Community Resilience Indicators and Self-Rated Post-Disaster Regional Recovery in Iwanuma, Japan

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Introduction

- Some studies have validated community resilience indicators using secondary data, such as national census. While useful, they have limitations in capturing **social dimensions** such as trust or informal social ties.
- Other researchers have employed **field surveys** to assess the social aspects of community resilience, including social capital, and have found associations with post-disaster recovery. However, these studies assessed resilience after disasters had occurred.
- As a result, **it remains unclear** how **pre-disaster community resilience**—measured through field surveys—affects post-disaster recovery outcomes.

Research Question

Are pre-disaster community resilience indicators associated with individual and regional post-disaster recovery outcomes?

- Communities with higher scores on resilience indicators are expected to exhibit better recovery outcomes.

Study Area

- **Iwanuma City**, located in Miyagi Prefecture, Japan, had a population of 44,187 in 2010, with 19.8% aged 65 or older. The city was severely affected by the **2011 Great East Japan Earthquake and Tsunami** (GEJET), which inundated 48% of its land area and caused 187 deaths. More than 5,400 houses were damaged.
- Following the disaster, Iwanuma City implemented community-oriented recovery efforts, including **group-based temporary housing and relocation projects** aimed at preserving neighborhood ties and foster social cohesion during recovery.

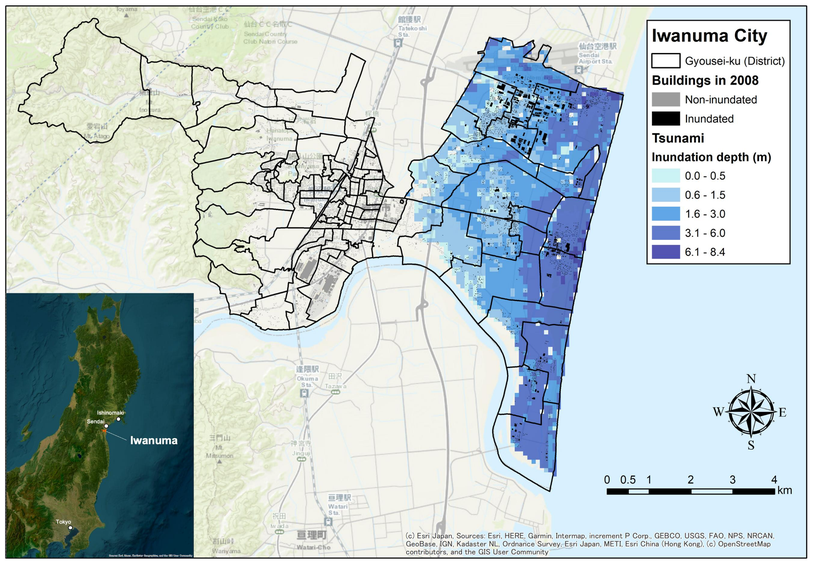


Fig. 1. Administrative Districts (Level-2 units) and Inundation Map of Iwanuma City

Data

We used data from the **Japan Gerontological Evaluation Study (JAGES)**, a nationwide longitudinal study of older adults in Japan.

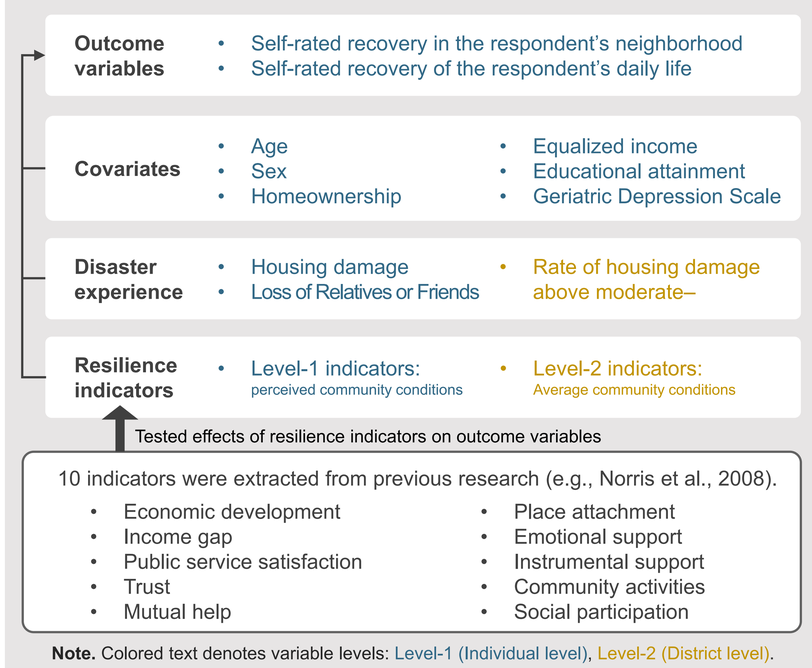
Table 1. Baseline and Follow-up Surveys of the JAGES in Iwanuma City

Survey	Timing	Sample	Notes
Baseline (Pre-disaster)	Aug 2010	**Enrolled participants:** n = 8,576 (age 65+) **Valid respondents:** n = 4,957	• Self-administered questionnaire (Response rate: 59.0%) • Respondents with invalid consent were excluded
Follow-up (Post-disaster)	Oct 2013: 2.5 years after GEJET	**Eligible for the follow-up** n = 4,380 **Analytical panel sample:** n = 3,523	• Face-to-face interviews (Response rate: 82.1%) • Respondents with invalid consent or inconsistent answers were excluded

Methods

- **Statistical model:** Multilevel logistic regression
- **Hierarchical structure:**
  - Level-1: Individuals (n = 3,523)
  - Level-2: Communities (Districts, K = 98)
    –> Mean: 35.9 respondents per district
    –> Range: 6–132 respondets

- **Analytical approach:**
  - Sequential models adding individual- and community-level indicators
  - **Cross-level interactions** tested (resilience × housing damage)
  - Missing data addressed via **multiple imputation** (m = 50)



Note. Colored text denotes variable levels: Level-1 (Individual level), Level-2 (District level).

Fig. 2. Analytical Framework

Table 2. Characteristics of the Analytical Sample

Variables	Categories	No. (%)	Mean (SD)	Timing
Self-rated recovery in the respondent's neighborhood (Level-1)	1: Completely/Mostly recovered	2,637 (74.9)		2013
	0: Halfway/Slightly/Not at all	674 (19.1)		
	Missing	212 (6.0)		
Self-rated recovery of the respondent's daily life (Level-1)	1: Completely/Mostly recovered	2,798 (79.4)		2013
	0: Halfway/Slightly/Not at all	551 (15.6)		
	Missing	174 (4.9)		
Housing damage (HD) (Level-1)	4: Major (MJ)	157 (4.5)		2010
	3: Moderate+ (MD+)	130 (3.7)		
	2: Moderate– (MD–)	254 (7.2)		
	1: Minor (MI)	1,479 (42.0)		
	0: No damage (ND)	1,405 (39.9)		
	Missing	98 (2.8)		
Loss of relatives or friends (Level-1)	1: Yes	1,314 (37.3)		2010
	0: No	2,140 (60.7)		
	Missing	69 (2.0)		
Rate of HD above MD– (Level-2)	District-level mean	98 (100.0)	0.19 (0.32)	2010
Age (Level-1)	In years (≥ 65 years old)	3,523 (100.0)	73.64 (6.28)	2010
	Missing	0		
Sex (Level-1)	Female	1,993 (56.6)		2010
	Male	1,530 (43.4)		
	Missing	0		
Homeownership (Level-1)	1: Yes	3,138 (89.1)		2010
	0: No	246 (7.0)		
	Missing	139 (4.0)		
Equivalized income (Level-1)	In 10,000 JPY units	2,875 (81.6)	229.6(141.3)	2010
	Missing	648 (18.4)		
Educational attainment (Level-1)	1: < 6 years	47 (1.3)		2010
	2: 6 – 9 years	1,170 (33.2)		
	3: 10 – 12 years	1,467 (41.6)		
	4: ≥ 13 years	704 (20.0)		
	Missing	135 (3.8)		
Geriatric Depression Scale (GDS) (Level-1)	0: Lowest – 15: Highest	3,036 (86.2)	3.66 (3.44)	2010
	Missing	487 (13.8)		
Public service satisfaction (Level-1)	0: Deteriorated – 2: Improved	3,154 (97.7)	0.93 (0.39)	2010
	Missing	369 (10.5)		
Public service satisfaction (Level-2)	District-level mean	98 (100.0)	0.93 (0.11)	2010
Social participation (Level-1)	0 – 3: Groups joined ≥1/month (sports, hobby, volunteer)	2,680 (76.1)	0.72 (0.91)	2010
	Missing	843 (23.9)		
Social participation (Level-2)	District-level mean	98 (100.0)	0.67 (0.30)	2010
Community activities (Level-1)	0: Declined – 2: Increased	3,154 (89.5)	0.88 (0.52)	2010
	Missing	369 (10.5)		
Community activities (Level-2)	District-level mean	98 (100.0)	0.87 (0.16)	2010

Key Findings

- **Community-level social participation** significantly enhanced respondents' recovery perceptions.
- The positive impact of **community social activities** was particularly evident among those with severe housing damage, highlighting the factor's key role in recovery from major disasters.
- Conversely, in communities with higher **satisfaction with public services**, the negative effect of housing destruction was even greater—suggesting complex expectations and experiences regarding public support.

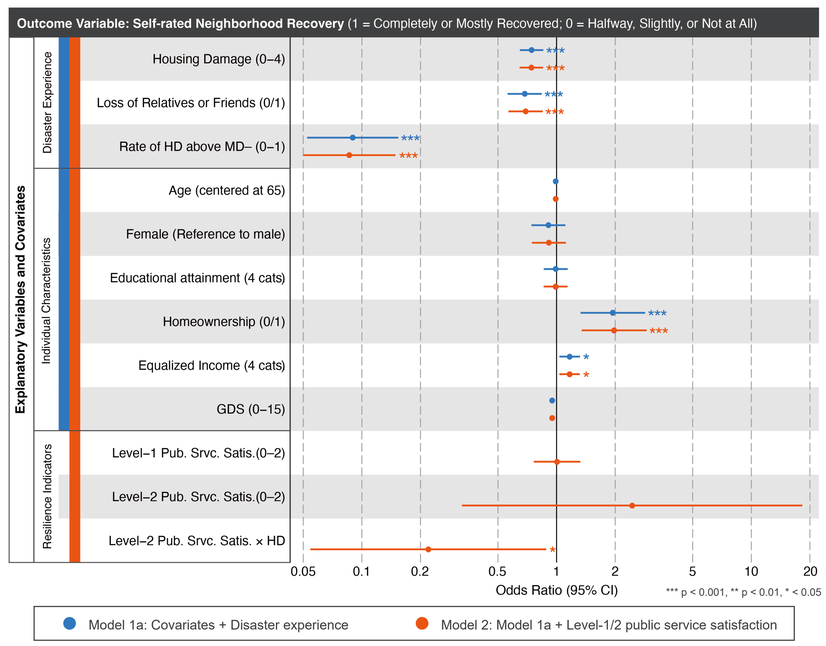


Fig. 3. Models Predicting Self-Rated Recovery in the Respondent's Neighborhood

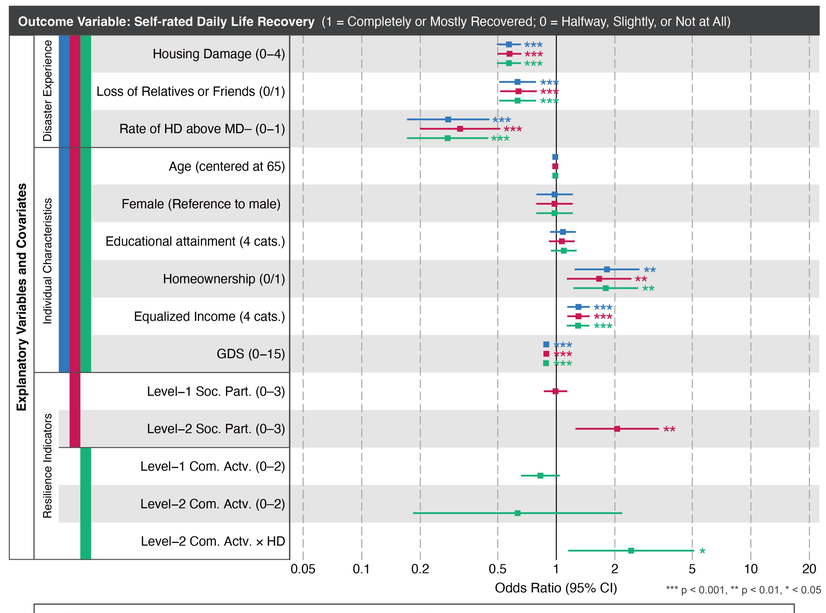
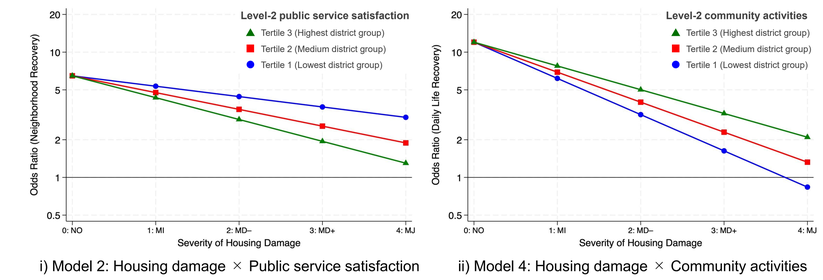


Fig. 4. Models Predicting Self-Rated Recovery of the Respondent's Daily Life



i) Model 2: Housing damage × Public service satisfaction ii) Model 4: Housing damage × Community activities

Fig. 5. Interaction Effects of Housing Damage and Level-2 Resilience Indicators

References

- Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, 41(1–2), 127–150.