement of boys by 0.035 (8%), primarily those from poorer households, whose schooling is reduced by 0.48 (13%).

Finally, we disaggregate the mortality/morbidity dummies by gender of the deceased/ill adult, and we find as with the attendance results that most of the significant negative effects of WA mortality/morbidity come from the death or illness of a WA male. For example, we find that a past period WA male death reduces school advancement of children from less poor households by 0.10 (26%) (Table 9). We also find that a recent WA male death reduces school advancement of children from poor households by 0.048 (11%), an effect that appears to be primarily borne by poor boys (Table 10). In addition, a chronically ill WA male reduces school advancement of poor children by 0.077 (20%) (Table 9), an effect that is borne by both poor boys and girls (Table 10).

Unlike the attendance results, there are several significant negative effects of WA female deaths on school advancement. For example, a recent WA female death reduces school advancement of children in the full sample by 0.045 (12%) (Table 9). In addition, a past period WA female death significantly reduces school advancement of girls from less poor households by 0.128 (33%) (Table 10).

To check the robustness of the school advancement results, we also estimate the school advancement model using OLS with household fixed effects. While this estimator enables us to control for unobserved, time-constant household-level heterogeneity, the disadvantage is that instead of using the pooled sample of n=9,016 children from 2002-05, we have to use a much smaller panel sample of approximately half that size who are observed in both 2002 and 2005. There are several findings in common between the school advancement results from the pooled and panel samples. For example, both samples find the following significant negative effects: past period WA adult death on girls; past WA male deaths on less poor children; past WA female deaths on less poor girls; and chronically ill male adults on poor children.

In summary, we note that there are a few common themes across our analysis of attendance and school advancement. First, both analyses find that a recent WA male adult death and a chronically ill male adult reduce the schooling of poor children (and this latter effect is negative and significant in the panel school attendance results). Second, there does not appear to be systematic bias against girls among households that suffer a WA death or have a chronically ill adult, as households appear to reduce schooling for both boys and girls in different instances. Third, WA male death or illness is more likely to cause reductions in either attendance or school advancement than a WA female death or illness. Fourth, negative effects of WA mortality/morbidity shocks are more likely for children from poorer households. Yet, the fact that we also find some significant negative effects of adult mortality among children from less poor households suggests that even those Mozambican households in the top half of the rural household income/AE distribution adjust to mortality/morbidity shocks by reducing child schooling, which may be due to the fact that quite a few of these 'less poor' households are technically at or below the rural poverty line (i.e., while they are relatively wealthier than other rural households, they are not wealthy enough to be able to withstand a mortality/morbidity shock without having to reduce child schooling).

Table 9. Determinants of School Advancement (OLS), by Wealth Category, 2002-2005

Covariates	All (A)	Poor (B)	Less Poor (B)
HIV prevalence rate at nearest sentinel site, 2001	0.001	0.014**	0.001
	(0.783)	(3.383)	(0.864)
Household-level adult mortality/morbidity shocks			
Past WA adult mortality (3-6 yrs ago) - MALE	-0.013	0.023	-0.102*
	(-0.314)	(0.422)	(-2.313)
Past WA adult mortality (3-6 yrs ago) - FEMALE	-0.021	0.017	-0.068
	(-0.680)	(0.459)	(-1.231)
Recent WA adult mortality (0-3 yrs ago) - MALE	-0.026	-0.042+	0.011
	(-1.202)	(-1.796)	(0.323)
Recent WA adult mortality (0-3 yrs ago) - FEMALE	-0.045*	-0.038+	-0.042
	(-2.360)	(-1.724)	(-1.445)
Chronically ill adult (3 months in last 12) - MALE	-0.028	-0.077**	0.038
	(-0.910)	(-2.644)	(0.692)
Chronically ill adult (3 months in last 12) - FEMALE	0.026	0.012	0.012
	(1.185)	(0.396)	(0.400)
Child characteristics			
Age	0.063**	0.050**	0.075**
	(4.637)	(2.732)	(3.904)
Age squared	-0.003**	-0.002**	-0.003**
	(-6.120)	(-3.575)	(-5.168)
Girl (= 1)	-0.058**	-0.061**	-0.058**
	(-8.140)	(-6.590)	(-5.458)
Household characteristics (in 2002)			
ln(Total landholding)	-0.001	-0.004	-0.001
	(-0.998)	(-1.094)	(-0.506)
ln(Total farm asset value)	0.007**	0.009**	0.005
	(3.970)	(3.968)	(1.612)
Head's years of education	0.007**	0.001	0.010**
	(2.631)	(0.268)	(2.927)
Maximum years of education (of female adults)	0.020**	0.015**	0.021**
	(7.535)	(3.768)	(6.312)
Maximum years of education (of all adults)	0.016**	0.019**	0.012**
	(5.934)	(4.974)	(3.313)
Head's age	0.002**	0.001*	0.003**
	(5.354)	(2.145)	(5.359)
Head is polygamous (= 1)	-0.063**	-0.057**	-0.063**
	(-4.234)	(-2.826)	(-3.158)
*Village or district-level characteristics (in 2002)**			
Travel time to nearest town of 10,000+ people (hrs)*	-0.001	-0.002*	-0.001
	(-1.151)	(-2.003)	(-0.850)
Distance to nearest public transport*	-0.000**	-0.000	-0.000
	(-2.938)	(-1.538)	(-1.241)
Mill in the village (or nearby village) (= 1)*	0.026**	0.015	0.025+
	(2.621)	(1.054)	(1.764)
Village has well or borehole (= 1)*	0.011	0.003	0.036*
	(1.126)	(0.212)	(2.540)
% of village HHs reporting significant crop loss	-0.010	0.001	-0.023
	(-0.646)	(0.053)	(-0.979)
# of district-level drought-days	0.000	-0.000	0.000
	(0.286)	(-0.767)	(0.921)
District road density (kms roads/1000 people)*	0.002	0.001	0.002
	(0.986)	(0.504)	(0.660)
Dummies for district, time and month of interview	Yes	Yes	Yes
No. of children	9,016	4,729	4,287

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 10. Determinants of School Advancement (OLS), by Gender and Wealth Category, 2002-2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
HIV prevalence rate at nearest sentinel site, 2001	0.009*	0.012**	0.008	0.024**	0.004	-0.000
	(2.522)	(3.629)	(1.531)	(2.651)	(0.728)	(-0.033)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 yrs ago) - MALE	-0.016	0.031	-0.023	0.087	-0.010	-0.106
	(-0.396)	(0.487)	(-0.407)	(0.976)	(-0.191)	(-1.554)
Past WA adult mortality (3-6 yrs ago) - FEMALE	-0.060	0.010	-0.037	0.058	-0.128*	-0.056
	(-1.380)	(0.235)	(-0.658)	(1.167)	(-2.143)	(-0.729)
Recent WA adult mortality (0-3 yrs ago) - MALE	-0.017	-0.014	-0.019	-0.050+	-0.024	0.063+
	(-0.681)	(-0.545)	(-0.618)	(-1.689)	(-0.558)	(1.669)
Recent WA adult mortality (0-3 yrs ago) - FEMALE	-0.034	-0.045*	-0.023	-0.043	-0.048	-0.040
	(-1.387)	(-2.018)	(-0.717)	(-1.538)	(-1.266)	(-1.169)
Chronically ill adult (3 months in last 12) - MALE	-0.034	-0.017	-0.053+	-0.084+	0.028	0.067
	(-1.075)	(-0.424)	(-1.662)	(-1.748)	(0.579)	(1.075)
Chronically ill adult (3 months in last 12) - FEMALE	-0.024	0.052+	-0.029	0.057	-0.022	-0.000
	(-0.891)	(1.805)	(-0.791)	(1.378)	(-0.558)	(-0.012)
Child characteristics						
Age	0.068**	0.043*	0.056*	0.048+	0.082**	0.046+
	(3.683)	(2.268)	(2.151)	(1.843)	(3.231)	(1.765)
Age squared	-0.003**	-0.002**	-0.003**	-0.002*	-0.004**	-0.002*
	(-4.936)	(-3.011)	(-2.884)	(-2.236)	(-4.284)	(-2.476)
Household characteristics (in 2002)						
ln(Total landholding)	-0.001	0.001	-0.010+	0.002	0.000	-0.001
	(-0.784)	(0.455)	(-1.884)	(0.421)	(0.397)	(-0.487)
ln(Total farm asset value)	0.008**	0.010**	0.010**	0.007*	0.003	0.010*
	(3.255)	(3.994)	(3.369)	(2.489)	(0.803)	(2.461)
Head's years of education	0.003	0.009**	-0.002	0.005	0.008	0.010*
	(0.763)	(2.883)	(-0.304)	(1.106)	(1.601)	(2.318)
Maximum years of education (of female adults)	0.025**	0.012**	0.020**	0.013**	0.025**	0.012**
	(7.386)	(3.611)	(3.851)	(2.704)	(5.765)	(2.656)
Maximum years of education (of all adults)	0.016**	0.012**	0.022**	0.013**	0.010+	0.013**
	(3.981)	(3.776)	(4.018)	(2.859)	(1.818)	(2.720)
Head's age	0.002**	0.001*	0.001*	0.001	0.003**	0.002*
	(4.657)	(2.479)	(2.151)	(0.888)	(4.471)	(2.551)
Head is polygamous (= 1)	-0.082**	-0.045*	-0.068**	-0.048*	-0.096**	-0.034
	(-4.009)	(-2.552)	(-2.637)	(-2.071)	(-3.045)	(-1.349)
*Village or district-level characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.001	-0.003*	-0.000	-0.004**	-0.001	-0.001
	(-1.104)	(-2.492)	(-0.101)	(-3.161)	(-0.877)	(-0.423)
Distance to nearest public transport*	-0.000	-0.001**	-0.000	-0.000+	-0.000	-0.001+
	(-0.508)	(-2.645)	(-0.390)	(-1.760)	(-0.127)	(-1.861)
Mill in the village (or nearby village) (= 1)*	0.014	0.013	0.027	-0.002	-0.003	0.026
	(0.995)	(0.978)	(1.523)	(-0.127)	(-0.156)	(1.302)
Village has well or borehole (= 1)*	0.020	0.020	0.008	0.000	0.017	0.045*
	(1.488)	(1.495)	(0.435)	(0.011)	(0.872)	(2.366)
% of village HHs reporting significant crop loss	0.008	-0.006	0.026	-0.014	-0.017	0.009
	(0.374)	(-0.284)	(0.855)	(-0.450)	(-0.506)	(0.275)
# of district-level drought-days	-0.001	0.001	-0.001	0.000	0.000	0.002*
	(-1.153)	(1.575)	(-1.095)	(0.183)	(0.152)	(1.967)
District road density (kms roads/1000 people)*	0.004	-0.003	0.003	-0.003	0.007+	-0.005
	(1.355)	(-1.318)	(0.686)	(-0.724)	(1.933)	(-1.055)
Dummies for district, time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	4,291	4,725	2,243	2,486	2,048	2,239

Notes: Regressions use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10.

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5.5. School Attendance and Orphan Status

We next investigate the extent to which orphan status affects child schooling outcomes. Using a sample of children age 10 to 14 from 2005 who have not yet completed primary school, we run various pooled probit regressions explaining child attendance. The means and standard deviations of the variables used in these regressions are shown in Appendix Table 6. While we do not find significantly lower attendance for single-parent orphans (maternal or paternal orphans) using the full sample of children, we find that the attendance of double-orphans is 0.12 lower than that of non-orphans (Table 11). Given that average attendance in this sample is 0.74, this means that double-orphans' probability of attendance is 16% lower than that of non-orphans. However, when we stratify the sample by total household income per AE in 2005, we find that the attendance of maternal orphans from households in the poorest 50% of household income per AE is 0.091 points lower (12%) than that of non-orphans in poor households, while that of double-orphans is 0.209 (28%) lower (Table 11). We also find that paternal orphans in less poor households have 0.077 (17%) lower attendance.

When we stratify the sample by gender of the child, we find that the negative effect on attendance for double-orphans is significant for boys in both poor and less poor households and for girls from poor households (Table 12). We also find a nearly significant effect (p=0.11) of maternal orphanhood on girls, whose attendance is 0.092 (or 12%) lower than that of non-orphans.

5.6. School Advancement and Orphan Status

Given that we have found evidence that double- orphans and maternal orphans from poorer households have lower attendance than non-orphans on average, we turn next to examine whether orphan status affects school advancement. We find that maternal orphans have 0.054 lower school advancement (Table 13) than non-orphans. Given that average school advancement in the sample is 0.44, this means that the school advancement of maternal orphans have 12% lower. When we stratify the sample by household income, we find that the negative maternal orphan effect appears to be significant primarily among children from less poor households (Table 13). When we instead stratify the sample by gender, we see that the negative maternal orphan effect is significant among girls (Table 14). We also find that paternal orphan boys from less poor households have 20% lower school advancement than of non-orphans (Table 14). We also find that the schooling advancement of double-orphan boys from less poor households is 0.13 (30%) lower than that of non-orphans.

In summary, our analysis of the effects of orphan status on child schooling finds lower attendance among maternal orphans from poor households, among paternal orphans from less poor households, and even larger attendance gaps among double-orphans from both poor and less poor households. We also find slower school advancement among maternal orphans, especially among girls, as well as paternal orphans from less poor households, and double-orphan boys from less poor households. We note that both the attendance and school advancement analyses find lower schooling among maternal orphan girls.

Table 11. Determinants of Primary School Attendance (Probit), by Orphan Status and Wealth Category, 2005

Covariates	All (A)	Poor (B)	Less Poor (B)
Child characteristics (in 2005)			
Paternal orphan (= 1)	-0.026	0.021	-0.077+
	(-0.952)	(0.659)	(-1.840)
Maternal orphan (= 1)	-0.059	-0.091+	0.004
	(-1.494)	(-1.750)	(0.071)
Double-parent orphan (= 1)	-0.120*	-0.209**	-0.043
	(-2.323)	(-2.957)	(-0.594)
Age	0.039	-0.032	0.122
	(0.381)	(-0.227)	(0.841)
Age squared	-0.001	0.002	-0.005
	(-0.350)	(0.265)	(-0.833)
Girl (= 1)	-0.040**	-0.041*	-0.035
	(-2.686)	(-2.011)	(-1.584)
Household characteristics (in 2005)			
ln(Total landholding)	-0.004	0.001	-0.007
	(-1.089)	(0.099)	(-1.587)
ln(Total farm asset value)	0.008*	0.010*	0.001
	(2.348)	(2.531)	(0.219)
Head's years of education	0.023**	0.019**	0.025**
	(5.188)	(2.842)	(4.520)
Maximum years of education (of female adults in HH)	0.007	0.011	-0.001
	(1.369)	(1.640)	(-0.089)
Maximum years of education (of all adults in HH)	0.009*	0.008	0.011+
	(2.158)	(1.361)	(1.758)
Head's age	0.001+	0.001	0.002*
	(1.872)	(0.840)	(2.195)
Head is polygamous (= 1)	-0.031	-0.055	0.024
	(-0.670)	(-0.934)	(0.348)
*Village characteristics (in 2002)**			
Travel time to nearest town of 10,000+ residents (hrs)*	-0.003*	-0.004*	-0.002
	(-2.553)	(-2.463)	(-1.062)
% of village hhs reporting significant crop yield loss	-0.007	0.054	-0.044
	(-0.153)	(0.927)	(-0.684)
Dummies for province, time and month of interview	Yes	Yes	Yes
No. of children	5,236	2,841	2,395

Notes: Regressions include children age 10-14 and use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 12. Determinants of Primary School Attendance (Probit), by Orphan Status, Gender, and Wealth Category, 2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
Child characteristics (in 2005)						
Paternal orphan (= 1)	-0.012	-0.031	0.046	0.027	-0.034	-0.067
	(-0.313)	(-0.857)	(1.082)	(0.604)	(-0.525)	(-1.258)
Maternal orphan (= 1)	-0.092	-0.038	-0.087	-0.094	-0.042	0.108
	(-1.558)	(-0.805)	(-1.140)	(-1.468)	(-0.576)	(1.582)
Double-parent orphan (= 1)	-0.090	-0.159**	-0.192*	-0.197*	-0.002	-0.109
	(-1.300)	(-2.718)	(-2.054)	(-2.452)	(-0.021)	(-1.453)
Age	0.022	0.075	0.049	-0.053	-0.056	0.370*
	(0.149)	(0.538)	(0.229)	(-0.281)	(-0.257)	(1.974)
Age squared	-0.001	-0.003	-0.002	0.003	0.002	-0.016*
	(-0.171)	(-0.496)	(-0.260)	(0.365)	(0.236)	(-1.969)
Household characteristics (in 2005)						
ln(Total landholding)	-0.005	-0.002	0.010	-0.004	-0.010	-0.002
	(-0.842)	(-0.335)	(1.147)	(-0.491)	(-1.544)	(-0.317)
ln(Total farm asset value)	0.010*	0.006	0.012*	0.007	0.006	-0.005
	(2.099)	(1.444)	(2.147)	(1.404)	(0.754)	(-0.809)
Head's years of education	0.025**	0.021**	0.029**	0.012	0.028**	0.026**
	(4.148)	(3.833)	(3.491)	(1.461)	(3.271)	(3.750)
Maximum years of education (of female adults)	0.006	0.005	0.014	0.008	-0.003	-0.001
	(0.958)	(0.799)	(1.518)	(0.933)	(-0.402)	(-0.132)
Maximum years of education (of all adults in HH)	0.019**	0.001	0.015*	0.004	0.021*	0.002
	(3.083)	(0.254)	(2.026)	(0.463)	(2.079)	(0.244)
Head's age	0.001	0.001	-0.000	0.001	0.003+	0.001
	(1.367)	(1.305)	(-0.398)	(1.071)	(1.953)	(1.048)
Head is polygamous (= 1)	-0.032	-0.037	-0.081	-0.130+	-0.032	0.024
	(-0.519)	(-0.608)	(-0.976)	(-1.845)	(-0.394)	(0.333)
*Village characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.004+	-0.003+	-0.005+	-0.004+	-0.002	-0.003
	(-1.908)	(-1.811)	(-1.853)	(-1.884)	(-0.575)	(-1.362)
% of village HHs reporting significant crop loss	0.027	-0.006	-0.007	-0.020	0.043	-0.032
	(0.431)	(-0.111)	(-0.088)	(-0.281)	(0.436)	(-0.360)
Dummies for province, time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,491	2,745	1,324	1,517	1,167	1,228

Notes: Regressions include children age 10-14 and use sampling weights which are adjusted for attrition bias. Coeffcients are Average Partial Effects (APE) on probability of school attendance; numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 13. Determinants of School Advancement (OLS), by Orphan Status and Wealth, 2005

Covariates	All (A)	Poor (B)	Less Poor (B)
Child characteristics (in 2005)			
Paternal orphan (= 1)	-0.006	0.038+	-0.055
	(-0.294)	(1.663)	(-1.621)
Maternal orphan (= 1)	-0.054+	-0.031	-0.103*
	(-1.931)	(-0.924)	(-2.248)
Double-parent orphan (= 1)	-0.016	0.025	-0.064
	(-0.400)	(0.368)	(-1.395)
Age	0.084	-0.018	0.175
	(1.206)	(-0.213)	(1.616)
Age squared	-0.004	0.001	-0.008+
	(-1.278)	(0.184)	(-1.657)
Girl (= 1)	-0.042**	-0.025+	-0.059**
	(-4.140)	(-1.932)	(-3.840)
Household characteristics (in 2005)			
ln(Total landholding)	-0.000	0.004	-0.002
	(-0.039)	(0.823)	(-0.498)
ln(Total farm asset value)	0.005+	0.006*	-0.003
	(1.940)	(2.022)	(-0.623)
Head's years of education	0.013**	0.006	0.019**
	(4.444)	(1.358)	(4.312)
Maximum years of education (of female adults in HH)	0.009**	0.010*	0.009*
	(2.808)	(2.443)	(2.068)
Maximum years of education (of all adults in HH)	0.014**	0.017**	0.008+
	(4.784)	(4.788)	(1.691)
Head's age	0.002**	0.002**	0.002*
	(3.482)	(2.944)	(2.524)
Head is polygamous (= 1)	-0.062*	-0.025	-0.130**
	(-2.071)	(-0.769)	(-2.680)
*Village characteristics (in 2002)**			
Travel time to nearest town of 10,000+ residents (hrs)*	-0.001	-0.001	-0.002
	(-1.300)	(-0.963)	(-1.321)
% of village hhs reporting significant crop yield loss	-0.015	0.013	-0.060
	(-0.475)	(0.336)	(-1.192)
Dummies for province, time and month of interview	Yes	Yes	Yes
No. of children	5,201	2,829	2,372

Notes: Regressions include children age 10-14 and use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Table 14. Determinants of School Advancement (OLS), by Orphan Status, Gender, and Wealth, 2005

	All		Poor		Less Poor	
Covariates	Girls (A)	Boys (B)	Girls (C)	Boys (D)	Girls (E)	Boys (F)
Child characteristics (in 2005)						
Paternal orphan (= 1)	0.001	-0.007	0.015	0.061*	0.014	-0.091+
	(0.018)	(-0.293)	(0.448)	(1.976)	(0.283)	(-1.894)
Maternal orphan (= 1)	-0.079*	-0.039	-0.050	-0.026	-0.124*	-0.044
	(-2.217)	(-1.002)	(-1.047)	(-0.608)	(-2.319)	(-0.628)
Double-parent orphan (= 1)	-0.032	-0.008	-0.025	0.079	-0.023	-0.136*
	(-0.771)	(-0.136)	(-0.346)	(0.845)	(-0.425)	(-2.326)
Age	0.019	0.147	-0.097	0.098	0.105	0.250
	(0.192)	(1.458)	(-0.752)	(0.787)	(0.686)	(1.549)
Age squared	-0.001	-0.006	0.004	-0.004	-0.005	-0.011
	(-0.256)	(-1.503)	(0.715)	(-0.805)	(-0.706)	(-1.574)
Household characteristics (in 2005)						
ln(Total landholding)	-0.000	0.001	0.010	0.004	-0.005	-0.001
	(-0.094)	(0.249)	(1.475)	(0.624)	(-0.954)	(-0.140)
ln(Total farm asset value)	0.006+	0.004	0.007*	0.005	0.003	-0.006
	(1.903)	(1.128)	(1.967)	(1.276)	(0.538)	(-0.943)
Head's years of education	0.013**	0.013**	0.007	0.002	0.019**	0.021**
	(3.801)	(3.154)	(1.326)	(0.348)	(3.766)	(3.415)
Maximum years of education (of female adults)	0.010**	0.006	0.008	0.011*	0.010+	0.004
	(2.586)	(1.368)	(1.303)	(1.972)	(1.831)	(0.669)
Maximum years of education (of all adults in HH)	0.017**	0.011**	0.019**	0.014**	0.014*	0.006
	(4.213)	(2.633)	(3.462)	(2.713)	(2.132)	(0.798)
Head's age	0.002**	0.001*	0.002*	0.002*	0.003**	0.002
	(3.627)	(1.963)	(2.114)	(2.454)	(2.768)	(1.382)
Head is polygamous (= 1)	-0.055	-0.068	-0.020	-0.042	-0.161**	-0.125+
	(-1.564)	(-1.485)	(-0.413)	(-0.822)	(-2.990)	(-1.848)
*Village characteristics (in 2002)**						
Travel time to nearest town of 10,000+ (hrs)*	-0.001	-0.001	-0.003	0.000	0.002	-0.005**
	(-0.740)	(-1.171)	(-1.562)	(0.207)	(1.151)	(-2.763)
% of village HHs reporting significant crop loss	0.020	-0.042	0.054	-0.040	-0.029	-0.059
	(0.498)	(-0.977)	(1.091)	(-0.747)	(-0.456)	(-0.874)
Dummies for province, time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,475	2,726	1,320	1,509	1,155	1,217

Notes: Regressions include children age 10-14 and use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

6. CONCLUSIONS

Since the 1994 peace agreement ended decades of civil war in Mozambique, the Mozambican government has greatly increased expenditures on primary and secondary schooling, and enrollment rates have risen dramatically. At the same time, Mozambique has faced the challenge of rising HIV prevalence and the possibility that recent gains in long-term human capital development could be eroded if households that suffer the death of a working-age (WA) adult pull their children out of school due to family labor shortages or financial constraints. This paper uses panel survey data from rural Mozambique and multivariate regression analysis to measure the impact of WA adult mortality, morbidity, and orphan status on primary school attendance and school advancement. There are six principal findings from this analysis.

First, we find that homogenous conceptualization of WA adult mortality or morbidity is not by itself a reliable indicator of poor child schooling outcomes. For example, we find that the effect of WA adult mortality and morbidity does not have a significant negative effect on primary school attendance using the full sample of children. Yet, we do find significant negative effects in some cases when we consider the gender of the child, the pre-death wealth level of the household, and/or the gender of the deceased or ill adult. Likewise, we find that while some orphans have lower attendance or school advancement relative to non-orphans – such as maternal orphans in poor households – that other orphans do not.

Second, we find that WA adult male death or illness is more likely to cause reductions in either attendance or school advancement than a WA female death or illness. For example, a WA male death within the past three years reduces attendance of children from poor households by 21%, while the effect of a recent WA female death is not significant. Likewise, we find that the presence of chronically ill WA male adult in the household reduces the probability of child school attendance by 25%, yet we find no significant negative schooling effect due to a chronically ill WA female adult. These results are consistent with other research using this panel dataset that found that significant reductions in household size, income, and assets are more likely found in the event of a WA male death rather than a WA female death (Mather and Donovan 2007). One potential explanation for the gender differential in mortality impacts is that on average, three out of four households with a WA female death are able to attract a new WA adult to the household, whereas, on average, no households with a WA male death are able to attract new adults (*ibid.* 2007).

Nevertheless, we do find some negative schooling effects from WA female deaths. For example, a recent WA female death (within the past 3 years) reduces attendance by 12% for children from less poor households, and reduces school advancement by 10% among children from poor households. In addition, a past period WA female death (3-6 years ago) reduces school advancement of girls from less poor households by 33%. In our analysis of the effects of orphan status on child schooling, we also find that negative school effects are more likely to occur for maternal as compared with paternal orphans.

Third, negative effects of WA mortality/morbidity shocks are more likely to occur for children from poorer households, which suggests that the opportunity costs of children in such households become high during the illness or following the death of a WA adult. It is likely that the financial constraints and increased labor demands faced by poorer households who suffer a WA adult death leads them to reallocate the time of children from school to family labor following the death of a WA adult. Yet, the fact that we also find some significant negative effects of adult mortality among children from less poor households, as well as significant negative schooling effects for orphans from less poor households, suggests that even those Mozambican households in the top half of the distribution of rural household income per adult equivalent adjust to mortality/morbidity shocks by reducing child schooling. This may be due to the fact that quite a few of these ‘less poor’ households are technically at or below the rural poverty line (i.e., while they are relatively wealthier than other rural households are, they are not wealthy enough to be able to withstand a mortality/morbidity shock without having to reduce child schooling).

Fourth, negative effects of WA mortality/morbidity shocks are quite large in magnitude. For example, a recent WA male death reduces the probability of attendance of children from poor households by approximately 21%, a chronically ill WA male in the household reduces the probability of child school attendance by 25%, and a recent WA female death reduces the attendance of children from less poor households by 21%.

Fifth, our analysis of the effects of orphan status on child schooling finds 12% lower attendance for maternal orphans from poor households (relative to non-orphans from poor households), 17% lower attendance for paternal orphans from less poor households, and 28% lower attendance for double-orphans from both poor and less poor households. We also find slower school advancement among maternal orphans (especially girls), paternal orphans from less poor households, and double-orphan boys from less poor households. We note that both the attendance and school advancement analyses find lower schooling among maternal orphan girls. These results suggest that maternal orphans from poorer households and double-orphans are likely to have lower schooling on average, relative to non-orphans. They also suggest that paternal orphans in less poor households are also not immune from lower schooling.

Sixth, we do not find evidence of systematic bias against boys or girls in how households that suffer a WA death or illness respond to this shock. Nevertheless, girls in rural Mozambique continue to face schooling bias in that they are less likely to attend school: 62% of girls age 10-18 in 2005 yet to complete primary school attended school in 2005 compared with 70% of boys.

There are several policy implications from these results. First, because the extent to which children’s schooling outcomes are affected by adult mortality or morbidity is specific to the gender of the child, the household’s wealth level, characteristics of the deceased or ill adult, and the timing of the adult death, it is inappropriate to categorize all children in Mozambique who are directly or indirectly affected by HIV/AIDS-related morbidity and mortality as being especially vulnerable and in need of targeted school subsidies. Policymakers should therefore resist the temptation to borrow a 'best practice' model of HIV mitigation strategy from other SSA countries, given that results from Mozambique and several other countries demonstrate that the effects of adult mortality and morbidity vary considerably across both countries and household wealth levels.

Second, it follows that social protection and education policymakers concerned with primary school under-enrollment in Mozambique need to tailor mitigation measures to the specific needs and situation of children in rural Mozambique. The evidence in this paper suggests that both boys and girls from households with either a recently deceased WA male adult or a currently ill male adult – especially those from poorer households – are most likely to face losses in school attendance and advancement. Mitigation measures appropriate for rural Mozambique may, therefore, include conditional cash transfers targeted to children that have incurred these mortality/morbidity shocks. Such assistance might not only ensure that these children attend school but could also enable poorer households to hire additional labor rather than keeping these children out of school to meet family labor demands.

Third, although Mozambique abolished primary school fees in 2005, there may still be barriers to enrollment such as continued household demand for child labor, additional educational expenses for transport, school uniforms and books, and declining school quality if enrollment outpaces new school construction and teacher hiring. These additional barriers to enrollment may explain why we have found evidence of negative effects of adult mortality and morbidity on child schooling, even in a time period after the government had abolished primary school fees. In addition, targeted schooling subsidies alone may not reduce schooling deficits of some orphans, in the event that their poor schooling progress is due to the emotional and psychological trauma of losing one or both parents or a lack of interest by their adult guardians in their schooling. This may help explain why we found evidence of schooling deficits among orphans in both poor and non-poor households.

Fourth, Mozambique should continue to provide universal free primary schooling, as this policy has been found in a number of countries to improve the enrollment and schooling progress of those children most likely to suffer from poor schooling – namely children from poorer households, both orphan and non-orphan alike. For example, evidence from Malawi and Uganda suggest that improvements in enrollments among the poor through universal abolition of primary school fees can substantially raise the enrollment of orphans, even to the point of eradicating orphan schooling deficits (Ainsworth and Filmer 2006).

Finally, it should be noted that because of the well-established positive correlation between educational attainment and safer sexual behavior (World Bank 1999), Education for All is itself an important policy that can help reduce the spread of HIV/AIDS and thus the probability of adult mortality-related reductions in child schooling (Ainsworth and Filmer 2006).

APPENDICES

Appendix Table A1. Probit Regression of Household Reinterview in 2005

Variables	Dependent variable = 1 if household was reinterviewed in 2005; =0 otherwise
Household Characteristics	
1=Head native of village	0.224**
	(4.56)
1=Spouse native of village	0.116*
	(2.40)
1=Female-headed HH	-0.105
	(1.63)
Age of household head (years)	0.037**
	(3.21)
Age of household head squared (years)	-0.0004**
	(2.96)
Education level of household head (years of schooling)	-0.025
	(1.61)
ln(Total landholding)	0.010
	(0.34)
# Tropical Livestock Units (TLU)	0.013
	(1.10)
# TLU squared	-0.0002
	(1.59)
1=HH dwelling has a good quality roof	0.350**
	(3.35)
# Male adults: 15-59 years old	-0.001
	(0.04)
# Female adults: 15-59 years old	0.076*
	(2.06)
# Infants/Children 0-5 years old	0.051*
	(2.03)
# Children 5-14 years old	0.053*
	(2.56)
# Elderly adults: age 59+	0.196*
	(2.60)
1=working age Male adult death due to illness (1999-2001)	-0.005
	(0.02)
1=WA Female adult death due to illness (1999-2001)	-0.273+
	(1.86)
1=More than one WA death due to illness (1999-2001)	-0.132
	(0.24)
1=Chronically ill WA male in 2002	-0.289
	(1.22)
1=Chronically ill WA female in 2002	-0.148
	(0.67)
Village and District Level Characteristics	
HIV prevalence at nearest sentinel site in 2000	-0.420**
	(16.63)
1=Regular public transport available in village	-0.041
	(0.57)
Constant	7.655**
	(14.25)
District dummies included	yes
P-value of test for joint significance test of HH characteristics	0.000
Number of households	4908

Source: Author's computations using TIA02 & TIA05. HIV sentinel site prevalence from 2004 CNCS report. Notes: Significance of t-stats with unequal variance (Wald statistics): ** 0.01 level; * 0.05 level; + 0.10 level. Coefficients are unadjusted; numbers in parentheses are absolute t-stats, calculated using linearized standard errors which account for complex sampling.

Appendix Table A2. Number of Cases of Children Age 10-18 by Gender and Wealth Category, 2005

	No. of cases 2005
All children age 10-18 in 2005	
Unafflicted households	4,684
HH with past period WA death (3-6 years agc	262
past period WA male death	141
past period WA female death	138
HH with recent WA death (0-3 years ago)	478
recent WA male death	245
recent WA female death	269
HH with current WA chronically ill adult	324
WA chronically ill adult, male	97
WA chronically ill adult, female	230
Children in poor households [1]	
Unafflicted households	2,357
HH with past period WA death (3-6 years agc	140
past period WA male death	76
past period WA female death	69
HH with recent WA death (0-3 years ago)	230
recent WA male death	120
recent WA female death	128
HH with current WA chronically ill adult	176
WA chronically ill adult, male	52
WA chronically ill adult, female	127
Children in less poor households [1]	
Unafflicted households	2,327
HH with past period WA death (3-6 years agc	122
past period WA male death	65
past period WA female death	69
HH with recent WA death (0-3 years ago)	248
recent WA male death	125
recent WA female death	141
HH with current WA chronically ill adult	148
WA chronically ill adult, male	45
WA chronically ill adult, female	103

	No. of cases 2005
Girls, age 10-18 in 2005	
Unafflicted households	2,212
HH with past period WA death (3-6 years agc	123
past period WA male death	74
past period WA female death	58
HH with recent WA death (0-3 years ago)	222
recent WA male death	110
recent WA female death	131
HH with current WA chronically ill adult	175
WA chronically ill adult, male	48
WA chronically ill adult, female	129
Boys, age 10-18 in 2005	
Unafflicted households	2,472
HH with past period WA death (3-6 years agc	139
past period WA male death	67
past period WA female death	80
HH with recent WA death (0-3 years ago)	256
recent WA male death	135
recent WA female death	138
HH with current WA chronically ill adult	149
WA chronically ill adult, male	49
WA chronically ill adult, female	101

Notes: 1) Poor HHs defined as those in the bottom 50% of total gross income/AE in 2002; Less poor are in the top 50% of total gross income/AE

Source: Author's calculations using TIA05.

Appendix Table A3. Number of Cases of Children Age 10-14 in 2005 by Orphan Status, Gender, and Wealth Category

	No. of cases
	2005
All children age 10-14 in 2005	
Both parents alive	4,345
Paternal orphan	511
Maternal orphan	203
Double-parent orphan	182
Children in poor households [1]	
Both parents alive	2,310
Paternal orphan	334
Maternal orphan	101
Double-parent orphan	98
Children in less poor households [1]	
Both parents alive	2,035
Paternal orphan	177
Maternal orphan	102
Double-parent orphan	84
Girls	
Both parents alive	2,058
Paternal orphan	237
Maternal orphan	104
Double-parent orphan	94
Boys	
Both parents alive	2,287
Paternal orphan	274
Maternal orphan	99
Double-parent orphan	88

Notes: 1) Poor HHs defined as those in the bottom 50% of total gross income/AE in 2005; Less poor are in the top 50% of total gross income/AE

Source: Author's calculations using TIA05.

Appendix Table A4. Summary Statistics of Children Yet to Complete Primary School Age 10-18 in 2002 and 2005, by Wealth Category

	All children				Poor				Less Poor			
	2002		2005		2002		2005		2002		2005	
	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE
Dependent variables												
Grade progress	0.328	0.005	0.421	0.005	0.300	0.006	0.392	0.007	0.363	0.007	0.461	0.008
Highest grade achieved	2.443	0.035	2.999	0.036	2.243	0.046	2.794	0.047	2.687	0.052	3.271	0.056
Explanatory Variables												
Lagged HIV prevalence rate	10.032	0.112	10.119	0.111	10.210	0.158	10.045	0.149	9.816	0.155	10.218	0.165
Household-level adult mortality/morbidity shocks												
Past WA adult mortality (3-6 years ago)	0.000	0.000	0.039	0.003	0.000	0.000	0.047	0.005	0.000	0.000	0.029	0.005
Recent WA adult mortality (0-3 years ago)	0.043	0.004	0.067	0.004	0.050	0.005	0.070	0.006	0.034	0.005	0.065	0.006
Chronically ill adult	0.029	0.003	0.059	0.004	0.027	0.004	0.066	0.006	0.031	0.005	0.051	0.006
Child characteristics												
Age	13.807	0.048	13.316	0.046	13.756	0.064	13.296	0.061	13.870	0.072	13.342	0.071
Age squared	197.414	1.339	183.691	1.274	195.806	1.777	183.090	1.676	199.375	2.033	184.485	1.961
Girl (= 1)	0.494	0.009	0.465	0.009	0.487	0.012	0.463	0.012	0.501	0.014	0.469	0.014
Household characteristics (in 2002)												
ln(Total landholding)	2.195	0.029	2.335	0.029	1.944	0.035	2.102	0.037	2.500	0.048	2.644	0.047
ln(Total farm asset value)	6.067	0.045	6.363	0.044	5.643	0.065	5.930	0.063	6.586	0.060	6.936	0.056
Head's years of education	2.371	0.043	2.384	0.042	1.830	0.048	1.926	0.048	3.031	0.071	2.991	0.070
Maximum years of education (of female adults in HH)	1.485	0.036	1.616	0.037	1.201	0.043	1.323	0.045	1.832	0.060	2.004	0.060
Maximum years of education (of all adults in HH)	3.230	0.047	3.391	0.047	2.696	0.057	2.883	0.057	3.881	0.073	4.062	0.076
Head's age	43.046	0.238	43.833	0.222	43.808	0.319	43.830	0.291	42.117	0.355	43.838	0.342
Head is polygamous (= 1)	0.050	0.004	0.076	0.004	0.053	0.005	0.080	0.006	0.047	0.006	0.071	0.006
Village and district characteristics (in 2002)*												
Travel time to nearest town of 10,000+ residents (hrs)*	7.784	0.111	7.700	0.111	7.562	0.141	7.631	0.138	8.055	0.175	7.791	0.183
Distance to nearest public transport*	27.212	0.553	26.833	0.528	28.543	0.777	28.235	0.709	25.588	0.778	24.976	0.788
Mill in the village (or nearby village) (= 1)*	0.400	0.009	0.405	0.009	0.364	0.012	0.372	0.012	0.444	0.014	0.449	0.014
Village has well or borehole (= 1)*	0.708	0.008	0.708	0.008	0.712	0.011	0.701	0.011	0.703	0.012	0.717	0.012
% of village hhs reporting significant crop yield loss	0.554	0.005	0.721	0.006	0.559	0.008	0.712	0.008	0.547	0.008	0.732	0.008
# of district-level drought-days	28.815	0.570	47.037	0.479	29.922	0.776	46.943	0.628	27.465	0.839	47.161	0.741
district-level road density (kms of roads/1000 people)*	2.079	0.030	2.079	0.029	2.086	0.041	2.067	0.038	2.070	0.046	2.095	0.044
1=HH interviewed in October	0.064	0.005	0.352	0.009	0.055	0.006	0.351	0.011	0.075	0.008	0.355	0.013
1=HH interviewed in November	0.000	0.000	0.510	0.009	0.000	0.000	0.515	0.012	0.000	0.000	0.504	0.014
1=HH interviewed in December	0.000	0.000	0.089	0.005	0.000	0.000	0.090	0.007	0.000	0.000	0.087	0.008
Number of cases	4,246		4,770		2,232		2,497		2,014		2,273	

Notes: 1) Poor HHs defined as those in the bottom 50% of total gross HH income/AE in 2002; Less poor are in the top 50% of total gross HH income/AE

Source: Author's calculations using TIA02 and TIA05.

Appendix Table A5. Summary Statistics of Children Age 10-18 Yet to Complete Primary School in 2002 and 2005, by Gender

	Girls				Boys			
	2002		2005		2002		2005	
	mean	SE	mean	SE	mean	SE	mean	SE
Dependent variables								
Grade progress	0.283	0.006	0.399	0.007	0.373	0.006	0.441	0.007
Highest grade achieved	2.097	0.049	2.780	0.052	2.781	0.048	3.190	0.050
Explanatory Variables								
Lagged HIV prevalence rate	10.134	0.160	10.167	0.163	9.933	0.156	10.078	0.151
Household-level adult mortality/morbidity shocks								
Past WA adult mortality (3-6 years ago)	0.000	0.000	0.037	0.005	0.000	0.000	0.041	0.005
Recent WA adult mortality (0-3 years ago)	0.044	0.005	0.063	0.006	0.041	0.005	0.071	0.006
Chronically ill adult	0.030	0.004	0.064	0.006	0.028	0.004	0.056	0.006
Child characteristics								
Age	13.926	0.070	13.202	0.066	13.691	0.065	13.415	0.064
Age squared	201.100	1.961	180.493	1.834	193.823	1.820	186.472	1.767
Household characteristics (in 2002)								
ln(Total landholding)	2.188	0.041	2.342	0.043	2.201	0.043	2.329	0.041
ln(Total farm asset value)	5.993	0.065	6.334	0.062	6.140	0.063	6.388	0.062
Head's years of education	2.321	0.059	2.356	0.062	2.421	0.062	2.409	0.057
Maximum years of education (of female adults in HH)	1.527	0.052	1.599	0.054	1.445	0.051	1.631	0.051
Maximum years of education (of all adults in HH)	3.136	0.064	3.396	0.070	3.321	0.067	3.385	0.064
Head's age	42.059	0.345	43.599	0.325	44.007	0.326	44.037	0.303
Head is polygamous (= 1)	0.050	0.005	0.072	0.006	0.050	0.005	0.079	0.006
Village and district characteristics (in 2002)*								
Travel time to nearest town of 10,000+ residents (hrs)*	7.742	0.160	7.549	0.161	7.825	0.154	7.832	0.153
Distance to nearest public transport*	27.333	0.819	26.727	0.803	27.094	0.744	26.925	0.697
Mill in the village (or nearby village) (= 1)*	0.387	0.013	0.402	0.013	0.413	0.013	0.408	0.012
Village has well or borehole (= 1)*	0.702	0.012	0.709	0.012	0.713	0.012	0.707	0.011
% of village hhs reporting significant crop yield loss	0.559	0.008	0.718	0.008	0.548	0.008	0.722	0.008
# of district-level drought-days	29.774	0.830	46.701	0.695	27.881	0.781	47.329	0.662
district-level road density (kms of roads/1000 people)*	2.080	0.042	2.084	0.042	2.079	0.044	2.075	0.040
1=HH interviewed in October	0.058	0.007	0.339	0.012	0.070	0.007	0.364	0.012
1=HH interviewed in November	0.000	0.000	0.529	0.013	0.000	0.000	0.494	0.012
1=HH interviewed in December	0.000	0.000	0.087	0.008	0.000	0.000	0.090	0.007
Number of cases	2,077		2,214		2,169		2,556	

Source: Author's calculations using TIA02 and TIA05.

Appendix Table A6. Summary Statistics of Children Age 10-14 Yet to Complete Primary School, by Orphan Status, Gender, and Wealth Category, 2005

	All		Poor		Less Poor		Girls		Boys	
	2005		2005		2005		2005		2005	
	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE
Dependent variables										
Primary school attendance (=1)	0.743	0.008	0.720	0.011	0.771	0.012	0.719	0.012	0.764	0.011
Grade progress	0.442	0.006	0.416	0.007	0.476	0.009	0.422	0.008	0.461	0.008
Highest grade achieved	2.554	0.033	2.404	0.044	2.739	0.052	2.428	0.047	2.669	0.047
Explanatory Variables										
Child characteristics										
Paternal orphan (=1)	0.092	0.005	0.107	0.007	0.074	0.007	0.093	0.007	0.092	0.007
Maternal orphan (=1)	0.038	0.003	0.037	0.005	0.038	0.005	0.038	0.005	0.038	0.005
Double-parent orphan (=1)	0.031	0.003	0.028	0.004	0.034	0.005	0.035	0.005	0.026	0.004
Age	11.757	0.024	11.756	0.032	11.758	0.037	11.754	0.035	11.760	0.034
Age squared	140.070	0.580	140.027	0.768	140.124	0.882	139.973	0.822	140.159	0.816
Girl (= 1)	0.477	0.009	0.468	0.012	0.489	0.013				
Household characteristics (in 2005)										
ln(Total landholding)	2.438	0.031	2.238	0.036	2.685	0.053	2.372	0.045	2.498	0.043
ln(Total farm asset value)	6.359	0.047	5.864	0.067	6.971	0.061	6.326	0.066	6.390	0.066
Head's years of education	2.389	0.048	1.791	0.055	3.127	0.079	2.408	0.070	2.371	0.065
Maximum years of education (of female adults in HH)	2.036	0.043	1.789	0.054	2.342	0.069	2.158	0.064	1.926	0.058
Maximum years of education (of all adults in HH)	4.073	0.051	3.589	0.065	4.671	0.080	4.115	0.074	4.035	0.070
Head's age	46.053	0.229	47.044	0.321	44.828	0.320	45.873	0.329	46.217	0.318
Head is polygamous (= 1)	0.032	0.003	0.036	0.004	0.027	0.004	0.032	0.004	0.031	0.004
Village and district characteristics (in 2002)*										
Travel time to nearest town of 10,000+ residents (hrs)*	7.966	0.129	8.303	0.182	7.550	0.179	7.865	0.183	8.058	0.181
% of village hhs reporting significant crop yield loss	0.728	0.005	0.728	0.007	0.727	0.008	0.721	0.008	0.734	0.007
1=HH interviewed in October	0.371	0.009	0.366	0.011	0.378	0.013	0.360	0.012	0.382	0.012
1=HH interviewed in November	0.494	0.009	0.495	0.012	0.494	0.014	0.503	0.013	0.486	0.012
1=HH interviewed in December	0.084	0.005	0.086	0.007	0.081	0.007	0.084	0.007	0.084	0.007
No. of children	5,236		2,841		2,487		2,491		2,395	

Notes: 1) Poor HHs defined as those in the bottom 50% of total gross HH income/AE in 2002; Less poor are in the top 50% of total gross HH income/AE

Source: Author's calculations using TIA05.

Appendix Table A7. Determinants of School Advancement (OLS) with Household Fixed Effects, by Wealth Category, 2002-2005

Covariates	All (A)	Poor (B)	Less Poor (B)
Household-level adult mortality/morbidity shocks			
Past WA adult mortality (3-6 years ago)	0.013	0.060*	-0.064
	(0.540)	(2.222)	(-1.551)
Recent WA adult mortality (0-3 years ago)	0.021	0.052*	-0.016
	(1.067)	(2.127)	(-0.621)
Chronically ill adult (3 months in past year)	-0.006	-0.005	-0.008
	(-0.374)	(-0.268)	(-0.357)
Child characteristics			
Age	0.056**	0.056**	0.051**
	(4.709)	(3.485)	(3.030)
Age squared	-0.002**	-0.002**	-0.002**
	(-5.238)	(-3.962)	(-3.195)
Village or district-level characteristics			
% of village hhs reporting significant crop yield loss	-0.062**	-0.099**	-0.007
	(-4.073)	(-5.244)	(-0.305)
# of district-level drought-days	-0.018	-0.042*	0.019
	(-1.195)	(-2.090)	(0.820)
Household fixed effects	Yes	Yes	Yes
Dummies for time and month of interview	Yes	Yes	Yes
No. of children	4,690	2,485	2,205

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Appendix Table A8. Determinants of School Advancement (OLS) with Household Fixed Effects, by Gender and Wealth Category, 2002-2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 years ago)	-0.039	0.044	0.055	0.076*	-0.113*	-0.040
	(-1.011)	(1.383)	(1.210)	(2.350)	(-2.481)	(-0.593)
Recent WA adult mortality (0-3 years ago)	-0.002	0.024	0.080*	0.032	-0.073*	0.008
	(-0.066)	(1.086)	(2.127)	(1.165)	(-2.399)	(0.239)
Chronically ill adult (3 months in past year)	-0.012	0.001	-0.012	-0.007	-0.022	0.012
	(-0.685)	(0.065)	(-0.513)	(-0.243)	(-0.917)	(0.327)
Child characteristics						
Age	0.040*	0.054**	0.036	0.061**	0.041	0.045*
	(2.254)	(3.491)	(1.498)	(2.990)	(1.640)	(1.982)
Age squared	-0.002**	-0.002**	-0.002*	-0.002**	-0.001+	-0.002*
	(-2.908)	(-3.719)	(-2.292)	(-3.055)	(-1.743)	(-2.269)
Village or district-level characteristics						
% of village hhs reporting significant crop yield loss	0.027	-0.050*	0.009	-0.071**	0.055+	-0.008
	(1.402)	(-2.488)	(0.364)	(-2.923)	(1.944)	(-0.233)
# of district-level drought-days	0.000	0.000	0.001*	0.001	-0.001	-0.000
	(0.817)	(0.714)	(2.140)	(1.573)	(-1.550)	(-0.781)
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Dummies for time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,111	2,579	1,090	1,395	1,021	1,184

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Appendix Table A9. Determinants of School Advancement (OLS) with Household Fixed Effects, by Wealth Category, 2002-2005

Covariates	All (A)	Poor (B)	Less Poor (B)
Household-level adult mortality/morbidity shocks			
Past WA adult mortality (3-6 years ago) - MALE	-0.059+	-0.030	-0.130*
	(-1.886)	(-0.951)	(-2.048)
Past WA adult mortality (3-6 years ago) - FEMALE	0.064+	0.115**	-0.011
	(1.957)	(2.805)	(-0.249)
Recent WA adult mortality (0-3 years ago) - MALE	-0.024	-0.024	-0.024
	(-1.111)	(-0.837)	(-0.725)
Recent WA adult mortality (0-3 years ago) - FEMALE	0.055*	0.091**	0.008
	(2.021)	(2.609)	(0.219)
Chronically ill adult (3 months in past year) - MALE	-0.038+	-0.038+	-0.043
	(-1.862)	(-1.701)	(-1.189)
Chronically ill adult (3 months in past year) - FEMALE	0.011	0.013	0.002
	(0.562)	(0.517)	(0.058)
Child characteristics			
Age	0.059**	0.063**	0.051**
	(4.839)	(3.734)	(2.991)
Age squared	-0.002**	-0.002**	-0.002**
	(-5.252)	(-4.099)	(-3.146)
*Village or district-level characteristics (in 2002)**			
% of village hhs reporting significant crop yield loss	-0.016	-0.039+	0.021
	(-1.040)	(-1.925)	(0.908)
# of district-level drought-days	0.000	0.001	-0.000
	(0.460)	(1.500)	(-1.223)
Household fixed effects	Yes	Yes	Yes
Dummies for time and month of interview	Yes	Yes	Yes
No. of children	1,741	894	847

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

Appendix Table A10. Determinants of School Advancement (OLS) with Child Fixed Effects, by Gender and Wealth Category, 2002-2005

	All		Poor		Less Poor	
	Girls	Boys	Girls	Boys	Girls	Boys
Covariates	(A)	(B)	(C)	(D)	(E)	(F)
Household-level adult mortality/morbidity shocks						
Past WA adult mortality (3-6 years ago) - MALE	-0.078+	-0.044	-0.025	-0.006	-0.148*	-0.159+
	(-1.735)	(-0.973)	(-0.466)	(-0.184)	(-2.116)	(-1.708)
Past WA adult mortality (3-6 years ago) - FEMALE	-0.017	0.113**	0.107	0.138**	-0.117**	0.062
	(-0.281)	(2.906)	(1.301)	(2.964)	(-2.775)	(1.111)
Recent WA adult mortality (0-3 years ago) - MALE	-0.025	-0.030	0.017	-0.042	-0.050	-0.017
	(-0.656)	(-1.223)	(0.351)	(-1.521)	(-1.139)	(-0.379)
Recent WA adult mortality (0-3 years ago) - FEMALE	0.012	0.064*	0.093	0.081*	-0.093**	0.041
	(0.214)	(2.268)	(1.452)	(2.182)	(-3.405)	(0.971)
Chronically ill adult (3 months in past year) - MALE	-0.038	-0.028	-0.029	-0.042	-0.090**	-0.000
	(-1.629)	(-0.767)	(-0.977)	(-1.123)	(-2.674)	(-0.007)
Chronically ill adult (3 months in past year) - FEMALE	0.005	0.013	-0.002	0.005	-0.005	0.017
	(0.188)	(0.451)	(-0.058)	(0.151)	(-0.133)	(0.392)
Child characteristics						
Age	0.039*	0.055**	0.034	0.064**	0.041	0.045+
	(2.171)	(3.577)	(1.402)	(3.102)	(1.632)	(1.931)
Age squared	-0.002**	-0.002**	-0.002*	-0.002**	-0.001+	-0.002*
	(-2.816)	(-3.796)	(-2.156)	(-3.168)	(-1.744)	(-2.193)
Village or district-level characteristics						
% of village hhs reporting significant crop yield loss	0.026	-0.046*	0.008	-0.067**	0.058*	-0.007
	(1.344)	(-2.297)	(0.304)	(-2.727)	(2.045)	(-0.197)
# of district-level drought-days	0.000	0.000	0.001*	0.001	-0.001	-0.000
	(0.734)	(0.539)	(2.102)	(1.384)	(-1.623)	(-0.532)
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Dummies for time and month of interview	Yes	Yes	Yes	Yes	Yes	Yes
No. of children	2,111	2,579	1,090	1,395	1,021	1,184

Notes: Regressions use sampling weights which are adjusted for attrition bias. Numbers in parentheses are absolute robust z-scores calculated using heteroskedasticity robust standard errors clustered for households; significance levels indicated by: ** p<0.01; * p<0.05; + p<0.10

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