

# **The Impact of Parental Death on Children's Well-being:** Evidence from an Exogenous Shock in Indonesia

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## **Abstract**

The question of how parental death affects children's welfare has become more prominent as the AIDS epidemic has generated rising proportions of children in this situation. Arriving at answers, however, is complicated by the fact that researchers are rarely able to exploit situations where parental deaths are exogenously determined with respect to other behaviors that affect children's welfare. We use panel data collected in Aceh, Indonesia before and after the 2004 Indian Ocean tsunami to address this question. The tsunami was unanticipated and death in the affected areas was determined by largely idiosyncratic factors such as proximity to the shore, which provides a window into effects on children of parental loss. In 2005-06 we conducted follow up interviews with children who were first interviewed in February 2004 as part of a cross-sectional survey, when they were between the ages of 11 and 18. We find that when a mother or father dies unexpectedly, both boys and girls remain in school at the same rates as children whose parents survived, at least for the short term. Other aspects of time use change, especially for girls. Regardless of which parent died, girls increase the time they spend on work in the household relative to girls whose parents survived. And, when the father has died, girls are also more likely to work outside the household. Finally, girls who have lost a father are much less likely to aspire to a college education. None of these impacts emerge for boys. These effects may have long term impacts on later-life outcomes as these children make the transition to adulthood, which analysis of later rounds of the data we are collecting will reveal.

## **1. Introduction**

On December 26, 2004, one of the most destructive disasters in human history occurred in the Indian Ocean. Registering a magnitude of 9.3 on the Richter scale, the Sumatra-Andaman earthquake killed upwards of 200,000 people and displaced another 1.7 million (Rofi et al. 2006, Doocy et al. 2007). The tsunami ultimately affected 26 countries bordering the Indian Ocean, but the majority of casualties occurred in Indonesia which left in its wake children who lost parents and family members.

An immediate public concern in the aftermath of the tsunami was the potential impact of parental death on surviving children's well-being, fueled in part by media reports of thousands of children left parentless, potentially at risk of mistreatment. In Indonesia most tsunami orphans were successfully resettled with family members, with UNICEF ultimately reporting that only 60 children in all of Aceh had been left without support from any adult they had known before the disaster. Although the initial predictions of large numbers of children being taken out of Indonesia illegally or institutionalized within the country did not materialize, the question of how these children have fared remains salient and largely unanswered.

More generally, the plight of children who have lost one or both parents has received considerable attention in the social science literature in recent years. The attention is due in part to the increasing proportions of children whose parents have died as a result of the AIDS epidemic. The orphan crisis is most acute in sub-Saharan Africa, where a USAID report estimates that as of 2009, in at least eight countries between 20 and 35 percent of children under 15 will have lost one or both parents (USAID, 2000). Understanding whether these children face special risks relative to children whose parents are alive is important in assessing whether policies designed to promote

investment in children's human capital should target orphans for specific interventions (Case, Paxson, and Ableidinger, 2004).

The negative effects for children of losing one or both parents may accrue through several possible mechanisms. A parent's death is almost inevitably harmful psychologically, which could in turn affect children's health and schooling outcomes. The loss of a parent could also result in a loss of family income, limiting the investments that are made in a child's health and education. Finally, loss of a parent may affect demands for children's time, shifting the emphasis away from investment in schooling and towards working in or outside the household. The extent to which these pathways operate likely varies with both the age and sex of the child and the sex of the parent that dies. For instance, a maternal death might increase the value of older daughters' time at home if they are the best substitutes for the mother. Likewise, paternal death may increase the value of older sons' time at work if they serve as substitutes for the father. On the other hand, protecting the investment that has already been made in an older child's education, by seeing that he or she completes a certain level of schooling, may be a paramount concern.

The question of whether and how much a parental death affects the children that are left behind is not straightforward to answer. Families in which a parent dies may be fundamentally different from families in which parents survive, in ways that affect children's outcomes over and above the effect of the parental death itself. Rarely are researchers able to exploit data from a situation where it is plausible that parental deaths are "randomly assigned" (although see Gertler, Levine, and Ames, 2004, and Chen, Chen, and Liu, 2009, for examples that make use of cases where deaths are from accidental causes rather than from chronic illnesses). In some cases, panel data sets can help address concerns about causality (for example, see Yamano and Jayne, 2004, Ainsworth, Beegle, and Koda, 2005, Case and Ardington, 2006 and Evans and Miguel, 2007).

This paper attempts to contribute to the literature in two ways. First, we use a plausibly exogenous cause of death. Because the 2004 Indian Ocean tsunami and the havoc it wreaked were unanticipated, and death in the affected areas was determined by largely idiosyncratic factors (such as proximity to the shore), the event provides a window into the question of how children's well-being is affected by parental deaths that are unanticipated and arguably randomly assigned. Second, we examine a wider array of child outcomes than most papers are able to consider, extending our analysis beyond children's current schooling enrollment to time allocation and aspirations for future education levels.

The data for our study come from the Study of the Tsunami Aftermath and Recovery (STAR), a panel survey of a representative sample of some 39,500 individuals in the tsunami-affected areas of Aceh and in nearby comparison areas of inland Aceh and the neighboring province of North Sumatra. This aspect of the study design is unusual in the context of disaster studies, which more typically involve drawing a sample after the event, with little information on survivors' pre-disaster characteristics or degree of representativeness of the pre-disaster population. Because we have survey data on our respondents before the event we are able to control for vulnerability of the children prior to the tsunami.

The remainder of the paper proceeds as follows. Section 2 provides the review of related literature. Section 3 gives a brief review of related literature. Section 4 describes the data and methodology. Section 5 presents the results and discussion. Section 6 concludes.

## **2. Review of Related Literature**

Some empirical literature in economics and demography examines the impact of parental death on children's schooling outcomes. We focus this review on outcomes related to schooling,

time use, and aspirations (other literature considers the impacts of parental loss on mental health). While most empirical evidence implies that parental death results in poorer schooling outcomes, some studies provide mixed results.

The earliest studies mainly used cross-sectional datasets to examine enrollment at the time of the survey as a function of a parental death at some earlier point. Because the datasets do not provide information on timing of parents' death, it is difficult to determine whether the outcomes reflect an immediate or longer term impact. Nevertheless, such studies have highlighted the various circumstances and heterogeneity in relationships between orphan status and schooling outcomes across countries. For instance, Lloyd and Blanc (1996) first used the Demographic Health Surveys (DHS) to examine the orphan status, living arrangement and enrollment rates of children aged 10-14 in seven African countries (Cameroon, Kenya, Malawi, Namibia, Niger, Tanzania and Zambia) to analyze the impact of adult mortality on children's schooling. They could not find a statistically significant impact of maternal or paternal death. Bicego et. al. (2003), using DHS data, examine the levels, trends and differentials in orphan prevalence of five countries in sub-Saharan Africa (Ghana, Kenya, Niger, Tanzania and Zimbabwe). They find that losing one or both parents is associated with reduced probability of being in the appropriate grade level for a child's age. They provide a caveat that their estimates may not reflect the true magnitude of the effects as educational attainment of the child may have begun to deteriorate with the onset of the illness of the parent. Case et. al.(2004) also used the African DHS to examine the schooling outcomes of orphans in 10 sub-Saharan African countries. Similar to Bicego et. al., they find that orphanhood depresses schooling. They however also examine different hypotheses for the source of disadvantage that orphans face and specifically test for role of living arrangements in orphans' disadvantage and whether there is within-household discrimination against orphans. They find that the lower

enrollment of orphans is largely explained by this group's tendency to live with distant relatives or unrelated caregivers.

More recent studies have used panel datasets to take into account of the dynamic impact of AIDS-induced parental death on children's schooling. Compared to the above cross-sectional studies, these studies were able to evaluate alternative explanations for children's outcomes before and after the parents' death. Yamano and Jayne (2004) used a two-year panel of Kenyan households to examine the impact of working-age adult mortality on school enrollment. Using a difference-in-difference estimation strategy, they find a significant negative impact but only among children living in poorer households. Ainsworth, Beegle and Koda (2005) used a well-designed panel survey of 757 households from Northwestern Tanzania to examine impact of adult mortality and orphan status on household's decision to send children to primary school and conditioned on that decision, the number of hours that children aged 7-14 spend at school. Controlling for baseline household characteristics, they find that adult mortality delays entry in school but it does not affect enrollment. Case and Ardington (2006) used a longitudinal survey in Northern KwaZulu-Natal to analyze the relationship between parental death and children's educational attainment, enrollment and the resources devoted to each child's education. Specifically, they separately examined the impact of maternal and paternal death on children's schooling outcomes and found that maternal death has strong negative effects on enrollment but paternal death does not have such effects. They noted that the correlation between father's deaths and children's schooling outcomes seem to be driven entirely by their common association with household socioeconomic status. An important contribution of this study is to rule out some of the concerns related to the endogeneity of parental death. The authors examined whether mother's future death has impact on child's schooling performance in the first round of survey. They also analyzed the impact of parental death within the

two survey rounds on the change observed in years of completed education and on the change observed in children's enrollment between the survey rounds. Meanwhile, a recent study by Evans and Miguel (2007) compared the changes in primary school participation of children whose parents died during the period 1999-2002 to changes for children whose parents did not die. Controlling for child fixed effects, they find substantial and statistically significant negative impact of parental death on school participation. They also find that the impact of maternal deaths is more than twice that of paternal deaths.

One study by Gertler et. al. (2004) focuses on the case of parental death in Indonesia. Using parametric and non-parametric methods, this study finds that recent parental death reduces children's enrollment in Indonesia. Their results also suggest that older children and specifically, elder daughters that have younger siblings, are at higher risk of dropping out when a parent dies.

Another study takes advantage of administrative records from Taiwan to examine the relationship between parental deaths due to accidents and college enrollment (children who attained 18 years of age before the death occurred are compared to their younger siblings who were less than 18 at the time of the death) (Chen, Chen, and Liu 2009). This paper finds that the death of a mother has a large negative impact on college enrollment, whereas the death of a father does not affect enrollment. The authors interpret this as evidence that maternal provision of nonfinancial support is as important a driver of college-going behavior as the provision of financial support that typically flows from the father. In this analysis no evidence emerges to suggest that daughters are disproportionately disadvantaged by a parental death (Chen, Chen, and Liu 2009).

### **3. Background on the 2004 Indian Ocean Tsunami**

The broad parameters of the Boxing Day Disaster have been well-documented. On December 26, 2004 the Sumatra-Andaman earthquake occurred in the Indian Ocean. Registering a magnitude of 9.3 on the Richter scale, the quake's vibrations were strong enough to shift the location of the North Pole by several centimeters (NASA 2005). The quake generated a 1200 mile rupture, offsetting the fault plane by up to 15 meters, displacing a trillion tons of water, and generating a tsunami surge that slammed into the island of Sumatra shortly after the earthquake (Kerr 2005; Lay et al. 2005; Marris 2005; Sinadinovski 2006). The tsunami ultimately affected 26 countries bordering the Indian Ocean, but Indonesia was unquestionably hit the hardest. Some 130,000 individuals perished and another 30,000 remain classified as missing (Rofi et al. 2006; Doocy et al. 2007).

The disaster has had immense consequences for the affected region. Estimates suggest that as many as 700,000 survivors were displaced and some 600,000 people (25% of the region's population) lost their source of livelihood. Many individuals in the tsunami-affected areas support themselves by fishing or farming rice. These activities were disrupted by damage to irrigation systems, fisheries and aquaculture sites, and coral reefs and by reduction in soil fertility as a result of inundation by seawater (NACO et al. 2005). Drinking water supplies were ruined as well—the tsunami is estimated to have destroyed some 600,000 wells and 15,000 hand pumps (Kohl et al. 2005).

Over the past several years research on the tsunami has begun to appear in the published literature. Less work has focused on Indonesia than on other settings even though it unquestionably suffered the largest losses.

In this study, we use the 2004 Indian Ocean tsunami event to further advance the literature. Two distinct features of the tsunami make it an exceptional event for evaluating the effects of parental death on children's outcomes. First, it was not expected. Geological evidence dates the last tsunami on mainland Sumatra to 500 years ago. Likewise, the last tsunami anywhere in the region was in 1907 (dated from coral reef damage) on Simelue Island. Second, the severity of disaster varied across areas in the region. Among the areas encompassed by our baseline survey, those that were closest to the epicenter of the earthquake and that experienced the greatest inundation of water suffered the greatest damage. Other nearby areas suffered no damage because of topographical features of the coastline such as slope and elevation. Therefore, genetic and behavioral risk factors are relatively less important in tsunami deaths than deaths from illness, which is the cause of parental death in most of existing studies on orphanhood.

#### **4. Data and Methodology**

The data for this study come from the Study of the Tsunami Aftermath and Recovery (STAR), a survey of some 39,500 individuals in the tsunami-affected areas of Aceh and in nearby comparison areas of inland Aceh and the neighboring province of North Sumatra. These individuals were living in households from which baseline data were collected in February 2004, prior to the earthquake, by Statistics Indonesia as part of their annual cross-sectional Socioeconomic Survey (SUSENAS). That survey is representative of the area's population. SUSENAS is generally regarded as very high in quality and the data have been widely used in the social science literature. Since the late 1990s, every wave of the survey has collected information on demographic, health and economic characteristics of respondents along with a special module that is administered to a sub-sample of respondents.

With Statistics Indonesia assistance, we fielded the first follow up wave (STAR1) between May 2005 and July 2006. For STAR1, we targeted SUSENAS respondents from the 2004 survey in 11 *kabupaten* in Aceh and 8 *kabupaten* in North Sumatra, which together yielded 585 enumeration areas in 525 villages. The *kabupaten* were selected because they were geographically positioned so that their coastlines were vulnerable to inundation from the tsunami waves. The extent to which inundation actually occurred varied considerably as a function of distance from the earthquake epicenter, shape of the beachfront, presence of rivers or canals flowing into the ocean, and elevation. All the *kabupaten* included in the study have a coastline that the tsunami had the potential to inundate, but all extend inland to include highland areas as well.

With respect to the initial survey (STAR0), informants reported on the socioeconomic and demographic characteristics of themselves and the household. In 2005-06 (STAR1), individual and household-level data were collected (drawing on and augmenting the STAR0 questionnaire) and a large community-level survey was conducted by interviewing village leaders, and in local schools and health facilities.

In this paper we focus on 629 children who, at the time of the tsunami were between 11 and 18 years old at the time of the post-tsunami interview and were living, at the time of the tsunami, in the communities that were heavily damaged. We limit our analysis geographically to the heavy damage zone because the majority of the parental deaths occurred in these areas. Overall, about 29% of the population in the heavily damaged zone perished (the rate for the undamaged zone, in contrast, is only 2%). Among children in our target age range, about 30% were killed. We interviewed about 84% of these surviving children (14% were not relocated, 2% refused to be interviewed). Of these children, roughly 18% lost either parent, 14% lost a mother, 9% lost a father and 5% lost both parents.

## Methods

In this paper, we examine the outcomes of surviving children aged 11-18 with respect to schooling, time use and aspirations. Two of the outcomes occurred between the time of tsunami and the first follow-up interview, which took place 5-17 months after the tsunami: an indicator of whether a child missed any school and an indicator of whether the child received a scholarship. Three other outcomes reflect the child's status at the interview date. Two of these refer to time use: whether the child is enrolled and whether the child spent time on household work in the past week. Finally, we include a measure of how much schooling the child hopes to receive – a question about aspirations for schooling. Because children express their aspirations in terms of level of schooling, we use an indicator of whether a child aspires for post-secondary schooling.

Among children from the heavily damaged zone, we compare outcomes of those who lost their parents at the time of the tsunami to those whose parents were not killed in the tsunami.<sup>1</sup> We begin by investigating the relationship between parental death and each outcome, using two specifications:

$$(1) \quad Y_{ic} = \alpha + \beta M_{ict=0} + \gamma F_{ict=0} + T + \mu_c + \varepsilon_{ic}$$

$$(2) \quad Y_{ic} = \alpha + \beta M_{ict=0} + \gamma F_{ict=0} + \delta X_{ict=-1} + T + \mu_c + \varepsilon_{ic}$$

where  $Y_{ic}$  is individual-level outcome of interest after the tsunami (all outcomes are dichotomous, we estimate our regressions using linear probability models).  $M_{ict=0}$  is an indicator of whether the mother died due to tsunami and  $F_{ict=0}$  is an indicator of whether the father died due to tsunami. Each equation above includes time and community fixed effects to take into account temporal and spatial heterogeneity.

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<sup>1</sup> Before the tsunami 7% of children were living in a household that did not include and 13% were living in a household that did not include their father. We control for pre-tsunami parental absence.

The first equation produces unadjusted regression coefficients distinguishing the effect of losing a mother and the effect of losing a father, but without controls for other characteristics of the family. The second equation adds a vector of individual-level characteristics,  $X_{ict=-1}$ , measured before the tsunami. These include an indicator variable for whether the child is at the younger end of the age spectrum (11-14 years of age), an indicator for the child's gender, indicators of maternal and paternal education (no education serves as the reference), and variables measuring the monthly per capita spending level of the child's household before the tsunami (captured as splines, with knots at the quartiles). To examine whether parental deaths affects girls and boys differently, we also estimate equation two separately for male and female children.

Because our sample size, and thus the number of children experiencing a parental loss, is relatively small, our coefficients are relatively imprecisely estimated. Our coefficients are multiplied by 100 and so can be interpreted as the percentage point difference in the outcome associated with loss of either a father or mother.

Before turning to the results of the regressions, we first discuss the summary statistics for the sample overall (Table 1). Overall, nearly one in five children lost a mother or a father at the time of the tsunami. Loss of mother was more common, affecting 14% of children. Just under one in ten children lost a father. About 5% of children lost both parents.

The second panel of the table displays our outcome variables. For children living in the heavily damaged zone at the time of the tsunami, missing school between the tsunami and the first follow-up survey is very common: fully 85% of children who were enrolled at the time of the tsunami subsequently missed some school. Such absences are not surprising given that the tremendous damage in these communities inevitably caused schooling disruptions, in part because

many school buildings were destroyed.<sup>2</sup> About a quarter of children received a scholarship to attend school after the tsunami, and by STAR2, the vast majority of children (83%) were enrolled in school.

With respect to other aspects of time allocation, a little more than one third of children spent some time helping with work around the household in the week before the tsunami. Another 9% did some work for pay in that period.<sup>3</sup>

Most analyses of children's well-being in the aftermath of parental loss focus on measures that reflect their immediate circumstances at the time of the interview. One of the ways that parental loss may affect children, however, is by changing their hopes for the future. To address the question of aspirations, we asked children who had been enrolled in school at the time of the tsunami to tell us how much education they hoped ultimately to acquire. Almost three-quarters reported aspirations for post-secondary education.

These summary statistics suggest that the tsunami disrupted schooling for many children, but that on average, enrollment and educational aspirations, were not catastrophically affected. We now turn to the question of whether these outcomes vary for children who lost their parents in the disaster.

## **5. Results and Discussion**

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<sup>2</sup> Children under the age of 15 were asked the number of weeks of school that they missed between the tsunami and the STAR2 interview. On average, these children missed 6 weeks of school.

<sup>3</sup> The relatively low levels of reported work may reflect the lack of earning opportunities in the tsunami's aftermath. While there were many "work for pay" schemes, these may have been available only to adults.

Table 2 displays the results of the effect of maternal and paternal death on the outcomes we consider. The first five columns present the coefficients for parental loss, without adjusting for other factors.

Children who lost a mother or father are not significantly more or less likely to miss school in the tsunami's aftermath. They are, however, significantly more likely to receive a scholarship. The rate of scholarship receipt is about 12 percentage points higher for children whose mothers died (the p-value for this result is 0.09). And for children whose fathers died, the rate is almost 28 percentage points higher. These results strongly suggest that parental loss, particularly of fathers, was used a mechanism to target children for assistance in getting back to school after the tsunami.

A maternal death is not associated with the other outcomes that we consider at standard levels of statistical significance, although the effects are very nearly significant for school enrolment (children who lost mothers are enrolled at higher rates than those who did not, a result that is contrary to findings in the previous literature, where loss of a mother depresses children's schooling enrollment). Loss of a mother also has a large and positive effect on spending time on household chores. Paternal deaths also have a large positive (and statistically significant) effect on having done household chores in the past week. Children who lost either a mother or a father in the tsunami participate in household work at rates that are 13-14 percentage points higher than other children.

Children who lost a father during the tsunami are also much less likely than other children to aspire to attaining a college education. The death of a father depresses these aspirations by 17 percentage points.

To summarize, relative to children whose parents survived the tsunami, children who lost parents in the tsunami are more likely to have received a scholarship in the tsunami's aftermath and

just as likely to be enrolled in school, but they are also more likely to work in the household. And when it is the father who died, they less likely to aspire to post-secondary school.

Columns 6-10 of Table 2 display the results of adding controls for children's age and sex, their parents' educational levels, the expenditure levels of their household (pre-tsunami), and whether their parents were household members at the time of the pre-tsunami interview.

The coefficients on maternal and paternal death change little once additional demographic and socioeconomic control variables are added, although in some instances they are more precisely estimated.<sup>4</sup> Children whose mothers were killed are more likely to receive a scholarship, more likely to be enrolled in school, and more likely to have performed household work in the week before the survey. Children whose fathers were killed are less likely to miss school, more likely to have received a scholarship, and less likely to aspire to college.

Although some of these relationships are statistically significant only at levels within 10%, for all of the relationships, the sizes of the effects are relatively large, generating 10 or more percentage point differences in children's outcomes.

The remaining rows of the table display the coefficients associated with other characteristics measured before the tsunami. Significant differences in outcomes emerge with respect to the child's gender and age. Males, for instance, are significantly more likely to have worked outside the home in the past week, much less likely to have worked around the household, and less likely to aspire to post-secondary education. Younger children are considerably much more likely to be enrolled at the time of the post-tsunami interview, and they are less likely to have worked outside or in the household, or to aspire to a post-secondary school education.

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<sup>4</sup> The fact that the coefficients for the measures of parental death change little upon introduction of controls for demographic attributes and socioeconomic status pre-tsunami is a good indication that parental death is randomly distributed with respect to these characteristics.

Most of the other variables that are included as controls reflect the socioeconomic status of the child's parents, as measured before the tsunami. The results do not suggest that the outcomes we consider are systematically different (or poorer) for the children from the relatively disadvantaged households pre-tsunami. Although children with relatively well-educated fathers are more likely to have received a scholarship, higher levels of maternal education are negatively associated with scholarship receipt. Children from the households that were poorest pre-tsunami are more likely to miss school after the tsunami (within the first quartile, as expenditures rise, the likelihood of missing school falls). For children from relatively well-off households (those within the third quartile of the expenditure distribution, pre-tsunami) working outside the household declines as pre-tsunami level of expenditure rises.

The last two rows of the table present the coefficients associated with living in a household in which the mother or father was absent before the tsunami. Children whose fathers were out of the household at STAR1 are more likely to receive a scholarship. Parental absence, and particularly the absence of fathers, seems to be a targeting characteristic for subsidized education.

We now turn to the question of whether parental loss affects male and female children differently. It is logical that deaths have different impacts by gender given the typical division of labor whereby females assume a greater degree of responsibility for running the home and providing care for dependents and males assume a greater degree of responsibility for bringing in income.

Table 3 shows the results for the effect of maternal and paternal death on schooling-related outcomes when we stratify by gender of the child. Because the unadjusted and adjusted estimates do not differ, we simply present the results for the adjusted estimates.

A number of differences emerge between male and female children. The impact of a paternal death on missing school is qualitatively larger in size for girls (for whom it is statistically significant) than for boys, although it is negative for both. On the other hand loss of a father has an extremely large (and statistically significant) impact on the probability of receiving scholarship for male children, as does loss of a mother. For girls, however, losing a parent in the tsunami is unrelated to scholarship receipt. Neither a mother nor father's death is related to girls' school enrollment post-tsunami, but boys' enrollment rates are higher when their mother died than when she survived.

With respect to time allocation and aspirations, the impacts of parental loss emerge for girls to a greater degree than for boys. Girls who lost their father work outside the home at higher rates than girls who did not, and girls who lost either a father or a mother are much more likely to spend time doing household chores than girls whose parents survived. Finally, girls who lost a father are much less likely to have aspirations for college. The percentage of girls expressing an expectation of going to college is fully 28 percentage points lower for those whose father died in the tsunami relative to those whose fathers survived. None of these effects emerge for boys.

Taken together, these results suggest that when a parent dies unexpectedly, boys and girls remain in school, at least for the short term, but girls increase the time they spend on work in and outside the household, with negative impacts on their aspirations for the future. The impacts of parental death on time use and aspirations do not appear for boys. Part of the explanation for the difference between boys and girls may lie in the fact that boys who have lost a parent are more frequently the recipients of scholarships than are girls— possibly the award serves to keep boys from shifting time into work.

## 6. Conclusion

The results we present provide evidence that maternal and paternal deaths do not affect children the same way. Children whose mothers were killed are more likely to receive a scholarship, more likely to be enrolled in school, and more likely to have performed household work in the week before the survey. Children whose fathers were killed are less likely to miss school, more likely to have received a scholarship, and less likely to aspire to college.

Moreover, maternal and paternal deaths do not affect male and female children in the same way. When a mother or father dies unexpectedly, boys and girls remain in school, at least for the short term, but girls increase the time they spend on work in the household (regardless of which parent died) and, when the father has died, on work outside the household, with negative impacts on their aspirations for the future.

These effects may have long term impacts on later-life outcomes as these children make the transition to adulthood. We will observe these effects in later rounds of data that we are collecting.

Much of the other work on orphans has focused on children whose parents have died of illnesses. Our results are from a context in which death was accidental and arguably randomly distributed. As such, they may not generalize to children who lose parents through protracted illness, but they can reveal the impact of parental death when the loss is unexpected.

Natural disasters will continue to plague human populations and these results give us some sense of how their toll on parents affects education and time use in the short term of the children left behind. How parental loss plays out over the long term remains to be seen. Although it appears that children were able to get back to school, even in the face of school closures immediately after the disaster, it may not be possible for them to stay in school, or progress to higher levels, once the assistance packages that were put in place after the tsunami wind down.

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**Table 1. Summary Statistics**

Variables	Children 11-18 years old
<b>Parental Loss</b>	
Lost a mother	14%
Lost a father	9%
Lost either parent	18%
Lost both parents	5%
<b>Outcomes</b>	
Missed school between tsunami and STAR2	85%
Received scholarship between tsunami and STAR2	24%
Worked for pay, past week	9%
Performed household work, past week	36%
Enrolled at STAR2	83%
Aspire for post-secondary school	80%
<b>Pre-tsunami Characteristics</b>	
Age (years)	14.6
Female	44%
Maternal Education (years)	8.3
Paternal Education (years)	9.0
Pre-tsunami PCE (rupiah)*	Rp 479,381
Mother out of household	7%
Father out of household	13%
N	629

\*US\$1 = Rp. 10,000

**Table 2. Effect of Maternal and Paternal Death on Schooling-Related Outcomes**

	Miss School	Receive Schlrshp	Enrolled in School	Worked in Past Week	HH Work Past Week	Aspire to College	Miss School	Receive Schlrshp	Enrolled in School	Worked in Past Week	HH Work Past Week	Aspire to College
Maternal death, tsunami	-9.59	11.92	8.91	6.18	13.53	3.92	-6.88	13.32	9.675	6.295	17.29	3.69
	[1.04]	[1.67]+	[1.64]	[1.33]	[1.50]	[0.52]	[0.78]	[1.74]+	[1.83]+	[1.33]	[1.80]+	[0.52]
Paternal death, tsunami	-7.51	27.60	-9.39	2.27	14.70	-16.57	-10.07	22.52	-7.34	3.049	10.23	-13.89
	[1.24]	[3.78]**	[1.04]	[0.42]	[1.93]+	[1.92]+	[1.70]+	[2.98]**	[0.86]	[0.65]	[1.47]	[1.81]+
Male							-2.97	-3.91	-0.435	7.839	-29.02	-8.22
							[0.98]	[0.98]	[0.14]	[2.54]*	[7.49]**	[2.04]*
Age: 11-14 years (ref: 15-18 yrs)							-0.94	3.98	21.726	-9.7	-13.40	-10.11
							[0.29]	[0.91]	[7.43]**	[3.96]**	[3.82]**	[3.03]**
Maternal educ: 6-8 years (ref: 0-5 yrs)							-8.25	-17.42	1.23	1.923	-5.52	3.46
							[1.06]	[1.82]+	[0.19]	[0.30]	[0.78]	[0.46]
9-11 years							0.16	-5.89	-0.019	-4.886	-0.49	-6.88
							[0.02]	[0.58]	[0.00]	[0.73]	[0.06]	[0.80]
12 years plus							-4.99	-4.17	3.566	-3.871	-8.27	13.47
							[0.63]	[0.48]	[0.53]	[0.61]	[0.99]	[1.55]
Paternal educ: 6-8 years (ref: 0-5 years)							10.76	16.33	-16.981	7.908	3.31	-0.47
							[1.43]	[1.71]+	[2.78]**	[1.51]	[0.38]	[0.07]
9-11 years							11.70	23.04	-14.04	4.061	8.77	2.21
							[1.38]	[2.85]**	[2.27]*	[0.74]	[1.14]	[0.25]
12 or more yrs							2.41	6.73	-8.747	8.563	4.84	-3.14
							[0.35]	[0.73]	[1.56]	[1.59]	[0.71]	[0.43]
1st Qrtile, per cap expend							-49.42	-37.03	6.966	10.599	1.27	-21.90
							[2.13]*	[0.92]	[0.29]	[0.71]	[0.05]	[0.93]
2nd Qrtile, per cap expend							11.16	17.19	-9.395	7.483	16.05	4.00
							[0.41]	[0.50]	[0.40]	[0.32]	[0.70]	[0.11]
3rd Qrtile, per cap expend							-12.72	-14.15	18.455	-26.776	-0.97	-16.48
							[0.67]	[0.60]	[1.09]	[1.88]+	[0.04]	[0.73]
4th Qrtile, per cap expend							0.80	8.49	4.515	-1.59	-7.88	-1.82
							[0.12]	[1.21]	[0.87]	[0.43]	[0.75]	[0.42]
Mother out of HH in STAR1							-3.33	1.81	-5.578	-4.008	-5.58	-5.57
							[0.41]	[0.18]	[0.52]	[0.57]	[0.52]	[0.54]
Father out of HH in STAR1							6.64	31.75	-4.71	9.018	-4.71	3.04
							[0.79]	[3.06]**	[0.62]	[1.46]	[0.62]	[0.32]
Constant	87.7	21.8	81.9	29.1	26.9	82.9	698	575	-5.7	-108.6	39.1	360
Observations	545	548	629	628	628	542	548	548	629	628	628	542
Ho: maternal = paternal (p-	0.86	0.11	0.11	0.66	0.93	0.13	0.77	0.27	0.10	0.7	0.58	0.16
Ho: maternal & paternal=0	0.22	0.00	0.20	0.19	0.03	0.16	0.17	0.00	0.14	0.11	0.05	0.19

Robust t statistics in bracket + significant at 10%; \* significant at 5%; \*\* significant at 1%

Table 3. Effect of Maternal and Paternal Death on Outcomes, Stratified By Gender

	Missed School		Recv'd Scholarship		Enrolled in School		Work past week		HH work past week		Aspire to College	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Maternal death from tsunami	-14.65	1.32	22.60	5.52	13.28	7.26	7.56	0.76	1.66	34.11	0.58	5.52
	[1.32]	[0.14]	[2.29]*	[0.28]	[1.74]+	[0.70]	[1.34]	[0.12]	[0.14]	[2.17]*	[0.05]	[0.84]
Paternal death from tsunami	-7.92	-27.17	31.13	19.55	-6.52	-4.09	-2.50	8.64	8.74	23.97	-9.57	-28.12
	[1.29]	[2.76]**	[3.14]**	[1.11]	[0.65]	[0.32]	[0.48]	[1.86]+	[0.97]	[2.23]*	[0.93]	[2.54]*
Age: 11-14 years old (ref: 15-18 yrs)	3.70	-11.42	2.31	7.20	25.27	18.72	-15.95	-2.42	-5.85	-19.76	-13.25	-11.70
	[0.89]	[1.80]+	[0.43]	[0.81]	[5.97]**	[3.39]**	[4.16]**	[0.67]	[1.18]	[2.60]*	[2.37]*	[3.25]**
Maternal education: 6-8 years (ref: 0-5 yrs)	1.49	-13.78	-28.17	-4.02	-1.52	8.74	2.59	1.78	-1.57	-14.54	1.01	16.52
	[0.13]	[1.31]	[2.16]*	[0.31]	[0.14]	[0.82]	[0.24]	[0.26]	[0.17]	[1.18]	[0.09]	[1.26]
9-11 years	15.78	2.41	-15.14	4.09	-3.74	14.06	-4.16	-2.24	2.59	-5.67	-12.17	11.99
	[1.18]	[0.25]	[1.14]	[0.27]	[0.41]	[1.13]	[0.35]	[0.34]	[0.24]	[0.33]	[1.02]	[0.77]
12 years or more	2.58	-6.33	-2.16	5.70	-0.36	11.87	-5.35	-4.24	1.06	-33.89	11.52	29.29
	[0.18]	[0.58]	[0.16]	[0.40]	[0.04]	[1.19]	[0.48]	[0.65]	[0.11]	[2.25]*	[0.81]	[1.62]
Paternal education: 6-8 years (ref: 0-5 years)	13.80	8.37	22.99	11.28	-20.99	-12.35	9.87	-0.20	-9.25	19.70	0.78	-6.68
	[1.13]	[0.87]	[1.49]	[0.93]	[2.26]*	[1.32]	[1.15]	[0.03]	[0.68]	[1.93]+	[0.07]	[0.52]
9-11 years	3.76	26.85	27.42	23.52	-17.38	-10.90	8.13	0.22	-9.32	20.55	5.68	-4.97
	[0.28]	[2.68]**	[1.76]+	[1.64]	[1.81]+	[0.95]	[1.01]	[0.03]	[0.78]	[1.68]+	[0.49]	[0.29]
12 years or more	-8.56	5.17	16.01	7.52	-11.56	-9.03	8.87	2.67	-6.81	25.87	6.16	-19.15
	[0.68]	[0.55]	[1.05]	[0.62]	[1.23]	[1.02]	[1.08]	[0.35]	[0.64]	[2.09]*	[0.55]	[1.39]
1st Qrtile per capita expend.	-13.15	-73.98	-86.48	12.24	1.05	19.46	21.46	-10.90	4.98	-4.35	-22.98	-33.71
	[0.67]	[1.47]	[2.03]*	[0.19]	[0.04]	[0.64]	[0.98]	[0.77]	[0.12]	[0.13]	[0.49]	[1.09]
2nd Qrtile per capita expend.	-60.22	65.17	-20.73	-7.72	43.14	-47.21	0.20	28.11	-15.92	76.66	-0.46	-6.04
	[1.83]+	[1.72]+	[0.48]	[0.16]	[1.00]	[1.08]	[0.00]	[1.32]	[0.44]	[1.57]	[0.01]	[0.11]
3rd Qrtile per capita expend.	-9.02	2.94	22.64	-45.90	-11.87	54.21	-19.01	-14.68	2.50	-21.21	-6.53	17.52
	[0.27]	[0.13]	[0.61]	[1.19]	[0.41]	[1.80]+	[0.68]	[0.72]	[0.07]	[0.60]	[0.15]	[0.64]
4th Qrtile per capita expend.	1.40	-5.91	-6.62	17.72	2.32	1.21	4.83	-4.51	7.98	-28.51	4.24	-3.61
	[0.15]	[0.53]	[0.59]	[1.54]	[0.24]	[0.19]	[0.51]	[1.26]	[0.65]	[1.72]+	[0.40]	[0.95]
Mother out of HH in STAR A	10.26	-9.59	-7.07	24.29	2.51	5.31	-1.47	-1.75	9.33	-35.76	-8.72	9.63
	[0.85]	[0.69]	[0.43]	[1.47]	[0.26]	[0.42]	[0.10]	[0.21]	[0.61]	[2.14]*	[0.51]	[0.74]
Father out of HH in STAR A	-3.68	10.08	45.90	39.34	-20.06	-15.67	15.85	-3.04	-18.60	10.99	6.72	2.01
	[0.26]	[0.97]	[3.18]**	[3.15]**	[2.23]*	[1.40]	[1.69]+	[0.46]	[1.70]+	[0.80]	[0.49]	[0.13]
Constant	261	981	1251	-31	66.23	-138.39	-236	151.8	-147	-35	365	488
Observations	304	241	291	237	355	274	354	274	354	274	297	245
Ho: mat death = pat death (p-value)	0.56	0.05	0.31	0.52	0.14	0.50	0.24	0.36	0.66	0.64	0.56	0.01
Ho: mat & pat death=0 (p-value)	0.25	0.03	0.00	0.52	0.21	0.74	0.4	0.16	0.60	0.00	0.65	0.04

Robust t statistics in brackets + significant at 10%; \* significant at 5%; \*\* significant at 1%