

Recovering from a Natural Disaster: Indonesia in the aftermath of the 2004 Indian Ocean Tsunami

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The Event

- Dec 26 2004 Sumatra-Andaman earthquake
- 9.3 on Richter scale
- Shifted North Pole by several centimeters
- 1,200 km rupture in earth
- Sea floor forced upwards by 10-15 meters

Shock in Aceh, Indonesia

- **Destruction:** property estimated at \$US 4.5 billion.
- **Mortality:** roughly 5% of Aceh's total population died (~160,000 people)
- **Displacement:** more than 700,000 survivors
- **Assistance:** pledges poured in
- **Reconstruction:** By 2007, largest reconstruction effort in a developing country

Shock in Indonesia: not unique

Earthquakes:

- Indonesia, 2004: 130,000 killed
- Pakistan, 2005: 80,000 killed
- China, 2008: 70,000 killed
- Haiti, 2010: ~200,000 killed
- Japan, 2011: ~28,000 killed

U.S. Events:

- Katrina: ~1500 fatalities
- Tornadoes in 2011: 546 fatalities

Studies that provide insights into impacts and the recovery process can inform science and policy

Study Design of STAR: *Study of the Tsunami Aftermath and Recovery*

To understand a disaster's impact we need to:

- Know something about the affected population *before* the event
- Compare individuals in the affected areas with individuals in relatively unaffected *comparison* areas
- Measure multiple dimensions of peoples' lives, and aspects of their families, and their communities
- Follow individuals over time

STAR has all these features

Study Design of STAR

STAR A: Baseline survey: 2004 wave of SUSENAS
Representative of pre-tsunami population before event
525 communities

STAR B: First follow-up, same respondents 5-17 months
after tsunami (N~40,000)
communities directly affected by tsunami and
“comparison” areas

STAR C, D, E, F: Follow-up for 5 years (trace evolution)

Study Design of STAR: How to identify affected areas?

Combine:

- Information from interviews on the ground: index of damage in communities based on village leader reports and direct observation of survey supervisors
- Satellite images: index of damage based on change in ground cover

Gleebruk Village, before and after the tsunami



Key Points:

Recovery:

takes years not months

Vulnerability:

Multi-dimensional and dynamic

Effective targeting of assistance:

could improve pace and extent of
recovery

Recovery: years not months

Heavy Damage Area:

% living in home owned by household member

2004	79%
2005-06	47%
2006-07	64%
2007-08	73%
2008-09	75%
2009-10	77%

By 2010, home ownership at pre-tsunami rates

Much less help was available to non-land owners



2004

Gleebruk Village



Just
after
tsunami

2010



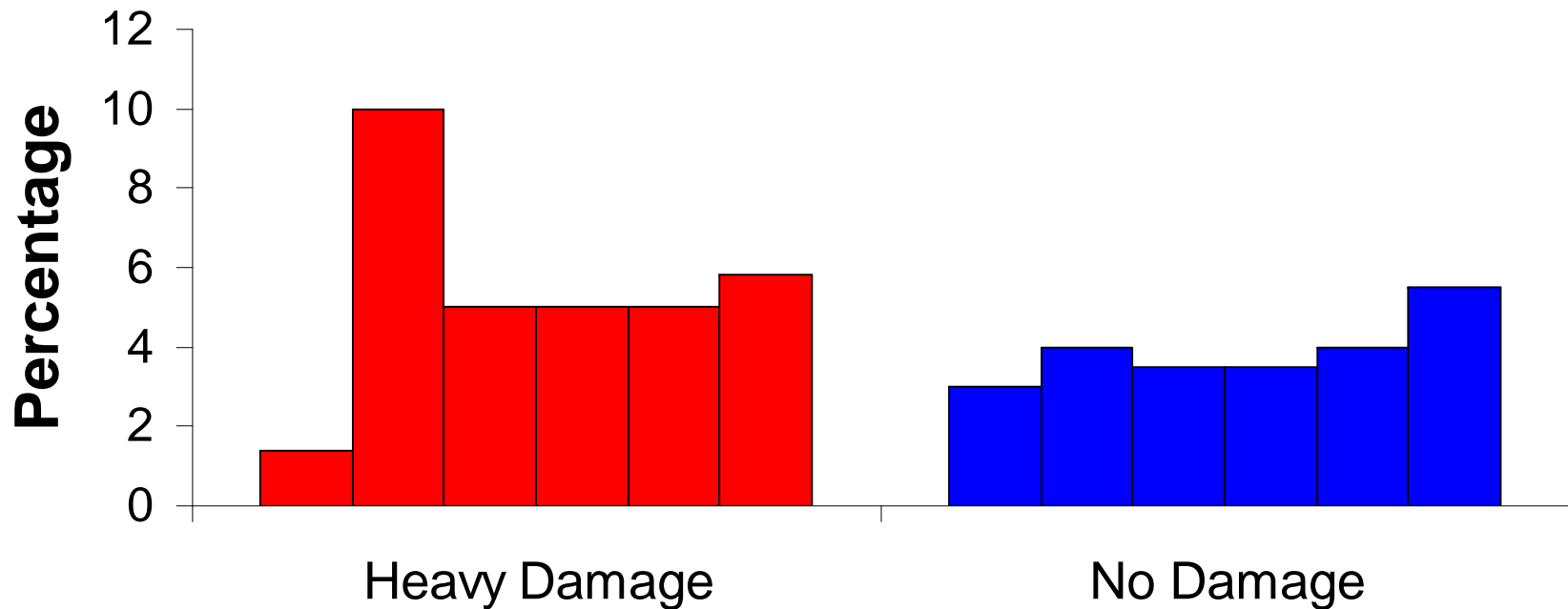
Vulnerability: multi-dimensional and dynamic

Post-traumatic stress reactivity index (PTSR):

- Computed from questions on symptoms of traumatic stress, varies from 0 to 21
- At its maximum, the index is 9.3 in the heavy damage zone, versus 6.4 in the zone without tsunami damage-- Post-traumatic stress not limited to heavy damage zone
- In both areas PTSR gradually declines-- by 2008 it's stable in both areas, and similar between damage zones
- Access to mental health counseling very limited
- Outside the heavy damage zone, use of mental health services was far more likely among the best-educated

Vulnerability: multi-dimensional and dynamic

Percentage of Widowers, Males 45-59



Sharp increase in percentage of men who are widowers in heavy damage zone, but rapid remarriage

Vulnerability: multi-dimensional and dynamic

Orphans:

- 1 in 6 children aged 10-18 lost parent(s)
- Effects vary by age at orphanhood and gender
- Effects of orphanhood for children aged 10-15 were muted... appear to have been protected through scholarships and support from family and friends
- Substantial effects for children aged 16-18.
 - Children who lost both parents did not receive scholarships
 - Relative to boys whose parents survived, orphaned boys completed 1.7 fewer years of education
 - Relative to girls whose parents survived, orphaned girls were much more likely to marry

Conclusions

Funding from the NIH, NSF and the World Bank critical

Investment in data collection has payoffs for basic science and but also for facilitating recovery

What lessons generalize to other contexts?

- Assistance for rebuilding infrastructure:
 - reconstruction takes time, but can ultimately succeed
- Targeting assistance is complicated for programs aimed at human behaviors, such as staying in school
- High mortality disasters:
 - family composition changes, invokes replacement behavior
 - But parents can't be replaced, and so for orphans, transitions to adulthood may speed up