The Impact of Parental Death on Child Well-being

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Abstract

Identifying the impact of parental death on the well-being of children is complicated because parental death is not usually exogenous with respect to other factors that affect child well-being. Longitudinal data collected in Aceh, Indonesia, before and after the Indian Ocean tsunami are used to identify the impact of parental deaths that are arguably exogenous. Because the tsunami was unanticipated and the force of the water varied as a function of idiosyncratic features of the topography and landscape, chance played a dominant role in mortality. Baseline data were collected on 1,173 children age 9-17 years as part of a population-representative survey conducted ten months prior to the December 2004 tsunami in areas that were subsequently heavily damaged by the tsunami. With data from interviews with the same children after the tsunami, comparisons are drawn between those who lost one parent, both parents and those whose parents survived. Shorter-term impacts on school attendance, aspirations and time allocation a year after the tsunami are examined as well as longer-term impacts on education and marriage five years after the tsunami.

1. Introduction

Demographers, sociologists, economists, and psychologists share a long-standing interest in understanding how family structures, and in particular, parental absence, affect the well-being of children. This interest has intensified as divorce, domestic and international migration, and the HIV/AIDS epidemic have increased the numbers of children experiencing the absence or loss of a parent. Moreover, in recent years a number of high-mortality natural disasters have created sudden surges in the numbers of children without parents, bringing media attention and humanitarian concern to the plight of these children.

Establishing the impact of a parental death on children is not straightforward. A family in which a parent dies may differ from other families in ways that would have affected a child's outcomes had the parent survived. Only in rare circumstances is it possible to identify the causal effect of parental death on child well-being.

We provide new evidence on this issue using longitudinal data from Indonesia collected before and after the December 2004 Indian Ocean earthquake and tsunami. The baseline of the Study of the Tsunami Aftermath and Recovery (STAR) was conducted ten months before the tsunami and is representative of the population living along the coast of Aceh at that time. Re-interviews have been conducted annually since then. The short-term impact of the tsunami is measured in the first post-tsunami interview, about a year after the tsunami. The longer-term impact is measured in the most recent interview, about 5 years after the tsunami.

The 2004 Indian Ocean earthquake and tsunami were largely unanticipated, and the event's intensity varied within small areas as a function of the topography and orientation of the land relative to the direction and force of the waves. Survival, therefore, can to a large extent be attributed to idiosyncratic factors revolving around the precise location where the waves hit land

and where people were located at that moment. For these reasons parental death is less likely to be related to prior behaviors than might be the case when death is due to an illness like HIV/AIDS. We show, though, that parental survival is related to several child characteristics measured in the pre-tsunami baseline. Therefore, to identify the causal impact of the tsunami, before and after comparisons are drawn between children whose parents did not survive the tsunami with children whose parents did survive. The combination of the longitudinal data on children who were living along the coast of Aceh and the unanticipated nature of the tsunami yield a unique window on how children's well-being is affected by parental death.

We examine measures of well-being that are related to human capital and time allocation and that were collected before and after the tsunami. Other indicators of well-being that were potentially affected by parental death, such as psycho-social health, were not collected in the baseline and so are not examined in this research.

We find that the impact of parental death varies with the age and gender of the child and that shorter term impacts are not reliable indicators of the effects that emerge in the longer-term. Death of both parents, which has been little explored in the literature, has a large, negative impact on the human capital accumulation of 15-17 year old males and females, and likely of 9-14 year old females. Older males whose fathers died also acquire less education than males whose parents survived the tsunami. We find little evidence that parental death affects the human capital of 9-14 year old males. Maternal death has little impact on schooling outcomes of children but does affect their time allocation.

2. Background

A parent's death typically ends a child's relationship with someone of central emotional

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importance, with the attendant potential for straining his or her relationship with the remaining parent or caregiver; worsening the family's economic status and living situation; creating pressure to take on responsibilities of the dead parent, and isolating the child from friends (Worden 1996; Tremblay and Israel 1998, Stokes, Reid, and Cook 2009).

Not surprisingly, parental absence is often accompanied by symptoms of poor psycho-social well-being. Sometimes changes in behavior and school performance occur as well. The results of studies examining how children fare after a parental death, however, are not uniform, and this has led to efforts to identify factors that either predispose children to or that mediate the impact of parental loss (Leuken, 2008; Sandler, 2003). Studies have focused on the child's age and gender, the parent's gender, and the interaction of the child's and parent's gender.

A key challenge in this literature is that parental loss is potentially correlated with other, unobserved factors that affect children's welfare. Some authors have contrasted the impacts of parental absence brought on by a death with absence because of divorce, arguing that the death of a parent is "more" exogenous with respect to child welfare than absence because of divorce. Using data from a British cohort study, Fronstin et al (2001) shows that parental absence when a child is 11-15 years old is associated with reduced educational attainment for males and females. For males the association is larger in magnitude if the absence results from death rather than divorce, whereas for females, the associations are very similar in magnitude. Steele et al (2009), drawing on Norwegian registry data, report that a paternal death lowers transition rates from lower to upper secondary school, but that the effects are similar in magnitude to those estimated for divorce. Mother-specific random effects are included in these models to control for selection. It is not clear that random effects absorb all unobserved differences between children whose parents divorce relative to those whose parent dies. More generally, while some parent deaths are

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likely to be random, it is not clear that, in general, parental death is "more exogenous" than divorce.

In developing countries much of the work on the impacts of parental death focuses on death due to HIV-AIDS. The earliest studies relied on cross-sectional surveys to examine school enrollment at the time of the survey as a function of a parental death at an earlier point. For example, Lloyd and Blanc (1996) examine living arrangements and enrollment rates of children aged 10-14 as a function of orphan status in seven African countries using Demographic and Health Surveys (DHS). They find no statistically significant associations between enrolment and maternal or paternal death. Bicego et al. (2003) examine the levels, trends and differentials in orphan prevalence in five sub-Saharan Africa countries and show that losing one or both parents is associated with a reduced probability of being in the appropriate grade level for a child's age. Case et al (2004) find that in 10 sub-Saharan African countries, orphanhood is associated with reduced school attendance, and that this is largely explained by orphans who live with distantly or unrelated caregivers. As Case et al note, it is possible that these associations are driven by unobserved heterogeneity: children whose parents died may be less likely to attend school even if the parent had lived.

To address this concern, and investigate the dynamic impact of AIDS-induced parental death on child outcomes, several studies have used longitudinal data collected in Africa. Yamano and Jayne (2004) examine the impact of working-age adult mortality in Kenyan households on school enrollment using two waves of a panel survey. Their difference-in-difference estimates indicate a significant negative impact of death of an adult, but only among children living in poorer households. Using panel data from Tanzania, Ainsworth, Beegle and Koda (2005) find that for children age 7-14 years, death of an adult delays entry into school but has no effect on

subsequent enrollment among those who have already started school,

Case and Ardington (2006) analyze the relationship between maternal death, paternal death and investments in child education using longitudinal data from rural Kwa-Zulu Natal, South Africa. Maternal death has strong negative effects on subsequent enrollment, school attainment and education spending. Since future maternal death does not predict baseline school outcomes, this result is unlikely to be driven by unobserved heterogeneity. The careful attention paid to identifying the causal effect of maternal death on school outcomes is an important contribution of the work. In contrast with the result for maternal death, Case and Ardington find that paternal death has no effect on school outcomes. They suggest that, to the extent such effects exist, they likely operate through socio-economic status since paternal death is a powerful predictor of subsequent socio-economic status. An alternative interpretation is that paternal death is not salient for many children in rural Kwa-Zulu Natal because many of the fathers are absent, working on the mines or in urban centers. In their sample, less than 30% of children co-reside with the father while around two-thirds co-reside with the mother. (Case and Ardington, 2006.)

Evans and Miguel (2007) use panel data from Kenya to compare changes in primary school participation of children whose parents died between 1999 and 2002 with changes for children whose parents did not die. They find a child is about 5% less likely to be in school after the mother dies. This effect emerges about two years prior to the mother's death, which the authors attribute to the influence of parental illness due to HIV/AIDS and persists for several years after the death. As in Case and Ardington, effects of paternal death are smaller and not statistically significant.

In a study of longer-term impacts of orphanhood in Tanzania, Beegle, DeWeerdt, and Dercon (2010) follow up children who were age between 7 and 15 years old and had both

parents alive. Ten years later, those children who lost a parent during the hiatus completed one year less of schooling and are 2 cms shorter than those who did not lose a parent. Since height is largely determined by the time a child is age 4 or 5 (Martorell and Habicht, 1986), it is possible that these differences reflect pre-existing differences between children who lose a parent and those who do not and that these differences are not controlled in the models. This underscores a recurring theme in the literature on the impact of death from HIV/AIDS -- the parent's death may be related to other behaviors that are associated with investments in children and the adult is often ill for several years prior to death.

The latter concern has been directly addressed in the literature. A prolonged illness may help prepare the family, including children, for their eventual loss (Worden 1996). In a study of adolescents who lost a parent to HIV/AIDS, Rotheram-Borus et al (2005) found that emotional distress and contact with the juvenile justice system peaked in the year before the death, then steadily declined. Similar results were reported in children who lost a parent to cancer (Siegel et al 1992, Siegel, Karus, Raveis 1996).

It has been suggested that since deaths from accidents are less predictable than deaths from a chronic illness, identifying the causal effect of orphanhood is more credible in studies that are predicated on this element of surprise. Gertler et al (2004) focus on parental deaths in Indonesia, some of which may be a surprise. They find that recent parental death is associated with reduced school enrollment among children. Their results suggest that older children and specifically, elder daughters that have younger siblings, are at higher risk of dropping out when a parent dies. Administrative records from Taiwan are used to examine the relationship between parental deaths due to accidents and college enrollment, (Chen, Chen, and Liu 2009). Comparing children who were at least 18 years of age when the death occurred with their younger siblings,

the unexpected death of a mother results in a 4% lower probability of enrolling in college. Death of a father does not affect college enrollment.[1] The authors interpret this as evidence that maternal provision of non-financial support is more important in driving college-going behavior than the provision of financial support from the father which, they suggest is substitutable with resources that are provided to families in the event of the father's death.

There are at least three contributions of our research. First, identification of the effect of orphanhood is based on unexpected parental deaths that occurred because of the tsunami. Second, using longitudinal data collected before and after the tsunami, the empirical models we estimate are designed to purge estimates of contamination due to unobserved heterogeneity that is fixed at the child and family level. Third, we examine both shorter- and longer-term impacts of parental death on child outcomes, distinguishing male from female children, older from younger children and distinguishing the loss of a mother, a father or both parents. We turn next to a description of the tsunami and our study context.

3. The 2004 Indian Ocean tsunami

The Sumatra-Andaman earthquake of 2004 resulted in a 2,000 km rupture along the floor of the Indian Ocean. The displaced water generated a huge tsunami surge, which slammed into the island of Sumatra shortly after the earthquake (Kerr 2005; Lay et al. 2005; Marris 2005; Sinadinovski 2006). While the tsunami affected 26 countries bordering the Indian Ocean, Indonesia was hit hardest with 130,000 individuals killed and another 30,000 classified as missing (Rofi et al. 2006; Doocy et al. 2007).

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[1] The authors report that paternal death is associated with lower college enrollment in the cross section but this can be attributed to the role of unobserved heterogeneity.

The earthquake, tsunami and its aftermath are examined in order to provide new insights into understanding the impact on child-wellbeing of parental loss. Two features of the tsunami are important for our empirical approach. First, the tsunami was not expected. Geological evidence documents the next most recent tsunami that reached mainland Sumatra occurred more than 600 years ago and the last tsunami in the region occurred in 1907, affeceting Simeulue Island off the coast of Sumatra (Monecke et al 2008). No early warning systems were in place. Second, the severity of the impact varied in ways that could not be anticipated even within small areas. The greatest damage occurred in areas that experienced the most forceful inundation of water, but many of these sites were close to areas sheltered from the water's full force by topographical features of the coastline, primarily the slope, the aspect relative to the wave and the elevation (Frankenberg, et al, 2011). The role that idiosyncratic features of the landscape played in determining risk means that parental deaths from the tsunami are less a function of genetic risk factors, prior behavioral choices, and socioeconomic status than is the case for parental absence caused by, for example, death from illness. This is an advantage of our research design for identifying the causal effect of parental death on child well-being.

4. Data

Data are drawn from the Study of the Tsunami Aftermath and Recovery (STAR), a longitudinal survey of individuals who were living, prior to the tsunami, along the coast of Aceh and the neighboring province of North Sumatra. The baseline survey was conducted in February 2004, as part of the population-representative cross-section socioeconomic survey, SUSENAS, conducted annually by Statistics Indonesia.

With Statistics Indonesia assistance, we fielded the first follow up wave, STAR1,

between May 2005 and July 2006. For STAR1 we targeted all SUSENAS respondents from the 2004 survey who were living in any of 11 *kabupaten* (districts) that had a coastline in Aceh and 8 *kabupaten* along the coast of North Sumatra. The baseline sample survey includes 585 enumeration areas in 525 villages. The *kabupaten* were selected because their coastlines were, in principle, vulnerable to inundation from the tsunami waves. Not all areas in these kabupaten were directly affected by the tsunami; the force and reach of the water varied considerably as a function of shape and aspect of the beachfront, presence of rivers or canals and elevation.

In the baseline survey, informants reported on the socioeconomic and demographic characteristics of themselves and other household members. In STAR1 we collected individual and household-level data, drawing on and augmenting the baseline questionnaire. In addition village leaders and informants at local schools and health facilities provided information as part of a large community-level survey.

STAR1 was the first of five annual post-tsunami surveys. We also draw on data from the fifth follow-up, STAR5, which took place between September, 2009 and December 2010.

We focus on children and young adults who were between 9 and 17 years old at the time of the baseline survey and were living in 91 communities along the coast that sustained heavy damage from the tsunami, as measured by a combination of satellite imagery, direct observations of survey supervisors, and interviews with village leaders. The vast majority of deaths due to the tsunami occurred in these areas. We put considerable effort into identifying the baseline respondents who had died and locating all of the survivors. If a respondent could not be found in the baseline location interviewers obtained proxy information about their whereabouts and tracked them to their new location. In about half the cases, survivors had moved to temporary camps; in the other half, respondents move to the homes of family or friends. Survival status was

obtained from family members or, if none could be found, from neighbors, village leaders and local death registers that were compiled after the tsunami. When reports conflicted, a respondent was identified as dead only after the conflicts had been resolved. Of 1,173 age-eligible children in the baseline, 345 (30%) are known to have died. Of the remaining 828 children, 709 (86%) were interviewed in the first follow-up. Persistent attempts to track all survivors in subsequent waves paid off: we found more of them and 737 (89%) were assessed in the final interview. [2]

As shown in panel A of Table 1, about one in six of the children interviewed in the first follow-up lost at least one parent. The literature indicates that the impact on child human capital outcomes tends to be larger in absolute magnitude if the child lost a mother relative to a father. We will draw out this distinction in our empirical models and we will also distinguish those children who lost both parents to the tsunami. In our study sample of children, 7.9% lost a mother, 4.5% lost a father and about the same fraction, 4.4%, lost both parents to the tsunami.

We examine five shorter-term child outcomes and five longer-term outcomes that are broadly related to human capital and time allocation. The shorter-term outcomes are measured at the first follow-up interview, about a year after the tsunami, when the children were age 10 through 18 years. As shown in panel B of Table 1, 83% were enrolled in school at the time, 9% had worked in the previous week and 36% had helped with housekeeping in the previous week. About 19% of the children had received a scholarship after the tsunami to encourage them to stay at school. In the follow-up interview, we asked each child who was enrolled in school, or planned to return to school, whether he/she planned to continue beyond a post-secondary education. Slightly over three-quarters of them aspired to some form of tertiary education.

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[2] 1% of the children refused to participate in each wave, 2 children died between the first and final re-survey and the remaining children were lost to follow-up.

By the time of the final interview, about five years later, less than two-thirds of the children were enrolled in school and the average child had completed 10.3 years of schooling. About 28% were working and 39% did housework in the week prior to the survey and 10% had married.

5. Empirical strategy

Our goal is to identify the extent to which variation in these human-capital related outcomes can be attributed to the death of a parent in the tsunami. A natural starting place is to estimate the relationship between each of the shorter-term and longer-term outcomes for child i at time t (where t spans the period before and after the tsunami), Y_{it}, and parental death, D_{it}, controlling time varying and time invariant child and family characteristics, X_{it}, and X_i, respectively:

$$Y_{it} = \alpha + \beta D_{it} + \gamma X_{it} + \delta X_i + \varepsilon_{it} \qquad [1]$$

Parental death, D, is vector-valued distinguishing children who lost their mother, those who lost their father and those who lost both parents in the tsunami. An important advantage of our research design is that, in contrast with much of the literature that examines the impact of AIDS mortality, parental death in this study does not reflect prior health-related behaviors but rather is the consequence of a large and unexpected natural disaster. If parental death in the tsunami can be treated as random, then estimates from [1] can be given a causal interpretation. Formally, it is necessary to assume that unobserved heterogeneity ε_{it} is not correlated with covariates in the model including parental death, D_{it}. This assumption may not hold. It is possible that parents who survived the tsunami are stronger or better able to swim than other parents, or they may live in more robust houses that were better able to withstand the force of the water. If these surviving

parents were also more inclined to invest in the human capital of their children prior to the tsunami, then the assumption that ε_{it} is unrelated to parental death is unlikely to be true.

To the extent that such differences exist and reflect traits that do not change during the study period, they can be taken into account in [1] by including a child-specific fixed effect. Specifically, separating unobserved heterogeneity into two components, a fixed effect that is time invariant for each child, μ_i, and a component that varies over time for each child, ω_{it}, rewrite [1] as

$$Y_{it} = \alpha + \beta D_{it} + \gamma X_{it} + \mu_i + \omega_{it} \qquad\qquad [2]$$

The fixed effect absorbs all characteristics of the parent and child that do not change over time and affect the outcome, Y_{it}, in a linear and additive way. These include, for example, parents' tastes for investments in their children and characteristics of the child such as ability and ambition, as well as characteristics of the family and community in which they were living at the time of the tsunami.

Estimates of [2] require repeat observations on the same child before and after the tsunami. Therein lies a second key advantage of our research design which includes a baseline pre-tsunami survey and follow-up interviews conducted with the same children after the tsunami. We examine indicators of schooling and time allocation in this framework that were measured in the baseline and in the surveys conducted after the tsunami.

Two indicators that we consider were only collected after the tsunami. In the first resurvey we asked about participation in programs implemented after the tsunami to assist families, including whether the child received a scholarship from such a program. The question was not relevant at baseline and we set all children as not receiving a scholarship at that time.

The second question that we added in the first resurvey asked children about their

aspirations regarding post-secondary schooling. The question was motivated by three lines of research. First, theory suggests that loss of a parent has the potential to affect beliefs about the future and future-looking decisions. Second, loss of a parent potentially affects resources available for schooling which may have affected aspirations. Third, psycho-social well-being may have been affected which would also potentially affect future aspirations. Because we have no information about aspirations at baseline, it is not possible to estimate models with child fixed effects. We adopt an alternative approach and draw comparisons between children who were living in the same enumeration area, some of whom lost a parent and others did not. These estimates exploit the local nature of the tsunami's impact and include a community fixed effect which absorb differences across communities in levels of destruction, assistance program and education aspirations. In addition to parental death, the models include child, parent and household characteristics, Z, measured at baseline, along with the community fixed effect, μ_c:

$$Y_{it} = \alpha + \beta D_{it} + \gamma Z_{it} + \mu_c + \upsilon_{it} \qquad\qquad [3]$$

Before presenting empirical results, it is useful to assess whether parental death can legitimately be treated as exogenous and, thereby, provide insights into the value-added of exploiting the longitudinal dimension of our research design. We compare indicators measured prior to the tsunami at baseline for children whose parents subsequently survived the tsunami with those who lost one or both parent in the tsunami.

As shown in the first row of Table 2, children whose parents survived the tsunami were, on average, age 12.9 at the baseline survey (column 1). Those who lost a parent were, on average, age 13.5 (column 2), and the difference of 0.6 years is significant (column 3). The differences for children who lost their mother, their father or both parents, relative to those whose parents survived are displayed in columns 4, 5 and 6, respectively. None of the

differences is significant.

The second row of the table indicates that males constitute a higher fraction of survivors within the group of children that lost parents than within the group of children whose parents survived, and this difference is significant. The difference is largest for children who lost both parents – in this group there are 19.9% more surviving young males relative to females, and this difference is also significant.

Children whose parents died in the tsunami were also significantly better educated and significantly more likely to be enrolled in school prior to the tsunami. They were about half as likely to be working and half as likely to be engaged in housekeeping during the week prior to the pre-tsunami survey relative to those whose parents survived (these differences are not significant.) The rest of Table 2 compares parental education, whether the parents were alive at baseline, household per capita expenditure, an indicator of resource availability, and household composition, all measured at baseline. In these dimensions there are no significant differences between children whose parents survived and those who did not.

Overall, children who lost one or both parents appear to have higher levels of human capital investments before the tsunami than those whose parents survived the tsunami and these pre-existing differences underscore the critical importance of having a pre-tsunami baseline in order to identify the causal effect of parental death on the outcomes.[3]

We established above that males are more likely to have survived the tsunami than females. The male survival advantage characterizes our sample of adolescents and young adults, and also holds for all adults. It has been attributed to the fact that males are stronger and, in

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[3] In models that include a community fixed effect, which compares children *within* each community, we find no significant differences in any of the indicators in the table between children who lost one or more parents and those who did not. Thus, some of the differences between orphans and non-orphans can be attributed to differences in the composition of communities in which parents were more likely to perish relative to the communities where parents survived.

Islamic Aceh, much more likely to know how to swim than females (Frankenberg et al, 2011). We will estimate models separately for males and females.

We also explore whether other attributes are associated with children's survival status (Appendix Table 1). As documented above, male children were significantly more likely to survive. Examining the other indicators in Appendix Table 1, children who helped with housekeeping were more likely to survive. This difference is not significant when comparisons are drawn within communities suggesting that it reflects variation in tsunami-related mortality across study sites. The evidence points to children's deaths in the tsunami being largely random and not related to own human capital, parental human capital or household resources.

The final three columns of Appendix Table 1 compare the same indicators for respondents who were interviewed in the first follow-up with those who were not. None of the differences is significant and, taken together, the indicators explain only 1.2% of the variation in the probability an individual is not interviewed in the follow-up survey (F statistic for the significance of all the covariates in the appendix table is 1.2, p value is 0.31.) In short, we find no evidence that attrition is selected on observed characteristics measured at baseline.

6. Results

The empirical models, [2] and [3], are estimated by ordinary least squares. All estimates of variance-covariance matrices take into account clustering at the community level and are robust to arbitrary forms of heteroskedasticity. Results for short-term outcomes, measured a year after the tsunami, are reported in Table 3. Results for longer-term outcomes are reported in Table 4. All models are stratified by gender of the child and we also distinguish younger children (age 9 through 14 at baseline) from older children (age 15 through 17 at baseline) who are more likely

to make the transition from school to work during the study period. Each panel of the table reports the impact on the outcome listed in the first column of the table: death of the mother, death of the father, and death of both parents relative to both parents surviving the tsunami. All models include child fixed effects, [2], except estimates of the impact of aspirations to go to college (or any tertiary education institution).

Beginning with shorter-term impacts of parental death, in the first column of Table 3, older males-- those orphaned at 15-17 years of age-- are less likely to be enrolled in school if a parent died – an impact that is large and significant if the father died. If both parents died, these young men are more likely to be working, less likely to receive a scholarship and much less likely to aspire to college.[4] Apparently, for this group, scholarship receipt was not well-targeted to those who lost parents and had little impact on school enrollment.

These deleterious impacts of death of parents in the short-term are reflected in the longer-term outcomes, some five years after the tsunami, which are displayed in the first column of Table 4. At the time of the final interview, relative to males whose parents survived the tsunami, those who lost both parents at ages 15 to 17 are 40% less likely to be enrolled in school, have completed 1.7 fewer years of education, are 34% more likely to be working and 8% more likely to be doing housework. They are also 7% less likely to be married. All of these effects are significant at a 5% level. Loss of a father had essentially the same impact, although perhaps it is smaller (albeit not significantly). Loss of the father, or both parents, has clearly taken a toll on the human capital accumulation of these young men that they will likely carry through adulthood.

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[4] The effect on scholarship receipt is significant at a 5% size of test; the effects on working and aspirations are significant at the 10% level.

Results for older females are reported in the second column of each table. In the shorter-term, death of a father results in higher rates of school enrollment and lower rates of doing housework. However, death of the mother or both parents results in lower school enrollment (albeit not significantly) and substantially higher rates of doing housework (34% and 53% respectively). It appears that when the father dies, the mother protects older females, whereas the death of the mother results in the older female stepping into the mother's role, at least in terms of housekeeping. Again, the scholarship program does not appear to have been well-targeted, as older females who lost both parents are the least likely to receive a scholarship. Parental death does not appear to affect aspirations for education.

However, in the longer term, for older girls, death of both parents results in 56% lower school enrollment, lower rates of participation in the work force, higher rates of keeping house and very much higher rates of marriage (62%). These young women are transitioning to the adult role of marriage earlier than women who lost one parent or whose parents survived the tsunami. The only significant impact of death of one parent on older females is elevated rates of doing housework as they substitute for mothers who have died or to assist those mothers who are widows and are working in the labor market to replace income lost with the death of the father.

Although mothers who survived may have attempted to protect their older daughters' schooling investments in the short-term, there is little evidence that this effort was sustainable over the longer-term, at least relative to those whose father survived. However, death of both parents appears to have an enduring impact on girls orphaned at ages between 15 and 17.

We turn now to results for those orphaned between the ages of 9 and 14. Although younger males are no more or less likely to be enrolled in school if one or both parents died in the tsunami than are younger males whose parents survived, they are 30% more likely to have

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received a scholarship if the father died or both parents died. If both parents died, they are less likely to be working or doing housework, and if the father died, they are also less likely to be doing housework. It is possible that these effects on time allocation are driven by the scholarship program. Very little evidence suggests longer-term impacts of orphanhood on these younger males apart from a slightly higher probability of doing housework if the mother or father died.

Younger females who lost their mother or both parents are significantly more likely to be enrolled in school. Targeting of scholarships to young girls who lost both parents may explain one piece of these results. But young females who lost their father are also more likely to receive a scholarship and their enrollment rates are not higher, whereas enrollment rates of the young girls who lost a mother are higher, yet these girls were not more likely to receive a scholarship. No significant differences emerge in working and housework among those who lost one or both parents and those who did not.

Aspirations of young girls, however, are affected: girls who lost both parents are 66% less likely to aspire to college, relative to those whose parents survived. Five years later, these girls are 50% less likely to be enrolled in school. Loss of a father has effects in the same direction (but half the magnitude and significant only at the 10% level for aspirations). Although there are no detectable differences in completed schooling for these young women, relative to those whose parents survived, the low enrollment rates suggest the gaps will emerge in the coming years. Whereas loss of a mother or a father results in significantly lower rates of working in the market, loss of both parents results in a 24% increase in that probability – these girls have left school and entered the labor force earlier than similar girls whose parents did not die in the tsunami. Death of a father does result in higher rates of housekeeping for these young girls, who, like older females, may substitute for the mother.

7. Discussion and Conclusions

The potential repercussions for children of the death of a parent are likely to be multi-faceted and to evolve over time. The role in the family played by the parent goes unfilled for at least some period of time. The surviving parent may assume some of the deceased parent's responsibilities and, depending on the child's age and gender, the child may also take on some of those responsibilities. The child's relationship with the surviving parent (and/or other relatives and care-givers) likely changes and the child may strike out on his or her own earlier than if the parent had not died. Parental death is often accompanied by changes in the socioeconomic status of the family. All of these processes likely change over time. We have, therefore, investigated both the short and longer-term impacts of parental death on boys and girls focusing on human capital related indicators.

A considerable body of evidence indicates that children who lose a parent have less human capital than those who do not. While it may be intuitively appealing to interpret this as a causal relationship, in fact, establishing a causal link has proved to be a significant challenge.

Using data collected before and after the Indian Ocean tsunami, we examine the impact of death of one or both parents on child outcomes soon after the tsunami and over the longer-term. Although the tsunami was unexpected and survival depended largely on where people were located when the water came ashore, identifying the causal impact of parental death is facilitated by the availability of measures of human capital and time allocation before and after the tsunami.

We find that the impact of parental death varies with the age and gender of the child and that shorter term impacts are not reliable indicators of the effects that emerge in the longer-term. An older male child who lost his father or lost both his parents in the tsunami has substantially lower levels of education and is more likely to be working than a son whose parents survived the

tsunami. It is likely that older females who lost both parents will also have less human capital than those that did not; these females are less likely to be in school or working and much more likely to be married five years after the tsunami. An older female is more likely to be doing housework if her mother, father of both parents died suggesting that she substitutes for the parent who died in a complex way. These girls will likely carry the costs of parental death through their entire lives.

The impact of parental death on younger children is more muted. Younger males are largely protected from the deleterious impact of the death of any parent. Whereas this may be true for a younger female who lost either her mother or father, those who lost both parents appear to be on trajectory of lower human capital investments that have not yet fully played out. It is possible that a scholarship program that targeted younger children who lost their fathers or both parents offset negative impacts on enrolment among these children immediately after the tsunami. More generally, it is possible that the impact of parental death on the outcomes we consider has been offset by the influx of assistance after the tsunami, which included opening temporary schools in camps and subsequent reconstruction of infrastructure. We note, however, that children whose parents did not die were also able to take advantage of these services. Indeed, it is precisely those children who serve as the control group in our empirical models.

The literature on HIV/AIDS mortality in Africa indicates that death of a mother typically has significant negative consequences for child education whereas death of a father has negligible and insignificant effects. It has been suggested that this may, in part, reflect the fact at many children do not co-reside with their fathers, particularly in South Africa. In contrast, we find that death of a father in the tsunami has significant negative consequences for the educational attainment of older sons whereas the impact of maternal death is more muted. The

evidence suggests that children and the surviving parent substitute for the parent that died. However, the death of both parents in the tsunami has large and substantively important impacts on older males, older females and possibly younger females. No studies have examined the impact of the loss of both parents in a longitudinal design that compares children before and after the death of the parents. This is important since clearly its impact is not the sum of the impacts of maternal and paternal death.

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Table 1 : Parental death, shorter term and longer-term outcomes

A. Parental death as a result of the tsunami

% of children who lost one or both parents	16.8
% of children whose	
mother died	7.9
father died	4.5
mother and father both died	4.4

B. Child outcomes

B.1 Shorter-term outcomes (at first follow-up interview)

% of children	
enrolled in school at time of follow-up interview	83.2
received scholarship[a]	19.2
working in market sector in week before interview	9.2
housekeeping in week before interview	35.7
aspire to post-secondary school[b]	78.4
Sample size	709

B.2 Longer-term outcomes (at final follow-up interview)

Completed years of education	10.2
% of children	
enrolled in school at time of interview	62.1
working in market sector in week before interview	28.2
housekeeping in week before interview	38.5
ever married by time of interview	11.1
Sample size	696

Notes: Sample consists of tsunami survivors who were, at baseline interview age 9 through 17 years
and living in a community that was subsequently heavily damaged by the tsunami.
Shorter-term outcomes measured during first post-tsunami interview, about a year after tsunami.
Longer-term outcomes measured in final interview, about 5 years after the tsunami.

[a] Between time of tsunami and first follow-up interview

[b] Subsample of 606 respondents who are enrolled in school or plan to return to school at first follow-up.

Table 2 : Child and family characteristics at pre-tsunami baseline
Stratified by survival status of parents

	Both parents survived tsunami [1]	One of both parents died during tsunami [2]	Difference (relative to both parents survived)			
			Any parent died [3]	Mother died [4]	Father died [5]	Both parents died [6]
Age (years)	12.9	13.5	0.6	0.6	0.2	0.8
	[0.1]	[0.2]	[0.3]	[0.4]	[0.5]	[0.4]
Male (%)	54.2	65.5	11.3	8.2	8.2	19.9
	[2.1]	[4.7]	[5.1]	[8.3]	[9.1]	[8.8]
Education (years)	6.0	7.2	1.15	1.1	0.9	1.6
	[0.2]	[0.2]	[0.29]	[0.4]	[0.6]	[0.5]
Enrolled in school (%)	91.4	96.6	5.25	5.0	5.5	5.4
	[1.5]	[1.5]	[2.17]	[2.8]	[3.5]	[3.6]
Working for a wage (%)	4.6	2.8	-1.82	-2.7	3.1	-4.6
	[1.6]	[1.5]	[2.19]	[2.5]	[5.5]	[1.6]
Engaged in housekeeping (%)	8.2	3.8	-4.40	-4.3	-8.2	-1.3
	[1.8]	[2.9]	[3.39]	[4.2]	[1.8]	[5.1]
Mother's education (years)	8.5	8.6	0.10	0.5	-0.8	0.3
	[0.4]	[0.4]	[0.52]	[0.8]	[0.8]	[0.6]
Father's education (years)	9.4	9.0	-0.39	-0.5	-0.9	0.3
	[0.4]	[0.4]	[0.52]	[0.7]	[0.8]	[0.7]
Mother alive at baseline (%)	98.1	99.2	1.02	1.9	-1.3	1.9
	[0.7]	[0.9]	[1.08]	[0.7]	[3.2]	[0.7]
Father alive at baseline (%)	95.4	90.8	-4.68	-0.8	-4.8	-11.6
	[1.0]	[4.0]	[4.03]	[5.3]	[9.0]	[7.3]
Per capita expenditure (Rp10,000 per month)[a]	40.0	41.8	1.84	7.9	-10.1	3.1
	[2.7]	[5.7]	[5.94]	[11.0]	[3.7]	[5.6]
Household size	5.9	5.8	-0.13	0.0	-0.1	-0.5
	[0.2]	[0.2]	[0.22]	[0.3]	[0.4]	[0.3]

Notes: [Standard errors] adjusted for clustering at community level. Col3=Col2-Col1.

[a]Rp10,000 is approximately equal to US$1.

Table 3 : Effects of death of a parent on shorter-term outcomes
Comparing first post-tsunami interview with pre-tsunami interview

		Older males	Older females	Younger males	Younger females
		[1]	[2]	[3]	[4]
% enrolled in school	Mother died/father alive	-11.6	-22.2	2.5	7.5
		[18.0]	[17.4]	[2.2]	[3.4]
	Father died/mother alive	-37.7	14.5	2.8	-4.1
		[18.6]	[4.9]	[2.5]	[11.1]
	Both mother and father died	-9.2	-15.9	2.8	6.3
		[14.7]	[28.7]	[2.5]	[2.8]
% working	Mother died/father alive	12.8	8.1	0.0	-2.4
(previous week)		[13.5]	[11.3]	[5.4]	[1.6]
	Father died/mother alive	2.0	-37.5	7.1	8.9
		[11.7]	[28.0]	[12.2]	[9.6]
	Both mother and father died	27.1	-5.0	-5.4	-2.0
		[16.2]	[3.0]	[2.2]	[1.4]
% doing housework	Mother died/father alive	15.0	34.0	12.6	-1.1
(previous week)		[21.9]	[12.8]	[10.5]	[17.0]
	Father died/mother alive	18.9	-39.0	-12.7	15.0
		[13.6]	[8.5]	[3.6]	[21.2]
	Both mother and father died	-5.5	53.2	-21.0	-26.5
		[10.8]	[6.5]	[9.0]	[30.3]
% received scholarship	Mother died/father alive	-13.3	10.2	3.2	6.7
		[7.3]	[9.2]	[8.3]	[14.7]
	Father died/mother alive	0.6	19.3	32.0	22.2
		[15.4]	[26.8]	[19.7]	[13.2]
	Both mother and father died	-21.8	-16.9	32.0	40.0
		[4.3]	[4.3]	[11.9]	[24.9]
% aspire to go to college	Mother died/father alive	-1.7	18.4	4.4	6.9
		[13.3]	[19.4]	[15.9]	[10.4]
	Father died/mother alive	0.7	23.9	-10.0	-30.7
		[13.4]	[18.0]	[24.6]	[16.5]
	Both mother and father died	-51.1	12.8	-28.2	-65.9
		[29.9]	[11.8]	[41.6]	[25.2]

Notes:Older children age 15-17 at baseline; younger children age 9-14 at baseline. Linear probabily estimates and [standard errors]. All models (except aspiration to college) include child fixed effects and age. Aspirations to college models include community fixed effects and also control presence and education of mother and father, log(per capita expenditure) and household size, all measured pre-tsunami. [Standard errors] take into account clustering at community level and are robust to arbitrary forms of heteroskedasticity.

Table 4 : Effects of death of a parent on longer-term outcomes

Comparing final post-tsunami interview with pre-tsunami interview

		Older males	Older females	Younger males	Younger females
		[1]	[2]	[3]	[4]
% enrolled in school	Mother died/father alive	7.0	-0.5	-13.0	9.0
		[15.2]	[21.1]	[13.5]	[8.3]
	Father died/mother alive	-24.7	11.4	-2.1	-26.9
		[16.5]	[29.4]	[22.9]	[21.8]
	Both mother and father died	-40.2	-55.7	-13.6	-50.8
		[10.6]	[4.5]	[12.4]	[16.7]
Years of education	Mother died/father alive	-0.9	0.7	-0.3	0.4
(completed)		[0.6]	[1.0]	[0.3]	[0.5]
	Father died/mother alive	-1.3	-0.5	-1.4	1.0
		[0.7]	[0.5]	[1.0]	[1.0]
	Both mother and father died	-1.7	-0.1	-0.2	-0.2
		[0.4]	[0.5]	[0.8]	[0.4]
% working	Mother died/father alive	-10.1	7.7	2.6	-9.9
(previous week)		[13.6]	[21.0]	[12.3]	[4.8]
	Father died/mother alive	3.7	-26.1	26.7	-9.8
		[17.8]	[48.1]	[25.9]	[4.8]
	Both mother and father died	34.2	-25.8	22.3	23.6
		[14.3]	[4.9]	[16.1]	[21.6]
% doing housework	Mother died/father alive	0.8	15.2	2.6	0.5
(previous week)		[7.6]	[3.7]	[1.2]	[7.5]
	Father died/mother alive	7.8	15.4	2.3	7.8
		[2.8]	[3.9]	[1.3]	[2.6]
	Both mother and father died	7.7	15.9	-6.3	-8.8
		[2.8]	[3.8]	[9.0]	[16.2]
% ever married	Mother died/father alive	-0.1	7.1	.	.
		[7.7]	[20.5]		
	Father died/mother alive	-7.3	-4.7	.	.
		[2.9]	[27.3]		
	Both mother and father died	-7.2	62.3	.	.
		[2.8]	[5.6]		

Notes: Linear probability models include child fixed effects and age of child. [Standard errors] take into account clustering at community level
Older are age 14-17 at baseline; younger are age 9-13 at baseline.

Appendix Table 1: Attrition - Comparison of characteristics at baseline

Means, differences and [standard errors] of survivors (relative to those who died) and
among survivors, those who were interviewed (relative to those not interviewed)

Baseline characteristics	All age eligible children	Died in tsunami	Survived tsunami	Difference (Surv-Died)	Interviewed in first resuvey	Not ivwed in first resurvey	Difference (Ivw-Not ivw)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (years)	13.0	13.0	13.0	0.03	13.0	12.9	0.12
				[0.14]			[0.24]
Male	52.34	46.09	46.09	8.86	56.14	47.90	-8.24
				[4.3]			[5.2]
Education (years)	6.3	6.5	6.2	-0.25	6.2	6.3	-0.03
				[0.27]			[0.44]
Enrolled in school (%)	92.0	93.0	91.7	-1.36	92.5	86.3	6.20
				[1.82]			[4.76]
Working for a wage (%)	4.1	3.1	4.5	1.37	4.3	5.7	-1.39
				[1.72]			[3.44]
Engaged in housekeeping (%)	6.5	3.7	7.7	3.97	7.4	9.5	-2.12
				[1.84]			[3.31]
Per capita expenditure	39.7	38.3	40.2	1.93	40.3	39.6	0.78
(Rp10,000 per month)[a]				[3.84]			[5.15]
Household size	5.9	5.7	5.9	0.21	5.9	6.1	-0.16
				[0.22]			[0.71]
Sample size	1,173	345	828		709	119	

[a]Rp10,000 is approximately equal to US$1.