Tsunami Mortality in Aceh Province, Indonesia

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ABSTRACT

Cluster sample surveys of a total of nearly 1,600 Indonesian households in eight coastal districts in Aceh Province were conducted between February and August 2005. Completed analysis of 388 households in Aceh Barat and Nagan Raya Districts, showed that 61.8% of households reported one or more family members as dead or missing (here, presumed dead) as result of the tsunami, with an overall mortality rate of 13.9% (95% CI: 12.4-15.4). Risk of death was greatest in the youngest and oldest age groups and among females. Data from additional surveys in other areas of Aceh Province (including Banda Aceh, Aceh Besar, Aceh Jaya are now being analyzed but are expected to show similar patterns of higher risk of mortality among females and among the youngest and oldest age groups. Data below are presented for mortality findings from the two districts of Aceh Barat and Nagan Raya on Aceh's west coast.

INTRODUCTION AND METHODS

Out of a pre-tsunami population estimated by the Government of Indonesia at 338,985 in Aceh Barat and Nagan Raya Districts (WFP, 2005), approximately 1,500 were confirmed dead and more than 13,000 were reported missing as of January 23, 2005. An estimated 30,564 internally displaced persons (IDPs) were residing in more than 30 locations in ten sub-districts of Aceh Barat and three sub-districts of Nagan Raya (Indonesian National Army, 2005); this number was believed to include some but not all of IDPs residing in host communities, and thus may be an underestimate of the total IDP population in the two districts.

A survey of the displaced population in affected sub-districts in Aceh Barat and Nagan Raya Districts was conducted between February 1 and 5, 2005. Affected sub-districts included Johan Pahlawan, Samatiga, Arongan Lambalek, Mereubo, Kaway XVI and Bubon in Aceh Barat, and Kuala and Darul Makmur in Nagan Raya. A total of 36 villages in four sub-districts in Aceh Barat were completely destroyed; the remaining affected districts absorbed a large number of IDPs and were thus classified as affected. In Nagan Raya, Kuala sub-district was the most heavily affected by the tsunami, with over 8,000 people being displaced.

As of January 23, 2005, an estimated 21,369 and 9,964 IDPs were residing in various locations in Aceh Barat and Nagan Raya Districts, respectively (Indonesian National Army, 2005). No specific information was available on the specific numbers of IDPs residing in camps versus in host communities, though it was estimated by some local sources that the breakdown was approximately 50:50 at the time of the survey design. Due to logistical complexities of accessing some populations farther inland, a total of 4,428 IDPs in Woyla, Woyla Barat, Woyla Timur, Pante Ceureumin sub-districts in Aceh Barat were excluded from the survey area, resulting in a reference population of 26,905 IDPs living in camps and host communities.

A cluster sample survey design was used, with probability proportional to size. Selection of clusters (n=20) was by camp location; population figures for the sampling frame were provided by the Indonesian military and were the most recent available (Indonesian National Army, 2005). The sampling interval was determined based on a total reference population of 26,905 IDPs. Of the 20 resulting clusters, there were twelve clusters in ten locations in Aceh Barat and eight clusters in six locations in Nagan Raya. A total of 20 households were sampled in each cluster; of these households, ten resided in the IDP camp and ten were being hosted by families living in surrounding communities.

For households residing in IDP camps, within-cluster sampling was conducted systematically using lists of households (when available) or by estimating the total number of households in a camp and then selecting every n^{th} household. Self-settled IDP households that were residing in host communities were identified by randomly selecting a direction from the IDP camp, proceeding to the nearest house, and inquiring if any IDPs were being hosted. Each adjacent house was visited until a total of ten IDP households had been interviewed. Informed, verbal consent was obtained from each respondent before interviews were conducted.

IDP household information was collected using a questionnaire developed by Mercy Corps and Johns Hopkins, which focused on household composition preceding the tsunami and current status of household members, as well as resettlement intentions and household livelihoods. The questionnaire was developed in Bahasa and English, and back translation and field testing were performed by Mercy Corps Indonesia. Interviewers were students from the University Student Organization of Aceh Barat; all received three days of training.

Data analysis was performed using STATA Version 8 (Stata Corp, College Station, TX) and SPSS Version 12.0 (SPSS Inc., Chicago, IL). Permission to conduct the survey was received from the Indonesian military and from community leaders in each IDP location surveyed. The study was approved by the Committee on Human Research, Johns Hopkins Bloomberg School of Public Health.

RESULTS

A total of 394 IDP households were surveyed in Aceh Barat and Nagan Raya districts. Of households surveyed, 59.8% were in Aceh Barat and 40.2% were in Nagan Raya. Interviews were completed in 200 IDP households residing in camps and 194 households in host communities.

The pre-tsunami population of the 388 households surveyed included 2,128 individuals. Post-tsunami status was reported for 2,121 individuals: 1,672 (78.8%) were alive and living in the household, 154 (7.3%) were alive and living elsewhere, 190 (9.0%) were dead, and 105 (5.0%) were reported as missing/status unknown. For this analysis, it was assumed that those who were still reported as missing/status unknown one month after the tsunami were likely to be dead. The mortality impact of the tsunami is discussed in terms of those presumed dead, which includes both those known to have died and those whose status was reported as still missing/unknown more than one month after the tsunami.

Overall, 61.8% (95% CI: 56.8-66.7) of IDP households reported one or more family members as presumed dead as a result of the tsunami. Of the pre-tsunami population in the households surveyed, 295 of 2,121 or 13.9% (95% CI: 12.4-15.4) perished; the mean number of deaths reported in IDP households was 0.8 (SD=1.3) with the average number of living household members declining from 5.1 (SD=1.9) to 4.3 (SD=1.8) after the tsunami ($p<.001$). The age composition and sex of the pre-tsunami population and tsunami victims is presented in Table 1. Mortality risk among females was 1.9 (95% CI: 1.5-3.0) times greater than males, with 18.4% (95% CI: 16.1-20.9) and 9.6% (95% CI: 7.9-11.5) of females and males, respectively, being presumed dead. Tsunami mortality rates by age group also differed considerably, with higher mortality observed in the oldest and youngest age groups (Figure 2). The lowest mortality was experienced by individuals between 20 and 39 years of age. Risk of mortality for children under 10 years and adults over 60 years, respectively, was 2.3 (95% CI: 1.6-3.4) and 3.1 (95% CI: 1.9-4.9) times greater as compared to those in the 20 to 39 year reference category.

DISCUSSION

In IDP households displaced by the tsunami, the overall tsunami mortality rate was 13.9% (95% CI: 12.4-15.4), that is to say, 13.9% of household members reported alive on December 25, 2004 were reported as dead or missing after the tsunami. Sub-district mortality rates varied from a low of 1.8%, (95% CI: 0.5-9.7) in Bubon, whose westernmost boundary lies more than 10 kilometers from the coastline, to a high of 36.8% (95% CI: 21.8-54.0) in Tuenom and 33.1% (95% CI: 28.4-38.2) in Samatiga, both of which are sub-districts with lengthy coastlines.

Overall, 61.8% (95% CI: 56.8-66.7) of IDP households reported one or more family members as presumed dead as a result of the tsunami. This percentage corresponds closely with a finding by the International Rescue Committee, based on a rapid health assessment conducted in January 2005, that 65.6% (95% CI 46.8-81.4) of the population in the city of Calang, Aceh Jaya District (just north of Aceh Barat District) had reported at least one death of an immediate family member as a result of the tsunami (Brennan, 2005).

The youngest and oldest age groups experienced the greatest mortality with rates of 21.1% (95% CI: 17.0-25.7) and 28.0% (95% CI: 20.6-36.5) for children under 10 years of age and those over 60 years of age, respectively. Mortality rates by age group show a clear trend (Figure 1) where older children and

younger adults had the lowest risk of death, with mortality increasing in groups near the beginning and end of the life span. Tsunami mortality among males and females also differed significantly, with nearly two-thirds of those presumed dead being female. Anecdotal impressions reported shortly after the tsunami noted a dearth of women and children among the survivors. One non-governmental organization (Oxfam, 2005) offered this explanation, drawn from interviews with survivors:

> *"In rural coastal areas, many men who were fishing far out at sea survived, as the giant waves passed harmlessly under their small boats. When the waves hit the shore, they flattened coastal communities and killed many of the women and children, most of whom were at home on that Sunday morning. In agricultural areas, men were often working out in the fields or doing errands away from the house, or were taking produce to markets…The sheer strength needed to stay alive in the torrent was often also decisive in determining who survived. Many women and young children, unable to stay on their feet, or afloat, in the powerful waves, simply tired and drowned. Women clinging to one or more children would have tired even more quickly."*

Oxfam reported that, based on surveys in villages in Aceh Besar and North Aceh districts, mortality rates among females may be up to four times higher than among males (Oxfam, 2005). While this study does not offer any explanations for differential survival patterns by age or by sex, the data does support the prevailing impression that younger children (and older people) as well as women were less likely to survive (WHO, 2005; ICMH, 2005). It is noted that surveys among displaced households rely on having at least one surviving member of the household. It may be that in areas where the devastation was so total that few survived, the effects of age and sex on mortality outcomes would be less.

In assessing the mortality impact of the tsunami in Indonesia, there are several limitations to this survey. First, it is focused only on Aceh Barat and Nagan Raya Districts on the western coast of Aceh Province, which were among the hardest hit areas in Indonesia. Second, the study focuses on displaced households only and may not be generalizable to the broader population. Finally, as noted above, households where no adult member survived are not captured in the assessment, creating a survivor bias. Limitations in terms of survivor bias and the focus on displaced households restrict interpretations of mortality findings to households in which displacement occurred as a result of the tsunami but at least one member survived.

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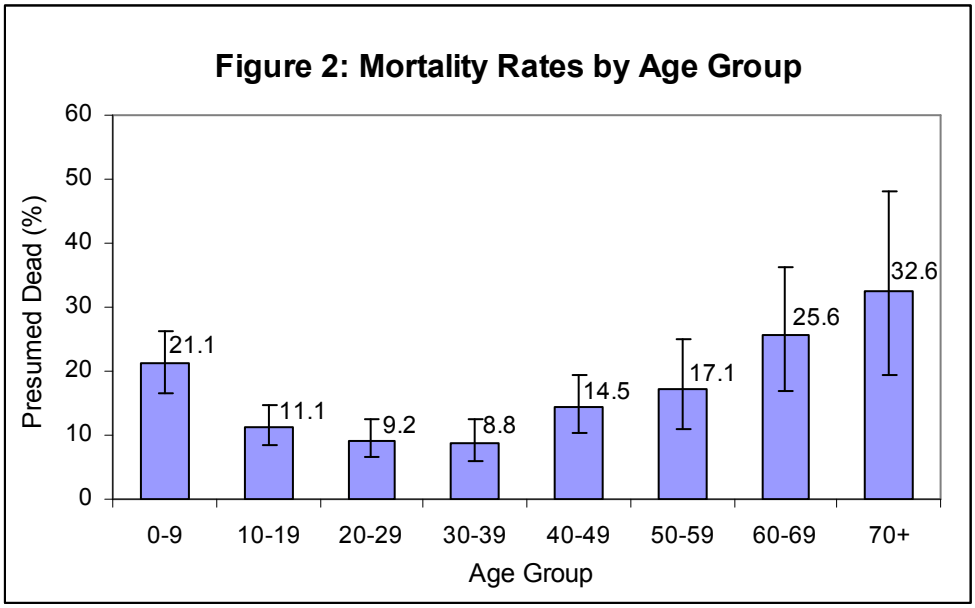

Table 1: Distribution of the Pre-tsunami Population and Tsunami Victims

	Pre-Tsunami Population			Tsunami Victims*		
	N=2128	Percent (95 CI)		N=295	Percent (95 CI)	
Sex						
Male	1084	51.1	(48.1-54.2)	104	35.3	(28.8-42.7)
Female	1037	48.9	(46.0-52.0)	191	64.7	(55.9-74.6)
Age						
0-4	156	7.4	(6.3-8.6)	37	12.7	(9.1-17.1)
5-9	204	9.7	(8.5-11.0)	39	13.4	(9.7-17.9)
10-14	225	10.7	(9.4-12.1)	26	8.9	(5.9-12.8)
15-19	234	11.1	(9.8-12.5)	25	8.6	(5.6-12.4)
20-29	424	20.2	(18.4-21.9)	39	13.4	(9.7-17.9)
30-39	352	16.8	(15.1-18.4)	31	10.7	(7.4-14.8)
40-49	249	11.9	(10.5-13.3)	36	12.4	(8.8-16.7)
50-59	123	5.9	(4.9-6.9)	21	7.2	(4.5-10.8)
60-69	86	4.1	(3.3-5.0)	22	7.6	(4.8-11.2)
70+	46	2.2	(1.6-2.9)	15	5.2	(2.9-8.4)

*Presumed dead; reported as dead or missing/unknown