PAA 2012 Extended Abstract – The Impact of a Natural Disaster on Child Health and Mortality

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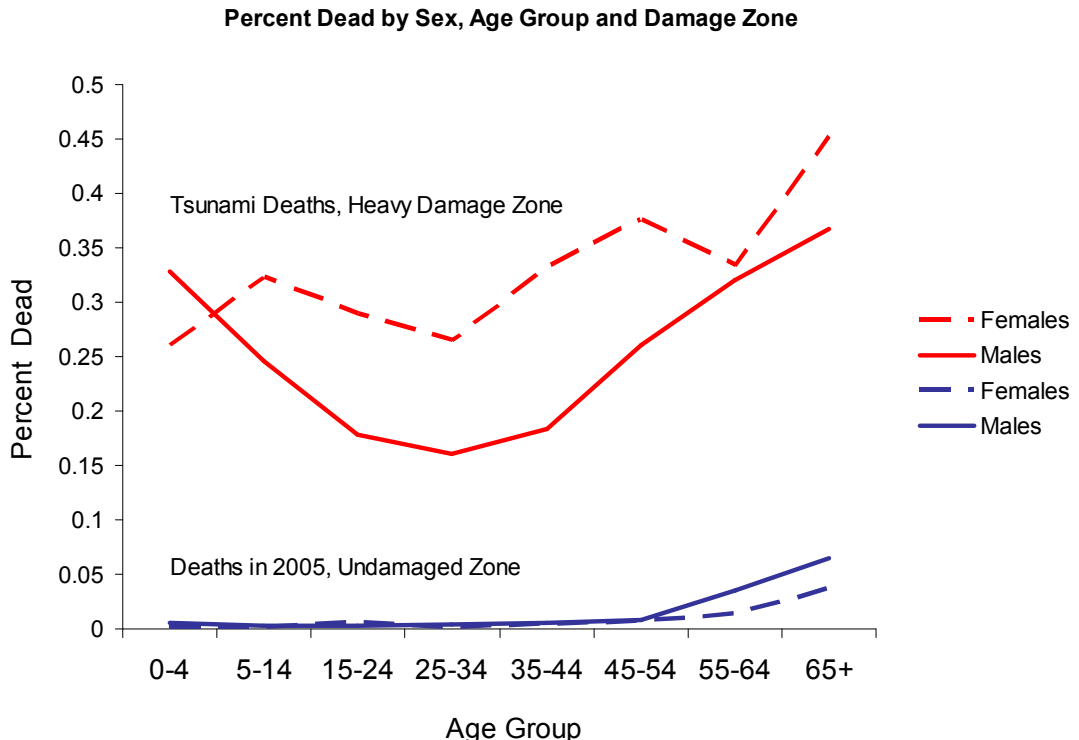
On December 26, 2004 an earthquake registering 9.1 on the Richter scale occurred 100 miles off the north-western coast of Sumatra, Indonesia. The earthquake resulted in a tsunami that hit the coast of Indonesia within 30 minutes and subsequently reached the coasts of, Thailand, Sri Lanka, and the East Coast of Africa. In Indonesia, the tsunami was largely unanticipated and the provinces of Aceh and North Sumatra were the hardest hit with an estimated 120,000 to 160,000 dead or missing and 700,000 displaced (Doocy et al, 2007; World Bank, 2005a). The disaster also destroyed much of the infrastructure and productive assets in the impacted communities leaving an estimated 600,000 without their primary source of income (World Bank, 2005b).

Using extremely rich longitudinal survey data collected before and after the Indian Ocean tsunami, we investigate the impact of the earthquake and tsunami on the mortality rates of children and on the height of young children who survived the tsunami or were born shortly after the tsunami.

Data for this research are drawn from the Survey of the Tsunami Aftermath and Recovery (STAR). STAR a demographic, health, and economic longitudinal survey of around 35,000 people households living in Aceh and North Sumatra prior to the tsunami. A population representative baseline survey was collected in February 2004, 10 months before the disaster, by Statistics Indonesia as part of their annual Socioeconomic Survey (SUSENAS). Five follow-up surveys were fielded annually beginning in May 2005, 5 months after the disaster. Attrition from the sample is low. Among survivors, 93% of respondents have been re-interviewed after the tsunami. Surveyed communities include both sites in heavily damaged parts of Aceh, as well as undamaged sites.

Figure 1 displays mortality rates by age, sex, and damage zone, as measured in 2005, for respondents to the 2004 survey.



Relative to the respondents in the undamaged areas, respondents in the heavy damage areas died at extremely high rates between the baseline survey and the follow up survey: 25-35%.

An interesting pattern emerges for children. Among those 0-4 at the time of the tsunami, mortality is lower for female children than for male children. Around age 5, however, this differential reverses and male mortality drops considerably below that for females.

We will explore the correlates of mortality after the tsunami, focusing on whether factors known to be protective outside the context of a natural disaster are also protective in this context (for example, socioeconomic status and parental education). We will interact these factors with child's sex to see if we can determine what factors underlie the seeming female survival advantage among infants and very young children.

We next turn to height. A substantial literature in the health and social sciences that uses both experimental and non-experimental methods establishes that linear growth in the first two or three years of life is a powerful predictor of attained adult height and health in later life as well as economic prosperity in adulthood, particularly in contexts where work is physically demanding (Haas et al., 1995; Rivera et al., 1995; Schroeder et al., 1995; Strauss and Thomas, 1995; Alderman et al., 2006; Hoddinott et al, 2008; Bozzoli et al., 2009).

There is also evidence suggesting that exposure to disasters results in reduced child growth. Foster (1995) finds that children exposed to severe flooding in Bangladesh in 1988 had lower body weight, especially for poor children. Hoddinott and Kinsey (2001) find evidence that children exposed to a drought in Zimbabwe between 1 to 2 years of age lost 1.2 to 2 centimeters of growth. Likewise, del Ninno and Lundberg (2005) find evidence that children exposed to flooding in Bangladesh in 1998 were shorter than unexposed children. A legitimate concern with all of these studies is that the disasters were predictable and that the estimated impacts may be contaminated by behavioral responses such as migration away from the study site. This not a concern with the Indian Ocean tsunami which can be treated as an unanticipated and exogenous shock.

Several features of STAR are key for this research. First heights of children and adults are measured in post-tsunami waves. Taking the biology of linear growth in combination with the timing of the tsunami it will be possible to identify the causal effect of the shock associated with the tsunami on child height. Specifically, comparing the heights of children age 0-3 at the time of the tsunami with those age, say, 4-7, at that time will provide one estimate of the impact of the tsunami. To take into account age effects, we will compare the heights of the younger cohort when they are age 4-7.

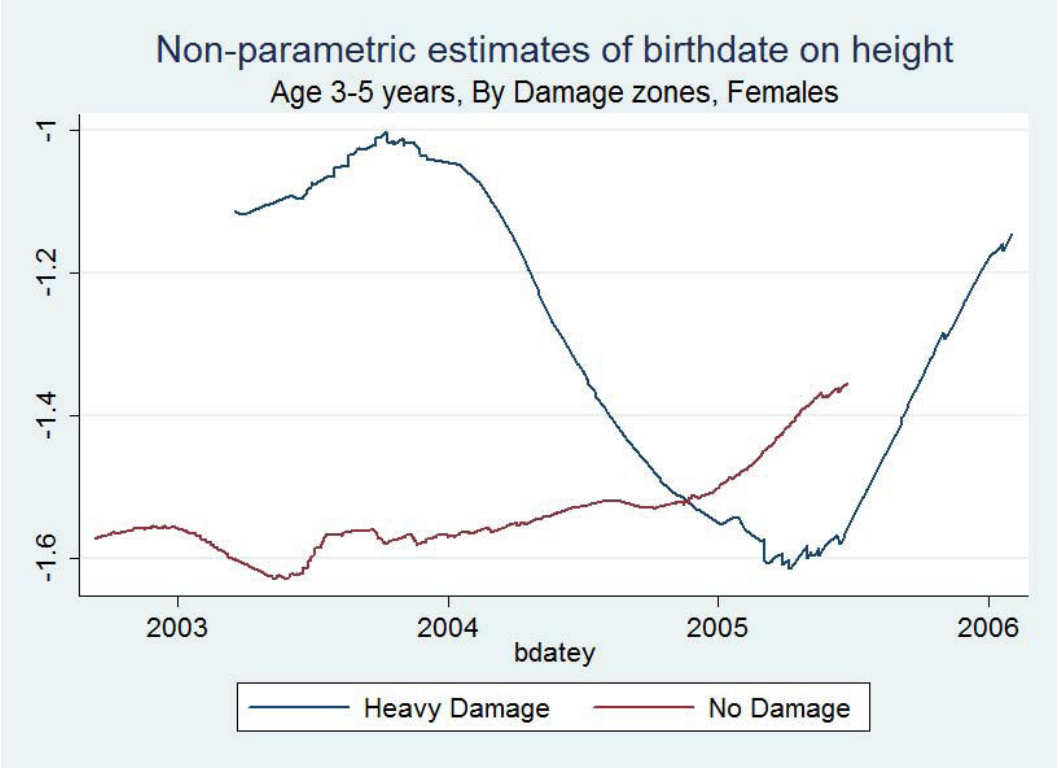
These estimates are also potentially biased by time effects. As a first step to take these into account, the research will draw on a second feature of STAR that is important for this research. Specifically, the study design includes both communities that were directly impacted by the tsunami and those that were not directly impacted. Using the latter as a "control" group for the impacted communities, the differences in growth of young children relative to older

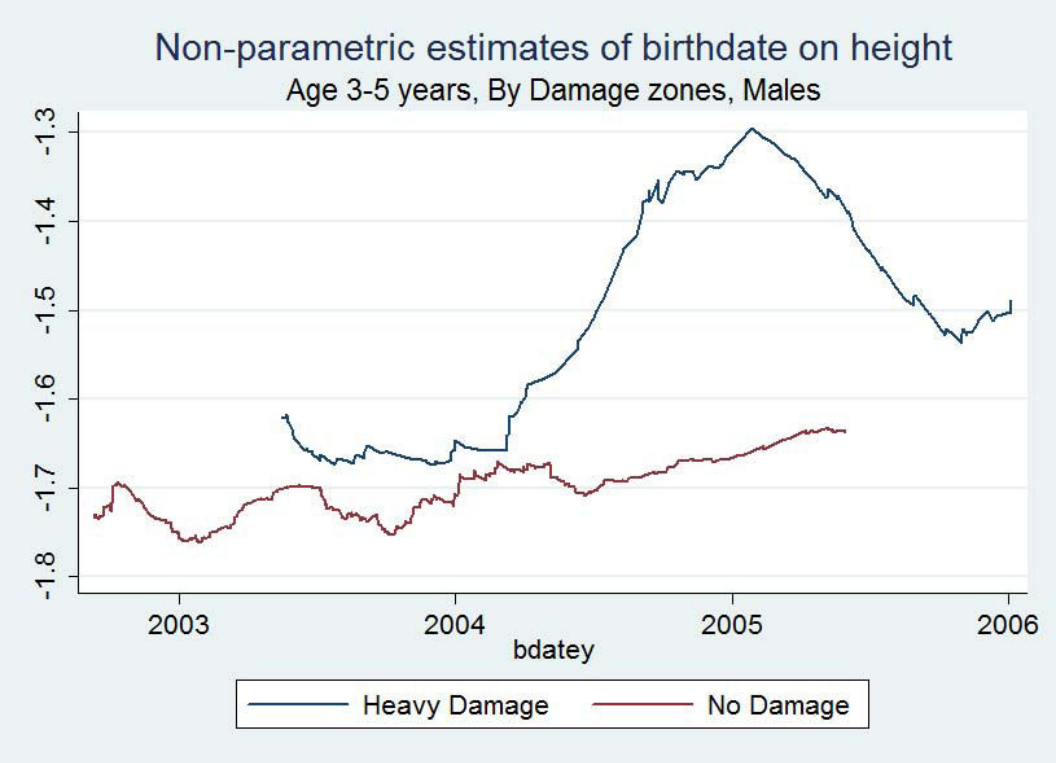
children in the impacted relative to the areas that were not directly impacted provides an estimate of the impact of exposure to the tsunami that takes into account a common time effect.

It is possible that the time effects differ in areas that were directly affected by the tsunami relative to those that were not. To address this concern, I will draw on a third feature of STAR to model the process of economic growth and reconstruction. Specifically, STAR collects extremely detailed information at the individual, household and community level about economic activity, reconstruction efforts, and assistance from government and non-government sources. Developing a measure of economic damage due to the tsunami and a time-specific measure of redevelopment after the tsunami, I will assess the extent to which the difference-in-difference estimates of the causal effect of the tsunami are mediated by economic change. Exploiting these data in combination with the range of ages of children, including those born after the tsunami, and the multiple waves of STAR, this research will provide a richer assessment of the impact of an unanticipated shock on the height of children.

Preliminary results are presented in the figures below, which display non-parametric estimates of height-for-age z-scores by age, sex, and damage zone. The pattern in interesting: for girls from the heavy damage zone who were born just before or just after the tsunami, there is a huge decrease in height-for-age z-score, suggesting that the disaster had a major effect on their linear growth patterns. In the meantime, the pattern for boys is the exact opposite: boys who were born just before or just after the tsunami have a huge increase in their height for age z-scores relative to boys born several years before or after the event.

In combination with the mortality results above, it suggests that the selection process with respect to who dies and survives during the tsunami differs considerably by gender. Our full paper will explore this dynamic, as well as lay out the correlates of mortality and health status in the tsunami's aftermath.


Non-parametric estimates of birthdate on height
Age 3-5 years, By Damage zones, Females
-1
-1.2
-1.4
-1.6
2003
2004
2005
2006
bdatey
Heavy Damage
No Damage


Non-parametric estimates of birthdate on height
Age 3-5 years, By Damage zones, Males
-1.3
-1.4
-1.5
-1.6
-1.7
-1.8
2003
2004
2005
2006
bdatey
Heavy Damage
No Damage

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