Family Formation in Indonesia after the 2004 Indian Ocean Tsunami

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The death of a spouse has many implications for the surviving partner and other family members. Events that cause high mortality within a population may disrupt not only the lives of those who lose a partner, but the dynamics of family formation more generally. In this paper we will use data from before and after the 2004 Indian Ocean tsunami to examine how marriage patterns are affected by a high mortality natural disaster. We draw on data from a unique longitudinal panel survey implemented in Sumatra, Indonesia following the 2004 Indian Ocean tsunami.

The 2004 Indian Ocean Tsunami

On December 26, 2004 the Sumatra-Andaman earthquake occurred in the Indian Ocean. The quake ruptured 1200-mile segment of the ocean floor and generated a tsunami surge that slammed into the island of Sumatra shortly after the earthquake.

Several elements of the disaster are particularly relevant with respect to examining relationships between mortality and union formation. First, the event took a heavy toll on human life, killing an estimated 160,000 people (roughly 4% of the population of Aceh, the province most severely affected). Second, mortality was higher for women than for men. Third, the tsunami was unexpected (the last major tsunami on mainland Aceh occurred some 600 years previously). Fourth, the effects were not uniformly distributed along Sumatra's coast but even within fairly local areas reflected complex interactions of function of slope, wave type, water depth, and coastal topography (Romakrishnan 2005).

Data

STAR is a multiwave longitudinal study that draws on a subset of respondents to the 2004 National Socioeconomic Survey (SUSENAS), implemented 10 months before the tsunami. With Statistics Indonesia assistance, we fielded the first wave of STAR between May 2005 and July 2006. We sought to recontact roughly 40,000 individuals originally interviewed in 9100 households in 585 enumeration areas in Aceh and North Sumatra. These communities span a continuum of damage, from near complete destruction to no damage.

We were able either to interview or establish the survival status of some 96% of original respondents. We collect detailed demographic and socioeconomic data on individuals and their immediate and extended families, as well as from community leaders. Additional follow-ups have been conducted annually through 2010. Variation in damage is measured through a combination of satellite imagery, surveyor reports, and informant interviews (Gillespie et al., 2009).

Analysis

Our analyses consider four aspects of marriage in post-tsunami Aceh. First, we document changes in widowhood, by sex and damage zone, after the tsunami. Second, we describe the transition from widowhood to remarriage and consider factors associated with it. Third, among those who remarry, we compare the characteristics of the new

partners to the original partners who perished in the tsunami. Fourth, we examine how entry into marriage (both first- and higher-order marriages) varies between heavily damaged and undamaged communities in the period after the tsunami. Below we describe preliminary results.

a. What was the incidence of widowhood?

We begin by describing how the tsunami affected existing marriages. Among communities in the zone of heavy damage the mortality rate from the tsunami averaged 25%, with a bigger toll on women than men. In communities outside this zone, mortality was low—on average about 1%-2% of respondents died between the pre-tsunami baseline survey and the first post-tsunami follow-up.

Table 1 (below) presents, by damage zone, the distribution of couples across four categories of husband-wife survival status. In the heavy damage zone, a full 15% of couples died. When only one spouse perished, it was much more likely to be the wife. That pattern is reversed in all other zones, which reflects the more standard age-sex patterns of mortality in which adult men die at younger ages than adult women.

Table 1: Spousal Survival Status, 2005-2006 (Wave B)[1]

	Both Died	Husband Survived, Wife Did Not	Wife Survived, Husband Did Not	Both Survived	Total
Heavy	15.10%	6.12%	3.86%	74.92%	100.00%
Moderate	0.25%	1.01%	1.89%	96.86%	100.00%
Light	0.49%	0.58%	2.63%	96.30%	100.00%
None	0.37%	0.67%	2.24%	96.72%	100.00%

b. What do patterns of remarriage look like over time?

Both men and women were widowed by the tsunami, but differentially high female mortality produced disproportionately elevated levels of male widowhood in heavy damage zones. In Figure 1 we present changes in widowhood over time, for male and female survivors who were married at the time of the pre-tsunami baseline survey. Among men in the heavy damage zone there is a sharp rise in widowhood, followed by a steady decrease until 2009. In contrast, for men outside the heavy damage zone there is a small rise between 2004 and 2005, after which the increases are very gradual. For females the differences between damage zones are practically non-existent. Interestingly, in the heavy damage zone men are more likely to be widowed than women in 2005, but by 2009 this difference has completely reversed, as men have remarried.

[1] Interviews comprising Wave B took place between May 2005 and May 2006, five to eighteen months after the December 26, 2004 tsunami.

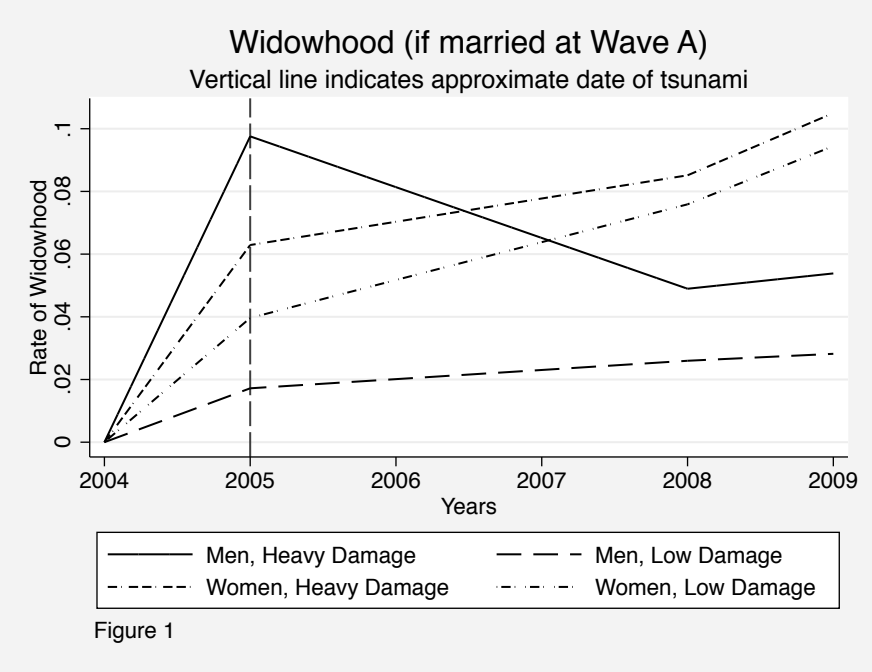

Figure 1

Nearly 10% of males married prior to the tsunami lost their spouses at the event. Five years after the tsunami, half have remarried. Remarriage after the tsunami does not alter the transition into widowhood for women. These findings are broadly consistent with studies of repartnering in the developed world being lower among women than men (Wu and Schimmele, 2005).

c. How do partner characteristics change as the widowed remarry?

Men who remarried after losing a wife in the tsunami chose partners who are different from those men's pre-tsunami mates. New marriages for males are characterized by relatively younger, better-educated wives. Prior to the event, males were on average 8 years older than their spouses.[2] With post-tsunami remarriage, the average age gap increased to over 13 years. Gaps in education moved in the opposite direction. In 2004, married couples were roughly equivalent in terms of years of education. On average, men remarried women relatively better educated than themselves by approximately half a year, shifting the education advantage in favor of their new wives. The distributions of husband-wife age and education differentials, by marriages formed pre-tsunami and re-marriages entered into after the tsunami, are displayed below.

[2] Here, we restrict our set of males to those exposed to heavy damage and subsequently widowed in 2004.

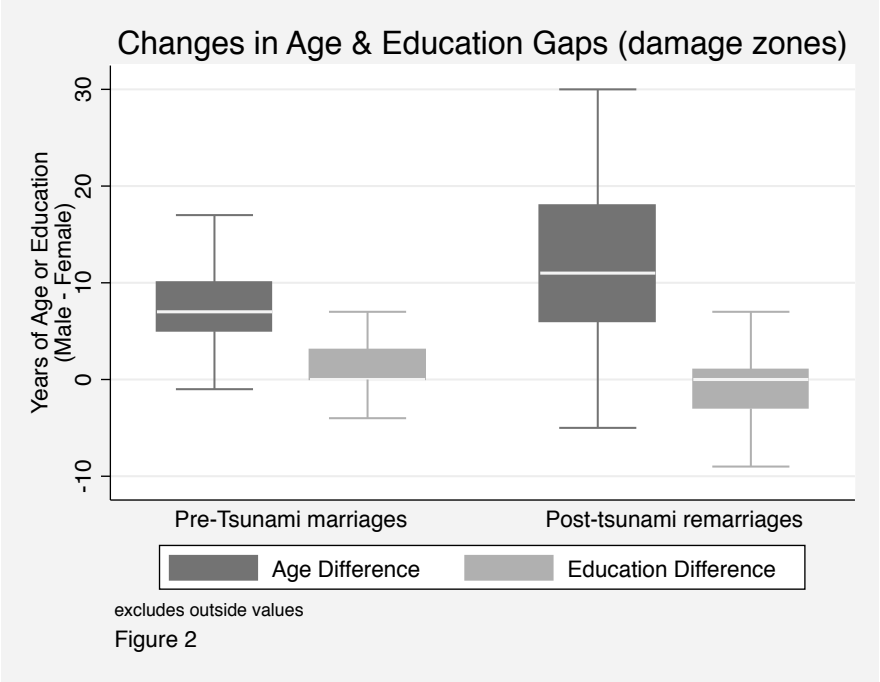

Figure 2

Initial comparisons with regions of Aceh outside the heavy damage zone suggest that the remarriage trends observed in areas of heavy damage are typical of remarriage across the province—in general, when a man remarries, he marries someone younger and better educated than his previous spouse. Thus, within couples the pattern of change in spouse characteristics may not differ by damage zone, but for the population as a whole, the frequency of new marriages is much higher in the heavy damage zone because so many men lost wives.

d. Impact on local marriage dynamics

In the developed world, repartnering is generally lower among women than men. Holden and Smock (1991) point out the economic necessity of remarriage for many widowed or divorced women for which vulnerability is increased after the conclusion of a first marriage, a dynamic which may broadly explain relatively high demand for males on the remarriage market. Aceh's society, where men have more flexibility in the jobs they take, and more mobility than women, perhaps exacerbated this dynamic (McFerran 2009; Berger 2005). We expect that the combination of pre-existing gender norms with tsunami mortality exerted unusual pressure on marriage dynamics.

We use logistic regression to explore how the probability of entering into marriage is related to damage zone and widowhood status just after the time of the tsunami. We present in Table 2 the results of preliminary analysis for male and female respondents between the ages of 11 and 45.[3]

[3] For reasons of accessibility, STAR roster data were used for preliminary analysis. Marriage histories will provide more reliable markers of age, education, and assets.

Table 2: Probability of Entry into Marriage, 2005-2009

	Males	Females
	(T-statistics in parenthesis)	
Heavy damage	0.01	0.25
	(0.13)	(2.60)
Widowed by 2005	0.01	-0.73
	(0.02)	(-1.78)
Heavy damage X widowed	1.27	0.54
	(2.83)	(0.94)
Worked last week?	0.23	0.16
	(2.24)	(1.51)
*Age at Wave F**		
11-17	1.09	1.23
	(2.99)	(6.77)
18-25	0.45	0.34
	(14.27)	(18.43)
26-35	0.13	-0.07
	(9.61)	(-4.26)
35+	-0.08	-0.16
	(-8.31)	(-9.96)
*Years of Education^*		
0-6	0.37	0.45
	(3.49)	(4.21)
7-9	0.31	0.54
	(2.98)	(4.51)
Constant	-12.32	-11.15
	(-4.90)	(-8.93)
Pseudo R2	0.34	0.32
N	6623	5827

**Modeled using piecewise linear splines*

^Modeled with indicator variables

Among men who were unmarried just after the tsunami, those residing in the heavy damage zone (at the time of the tsunami) are no more likely to enter into a marriage within the five years after the disaster than are men outside of that zone. For women, however, the story is different. Between 2005 and 2009, women in areas of heavy

damage experienced significantly higher likelihood of marriage than women in relatively unaffected areas.

Gender patterns to marriage also differ by whether an individual is widowed just after the tsunami. Male widowers are no more or less likely to enter into marriage over the next five years than never-married males, but female widows are much less likely to enter into a marriage than are never-married females. These differentials vary by damage zone. There is a strong positive effect on marriage for male widows in the heavy damage zone. For female widows the damage effect is also positive, but it is not statistically significant. Actively working men and women experienced improved odds of marriage, an effect stronger and more significant for men. In general, younger and better-educated men and women were more likely to marry between 2005 and 2009, but the age profile differs somewhat for men and women.

Plans for Further Developing the Paper

The preliminary results presented above provide a strong foundation for leveraging this research to more fully exploit the richness of the STAR data and address important hypotheses in the demographic literature about factors that affect marriage formation. First, it has been suggested that a parent whose spouse has died will seek a new partner to assist with raising surviving children; these effects should be strongest for a widow or widower with young children who survived the tsunami. We will test this hypothesis and also examine the impact of age- and gender-specific surviving children on the quality of the marriage match. Second, it has been suggested that a widow or widower will re-marry to rebuild families. This is a form of the replacement hypothesis which has played a prominent role in the demographic literature. Death of children in the tsunami, as well as fertility outcomes of newly married couples after the tsunami, provide unique windows to test this hypothesis. Third, studies suggest that marriage depends on economic resources. The destruction of houses and land in the tsunami shifted the distribution of wealth within the study communities. We will investigate whether marriage and re-marriage are related to the evolution of economic status before and after the tsunami as reconstruction progressed. Fourth, marriage and migration have been linked in the literature. We will examine the extent to which migration choices and marital outcomes are co-related.