

# The Impact of Unexpected Maternal Death on Education – First Evidence from Three National Administrative Data Links

Stacey H. Chen, Yen-Chien Chen, and Jin-Tan Liu\*

December 17, 2008

The death of a parent is undoubtedly one of the most traumatic incidents that can happen to a school-aged child. Children who have lost one or both parents (hereafter called “orphans”) are vulnerable in many ways. If the orphans’ extended families fail to fully insure the loss incurred, then losing a parent can reduce private investment in human capital (Susan Dynarski 2003) and have a long-lasting impact on cognitive ability and socioemotional development, particularly in cases of maternal deaths (Jere R. Behrman 1999). Unfortunately, the number of orphans has increased dramatically over recent decades, mostly because of wars and the global AIDS epidemic. A quarter of a century after the initial spread of AIDS, the number of children orphaned exceeds 15 million, according to statistics published by the United Nations in 2004. In 2008, the Iraq Body Count reported the deaths of more than

---

\*Direct correspondence to Jin-Tan Liu (liujt@ntu.edu.tw): National Taiwan University and NBER; phone: 886-2-23519641 ext 520; Fax (for all coauthors): 886-2-23516846; Mailing address (for all coauthors): 21 Hsu-Chow Road, Taipei 100, Taiwan. Stacey H. Chen (chens@nber.org): Royal Holloway University of London and the Institute of Economics in Academia Sinica. Yen-Chien Chen (yenchien@ntu.edu.tw): Ph.D. candidate of National Taiwan University. Each author has an equal contribution to this work. We thank NSC and NHRI of Taiwan for financial support. Session title: Human Capital Acquisition. Chair: Kristin Butcher, Wellesley College. Discussant: Deborah Reed, Public Policy Institute of California.

88,800 Iraqi civilians and nearly 5,000 coalition soldiers during the war. Adult males account for about 90 percent of the military deaths, leaving their children with only one parent. Although the growing number of orphans is regarded as a major social issue, empirical evidence of the impact of parental death on education is surprisingly thin and mixed. For example, using data from sub-Saharan Africa, where AIDS is prevalent, Ann Case and her coauthors (2004, 2006) suggest that maternal death reduces the average number of years of schooling. However, Martha Ainsworth, Kathleen Beegle, and Godlike Koda (2005) find no evidence of adverse effects of becoming orphaned on completing primary school.

The major challenge of identification is to disentangle correlation from causality, given the limitations of the data. On the one hand, evidence of the effects of being orphaned on children in AIDS-prevalent areas may *understate* the true impact of parental death, because children whose parents have AIDS might have died from AIDS themselves prior to their parents' deaths. On the other hand, even with data from non-epidemic regions, estimates may *overstate* the effects of being orphaned, because parents' unobserved health problems can worsen children's educational outcomes and increase the probability of parental death. Thus, observed comparisons of children's education between orphans and non-orphans do not necessarily reflect the effect of orphanhood.

To address the problems of sample selection and omitted-variable bias, several authors include a comprehensive set of family background characteristics in cross-sectional analysis; for example, parents' education and alcohol abuse in Kevin Lang and Jay L. Zagoraky (2001), or city-block effects and the prior education of children in Paul Gertler, David I. Levin and Minnie Ames (2004). In an attempt to identify the impact of divorce on children, Miles Corak (2001) used parental death as one exogenous cause of parental absence. Even with many covariates, however, cross-sectional estimates still can be biased, because parental death depends on unobserved pre-existing health conditions that might have affected child outcomes prior to the actual death. While fatal diseases often cause death within years or months of diagnosis, parents may have been divorced or hospitalized, or become unemployed or alcoholic during the survival time. The orphanhood effects that are suggested by cross-

sectional comparisons based on family types might have captured pre-existing adverse effects of parents' prediction about death.

This paper uses 3 national administrative data sets from Taiwan to estimate the impact of *unexpected* parental death on college attainment. We match Birth Registry to Death Registry for the entire population of Taiwan, and link the matched data to College Entrance Tests (CET) Records. This includes about 1.6 million children's birth dates, college attainment, family backgrounds, and vital information on their biological parents', whether alive or dead, especially on the causes and timing of any death. We exploit the timing of unexpected parental death, relative to when siblings took college entrance tests to identify the orphanhood effect. Our identification strategy involves observing gaps in college enrollment *between siblings* who are orphaned by an unexpected accident *before versus after* the age of 18. Using family fixed-effects models, we present strong evidence that maternal death has a much larger impact on education than paternal death, and that cross-sectional estimates of the orphanhood effect caused by *paternal* death are mostly spurious and confounded by unobserved family backgrounds. Our result has important policy implications for the impact of women's health on the next generations.

## I. Data and Descriptive Statistics

Siblings' education and parents' death data are obtained by linking three national administrative data sets from Taiwan: Birth and Death Registries and College Entrance Test Records. Parental death is recorded in the Death Registry, including the date and cause of each death. Possible causes of death include: deadly diseases, suicides, homicides, unexpected incidents, and unknown reasons. We exclude cases of suicides, and find that the results are insensitive to this exclusion. Up to 70 percent of deaths are caused by deadly diseases, mostly by cancers. About 27 percent of parental deaths are unforeseeable (called "unexpected deaths"), including deaths resulting from traffic accidents, natural disasters, or unexpected poisoning. We observe that deceased parents are most likely to be less educated,

residing in rural areas, and having had the first child at a younger age.

Sibling data is constructed by linking Birth Registry records for 1978-1999 based on the ID of mothers whose first birth occurred between 1978 and 1985. The sibling data is complete, because we trace all births of each mother over the time span of 15 years or more, and because no mother in the last two years of this period has another baby. Finally, siblings' college-going behavior at age 18 is obtained by matching the sibling data to the College Entrance Tests Records of 1996 to 2003.

Our analysis is based on a total of 1,582,142 children from 662,587 families with more than one child. There are 1,481,840 children who are from two-parent families, and 100,302 from families with at least one deceased parent (including 27,531 children whose parent died unexpectedly). The deceased parents are disproportionately fathers, especially among those who died unexpectedly. The number of paternal deaths is triple the number of maternal deaths for all types of death; and quadruple for unexpected deaths. Our statistics show that younger fathers are more likely to die from an accident, while older fathers are more likely to die from disease. With detailed information on parental death and a large sample, we are able to overcome many identification difficulties that earlier studies have faced.

The "treatment" variable in this study is an indicator for being orphaned at age 18. Children's educational outcome is measured by college attendance at the age 18. At that age, about 14.4 percent attend college if both parents are alive. Losing a mother or a father is associated with a 6 percentage point reduction in college enrollment rates; the enrollment rates drop by approximately 2 percentage points more for those orphaned by an accident. We use regression analysis below to examine how much of these reductions in college enrollment rates by parental death can be explained by differences in observed demographics between orphans and non-orphans.

## II. Cross-sectional Analysis

Cross-sectional comparisons of college enrollment rates between orphans and non-orphans are presented in Panel (A) of Table 1, with preliminary estimates based on linear probability models. We control for children's and parents' demographics, including each child's sex, birth year, and birth order; and the full set of indicators for residential counties, parents' age at birth, mother's age at the first birth and parental education. In contrast to the previous statistics that showed a 2 percentage point reduction in enrollment rates among children who lost parents to an accident, relative to those orphaned by any reason, the cross-sectional estimates suggest that the effect of being orphaned by any reason almost equals that of an unexpected parental death. In particular, losing a mother or a father - either to an accident or not - is associated with a 3 percentage point reduction in college enrollment rates, conditional on the covariates. These estimates are significant and represent about 20 percent of the overall enrollment rate (14.4 percent).

It is noteworthy that about half of the orphanhood effect suggested in the cross-sectional analysis is explained by the variation in observable demographics. It is likely that unobserved family backgrounds also affect children's education and parents' mortality. For example, parents who work in a high-risk but low-income job may suffer from higher mortality rates and invest less in children's education. As a robustness check, we add the average taxable household income in the town of residence as a plausibly exogenous proxy for household income. We find that the cross-sectional estimates remain almost the same (not reported here). To formally address the issue of unobserved family backgrounds, we next use family fixed-effects models to examine the robustness of the cross-sectional results, as below.

Table 1: Effect of Parental Death on College Attainment

	All types of death (1)	Unexpected death (2)
<b><i>A) Cross-sectional analysis</i></b>		
Mother died	-0.0310 (0.0020)	-0.0318 (0.0036)
Father died	-0.0273 (0.0012)	-0.0257 (0.0019)
p-value: mother died=father died	0.1256	0.1378
<b><i>B) Family Fixed-effects</i></b>		
Mother died	-0.0206 (0.0086)	-0.0422 (0.0220)
Father died	-0.0071 (0.0038)	-0.0034 (0.0085)
p-value: mother died=father died	0.1532	0.0467
Number of children	1,582,142	1,497,567
Number of families	662,587	630,531

Note: Robust standard errors in parentheses. Adjusted for family clustering in Column (1). In Column (2), we exclude subjects whose parent died by reasons other than unexpected incidents.

### III. Family Fixed-effects Analysis

Orphaned and non-orphaned families can differ in ways that cannot be measured or observed by data analysts. For example, children who are eventually orphaned may receive less family nurture than non-orphans, probably because of higher discount rates of the parents. Cross-sectional comparisons may yield a spurious result if the “control group” (i.e. children from two-parent families) essentially differs from the “treatment group” (i.e. those orphaned by an unexpected parental death).

In this section we use the timing of unexpected parental death to construct control and treatment groups *within families*, in order to remove differences between siblings. For this purpose, in Table 1 we focused on families with at least two children who turn 18 during our sample period of CET (1996-2003), because they were eligible to take college entrance

tests. For each of these families, the treatment group is the younger siblings who were unexpectedly orphaned by the age of 18, while the control group is the older siblings who were not orphaned until the age of 18 or older. We identify the orphanhood effect using the mean difference in college attainment among siblings in a given family, conditional on the same set of children’s characteristics as in the cross-sectional analysis (including gender, birth year, and birth order).

Using a family-fixed-effects model, we find a much smaller orphanhood effect than the cross-sectional estimates suggested, if we do not distinguish maternal from paternal death. Though not reported in the table, we find that losing a parent (either a mother or a father, to all death types) induces a 1 percentage point decrease in college enrollment rates, which is only 40 percent as large as the cross-sectional estimates. Evidently, the bulk of the observed gap in education between orphans and non-orphans results from variations in unobserved family background characteristics.

As we separate out the effect of being orphaned by maternal versus paternal death, two results clearly stand out in Table 1. First, after taking account of family-specific effects, we find that losing a father has a very small and insignificant effect on children’s college attainment, irrespective of the cause of death. In contrast, losing a mother has a drastic impact on college enrollment: the average enrollment rate decreases by 4.2 percentage points if the death is unforeseeable, and by 2.1 percentage points for all deaths. These figures represent as much as 30 percent and 15 percent respectively of the average college enrollment rates for children from two-parents families.

Second, after accounting for family-fixed effects, we find that losing a father (to an accident or not) has a very small and insignificant impact on children’s college attainment, contrary to the previous cross-sectional results. This suggests that cross-sectional estimates of the effect of being orphaned by a father’s death are spurious, driven mostly by family backgrounds not observed by data analysts.

The evidence that losing a mother has a greater impact on education than losing a father is robust, regardless of various models or sets of covariates (not reported here). This

finding is similar to Ann Case and Cally Ardington (2006) results using data from South Africa, though dissimilar to Gertler, Levine, and Ames' (2004) work that relied on data from Indonesia. As Behrman (1999) has noted, a mother's traditional role of rearing a child has a stronger impact on the child's cognitive ability and socioemotional development than a father's traditional role as bread winner. Our results also echo Stephen Cameron and James J. Heckman's (1998) finding, which suggests that college-going behaviors are driven primarily by long-term effects of family nurture, not by short-term effects of financial constraints – induced possibly by the recent loss of a father.

## IV. Conclusions

In this paper we use an unusually large administrative dataset from Taiwan to estimate the impact of unexpected parental death on children's college attainment. Our fixed-effects estimates suggest that loss of a mother has a considerably larger impact on children's college attainment than loss of a father, especially when the death is unexpected. Perhaps surprisingly, we find that the impact of paternal death is small and insignificant, regardless of death type, contrary to what the cross-sectional estimates have suggested. This suggests that the cross-sectional estimates of the effect of paternal death are mostly spurious, because much of the bias is attributed to unobserved family backgrounds. Furthermore, losing a mother unexpectedly causes the college enrollment rate to drop by more than 4 percentage points, which is twice the impact of losing a mother for all reasons.

Our study strongly suggests that losing a mother hinders the opportunity to attend college, while the impact of losing a father seems less clear. Much prior work has suggested that college-going behaviors are driven primarily by academic readiness, not credit constraints, but our findings highlight maternal roles in non-financial support, probably no less important than provision of financial support in shaping children's cognitive ability.



## References

- Ainsworth, Martha, Kathleen Beegle and Godlike Koda. 2005. "The Impact of Adult Mortality and Parental Deaths on Primary Schooling in North-Western Tanzania," *Journal of Development Studies*, 41(3):412-439.
- Behrman, Jere R. 1999. "Labor markets in developing countries" Chapter 43 in *Handbook of Labor Economics*, vol(3): 2859-2939
- Cameron, Stephen, and James J. Heckman. 2004. "Life-Cycle Schooling, and Educational Selectivity: Models and Choices" *Journal of Political Economy*, 106 (2):262-333.
- Case, Anne, Christina Paxson and Joseph Ableidinger. 2004. "Orphans in Africa: Parental Death, Poverty, and School Enrollment." *Demography*, 41:483-508.
- and Cally Ardington. 2006. "The Impact of Parental Death on School Outcomes: Longitudinal Evidence From South Africa," *Demography*, 43(3):401-420.
- Corak, Miles. 2001. "Death and Divorce: The Long-Term Consequences of Parental Loss on Adolescents," *Journal of Labor Economics*, 19(3):682-715.
- Gertler, Paul, David I. Levine, and Minnie Ames. 2004. "Schooling And Parental Death," *Review of Economics and Statistics*, 86(1):211-225.
- Lang, Kevin and Jay L. Zagorsky. 2001. "Does Growing up with a Parent Absent Really Hurt," *Journal of Human Resources*, 36(2):253-273.
- Dynarski, Susan. 2003. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion," *American Economic Reviews*, 279-288.