

Factors Influencing Willingness to Share Resources Postdisaster: A Cross-Cultural Comparison between US and Japanese Communities

Katherine Idziorek, Ph.D., AICP¹; Daniel B. Abramson, Ph.D.²; Natsuki Kitagawa³;
Toshiyuki Yamamoto⁴; and Cynthia Chen, Ph.D.⁵

Abstract: When large-scale disasters occur, people often are left on their own to seek critical resources: food, water, medications, and other important items. Historically, government agencies have developed disaster preparedness strategies focused primarily on either the level of the individual or household or on the ability of government agents to provide relief to affected areas. Such approaches do not consider the potential for community members to share needed resources with one another—a crucial factor in survival when earthquakes, floods, landslides, and other disruptions to transportation and communications cut off whole communities from external aid. In this study, we used a simple random sample survey to measure households' actual and perceived preparedness and assess individuals' willingness to share essential resources following a large disaster using survey data gathered from three communities in the Pacific Northwest of the US ($N = 638$; overall response rate 20.1%) and Nagoya, Japan ($N = 1,043$; response rate 13.6%), two regions that expect to experience a magnitude 9.0 megaquake. Analysis of the survey data using an ordered response probit model found that the strength of social ties and levels of social trust strongly influence willingness to share in both regions. Differences between the Japanese and American responses suggest different dependencies on and roles for government agencies in the two societies, as well as differences in the types of resources that community members are willing to share, and with whom. Trust emerges as the most important factor across both study regions and for all resources. Willingness to share may be enhanced through trust-building interventions and should be regarded as an effective focus for preparedness efforts, especially if it is shown to be beneficial for a variety of social purposes. DOI: [10.1061/NHREFO.NHENG-1836](https://doi.org/10.1061/NHREFO.NHENG-1836). © 2023 American Society of Civil Engineers.

Practical Applications: The impacts of natural disasters worldwide have increased in recent years, often leading to situations in which communities must fend for themselves and make do with what resources they have while waiting for outside assistance to arrive. This research considered the potential benefits of community members sharing resources with one another during disaster. We surveyed households in both US and Japanese communities facing extreme earthquake threats to understand how willing they would be to share resources with others in a disaster and what factors might affect their willingness to share. Our results show that although there are some differences, trust is the most important factor for sharing resources in both regions. We argue that building trust within communities can improve disaster outcomes while also providing everyday benefits for society.

Author keywords: Willingness to share; Trust; Earthquakes; Disaster preparedness; Peer-to-peer sharing; Cross-cultural comparison; Social ties.

¹Assistant Professor, Dept. of Geography and Earth Sciences, Univ. of North Carolina at Charlotte, McEniry 331, 9201, University City Blvd., Charlotte, NC 28223 (corresponding author). ORCID: <https://orcid.org/0000-0002-8130-0536>. Email: kidziore@charlotte.edu

²Associate Professor, Dept. of Urban Design and Planning, Univ. of Washington, 410 Gould Hall, Box 355740, Seattle, WA 98195. Email: abramson@uw.edu

³Department Chief, Toho Gas Network Co., Ltd., 456-0004 19-18 Sakuradacho, Atsuta-ku, Nagoya, Aichi 456-8511, Japan. Email: nkitagawa@tohogas.co.jp

⁴Professor, Institute of Materials and Systems for Sustainability, Nagoya Univ., Furocho, Chikusa-ku, Nagoya, Aichi 464-8601, Japan. Email: yamamoto@civil.nagoya-u.ac.jp

⁵Professor, Dept. of Civil and Environmental Engineering, Univ. of Washington, 201 More Hall, Box 352700, Seattle, WA 98195; Professor and Interim Chair, Dept. of Industrial Systems Engineering, Univ. of Washington, Box 352650, Seattle, WA 98195. Email: qzchen@uw.edu

Note. This manuscript was submitted on January 3, 2023; approved on June 15, 2023; published online on August 12, 2023. Discussion period open until January 12, 2024; separate discussions must be submitted for individual papers. This paper is part of the *Natural Hazards Review*, © ASCE, ISSN 1527-6988.

Introduction

When a disaster strikes, people come together to help one another: they share resources, pass along information, and volunteer to take on tasks outside their usual domains (Twigg and Mosel 2017). These kinds of activities, which have been reported in both the academic literature and through popular media, contradict conventional emergency management practices that assume the need for a top-down, governmental, and centralized approach to resource allocation (Lindell et al. 2006). In these situations, communities must rely upon local skills, knowledge, and material goods to survive and recover. In this context, individuals' willingness to share resources with others in their community becomes especially relevant given the need for localized self-sufficiency. Individuals who are willing and able to share resources within communities themselves constitute an important resource during times of disaster given the diversity and potential complementarity among households' resource stocks.

This study investigated people's willingness to share resources in a disaster scenario. These essential resources range from items

that provide sustenance, such as food and water, to items that enable transportation and communication—that together are critical for supporting community self-reliance in the wake of a disaster. We suggest that peer-to-peer resource sharing activities fill important gaps during times of disaster that cannot be filled by overwhelmed emergency response agencies and large aid organizations—a situation that is especially likely when disasters strike a large area and/or when disrupted transportation and communications systems isolate smaller communities from external aid and centralized distribution systems.

Although related studies have investigated willingness to share resources in the context of disaster-related evacuation and the sharing economy (Borowski and Stathopoulos 2020; Borowski et al. 2021; Wong and Shaheen 2019a; Wong et al. 2020b), we focused on peer-to-peer sharing within the context of place-based communities that will be unlikely to evacuate following a regional megquake event and that may need to shelter in place for an extended period, calling attention to the need for a geographically equitable distribution of resources to support community resilience in extreme disaster scenarios.

The foci of this study—the city of Nagoya, Japan, and the US Pacific Northwest cities of Seattle and Westport, Washington—face similar overwhelming and isolating effects from a widespread regional disaster, in the form of subduction zone megathrust earthquakes and their associated hazards common around the Pacific Ring of Fire (Gomberg and Ludwig 2017). In these events, ground shaking destroys bridges, power grids, and cellular networks across a wide area, and triggers tsunamis, landslides, and liquefaction that bury or wash away roads, ports, and other critical infrastructure.

Disasters of this scale and nature create islanding effects for communities, isolating them from external support (Cook and Butz 2013; Dong et al. 2021; Sheller 2013). In a large-scale event, emergency responders expect to be completely overwhelmed, and thus immediate help from the government is unlikely to come to many communities. In Washington state, the Emergency Management Division encourages individuals and families to be prepared to spend up to 2 weeks without outside assistance after a large-scale earthquake (Washington Emergency Management Division 2020). In Japan, the government recommends that people prepare resources for 1 week to survive huge disasters (Prime Minister's Office of Japan 2022). Many households have difficulty meeting these standards individually. The ability of neighbors to share resources is critical.

In this study, we explored factors influencing individuals' willingness to share different types of resources with others in a disaster scenario. Based on the results of a random sample survey administered in both regions, which we analyzed using an ordered response probit model, we identified three key insights in our exploration of willingness to share resources in a disaster context. First, willingness to share varies by resource type and social tie strength between provider and recipient, and strong social ties play a more prominent role in willingness to share among Nagoya respondents. Second, we found trust to be more strongly associated with willingness to share in both the US and Nagoya than are other potential explanatory variables, including actual level of preparedness with resources. Third, we found differences between the US communities and Nagoya, both in willingness to share different kinds of resources, with Washington state respondents generally being more willing to share than Nagoya City respondents, and in where respondents expect to seek resources in an emergency.

Exploration of Factors Influencing Willingness to Share

Disasters are inherently geographical, often causing communities to become reliant on local resources when municipalities and agencies become overwhelmed. The impacts of physical and technological infrastructure failure that occur during disasters are felt most by groups with pre-existing social vulnerabilities, leading to inequities in disaster response and recovery (Elliott and Howell 2016; Finch et al. 2010; Fothergill et al. 1999; Fothergill and Peek 2004; Klinenberg 2015; Tierney 2006). Previous research has shown that women, as well as individuals who are older, have lower socioeconomic status, and who are located in places that are more physically vulnerable, are impacted most negatively by earthquakes (Doocy et al. 2013; Masai et al. 2009). In addition, standard approaches to resilience planning tend to shift the responsibility for being resilient from government onto individuals and communities, leaving the most vulnerable people and places even more exposed (Davoudi 2012). However, community-based resources, including local knowledge and social ties, can contribute to resilience and aid in the development of sustainable, place-based strategies for hazard mitigation (Tierney 2014; Mileti 1999). Although challenges remain for organizing and implementing peer-to-peer sharing strategies to improve equity in disaster outcomes (Wong et al. 2020a), such strategies hold promise for improving the distribution of needed resources within communities when isolated by disaster.

We explored potential factors affecting willingness to share in accordance with the conceptual framework described in Fig. 1. In the literature on place-based social relations crucial to local disaster response, we focused on attitudinal and structural factors on both the interpersonal and community levels: generalized social trust and place attachment (attitudinal); and social ties and cultural determinants (structural). Studies of disaster preparation, response, and recovery have explored these factors largely through the concept of social capital, which generally is defined as resources that individuals and communities activate through varying and unique



Fig. 1. Conceptual framework of willingness to share factors explored.

combinations of social networks and relations of authority and trust (Bagnasco 2012; Meyer 2018).

Strength of Social Ties

Because sharing constitutes the transfer of resources between individuals, we built upon social network concepts of social distance and social ties. According to social network theory, social distance can be described in terms of the strength of the relationships—social ties—connecting people to one another. Closer relationships, such as those between family members or friends, constitute strong social ties, whereas more-distant relationships such as acquaintanceships constitute weak ties (Granovetter 1973). Previous research has found that social proximity increases cooperation (Harrison et al. 2011), and that willingness to share personal resources decreases as social distance increases (Schreiner et al. 2018).

A community's social network comprises the collection of individual ties among its members. Social networks support community health and wellbeing generally (Israel 1985), as well as enhancing community resilience and enabling community self-reliance during times of disaster (Alesch et al. 2009). Strong community networks create a mechanism for sharing critical resources and work to support community self-reliance during times of disaster (Wagh and Yang 2014), and they increase individuals' willingness to help neighbors and engage in collective action to support community recovery from disaster (Aldrich 2012; Islam and Nguyen 2018).

Social Trust

Trust facilitates many key societal functions, including the creation and maintenance of social networks. Social networks enhance social trust (Delhey and Newton 2003), which in turn supports interpersonal cooperation as well as the growth of civil society (Putnam 2000). Necessarily relying on the nature of the relationship between two entities, trust varies according to social distance, with strong-tie relationships exhibiting higher levels of trust than weak-tie relationships. Trust enables the development and sharing of social capital (Blumberg et al. 2012; Hardin 2001; Welch et al. 2005) thereby enabling societal flexibility and supporting the conditions necessary for adaptation to change (Adger 2003).

Social trust—the sense that others in society generally may be relied on for help—plays an important role in the facilitation of sharing behavior during times of disaster, and has been linked directly to individuals' propensity to share resources. For example, a survey of 510 individuals affected by either the 2017 Southern California wildfires or the 2018 Carr Wildfire found that higher levels of trust correlated with increased anticipated willingness to share shelter or transportation in a future disaster scenario (Wong et al. 2021). A shared experience of disaster can increase levels of social trust and therefore levels of social capital within communities, supporting postdisaster community recovery (Castro-Correa et al. 2020; Robles and Ichinose 2016).

Place Attachment

In disasters that cause spatial isolation of communities, cutting them off from regional communication and transportation systems, place attachment also would seem to be an important factor in how community members share resources and information to survive and recover. Place attachment, or the emotional and cognitive experience linking people to places, has been shown to motivate participation in cooperative efforts to improve one's community (Manzo and Perkins 2006), to support the maintenance of place-based social ties (Payton et al. 2005; Scannell et al. 2019), and

to enhance social trust (Stefaniak et al. 2017). Stronger place attachment has been associated with increased levels of pre-disaster preparedness, household decisions to rebuild housing in the community postdisaster, and a range of other recovery factors (Jamali and Nejat 2016; Mishra et al. 2010; Wallis et al. 2022; Wang et al. 2021). However, the relationship of place attachment to other key determinants of preparedness, such as risk perception and coping, is still poorly understood (Bonaiuto et al. 2016). We found no studies at all of place attachment's role in individual community members' postdisaster resource and information sharing attitudes or behavior.

Cultural Factors

All these factors have cultural foundations and reflect different political and institutional contexts. The "Research Context and Methodology" section describes a factor analysis we conducted to support the cross-cultural comparability of our survey questions and measurement scales. Our questions about social ties, social trust, and place attachment have been used in surveys in a wide range of cultural and social settings. For example, the question for social trust is similar to the World Values Survey question, "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?", which has been found to correlate strongly with trust in behavioral experiments internationally (Johnson and Mislin 2012). Studies across a diversity of cultural settings postdisaster have shown that actual disaster survival and recovery rates are correlated with high levels of local social capital, often regardless of (and sometimes despite) governmental or other collective actions to reduce disaster risk (Aldrich and Meyer 2015; Aldrich and Sawada 2015). Still, the cultural factors that shape responses to questions about these topics are not well understood, and remain on the frontier of research. The forms of generalized social trust that underlie social capital—for example, levels of trust in institutions of official versus unofficial authority and trust in civil society generally—vary across cultural contexts, and thus may influence responses to disaster differently. Measurement of place attachment also needs more cross-cultural testing.

Research Questions and Hypotheses

In a disaster, people are likely to have limited access to—and a limited supply of—resources needed for essential everyday activities. Our first research question is "How willing are people to share different types of resources with others to whom they have varying strengths of social ties?" Assuming that people have a 1-week supply of these resources on hand, we examined differences in individuals' willingness to share various items needed to conduct essential everyday activities during a disaster. Based on the literature, we expected that willingness to share will increase in accordance with social tie strength.

The second question asked in the study is "What factors affect people's willingness to share?" In particular, we explored how attitudinal factors such as social trust and place attachment, which further describe people's relationships to their place-based community beyond social tie strength, affect willingness to share. Based on the literature, we expected that higher levels of trust and place attachment will be positively correlated with increased willingness to share.

The third question the study sought to answer is "How do willingness to share, and factors influencing willingness to share, vary between different cultural contexts?" We expected to observe some differences between the two regions based on factors such as

collective attitudes toward sharing, governmental approaches to disaster preparedness, and cultural experience with disaster.

Research Context and Methodology

Aichi Prefecture and its capital, Nagoya City, Japan, face recurrent megaquakes from the Nankai Trough. It is anticipated there is a 70%–80% chance of a magnitude 8–9 Nankai Trough earthquake occurring within the next 30 years ([Headquarters for Earthquake Research Promotion 2022](#)). Governmental assessment of a worst-case scenario anticipates 6,700 deaths and damage to 66,000 buildings within Nagoya ([City of Nagoya 2022](#)), and as many as 323,000 fatalities and damage to 2,386,000 buildings with economic losses of ¥169.5 trillion (about \$1.4 trillion) nationwide ([Ministry of Land, Infrastructure, Transport and Tourism of Japan 2021](#))—many times worse than the Great East Japan Earthquake and tsunami of March 2011.

The comparably-sized Pacific Northwest region of the US faces a similar Cascadia Subduction Zone 8.0–9.2 magnitude megaquake which, although rarer than megaquakes elsewhere on the Pacific Rim, is estimated to occur at a probability of between 10% and 20% in the next 30 years ([Goldfinger et al. 2016](#); [Kulkarni et al. 2013](#); [Lindh 2016](#)). As many as 10,000 fatalities are estimated for Oregon and Washington states, with economic losses of more than \$80 billion ([Resilient Washington Subcabinet Project Team 2017](#)). Media reports in recent decades of the Indian Ocean disaster in 2004 and the Great East Japan disaster of 2011, as well as the potential for a “Big One” in Cascadia ([Schulz 2015](#)), have elevated public awareness of these hazards at the community level in the US and Canadian Pacific Northwest ([Edgington 2022](#)). Seattle’s Hazard Identification and Vulnerability Assessment (SHIVA) identifies subduction megaquakes as the city’s highest priority hazard risk, and refers specifically to the 2011 earthquake in Japan as a reference ([Seattle Office of Emergency Management 2019](#)). Smaller and more remote communities on the coast have begun to take action by building tsunami vertical evacuation structures and undertaking adaptive

long-term land-use planning ([Baker 2022](#); [Kuriyama et al. 2020](#)). Although these initiatives help to reduce risks to life in the direst moments, they do not address the challenge of surviving the aftermath of a disaster.

Study Communities

In Japan, the team gathered data from residents across Nagoya City, a city of 2.3 million with inhabitants from a range of sociodemographic backgrounds (Fig. 2 presents the study community locations). Nagoya, the capital of Aichi Prefecture, is located in the western part of the prefecture, and is the political, economic, and cultural center of the Chubu region of Japan. The city of Nagoya comprises 16 administrative wards, some of which are at risk of tsunami inundation. According to statistical data, the median annual income of residents is ¥3.7 million (approximately \$27,000), and the child poverty rate is 9.0%. The average age is 46.7 years old.

In Washington state, the research team selected three characteristically different communities to explore willingness to share in the US Pacific Northwest: two urban Seattle neighborhoods, Laurelhurst and South Park; and Westport, a small city in coastal Grays Harbor County. The team deliberately selected both urban and rural communities along a spectrum of economic status to capture variation in both urban character and access to resources.

Located in northeast Seattle adjacent to the University of Washington campus, the neighborhood of Laurelhurst is home to approximately 5,000 predominately White residents, with a median annual household income of \$176,300 and life expectancy among the highest of Seattle neighborhoods. In contrast, South Park is an underserved and ethnically diverse urban neighborhood in industrial southeast Seattle comprising approximately 4,000 residents, of whom more than 45% identify as Hispanic or Latinx, 50% speak languages other than English at home, and with a median annual household income of \$42,600, 25% live below the poverty level. Located on the south shore of Grays Harbor on Washington State’s Pacific coast, Westport is a maritime community of approximately 2,100 majority White and English-speaking year-round residents

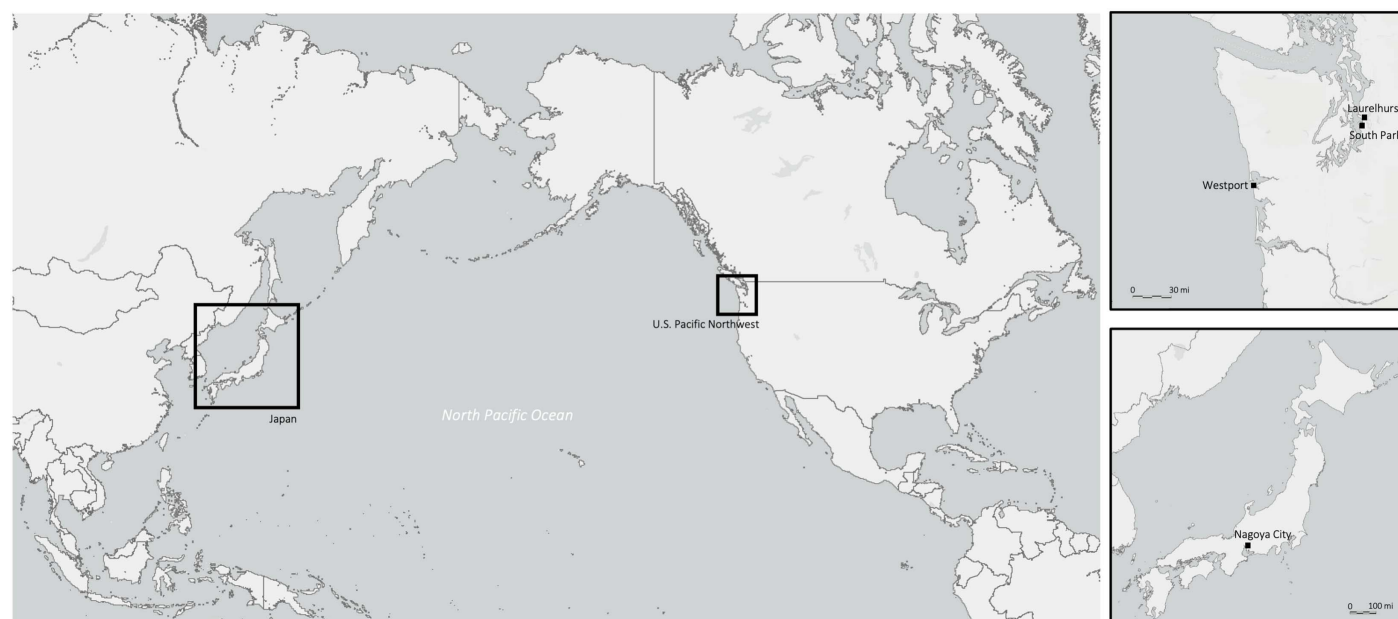


Fig. 2. Study community locations. (Map created using ArcGIS © Esri. Sources: Esri, HERE, Garmin, INCREMENT P, © OpenStreetMap contributors, and the GIS user community.)

with a median annual household income of \$37,600, a poverty rate of 17.5%, and a varying but important population of seasonal workers, many of whom do not speak English at home. Although all three communities are susceptible to earthquake hazards, Westport additionally faces the threat of an earthquake-induced tsunami.

Sample Survey

The survey instrument was designed to explore relationships between and among social ties, attitudes, and disaster preparedness at the community level. We asked respondents about their preparedness for a disaster both materially and socially as we gathered information about whether respondents would be willing to share each of nine essential resources with nobody, family and close friends only (strong social ties only), family, friends, or acquaintances (either strong or weak social ties), or anyone in need (regardless of pre-existing social ties). The list of nine essential resources (food, water, power, sanitation, medications, first aid supplies, communication, transportation, and warmth) was adapted from an emergency preparedness survey developed by the City of Seattle Office of Emergency Management (2015). The Washington state and Nagoya City research team members reviewed the list for appropriateness and to ensure that the listed items would translate correctly across cultural contexts. Respondents were asked about their willingness to share these resources in the context of a hypothetical disaster scenario in which they would be without water, electricity, and gas service for a week or more.

The survey instrument also measured respondents' attitudes toward people and place using an adapted four-item place attachment scale formulated for use at the neighborhood level (Fornara et al. 2010) and a three-item social trust scale adapted from the General Social Survey (Smith et al. 2018). We also collected data on sociodemographic factors such as age, gender, income level, household composition, and length of residence in the community.

A simple random sampling design was used in all study communities. Survey respondents in the Washington state communities were contacted by mail and presented with the option to either take the survey online or request a printed copy, whereas the

Nagoya survey was web-based and administered completely online. The surveys were distributed by the University of Washington and Nagoya University teams but were cobranded with local and/or municipal partners in each of the partner communities (i.e., the partners were mentioned in the introductory letter and their logos were included on the survey booklet). The survey was translated into Spanish for the communities of Westport and South Park, which have a significant share of Spanish-speaking residents, and into Japanese for Nagoya City. The surveys were designed to be as consistent as feasible in terms of format, presentation, and content across the four study communities. The surveys took participants approximately 20 min to complete. Respondents were offered a \$5 Amazon.com gift card to complete the survey in appreciation of their time. Survey response rates are presented in Table 1, and respondent characteristics are presented in Table 2. The survey was administered in Washington state between October 2018 and February 2019. The Nagoya City survey was administered in February 2021.

The authors acknowledge that the research entails a certain amount of self-selection bias, because participants chose whether to complete the survey. The survey results also are not representative of the overall population of the regions affected by megaseismicity, particularly in the US, where the research focused on specific study communities. In this case, an effort was made to select both urban and rural communities as well as those with a range of socioeconomic status. Limitations of the sampling frame include a bias toward internet users, particularly in Nagoya City, where potential participants did not receive a physical letter in the mail. In Westport, many residents receive mail at post-office boxes, which limited our ability to be certain that participants actually lived within the immediate study area. In addition, many residents live in Westport only seasonally, meaning that participation of part-time residents was likely not as robust as it could have been, because the survey was implemented during the fall and winter months.

Factor Analysis

Respondents' attitudes toward people and place were observed using Likert scales for place attachment and trust, with each item coded from +2 for strongly agree to −2 for strongly disagree. We conducted a factor analysis using responses to questions presented in Table 3 to test for the comparability of these questions between respondents in Nagoya and Washington state. Because the data were not normally distributed, we used principal axis factoring for the fitting procedure to create the scales. We also applied a direct oblimin rotation, which produces solutions with simpler structures when factors are expected to correlate so that the factors can be extracted more clearly. The scores for negatively worded questions [Questions 2, 3, 5, and 7 (Table 4)] were reversed for the factor analysis.

Table 1. Survey response rates by study community

Community	Number of households contacted	Total number of responses (completed surveys)	Percentage response (%)
Laurelhurst	733	233	31.8
South Park	1,200	211	17.6
Westport	1,243	194	15.6
Nagoya City	7,682	1,043	13.6

Table 2. Survey respondent characteristics by study community

Community	Gender female (%)	Age (mean)	Community tenure (years)	Households with children (%)	Annual household income (%)				
					Less than \$25,000 (%)	\$25,000–\$49,999	\$50,000–\$74,999	\$75,000–\$99,999	\$100,000 or more
Laurelhurst (<i>N</i> = 233)	49.2	56	18.1	36.4	5.0	3.1	7.4	7.8	65.6
South Park (<i>N</i> = 211)	63.2	46	10.8	29.7	12.9	15.3	13.4	14.4	40.6
Westport (<i>N</i> = 194)	62.1	62	15.5	20.0	24.6	24.6	17.9	10.3	15.3
Nagoya City (<i>N</i> = 1,043)	49.7	49	22.5	25.5	15.9	27.5	16.5	10.6	1.9

Note: Annual household income variables approximate for Nagoya City; and values converted to USD.

Table 3. Comparative means of responses to attitudinal survey items

Attitudinal survey item	Washington state (<i>N</i> = 638)		Nagoya City (<i>N</i> = 1,043)	
	Mean	Standard deviation	Mean	Standard deviation
General social trust survey items				
1. In general, you can trust people.	0.739	0.996	0.202	0.897
2. Nowadays, you can't rely on anybody.	−0.520	1.672	−0.049	0.933
3. It's better to be cautious before trusting strangers.	0.959	1.158	0.722	0.756
Place attachment survey items				
4. I feel [location] is a part of me.	0.601	1.294	−0.524	0.942
5. I do not feel integrated into the [location] community.	−0.305	1.400	0.228	0.998
6. [Location] is the ideal place for me.	0.656	1.212	−0.296	0.838
7. It would be very easy for me to move away from [location].	−0.307	1.340	0.363	0.987

Table 4. Factor matrix after oblimin rotation

Attitudinal survey item	Factor 1	Factor 2
1. In general, you can trust people.	0.309	0.422
2. Nowadays, you can't rely on anybody.	0.179	0.601
3. It's better to be cautious before trusting strangers.	−0.087	0.512
4. I feel [location] is a part of me.	0.913	−0.139
5. I do not feel integrated into the [location] community.	0.508	0.155
6. [Location] is the ideal place for me.	0.753	−0.025
7. It would be very easy for me to move away from [location].	0.524	0.051

Two factors were extracted. Factor 1 contained the items used to measure place attachment (4–7), and Factor 2 contained the items used to measure trust (1–3), as expected (Table 4). Factor scores were calculated by totaling the factor loadings of each item multiplied by the response values. Cronbach's alpha values for each factor were $\alpha = 0.594$ for trust and $\alpha = 0.770$ for place attachment.

Ordered Response Probit Models

Ordered response probit models of willingness to share were developed for each resource as the dependent variable (e.g., the answer to the question “With whom would you be willing to share drinking water assuming you had a one-week supply in the case of a large-scale disaster such as an earthquake?”). Ordered response probit models and ordered response logit models are basic regression methods commonly used when the dependent variable is ordinal. Because the normal distribution is a natural choice to represent omitted variables, ordered response probit models were used in this study. More-advanced representations of unobserved heterogeneity among respondents have been developed, such as mixed logit models and latent class models. Portfolio choice modeling also has been proposed to capture multidimensional dependency (Wong et al. 2023). The basic models were used in this study to focus on the identification of the factors influencing individuals' willingness to share different types of resources such as social trust and place attachment. The application of the advanced modeling remains as a future research task.

The model was run using SPSS statistics version 25 software. Using the estimated parameters, the marginal effects were calculated for trust and place attachment (Table 6) as the percentage change in the probability of sharing with anyone (the most inclusive of the four social tie answer options provided) given a one-unit increase in trust and place attachment, respectively.

Comparison of Means

Finally, we used comparison of means (*t*-tests) to assess differences in attitudes and preparedness across cultural contexts. We compared participants' self-reported preparedness with resources, overall willingness to share those resources with others, and attitudes related to trust and place attachment between the two study regions.

Results

Willingness to Share Different Types of Resources

The sample survey results showed that respondents' willingness to share resources varied according to both resource type and the nature of the respondent's social ties to the recipient (Fig. 3). Nagoya and South Park respondents reported requiring stronger social ties with recipients in order to share than did Westport and Laurelhurst respondents, and Nagoya had the highest share of “strong ties only” responses for all resources except sanitation. Medication was the only resource for which a relatively large percentage of Washington state respondents (14.7% in Laurelhurst, 23.4% in South Park, and 32.8% in Westport) anticipated not being willing to share with anyone. By contrast, only 7.2% of Nagoya respondents said they would not be willing to share medications with anyone regardless of social tie strength. Some cross-cultural differences in willingness to share resources also were observed for communication, transportation, and warmth. For these resources, a much larger share of Nagoya respondents indicated that strong social ties with the recipient would be important for sharing compared with any of the Washington state communities.

Factors Affecting Willingness to Share

The ordered response probit model found trust to be a key factor affecting willingness to share across the two cultural contexts (Table 5). The model quantified the association of factors of interest with the probability of an individual being willing to share a specific resource with different levels of social ties (i.e., 0 = no one, 1 = strong ties only, 2 = strong or weak ties, and 3 = anyone). The results suggest that an individual's level of social trust has a significant and consistent influence on willingness to share for all resources in both contexts. Respondents with higher levels of trust indicated being more willing to share with others across all resources included in the survey.

The marginal effects of trust on the probability of willingness to share resources with anyone in need were much larger than those of place attachment. Because both attitudes were calculated as factor scores using factor analysis, both variables were standardized with a mean of 0 and variance of 1. Whereas a one-unit increase in place

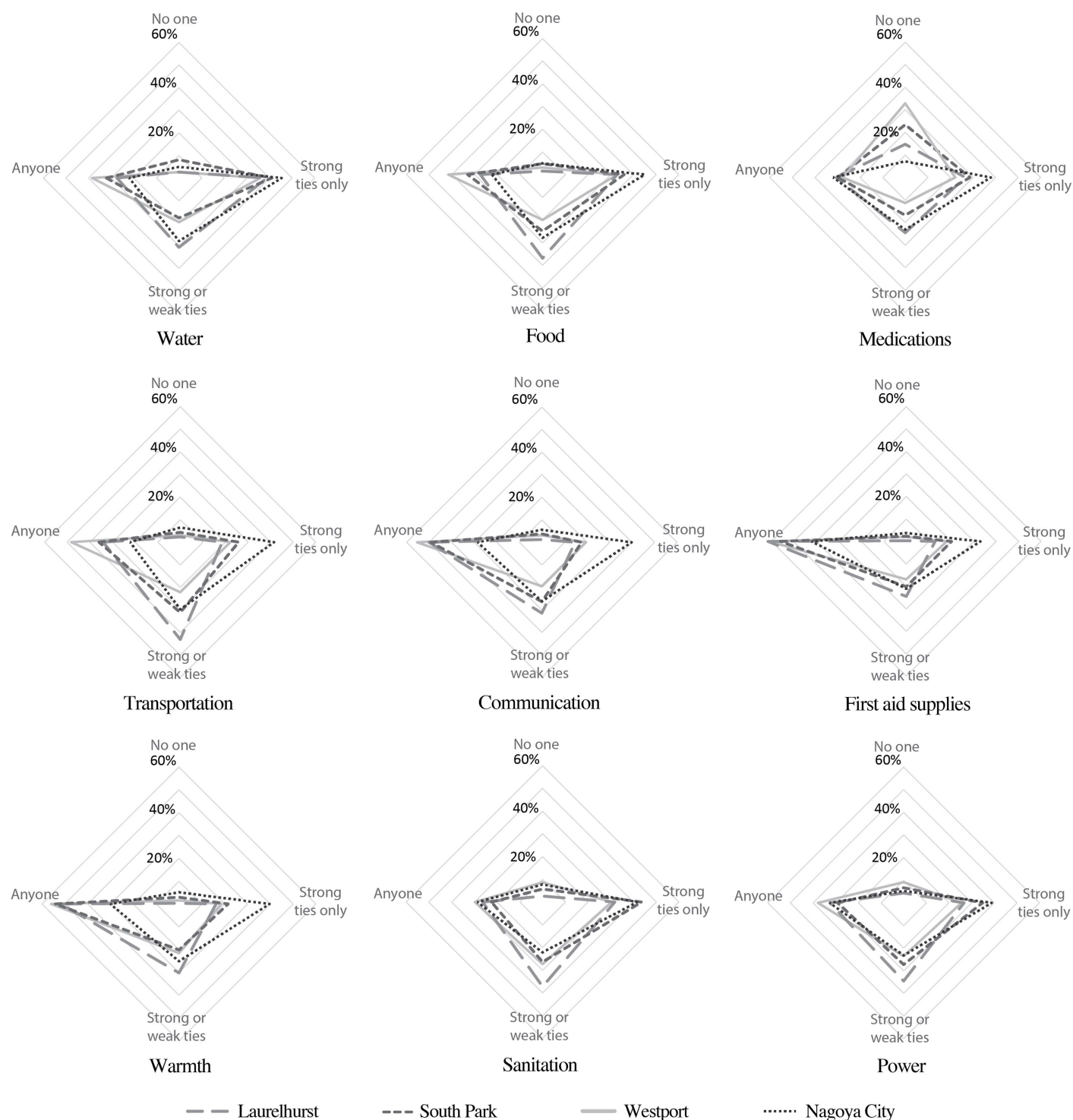


Fig. 3. Willingness to share resource profiles by percentage of respondents.

attachment increased willingness to share by between 0.3% and 3.0%, a one-unit increase in trust increased willingness to share by between 8.0% and 11.3%, depending on the resource in question (Table 6).

The relationship between increased household preparedness and willingness to share was significant only for some resources, in contrast to trust, which was significant for all resources. This suggests that whereas increased household preparedness might positively affect willingness to share for certain resources, it will not on its own improve people's willingness to share across the

full range of resources. We found some associations between demographic characteristics and willingness to share across all communities. Respondents living in households with children were more reluctant to share food, water, and sanitation facilities. Younger respondents (age ≤ 39) were relatively less willing to share water, first aid, warmth, and power. Older respondents (age ≥ 65) were relatively more willing to share transportation and communication resources. Tenure in the community was a significant influence factor for only one item—medications—and the effect was small. There were no differences in willingness to

Table 5. Willingness to share, nonstandardization coefficients

Factors tested	Water	Food	Medications	Transportation	Communication	First aid supplies	Warmth	Sanitation	Power
Threshold ^a									
Willingness = 0 1	-2.262**	-1.929**	-0.906**	-2.012**	-2.155**	-2.211**	-2.353**	-1.677**	-1.623**
Willingness = 1 2	-0.566**	-0.243*	-0.202*	-0.494*	-0.626**	-0.705**	-0.764**	-0.270*	-0.107*
Willingness = 2 3	-0.175*	-0.547**	-0.758**	-0.394*	-0.161*	-0.101*	-0.043*	0.394*	-0.610**
Resource preparedness	0.021	-0.108**	-0.017*	-0.068*	-0.064*	-0.121**	-0.103**	-0.064*	-0.050*
Having children	-0.192**	-0.187**	-0.005*	-0.008*	-0.018*	-0.050*	-0.123*	-0.151*	-0.116*
Trust ^b	0.265**	0.254**	-0.252**	-0.299**	-0.301**	-0.219**	-0.296**	0.305**	-0.232**
Age ≤ 39 ^c	-0.184**	-0.130*	-0.041*	-0.095*	-0.119*	-0.171*	-0.252**	-0.134**	-0.225**
Age ≥ 65 ^c	-0.094*	-0.088*	-0.075*	-0.188*	-0.181*	-0.086*	-0.032*	-0.004**	-0.099*
Laurelhurst resident ^d	-0.290*	-0.194*	-0.204*	-0.254*	-0.216*	-0.068*	-0.267*	-0.060**	-0.047*
South Park resident ^d	-0.178*	-0.033*	-0.185*	-0.076*	-0.003*	-0.110*	-0.053*	-0.038**	-0.010*
Nagoya resident ^d	-0.176*	-0.098*	-0.685**	-0.374**	-0.405**	-0.150*	-0.408**	-0.026**	-0.247*
Sample size	1,507	1,517	1,438	1,266	1,339	1,433	1,446	1,443	1,468
McFadden's R^2	-0.033*	-0.036*	-0.023*	-0.062*	-0.067*	-0.050*	-0.071*	-0.032**	-0.023*
Adjusted McFadden's R^2	0.021	0.024	0.012	0.049	0.054	0.037	0.059	0.020	0.012

Note: * p -value is significant at 0.05 level; and ** p -value is significant at 0.01 level.

^a θ_{jk} , the unknown threshold parameter to be estimated for sharing resource j .

^bFactor score calculated by factor analysis.

^c40 ≤ age < 65.

^dWestport residents used as the base.

Table 6. Marginal effects of willingness to share a resource with anyone given one-unit increase in trust or place attachment (%)

Attitudinal factors	Water	Food	Medications	Transportation	Communication	First aid supplies	Warmth	Sanitation	Power
Trust	8.5	8.2	8.8	9.7	11.1	8.7	11.3	10.6	8.0
Place attachment	2.3	2.1	0.3	2.4	3.0	2.2	2.5	2.3	2.9

Table 7. Willingness to share, comparison of means (*t*-tests)

Resource	Washington state	Effect	Nagoya City
Water	1.85	>*	1.67
Food	1.93	>*	1.68
Medications	1.56	<*	1.80
Transportation	2.11	>*	1.68
Communication	2.30	>*	1.78
First aid supplies	2.41	>*	2.02
Warmth	2.33	>*	1.80
Sanitation	1.91	>*	1.72
Power	1.80	<	1.83

Note: Strong ties = 1, strong or weak ties = 2, and no ties = 3. **p*-value is significant at 0.01 level.

Table 8. Household preparedness with resources, comparison of means (*t*-tests)

Resource	Washington state	Effect	Nagoya City
Water	3.91	>*	2.03
Food	5.17	>*	1.83
Medications	6.42	>*	2.82
Transportation	5.95	>*	3.09
Communication	4.69	>*	2.52
First aid supplies	5.26	>*	2.11
Warmth	6.68	>*	2.85
Sanitation	4.36	>*	0.85
Power	3.55	>*	0.79

Note: 0 days = 0; 1–3 days = 2; 4–6 days = 5; and 7+ days = 7. **p*-value is significant at 0.01 level.

Table 9. Attitudinal factors, comparison of means (*t*-tests)

Factor	Washington state	Effect	Nagoya City
Trust	0.29	>*	−0.18
Place attachment	0.56	>*	−0.35

Note: **p*-value is significant at 0.01 level.

share by income. Estimates of the dummy variables for the four residential areas suggest little variation in willingness to share different resources across the Washington state communities; most of the significant differences reflect Nagoya respondents' lower level of willingness to share compared with that of Washington state respondents.

Differences in Willingness to Share across Cultural Contexts

Nagoya respondents generally reported being less prepared with needed resources (Table 8). Nagoya respondents also were less willing than Washington state respondents to share nearly all resources except medications. These differences might be explained in part by familiarity with what is actually needed to prepare for a large earthquake. Whereas Japan has experienced multiple large earthquakes in recent years, the Pacific Northwest has not. Prior research has observed a gap between perceived and actual preparedness (Kohn et al. 2012), and the connection between previous disaster experience and increased levels of preparedness is well-documented (Onuma et al. 2017; Oral et al. 2015; Shapira et al. 2018). In other words, although Washington state residents may perceive themselves to be prepared, they may not be due to

lack of experience regarding what is truly needed during a large disaster. Washington state respondents reported being more prepared across all resources and had higher levels of both social trust and place attachment than did Nagoya City respondents (Tables 7–9).

Survey participants also were asked where they anticipated seeking essential resources in a disaster if they were not adequately prepared. Respondents from the two regions anticipated seeking resources from very different locations and entities (e.g., anticipated resource seeking for food and water in Figs. 4 and 5). Whereas Nagoya respondents anticipated turning to government shelters for critical resources such as food and water, Washington state respondents anticipated turning to stores and local institutions such as community centers or food banks. These differences may be explained in part by the existence of well-established, government-run disaster response protocols in Japan, compared with the more individual- and household-focused disaster preparedness efforts in the US.

Discussion

Although strategies to connect people with essential resources after a disaster vary between the US Pacific Northwest and Japan, mainstream disaster preparedness messaging and actions in both contexts have not explored the full potential for decentralized sharing within communities. In the US, disaster preparedness historically has taken place in a top-down manner. The role of individuals and households is to be prepared on their own, or to participate through volunteer Community Emergency Response Team (CERT) training and organization in response skills such as first aid “that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks” (FEMA 2022). In Japan, community-level disaster response capacity has existed for generations and even centuries in the form of volunteer fire-fighting brigades, mutual aid groups, evacuation drills, and designated refuge spaces with supply stores at temples, parks, and schools (Pastrana-Huguet et al. 2022). Japanese cities recently have increased efforts to adapt these historic practices and involve community-level organizations in disaster preparedness through neighborhood planning and community development groups (*machizukuri*) and volunteer emergency management officer (*Bosai Leader*) training and certification similar to the US CERT program (Kitagawa and Samadder 2022; Sakurai and Sato 2018). In Nagoya, 2,057 people are registered as *Bosai Leaders*. However, attempts to revive older community organizations focused on local collective (as distinct from individual) disaster preparedness and self-reliance (*jishu-bosai-soshiki*) still have tended to view the government as the leading agent, and struggled to motivate residents to be proactive (Okada et al. 2013). Similarly, household-based neighborhood associations (*chonaikai* and *jichikai*) also are “dependent on local government and lack political and social autonomy,” which may inhibit decentralized decision making in a disaster (Hasegawa 2014). Postdisaster resource provision is managed primarily by the government, which designates specific locations within communities to serve as public shelters and resource distribution hubs. Broad popular expectation of governmental responsibility for these activities may disincentivize private households from preparing their own access to resources, whether through stockpiling or sharing, compared with households in the US (Joffe 2012; Joffe et al. 2019). Our findings of low peer-to-peer willingness to share seem to be supported by other studies that have found broad social trust in Japan in governmental agencies and elites, but less trust in strangers and willingness to cooperate

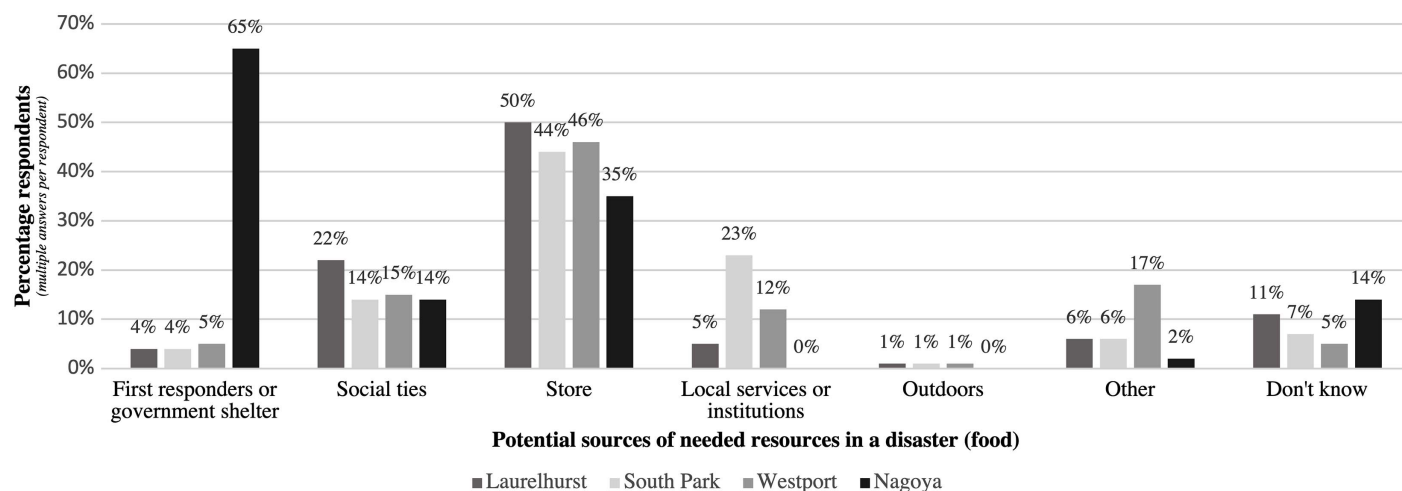


Fig. 4. Resource seeking—food. (Participants were able to list more than one response.)

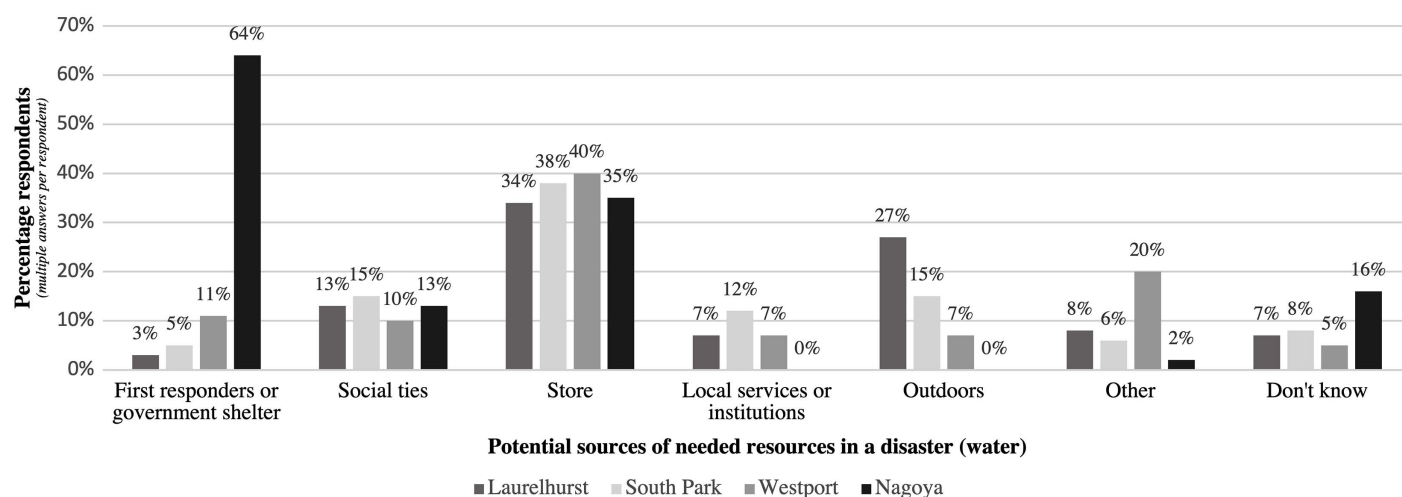


Fig. 5. Resource seeking—water. (Participants were able to list more than one response.)

with them, than is found in comparative studies of Americans, and that this lack of trust in strangers counterintuitively may be a feature of Japan's cultural collectivism (Yamagishi 2003).

Some US agencies and programs, notably Washington state's Map Your Neighborhood tools, have begun encouraging communities to build collective self-reliance and create an inventory of local resources for sharing and distribution in a disaster (Johnson 2009; Washington Emergency Management Division 2022). However, these agencies often lack a clear understanding of which resources are needed at the community level or awareness of pre-existing conditions that might either facilitate or hinder the efficient sharing of resources between and among community members. In addition, Map Your Neighborhood and other disaster preparedness-focused asset mapping efforts are time-consuming, difficult to keep up-to-date, and so far do not effectively make use of social networks (Kousky et al. 2019; Wells et al. 2013). Most emergency preparedness guidance in the US remains focused on what individual households can do for themselves.

Neither the household-focused strategy employed in the US nor the government-centered approach in Japan leverages the potential for person-to-person (or household-to-household) sharing.

Based on the results of this study, we suggest that collective-but-decentralized intracommunity sharing could complement existing disaster preparedness strategies in both the US and Japan by providing people with additional options for accessing resources via local social networks. To be functional in an emergency, such sharing should be informed by dynamic, frequently updated information about who in the community is able and willing to share what resources, and through what relationships. Public agencies then could focus on providing resources that are lacking in the community, and on serving community members who are marginal in social networks.

There also is good reason to believe that supporting a social network-based approach to preparedness would benefit community-building in general, expanding local social capital and helping local networks become more inclusive and adaptive for the whole community (Coleman 1988; Lin 2001, 2002; Beatley 2004; Dynes 2006, 2005; Bodin et al. 2019). However, in order for within-community sharing to serve as a successful disaster response strategy, the necessary supporting conditions—strong social ties and trust—need to be in place before a disaster so that community members are prepared when it occurs. This appears to be as true

in Japan as in the US, based on the studies we reviewed and the findings of our survey.

Trust is critical for facilitating resource sharing within communities in both the US and Japan. Trust-building among community members should be considered to be an integral component of place-based disaster preparedness strategies, distinct from (but complementary to) trust-building between community members and official agencies (Paton 2007). Such interventions might involve the development of community-based disaster-preparedness organizations or the expansion of existing organizations' missions to include disaster preparedness. However, trust-building initiatives need not be focused explicitly on disaster preparedness; they can be incorporated into everyday community life. For example, strengthening social infrastructure—the places and systems that support social interaction (e.g., parks, libraries, churches, and schools)—can help to support the development of relationships within a community and enhance its ability to adapt to change (Klinenberg 2015, 2018). These kinds of shared spaces contribute to more socially, environmentally, and culturally viable communities by providing a physical framework within which individuals interact to build trust and reciprocity (Gandy 2019), which could be leveraged in a time of disaster (Geis 2000). Public spaces also serve as gathering places for the exchange of resources and information following a disaster (Jong 2017; French et al. 2019). Supporting the vitality and use of social infrastructure could serve to strengthen social ties and trust at the community level, potentially increasing individuals' willingness to share resources with one another in a time of need.

One potential means of building trust and enabling resource sharing within communities is through the emerging concept of resilience hubs, which are community-managed facilities intended to support residents by coordinating resource distribution during times of disaster while serving as neighborhood centers on an everyday basis (Baja 2018). However, this concept is still being tested, and questions about equitable access to such facilities remain (Ciriaco and Wong 2022). Additionally, although the authors agree that community-led initiatives could effectively leverage local knowledge and existing social networks (Idziorek et al. 2021), significant and sustainable support would be required for community members or entities to be able to program, stock, and manage resilience hubs as currently conceptualized.

With the growing prevalence of modern communications technologies, we expect that peer-to-peer resource sharing will play an increasingly important role in filling resource gaps during disasters. For example, leveraging the sharing economy is emerging as a potentially effective strategy for disaster response (Wong and Shaheen 2019b) and management (Seddighi and Baharmand 2020). Increased peer-to-peer sharing within communities potentially enhances community cohesion, providing cobenefits that reach beyond disaster response and recovery efforts (Cherry and Pidgeon 2018).

Conclusion

This study of communities in both the US and Japan measured material household preparedness in terms of available resources, and further examined how aspects of social capital—levels of trust, levels of place attachment, and various sociodemographic factors—influence the predisaster willingness of community members to share disaster recovery resources. Differences between the Japanese and American responses suggest different dependencies on and roles for government agencies in the two societies, as well as differences in the types of resources that community members are willing to share, and with whom.

Previous research on cross-cultural disaster preparedness suggested that efforts to reduce disaster risk should strike a balance between emphasizing individual and collective (community-based) action depending on cultural context (Joffe et al. 2013). Likewise, we view decentralized sharing not as an alternative strategy for disaster preparedness, but rather as one that is complementary to existing approaches. Our study measured how prepared people believe themselves to be with resources on hand, as well as their willingness to share resources that their neighbors may lack. Trust was the most important factor across both study regions and for all resources. Willingness to share may be enhanced through trust-building interventions, and should be regarded as an effective focus for preparedness efforts, especially if it is shown to be beneficial for a variety of social purposes. Further research should explore the effect of potential interventions on willingness to share. Finally, there is a need for more cross-cultural comparative work on how community members trust each other for resource-sharing purposes, and whether (and how) place attachment may be a more important factor in willingness to share than our survey revealed. Although some of this work may take its cues from cross-cultural studies of collective and individual efficacy (Paton et al. 2017), it also should make use of anthropological, historical, and geographic perspectives (Edgington 2022).

Data Availability Statement

All data and models that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments

This work was supported by the National Science Foundation JST: SCC-PG: Socially-integrated Technological Solutions for Real-time Response and Neighborhood Survival After Extreme Events (NSF #1951418, JST: JPMJSC2005); the Bullitt Foundation's Building Community Adaptive Capacity—Thought Leadership and Innovation in Applied Urban Sustainability Research, Scholarship and Action program, and the Center for Teaching Old Models New Tricks (TOMNET), a USDOT Tier I University Transportation Center. The authors thank the community partners and academic colleagues—too numerous to list here—who provided thoughtful review of the survey instrument. The authors also thank our diligent peer reviewers for their time as well as their valuable comments and suggestions, which helped us to improve the quality of the manuscript.

References

- Adger, W. N. 2003. "Social capital, collective action, and adaptation to climate change." *Econ. Geogr.* 79 (4): 387–404. <https://doi.org/10.1111/j.1944-8287.2003.tb00220.x>.
- Aldrich, D. P. 2012. *Building resilience: Social capital in post-disaster recovery*. Chicago: University of Chicago Press.
- Aldrich, D. P., and M. A. Meyer. 2015. "Social capital and community resilience." *Am. Behav. Sci.* 59 (2): 254–269. <https://doi.org/10.1177/0002764214550299>.
- Aldrich, D. P., and Y. Sawada. 2015. "The physical and social determinants of mortality in the 3.11 tsunami." *Soc. Sci. Med.* 124 (Jan): 66–75. <https://doi.org/10.1016/j.socscimed.2014.11.025>.
- Alesch, D. J., L. A. Arendt, and J. N. Holly. 2009. *Managing for long-term recovery in the aftermath of disaster*. Fairfax, VA: Public Entity Risk Institute.

- Bagnasco, A. 2012. "Trust and social capital." In *The Wiley-Blackwell companion to political sociology*, edited by E. Amenta, K. Nash, and A. Scott, 1st ed., 252–262. Hoboken, NJ: Wiley.
- Baja, K. 2018. "Resilience hubs: Shifting power to communities and increasing community capacity." Accessed April 18, 2023. https://www.usdn.org/uploads/cms/documents/usdn_resiliencehubs_2018.pdf.
- Baker, M. 2022. "The tsunami could kill thousands. Can they build an escape?" Accessed February 7, 2022. <https://www.nytimes.com/2022/02/07/us/tsunami-northwest-evacuation-towers.html>.
- Beatley, T. 2004. *Native to nowhere: Sustaining home and community in a global age*. Washington, DC: Island Press.
- Blumberg, B. F., J. M. Peiro, and R. A. Roe. 2012. "Trust and social capital: Challenges for studying their dynamic relationship." In *Handbook of research methods on trust*, edited by F. Lyon, G. Mollering, and M. N. K. Saunders, 61–71. Cheltenham, UK: Edward Elgar.
- Bodin, Ö., D. Nohrstedt, J. Baird, R. Summers, and R. Plummer. 2019. "Working at the 'speed of trust': Pre-existing and emerging social ties in wildfire responder networks in Sweden and Canada." *Reg. Environ. Change* 19 (8): 2353–2364. <https://doi.org/10.1007/s10113-019-01546-z>.
- Bonaiuto, M., S. Alves, S. De Dominicis, and I. Petrucci. 2016. "Place attachment and natural hazard risk: Research review and agenda." *J. Environ. Psychol.* 48 (Dec): 33–53. <https://doi.org/10.1016/j.jenvp.2016.07.007>.
- Borowski, E., V. Cedillo, and A. Stathopoulos. 2021. "Dueling emergencies: Flood evacuation ridesharing during the COVID-19 pandemic." *Transp. Res. Interdiscip. Perspect.* 10 (Jun): 100352. <https://doi.org/10.1016/j.trip.2021.100352>.
- Borowski, E., and A. Stathopoulos. 2020. "On-demand ridesourcing for urban emergency evacuation events: An exploration of message content, emotionality, and intersectionality." *Int. J. Disaster Risk Reduct.* 44 (Apr): 101406. <https://doi.org/10.1016/j.ijdr.2019.101406>.
- Castro-Correa, C. P., P. Aldunce Ide, K. Wyndham Vásquez, D. Mena Maldonado, and S. Perez Tello. 2020. "Transformation of social capital during and after a disaster event: The cases Chañaral and Diego de Almagro, Atacama Region, Chile." *Nat. Hazards* 103 (2): 2427–2440. <https://doi.org/10.1007/s11069-020-04091-9>.
- Cherry, C. E., and N. F. Pidgeon. 2018. "Is sharing the solution? Exploring public acceptability of the sharing economy." *J. Cleaner Prod.* 195 (Sep): 939–948. <https://doi.org/10.1016/j.jclepro.2018.05.278>.
- Ciriaco, T. G. M., and S. D. Wong. 2022. "Review of resilience hubs and associated transportation needs." *Transp. Res. Interdiscip. Perspect.* 16 (Dec): 100697. <https://doi.org/10.1016/j.trip.2022.100697>.
- City of Nagoya. 2022. "Casualties and building damages." [In Japanese.] Accessed February 10, 2022. <https://www.city.nagoya.jp/bosaikikikanri/page/0000058347.html>.
- City of Seattle Office of Emergency Management. 2015. "Emergency preparedness survey 2015." Accessed January 11, 2021. https://www.seattle.gov/Documents/Departments/Emergency/Preparedness/City_of_Seattle_Preparedness_Survey_2015.pdf.
- Coleman, J. S. 1988. "Social capital in the creation of human capital." *Am. J. Sociol.* 94 (Sep): 95–120. <https://doi.org/10.1086/228943>.
- Cook, N., and D. Butz. 2013. "The Atta Abad landslide and everyday mobility in Gojal, Northern Pakistan." *Mt. Res. Dev.* 33 (4): 372–380. <https://doi.org/10.1659/MRD-JOURNAL-D-13-00013.1>.
- Davoudi, S. 2012. "Resilience: A bridging concept or a dead end?" *Plann. Theory Pract.* 13 (2): 299–307. <https://doi.org/10.1080/14649357.2012.677124>.
- Delhey, J., and K. Newton. 2003. "Who trusts?: The origins of social trust in seven societies." *Eur. Soc.* 5 (2): 93–137. <https://doi.org/10.1080/1461669032000072256>.
- Dong, S., M. Malecha, H. Farahmand, A. Mostafavi, P. R. Berke, and S. C. Woodruff. 2021. "Integrated infrastructure-plan analysis for resilience enhancement of post-hazards access to critical facilities." *Cities* 117 (Oct): 103318. <https://doi.org/10.1016/j.cities.2021.103318>.
- Doocy, S., A. Daniels, C. Packer, A. Dick, and T. D. Kirsch. 2013. "The human impact of earthquakes: A historical review of events 1980–2009 and systematic literature review." *PLoS Curr.* 5 (Apr): 5. <https://doi.org/10.1371/currents.dis.67bd14fe457f1db0b5433a8ee20fb833>.
- Dynes, R. R. 2005. *Community social capital as the primary basis for resilience*. Newark, DE: Univ. of Delaware Disaster Research Center.
- Dynes, R. R. 2006. "Social capital: Dealing with community emergencies." *Homeland Secur. Aff.* 2 (Jul): 2.
- Edgington, D. W. 2022. "Planning for earthquakes and tsunamis: Lessons from Japan for British Columbia, Canada." *Prog. Plann.* 163 (Sep): 100626. <https://doi.org/10.1016/j.progress.2021.100626>.
- Elliott, J. R., and J. Howell. 2016. "Beyond disasters: A longitudinal analysis of natural hazards' unequal impacts on residential instability." *Soc. Forces* 95 (3): 1181–1207. <https://doi.org/10.1093/sf/sow086>.
- FEMA. 2022. "Community emergency response team (CERT) [Website]." Accessed March 15, 2023. <https://www.fema.gov/emergency-managers/individuals-communities/preparedness-activities-webinars/community-emergency-response-team>.
- Finch, C., C. T. Emrich, and S. L. Cutter. 2010. "Disaster disparities and differential recovery in New Orleans." *Popul. Environ.* 31 (4): 179–202. <https://doi.org/10.1007/s11111-009-0099-8>.
- Fornara, F., M. Bonaiuto, and M. Bonnes. 2010. "Cross-validation of abbreviated perceived residential environment quality (PREQ) and neighborhood attachment (NA) indicators." *Environ. Behav.* 42 (2): 171–196. <https://doi.org/10.1177/0013916508330998>.
- Fothergill, A., E. G. M. Maestas, and J. D. Darlington. 1999. "Race, ethnicity and disasters in the United States: A review of the literature." *Disasters* 23 (2): 156–173. <https://doi.org/10.1111/1467-7717.00111>.
- Fothergill, A., and L. A. Peek. 2004. "Poverty and disasters in the United States: A review of recent sociological findings." *Nat. Hazards* 32 (1): 89–110. <https://doi.org/10.1023/B:NHAZ.0000026792.76181.d9>.
- French, E. L., S. J. Birchall, K. Landman, and R. D. Brown. 2019. "Designing public open space to support seismic resilience: A systematic review." *Int. J. Disaster Risk Reduct.* 34 (Mar): 1–10. <https://doi.org/10.1016/j.ijdr.2018.11.001>.
- Gandy, C. 2019. "Cultivating citizenship in the third place—Understanding the context for empowerment and deliberative democracy at share Okusawa and Okasan No Ie TOMO." Doctoral dissertation, Dept. of Urban Engineering, Graduate School of Engineering, Univ. of Tokyo.
- Geis, D. E. 2000. "By design: The disaster resistant and quality-of-life community." *Nat. Hazard. Rev.* 1 (3): 151–160. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2000\)1:3\(151\)](https://doi.org/10.1061/(ASCE)1527-6988(2000)1:3(151)).
- Goldfinger, C., I. Wong, R. Kulkarni, and J. W. Beeson. 2016. "Reply to 'Comment on Statistical analyses of great earthquake recurrence along the Cascadia subduction zone' by Ram Kulkarni, Ivan Wong, Judith Zachariassen, Chris Goldfinger, and Martin Lawrence' by Allan Goddard Lindh." *Bull. Seismol. Soc. Am.* 106 (6): 2935–2944. <https://doi.org/10.1785/0120150282>.
- Gomberg, J. S., and K. A. Ludwig. 2017. *Reducing risk where tectonic plates collide: U.S. geological survey fact sheet 2017–3024*. Reston, VA: USGS.
- Granovetter, M. S. 1973. "The strength of weak ties." *Am. J. Sociol.* 78 (6): 1360–1380. <https://doi.org/10.1086/225469>.
- Hardin, R. 2001. "Conceptions and explanations of trust." In *Trust in society*, edited by S. C. Karen, 3–39. New York: Russell Sage Foundation.
- Harrison, F., J. Sciberras, and R. James. 2011. "Strength of social tie predicts cooperative investment in a human social network." *PLoS One* 6 (3): e18338. <https://doi.org/10.1371/journal.pone.0018338>.
- Hasegawa, K. 2014. "The Fukushima nuclear accident and Japan's civil society: Context, reactions, and policy impacts." *Int. Sociol.* 29 (4): 283–301. <https://doi.org/10.1177/0268580914536413>.
- Headquarters for Earthquake Research Promotion. 2022. "Earthquakes in the Nankai trough." [In Japanese.] Accessed February 10, 2022. https://www.jishin.go.jp/regional_seismicity/rs_kaiko/k_nankai.
- Idzorek, K., C. Chen, and D. B. Abramson. 2021. *Attitudes and trust in leveraging integrated sociotechnical systems for enhancing community adaptive capacity: Phase IV: Meeting everyday needs in a disaster scenario: The potential for resource sharing through local networks*. Seattle: Univ. of Washington.
- Islam, A., and C. Nguyen. 2018. "Do networks matter after a natural disaster? A study of resource sharing within an informal network after Cyclone Aila." *J. Environ. Econ. Manage.* 90 (Jul): 249–268. <https://doi.org/10.1016/j.jeem.2018.06.007>.

- Israel, B. A. 1985. "Social networks and social support: Implications for natural helper and community level interventions." *Health Educ. Q.* 12 (1): 65–80. <https://doi.org/10.1177/109019818501200106>.
- Jamali, M., and A. Nejat. 2016. "Place attachment and disasters: Knowns and unknowns." *J. Emerg. Manage.* 14 (5): 349. <https://doi.org/10.5055/jem.2016.0299>.
- Joffe, H. 2012. "Cultural barriers to earthquake preparedness: A new study shows how cultural factors in the United States, Japan and Turkey affect disaster planning." Accessed November 14, 2022. https://link-gale-com.offcampus.lib.washington.edu/apps/doc/A293108571/AONE?u=wash_main&sid=bookmark-AONE&xid=ac079bc2.
- Joffe, H., H. W. W. Potts, T. Rossetto, C. Doğulu, E. Gul, and G. Perez-Fuentes. 2019. "The fix-it face-to-face intervention increases multi-hazard household preparedness cross-culturally." *Nat. Hum. Behav.* 3 (5): 453–461. <https://doi.org/10.1038/s41562-019-0563-0>.
- Joffe, H., T. Rossetto, C. Solberg, and C. O'Connor. 2013. "Social representations of earthquakes: A study of people living in three highly seismic areas." *Earthquake Spectra* 29 (2): 367–397. <https://doi.org/10.1193/1.4000138>.
- Johnson, L. A. K. 2009. "MYN map your neighborhood discussion guide: Building and strengthening disaster readiness among neighbors." Accessed March 30, 2022. <https://mil.wa.gov/asset/5ba4202849a61>.
- Johnson, N. D., and A. Mislin. 2012. "How much should we trust the World Values Survey trust question?" *Econ. Lett.* 116 (2): 210–212. <https://doi.org/10.1016/j.econlet.2012.02.010>.
- Jong, F. D. 2017. "Parks and bicycles were lifelines after Mexico City's earthquake." Accessed March 20, 2019. <https://www.citylab.com/environment/2017/09/parks-and-bicycles-were-lifelines-after-mexico-citys-earthquake/541320/>.
- Kitagawa, K., and S. Samaddar. 2022. "Widening community participation in preparing for climate-related disasters in Japan." *UCL Open Environ.* 4 (Dec): e053. <https://doi.org/10.14324/111.444/ucloe.000053>.
- Klinenberg, E. 2015. *Heat wave: A social autopsy of disaster in Chicago*. Chicago: University of Chicago Press.
- Klinenberg, E. 2018. *Palaces for the people: How social infrastructure can help fight inequality, polarization, and the decline of civic life*. 1st ed. New York: Crown.
- Kohn, S., J. L. Eaton, S. Feroz, A. A. Bainbridge, J. Hoolachan, and D. J. Barnett. 2012. "Personal disaster preparedness: An integrative review of the literature." *Disaster Med. Public Health Preparedness* 6 (3): 217–231. <https://doi.org/10.1001/dmp.2012.47>.
- Kousky, C., L. Ritchie, K. Tierney, and B. Lingle. 2019. "Return on investment analysis and its applicability to community disaster preparedness activities: Calculating costs and returns." *Int. J. Disaster Risk Reduct.* 41 (Dec): 101296. <https://doi.org/10.1016/j.ijdrr.2019.101296>.
- Kulkarni, R., I. Wong, J. Zachariasen, C. Goldfinger, and M. Lawrence. 2013. "Statistical analyses of great earthquake recurrence along the Cascadia subduction zone." *Bull. Seismol. Soc. Am.* 103 (6): 3205–3221. <https://doi.org/10.1785/0120120105>.
- Kuriyama, N., E. Maly, J. León, D. Abramson, L. T. Nguyen, and A. Bostrom. 2020. "Towards a comparative framework of adaptive planning and anticipatory action regimes in Chile, Japan, and the US: An exploration of multiple contexts informing tsunami risk-based planning and relocation." *J. Disaster Res.* 15 (7): 878–889. <https://doi.org/10.20965/jdr.2020.p0878>.
- Lin, N. 2001. "Building a network theory of social capital." In *Social capital: Theory and research*, edited by R. Nan Lin, S. Burt, and S. Karen, 3–28. New York: Aldine de Gruyter.
- Lin, N. 2002. "Social capital: A theory of social structure and action." In *Structural analysis in the social sciences*. Cambridge, MA: Cambridge University Press.
- Lindell, M. K., C. S. Prater, and R. W. Perry. 2006. "Myths and realities of household disaster response." In *Fundamentals of emergency management*. Emmitsburg, MD: Federal Emergency Management Agency.
- Lindh, A. G. 2016. "Statistical analyses of great earthquake recurrence along the Cascadia subduction Zone." *Bull. Seismol. Soc. Am.* 106 (6): 2927–2934. <https://doi.org/10.1785/0120150069>.
- Manzo, L. C., and D. D. Perkins. 2006. "Finding common ground: The importance of place attachment to community participation and planning." *J. Plann. Lit.* 20 (4): 335–350. <https://doi.org/10.1177/0885412205286160>.
- Masai, R., L. Kuzunishi, and T. Kondo. 2009. "Women in the Great Hanshin Earthquake." In *Women, gender and disaster: Global issues and initiatives*. New Delhi, India: SAGE.
- Meyer, M. A. 2018. "Social capital in disaster research." In *Handbook of disaster research*, edited by H. Rodríguez, W. Donner, and E. T. Joseph, 263–286. Berlin: Springer.
- Mileti, D. 1999. *Disasters by design: A reassessment of natural hazards in the United States*. Washington, DC: National Academies Press.
- Ministry of Land, Infrastructure, Transport and Tourism of Japan. 2021. "White paper on land, infrastructure, transport and tourism in Japan." [In Japanese.] Accessed April 2, 2023. <https://www.mlit.go.jp/hakusyo/mlit/r02/hakusho/r03/html/n1112000.html>.
- Mishra, S., S. Mazumdar, and D. Suar. 2010. "Place attachment and flood preparedness." *J. Environ. Psychol.* 30 (2): 187–197. <https://doi.org/10.1016/j.jenvp.2009.11.005>.
- Okada, N., L. Fang, and D. M. Kilgour. 2013. "Community-based decision making in Japan." *Group Decis. Negotiation* 22 (1): 45–52. <https://doi.org/10.1007/s10726-012-9320-8>.
- Onuma, H., K. J. Shin, and S. Managi. 2017. "Household preparedness for natural disasters: Impact of disaster experience and implications for future disaster risks in Japan." *Int. J. Disaster Risk Reduct.* 21 (Mar): 148–158. <https://doi.org/10.1016/j.ijdrr.2016.11.004>.
- Oral, M., A. Yenel, E. Oral, N. Aydin, and T. Tuncay. 2015. "Earthquake experience and preparedness in Turkey." *Disaster Prev. Manage.* 24 (1): 21–37. <https://doi.org/10.1108/DPM-01-2013-0008>.
- Pastrana-Huguet, J., M. F. Casado-Claro, and E. Gavari-Starkie. 2022. "Japan's culture of prevention: How *bosai* culture combines cultural heritage with state-of-the-art disaster risk management systems." *Sustainability* 14 (21): 13742. <https://doi.org/10.3390/su142113742>.
- Paton, D. 2007. "Preparing for natural hazards: The role of community trust." *Disaster Prev. Manage. Int. J.* 16 (3): 370–379. <https://doi.org/10.1108/09653560710758323>.
- Paton, D., L. -J. Jang, K. Kitagawa, L. Mamula-Seadon, and Y. Sun. 2017. "Coping with and adapting to natural hazard consequences: Cross-cultural perspectives." In *Disaster resilience: An integrated approach*, edited by D. Paton and D. M. Johnston, 2nd ed., 236–254. Springfield, IL: Charles C Thomas.
- Payton, M. A., D. C. Fulton, and D. H. Anderson. 2005. "Influence of place attachment and trust on civic action: A study at Sherburne National Wildlife Refuge." *Soc. Nat. Resour.* 18 (6): 511–528. <https://doi.org/10.1080/08941920590947940>.
- Prime Minister's Office of Japan. 2022. "Preparation at home for disaster: Let's prepare at least these!" [In Japanese.] Accessed November 15, 2022. <https://www.kantei.go.jp/jp/headline/bousai/sonae.html>.
- Putnam, R. D. 2000. *Bowling alone: The collapse and revival of American community*. New York: Simon and Schuster.
- Resilient Washington Subcabinet Project Team. 2017. "Resilient Washington subcabinet report: Findings and recommendations." Accessed March 20, 2022. <https://mil.wa.gov/asset/5ba420648fb16>.
- Robles, L. R., and T. Ichinose. 2016. "Connections, trust and social capital in disaster: A study on the 2013 typhoon Haiyan affected residents in Leyte, Philippines." *J. Environ. Inf. Sci.* 44 (Mar): 79–86. https://doi.org/10.11492/ceispapersen.44.5.0_79.
- Sakurai, A., and T. Sato. 2018. "Enhancing community resilience through capacity development after GEJE: The case of Sendaishi-Chiiki Bousai leaders (SBLs) in Miyagi prefecture." In *The 2011 Japan earthquake and Tsunami: Reconstruction and restoration*, edited by V. Santiago-Fandiño, S. Sato, N. Maki, and K. Iuchi, 113–126. Berlin: Springer.
- Scannell, L., L. Q. Tan, R. S. Cox, and R. Gifford. 2019. "Place attachment, well-being, and resilience." In *The Routledge handbook of people and place in the 21st-century city*, edited by K. Bishop and N. Marshall, 243–251. New York: Routledge.
- Schreiner, N., D. Pick, and P. Kenning. 2018. "To share or not to share? Explaining willingness to share in the context of social distance." *J. Consum. Behav.* 17 (4): 366–378. <https://doi.org/10.1002/cb.1717>.
- Schulz, K. 2015. "The really big one." Accessed July 13, 2015. <https://www.newyorker.com/magazine/2015/07/20/the-really-big-one>.

- Seattle Office of Emergency Management. 2019. "Seattle hazard identification and vulnerability analysis." Accessed July 27, 2020. <https://www.seattle.gov/Documents/Departments/Emergency/PlansOEM/SHIVA/SHIVAv7.0.pdf>.
- Seddighi, H., and H. Baharmand. 2020. "Exploring the role of the sharing economy in disasters management." *Technol. Soc.* 63 (Nov): 101363. <https://doi.org/10.1016/j.techsoc.2020.101363>.
- Shapira, S., L. Aharonson-Daniel, and Y. Bar-Dayana. 2018. "Anticipated behavioral response patterns to an earthquake: The role of personal and household characteristics, risk perception, previous experience and preparedness." *Int. J. Disaster Risk Reduct.* 31 (Oct): 1–8. <https://doi.org/10.1016/j.ijdr.2018.04.001>.
- Sheller, M. 2013. "The island effect: Post-disaster mobility systems and humanitarian logistics in Haiti." *Cult. Geographies* 20 (2): 185–204. <https://doi.org/10.1177/1474474012438828>.
- Smith, T. W., M. Davern, J. Freese, and S. Morgan. 2018. *General social surveys, 1972–2018 [Machine-readable data file]*. Chicago: NORC at the Univ. of Chicago.
- Stefaniak, A., M. Bilewicz, and M. Lewicka. 2017. "The merits of teaching local history: Increased place attachment enhances civic engagement and social trust." *J. Environ. Psychol.* 51 (Aug): 217–225. <https://doi.org/10.1016/j.jenvp.2017.03.014>.
- Tierney, K. 2006. "Social inequality, hazards, and disasters." In *On risk and disaster: Lessons from Hurricane Katrina*, edited by J. D. Ronald, F. K. Donald, and H. Kunreuther, 109–128. Philadelphia: University of Pennsylvania Press.
- Tierney, K. J. 2014. "The social roots of risk: Producing disasters, promoting resilience." In *High reliability and crisis management*. Stanford, CA: Stanford University Press.
- Twigg, J., and I. Mosel. 2017. "Emergent groups and spontaneous volunteers in urban disaster response." *Environ. Urbanization* 29 (2): 443–458. <https://doi.org/10.1177/0956247817721413>.
- Wallis, A., R. Fischer, and W. Abrahamse. 2022. "Place attachment and disaster preparedness: Examining the role of place scale and preparedness type." *Environ. Behav.* 54 (3): 670–711. <https://doi.org/10.1177/00139165211064196>.
- Wang, Z., Z. Han, L. Liu, and S. Yu. 2021. "Place attachment and household disaster preparedness: Examining the mediation role of self-efficacy." *Int. J. Environ. Res. Public Health* 18 (11): 5565. <https://doi.org/10.3390/ijerph18115565>.
- Washington Emergency Management Division. 2020. "Disaster ready Washington." Accessed October 24, 2020. <https://mil.wa.gov/preparedness>.
- Washington Emergency Management Division. 2022. "Map your neighborhood." Accessed December 22, 2022. <https://mil.wa.gov/map-your-neighborhood>.
- Waugh, W. L., and C. Yang. 2014. "Disasters, the whole community, and development as capacity building." In *Disaster and development*, edited by N. Kapucu and K. T. Liou, 167–179. Berlin: Springer.
- Welch, M. R., R. E. N. Rivera, B. P. Conway, J. Yonkoski, P. M. Lupton, and R. Giancola. 2005. "Determinants and consequences of social trust." *Sociological Inq.* 75 (4): 453–473. <https://doi.org/10.1111/j.1475-682X.2005.00132.x>.
- Wells, K. B., et al. 2013. "Applying community engagement to disaster planning: Developing the vision and design for the Los Angeles County community disaster resilience initiative." *Am. J. Public Health* 103 (7): 1172–1180. <https://doi.org/10.2105/AJPH.2013.301407>.
- Wong, S., and S. Shaheen. 2019a. *Current state of the sharing economy in evacuations: Lessons from California wildfires*. Berkeley, CA: Univ. of California Institute of Transportation Studies. <https://doi.org/10.7922/G2WW7FVK>.
- Wong, S., and S. Shaheen. 2019b. "Leveraging the sharing economy to expand shelter and transportation resources in California evacuations." Accessed December 10, 2019. <https://escholarship.org/uc/item/6pw2w52b>.
- Wong, S. D., J. C. Broader, and S. A. Shaheen. 2020a. "Can sharing economy platforms increase social equity for vulnerable populations in disaster response and relief? A case study of the 2017 and 2018 California wildfires." *Transp. Res. Interdiscip. Perspect.* 5 (May): 100131. <https://doi.org/10.1016/j.trip.2020.100131>.
- Wong, S. D., A. K. Mengqiao, S. A. Shaheen, and J. L. Walker. 2023. "Willingness of Hurricane Irma evacuees to share resources: A multi-modeling approach." *Transportmetrica A: Transp. Sci.* 19 (2): 2017064. <https://doi.org/10.1080/23249935.2021.2017064>.
- Wong, S. D., J. L. Walker, and S. A. Shaheen. 2020b. "Bridging the gap between evacuations and the sharing economy." *Transportation* 48 (3): 1409–1458. <https://doi.org/10.1007/s11116-020-10101-3>.
- Wong, S. D., J. L. Walker, and S. A. Shaheen. 2021. "Trust and compassion in willingness to share mobility and sheltering resources in evacuations: A case study of the 2017 and 2018 California wildfires." *Int. J. Disaster Risk Reduct.* 52 (Jan): 101900. <https://doi.org/10.1016/j.ijdr.2020.101900>.
- Yamagishi, T. 2003. "Cross-societal experimentation on trust: A comparison of the United States and Japan." In *Trust and reciprocity: Interdisciplinary lessons from experimental research*, edited by E. Ostrom and J. Walker, 352–370. New York: Russell Sage Foundation.