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Social networks and disaster preparedness at the community level: the role of social ties and social
infrastructure in connecting people with essential resources

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Abstract

Social networks and disaster preparedness at the community level: the role of social ties and social infrastructure in connecting people with essential resources

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In extreme disaster scenarios, community social networks – relationships between community members – can help to connect people with needed knowledge and resources but are rarely leveraged in standard approaches to disaster preparedness. Socioecological resilience theory and social network theory provide a framework for engaging three communities in Washington State to understand how community social networks can be leveraged to support localized self-sufficiency in a disaster scenario. Three empirical studies provide a conceptual framework illustrating how social networks can help to connect people with local resources following a disaster; an analysis of the potential for hyperlocal resource-matching post-disaster; and an analysis of anticipated willingness to share resources in a disaster scenario. The dissertation's findings provide evidence that local social networks, if strengthened and maintained, hold meaningful potential for connecting people with needed resources in both disaster and everyday scenarios. These findings suggest that ongoing efforts to integrate disaster preparedness concerns into urban planning research and practice should focus on enhancing community-level social networks and social infrastructure.

Table of Contents

List of figures	i
List of tables	iii
1. Introduction	1
<i>Background</i>	<i>1</i>
<i>Problem statement.....</i>	<i>2</i>
Reliance on interdependent infrastructures.....	2
Geographical nature of disasters.....	3
Top-down approaches to disaster preparedness and response.....	3
Challenges in planning for disasters	3
<i>Key theories.....</i>	<i>4</i>
Socio-ecological resilience theory.....	4
Social network theory.....	5
A combined perspective	5
<i>Aims.....</i>	<i>5</i>
Contributions	5
Research questions	6
<i>Overview of approach</i>	<i>7</i>
<i>Community-engaged, asset-based research approach</i>	<i>8</i>
Community-engaged approach	8
Asset-based approach.....	9
<i>Organization.....</i>	<i>10</i>
Structure	10
Key terms	11
2. Engagement with study communities.....	12
<i>The study communities.....</i>	<i>13</i>
Laurelhurst.....	14
South Park.....	20
Westport	28
Effects of the team's relationships with the study communities	36
3. Community resilience sample survey	37
Survey design and development.....	37
Survey modules.....	38
Sampling	40
Survey implementation.....	42
Survey response: comparative descriptive statistics	47
4. A community social network conceptual framework for carrying out essential everyday activities in a disaster scenario.....	52

<i>Introduction</i>	52
<i>Literature review</i>	53
Socioecological resilience theory and urban planning.....	53
Social network theory.....	57
<i>Essential everyday activities and interdependent infrastructure systems</i>	61
<i>Effects of a major earthquake on interdependent infrastructure systems</i>	63
<i>The role of social networks in obtaining hot food</i>	65
Existing social ties can enable knowledge sharing.....	65
Existing social ties can facilitate resource-sharing.....	65
Social ties can be created and/or strengthened through shared experience.....	66
<i>Obtaining hot food in a disaster context</i>	66
Existing social ties can enable knowledge sharing.....	67
Existing social ties can facilitate resource-sharing.....	67
Social ties can be created and/or strengthened through shared experience.....	68
<i>A conceptual framework for understanding community resource networks in a disaster scenario</i>	69
Relevant scales of place	69
Community network characteristics	69
Network dynamics: resource matching and sharing.....	71
Conceptual framework	71
<i>Community resource matching using real-world social network data</i>	71
<i>Conclusion</i>	78
Resource matching through local networks	79
Willingness to share resources	79
5. Meeting everyday needs in a disaster scenario: the potential for resource sharing through local networks	80
<i>Literature review</i>	81
The role of social ties and social capital in disaster scenarios	81
The potential of social infrastructure in disaster scenarios.....	82
Integrating urban planning and hazards planning: spatial planning and social networks.....	84
<i>Setting</i>	85
<i>Methods</i>	85
Community resilience sample survey	85
Interviews	85
<i>Findings</i>	87
Resource preparedness	87
Resource seeking	89
Interview findings: Gaps and opportunities.....	104
COVID experiences of the study communities.....	112
COVID lessons learned	113
<i>Conclusion</i>	115
The role of social ties in disaster preparedness.....	115
Access to local resources and disaster preparedness.....	115
Reliance on infrastructure	116

"We're on our own"	117
The role of urban planning in promoting disaster preparedness	118
6. Anticipated willingness to share resources in a disaster scenario: the role of social ties	120
<i>Introduction</i>	120
Research questions	121
<i>Literature review</i>	121
Willingness to share in disasters	121
Social trust, social ties, and sharing	123
<i>Methods</i>	124
Sample survey	124
Focus groups	124
Open coding	127
<i>Findings</i>	129
Quantitative analysis	129
Qualitative analysis: willingness to share motivations	136
<i>Discussion and recommendations</i>	143
Recommendations for intervention	144
Study limitations	146
<i>Conclusion</i>	146
7. Conclusion	148
<i>Summary and integration of findings</i>	148
The role of community social networks in disaster scenarios	148
Resource matching via local networks	148
Understanding anticipated willingness to share resources in a disaster scenario	149
Synthesis	149
<i>Reflection: Engaging in disaster research during the COVID-19 pandemic</i>	150
<i>Contributions</i>	151
Resource sharing	151
Willingness to share	152
Methodological contributions	152
<i>Directions for future research</i>	153
Resource matching	153
Willingness to share	154
8. References	155
Appendices	170
<i>Community resilience sample survey instrument</i>	171
<i>Interview guide</i>	179
<i>Focus group protocol</i>	183

List of figures

Figure 1: Cascadia earthquake sources, including the Cascadia Subduction Zone. Image credit: U.S. Geological Survey and Pacific Northwest Seismic Network.	1
Figure 2: Nodes and social ties in a social network	5
Figure 3: Community networks as the focal level in a complex adaptive system (Panarchy diagram adapted from Gunderson and Holling 2002)	5
Figure 4: Mixed methods sequential research design	7
Figure 5: Socioeconomic and urban/rural characteristics of the three study communities (MHI = median annual household income)	12
Figure 6: Study community locations within the Pacific Northwest. Maps created using ArcGIS Online (Esri n.d.)	12
Figure 7: Study community boundaries. Maps created using ArcGIS Online (Esri n.d.)	13
Figure 8: Laurelhurst's location within the greater Seattle area. Map created using ArcGIS Online (Esri n.d.)	14
Figure 9: The Laurelhurst neighborhood of Seattle. Map created using ArcGIS Online (Esri n.d.)	16
Figure 10: South Park's location within the greater Seattle area. Map created using ArcGIS Online (Esri n.d.)	20
Figure 11: The South Park neighborhood of Seattle. Map created using ArcGIS Online (Esri n.d.)	23
Figure 12: Westport's location on Washington's Pacific coast. Map created using ArcGIS Online (Esri n.d.)	28
Figure 13: Westport, WA. Map created using ArcGIS Online (Esri n.d.)	31
Figure 14: A schematic illustration of the panarchy concept applied in a community resilience context (figure reprinted from Berkes and Ross 2016 with permission – see footnote)	57
Figure 15: Interdependencies between resources needed for obtaining a hot meal	62
Figure 16: Resources needed for obtaining a hot meal in “normal” circumstances	63
Figure 17: Potential effects of a disaster on resources needed for obtaining a hot meal	63
Figure 18: Knowledge sharing in a social network (everyday scenario)	65
Figure 19: Resource sharing in a social network (everyday scenario)	66
Figure 20: Building social ties through shared experiences (everyday scenario)	66
Figure 21: Knowledge sharing in a social network (disaster scenario)	67
Figure 22: Resource sharing in a social network – cooking a hot meal (disaster scenario)	68
Figure 23: Building social ties through shared experiences (disaster scenario)	68
Figure 24: Nested scales of place relative to the community scale.....	69
Figure 25: Evolution of the two-mode network during a disaster.....	70
Figure 26: Social ties enable sharing of resources between nodes.....	71
Figure 27: Node adjacency matrix	72
Figure 28: The illustrative network. Nodes within Zone E are connected by social ties whose strength is determined by proximity and cluster membership.	73
Figure 29: Communication resource matching.....	74
Figure 30: Sanitation resource matching.....	75
Figure 31: Shelter resource matching.....	76
Figure 32: Water resource matching	77
Figure 33: Power resource matching	77

Figure 34: Percent of respondents prepared with 0-3 days' supply of essential resources, by community	88
Figure 35: Percent of respondents prepared with 4-6 days' supply of essential resources, by community	89
Figure 36: Percent of respondents prepared with 4-6 days' supply of essential resources, by community	89
Figure 37: Where respondents expect to turn for needed resources in a disaster scenario (by community)	91
Figure 38: Screenshot of the Miro post-it board from one of the focus groups	126
Figure 39: Example of a code network for the preliminary theme "familiarity" as visualized in ATLAS.ti	128
Figure 40: Willingness to share resource profiles by % respondents	130
Figure 41: Willingness to share resource profiles by % respondents (continued)	131
Figure 42: Willingness to share community profiles.....	132
Figure 43: Factors affecting willingness to share	137
Figure 44: Survey responses indicating willingness to share essential resources – Laurelhurst.....	141
Figure 45: Survey responses indicating willingness to share essential resources – South Park.....	142
Figure 46: Survey responses indicating willingness to share essential resources – Westport.....	142

List of tables

Table 1: Comparison of study communities – population, income, density, and ethnicity	13
Table 2: Sociodemographic characteristics for Laurelhurst and Sand Point	15
Table 3: Sociodemographic characteristics for South Park	22
Table 4: Sociodemographic characteristics for Westport.....	29
Table 5: Sample size parameters for full survey	42
Table 6: Pilot survey response totals by mode and incentive strategy	44
Table 7: Survey response rates by study community	47
Table 8: Survey response to demographic questions by study community	47
Table 9: Laurelhurst/Sand Point respondent characteristics compared to 2017 ACS 5-Year Estimates....	48
Table 10: South Park respondent characteristics compared to 2017 ACS 5-Year Estimates	49
Table 11: Westport respondent characteristics compared to 2019 ACS 5-Year Estimates.....	50
Table 12: Node attribute coding	72
Table 13: Interviewees.....	86
Table 14: Number of resource-seeking response items, by resource and community.....	90
Table 15: Expected sources for essential items in a disaster (Laurelhurst, % responses).....	92
Table 16: Expected sources for need items in a disaster (South Park, % responses).....	92
Table 17: Expected sources for need items in a disaster (Westport, % responses)	93
Table 18: Anticipated sources for essential resources with which households are the least prepared (by % households not prepared with 7+ days of resources listed).....	94
Table 19: Chi Square test of independence – pairwise comparison of resource-seeking distributions - communication	95
Table 20: Chi Square test of independence – pairwise comparison of resource-seeking distributions - first aid supplies	96
Table 21: Chi Square test of independence – pairwise comparison of resource-seeking distributions - food.....	97
Table 22: Chi Square test of independence – pairwise comparison of resource-seeking distributions - medications.....	99
Table 23: Chi Square test of independence – pairwise comparison of resource-seeking distributions - power	100
Table 24: Chi Square test of independence – pairwise comparison of resource-seeking distributions - sanitation	101
Table 25: Chi Square test of independence – pairwise comparison of resource-seeking distributions - shelter	101
Table 26: Chi Square test of independence – pairwise comparison of resource-seeking distributions - transportation.....	102
Table 27: Chi Square test of independence – pairwise comparison of resource-seeking distributions - warmth.....	103
Table 28: Chi Square test of independence – pairwise comparison of resource-seeking distributions - water	103
Table 29: Focus group scheduling and number of participants.....	125
Table 30: Community social profiles.....	129
Table 31: Pearson’s product-moment correlation – individual factors.....	133

Table 32: Spearman’s rank correlation – preparedness and willingness to share	134
Table 33: Pearson’s product-moment correlation between household characteristics and willingness to share	134
Table 34: Pearson’s product-moment correlation household characteristics and willingness to share (resource).....	135
Table 35: Focus group introductions - participants' favorite attributes of their communities	136
Table 36: Focus group warm-up activity – within-community sharing	136
Table 37: Summary of willingness to share factors	140

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1. Introduction

Background

This dissertation is motivated in large part by the anticipation of a large seismic event in the Pacific Northwest. In this part of the country, we live at risk of multiple types of earthquake hazards. One of particular concern is a Cascadia Subduction Zone (CSZ) magnitude 9.0 “megathrust” earthquake, which has recurred throughout our region’s history and which would cause widespread destruction throughout the region (Boyle 2020; United States Geological Survey 2021). For reference, the Great Tohoku earthquake of 2011 in Japan was a magnitude 9.0 event, the fifth largest ever recorded (Live Science Staff 2011). An earthquake of similar magnitude in the Pacific Northwest could result in more than 10,000 deaths, 30,000 injuries, and more than \$70 billion in economic loss (Cascadia Region Earthquake Workgroup 2013).

The Cascadia Subduction Zone comprises the 1,000-mile-long boundary between two moving tectonic plates. The fault stretches from Vancouver Island to northern California and is in the process of building up strain, which will eventually be released when the fault accumulates enough strain to rupture, resulting in an earthquake (see Figure 1). Because the plates are continuously moving, the process is cyclical, with earthquakes occurring periodically over the past several thousand years. There is approximately a one in 10 chance of a CSZ 9.0 earthquake occurring in the next 50 years (Atwater 2016). An event of this nature is also likely to generate a tsunami that would devastate coastal communities.

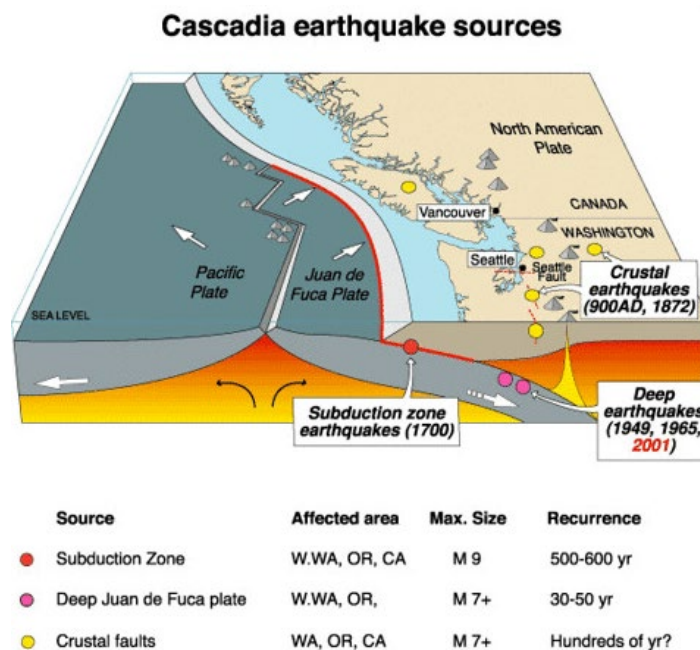


Figure 1: Cascadia earthquake sources, including the Cascadia Subduction Zone. Image credit: U.S. Geological Survey and Pacific Northwest Seismic Network.

This recurring CSZ event is relatively recent knowledge in the hazard science community. The Cascadia region was long thought to be incapable of generating earthquakes larger than a magnitude of 7.5, and it wasn’t until the 1980s and 90s that researchers gained a better understanding the true risk posed by Cascadia earthquakes, including the inevitability of a 9.0 event (Atwater 2016). This knowledge poses complex challenges regarding how to plan for the highly developed urban and coastal areas that are at high risk, including regional centers like Seattle and Portland as well as smaller coastal communities and Native American reservations. A 2015 New Yorker article written by Kathryn Schultz brought the risk of a CSZ earthquake to popular attention and voiced a call to action for leaders and disaster preparedness planners in the region to improve readiness for such an event (Schulz 2015).

In the case of a CSZ earthquake, communities will likely be on their own for an extended period of time with limited ability to carry out everyday activities, and they may need to rely on local resources for meeting basic needs for up to three weeks (Washington State Emergency Management Division 2020). Because government agencies would be overwhelmed and not likely to be able to provide timely assistance, some communities have developed grassroots disaster preparedness organizations to help mitigate local risk in the event of such a disaster. The collective skills of citizens have been recognized as a resource in times of crisis when preparedness professionals are limited in their ability to respond, and neighbors often serve as first responders during events out of necessity (Tierney 2014; Fugate 2017; James 2018).

Of course, a CSZ earthquake is not the only type of potential hazard faced by the Pacific Northwest. The region is also susceptible to other types of earthquakes as well as wildfires, floods, landslides, and volcanic eruptions, not to mention the kinds of chronic disasters embodied by pervasive economic inequality and socially determined disparities in health outcomes. The sudden onset of the COVID-19 pandemic has served as a reminder that disasters often cannot be anticipated, and that coping with their effects requires flexibility.

The economic, social, and cultural costs associated with long-range solutions for addressing hazards can create vulnerabilities in the short term (Bates and Pelanda 1994). Preparing for disasters is challenging due to the limited resources available for preparedness as well as inherent uncertainties about the nature, timing, and extent of potential disasters. It is difficult for people, and governments, to prioritize preparing for uncertain events when they are faced with a host of pressing issues in everyday life. While this dissertation adopts the frame of a CSZ earthquake to explore the potential of community social networks in disaster scenarios, it does so with an awareness that interventions and strategies developed from this research will be more effective if they can help communities prepare for a wide range of disasters as well as incorporate co-benefits that can help them to meet both their short- and long-term planning goals.

Problem statement

Disasters constitute sudden disruptions of collective social routines due to perceived threats, leading to the need for adaptation to cope with the crisis (Quarantelli 2000). Disasters are socially constructed, meaning that although external events may trigger disasters, their consequences are largely shaped by the social structure in which those they affect are embedded (Bankoff 2007; Tierney 2014). Disasters are becoming more common and pervasive, their effects felt across all sectors of society. In the United States, the number of climate- and weather-related disasters, and their associated costs, are rising due to a combination of increased exposure and vulnerability, as well as increased frequency of events due to climate change (Zagorsky 2017; Reidmiller et al. 2018). In 2020 alone, there were 22 billion-dollar weather and climate disasters in the U.S., costing the country \$95 billion in damages (A. B. Smith 2021).

Reliance on interdependent infrastructures

The increasing reliance of cities and urban-rural regions on complex and interdependent infrastructures has heightened community vulnerability to all scales of natural and man-made threats. In both urban and rural areas, smart cities systems have contributed to increasing societal dependence on the brittle infrastructure of cell phones, cloud computing and GPS-reliant devices – technologies that are susceptible to system-wide failure (A. M. Townsend 2013). People exist deeply embedded in these

socio-technical systems, dependent on such infrastructures for myriad everyday tasks and activities, not to mention critical services such as health care. Despite the risk and uncertainty associated with new technologies, people often trust them, even though they often fail (Li, Hess, and Valacich 2008; A. M. Townsend 2013). In addition, the disrepair of physical infrastructure systems is a problem in the U.S., with the nation's critical facilities and infrastructure receiving a grade of "D" in 2008 (Flynn and Burke 2011).

Geographical nature of disasters

Disasters are inherently geographical, and affected communities often become reliant on local resources when municipalities and agencies become overwhelmed. Disruptions caused by natural and man-made hazards exacerbate the impacts of physical and technological infrastructure failure, which are felt most by societal groups dealing with pre-existing vulnerabilities and social inequalities (Klinenberg 2015; Elliott and Howell 2016). Meanwhile, standard approaches to resilience planning tend to shift the responsibility for "being resilient" from government onto individuals and communities, leaving the most vulnerable places even more exposed (Davoudi 2012).

Top-down approaches to disaster preparedness and response

In the U.S., as in many other places, disaster preparedness and response have historically been approached by employing top-down, one-size fits all strategies focused on individuals or households (Scolobig et al. 2015). But top-down approaches don't recognize the unique values and identities of communities, nor do they fully consider how community members could work together to support resilience. For example, while FEMA's National Household Survey does ask one question about whether participants have spoken with their neighbors about disaster preparedness and whether their disaster preparedness plan includes checking in on neighbors, it focuses almost exclusively on preparation in terms of individual- or household-level actions and does not address specific preparedness or mitigation actions that could be taken at the community scale or in cooperation with one's neighbors (Federal Emergency Management Agency 2017).

Top-down approaches end to focus on strengthening hard infrastructure, which has not been shown to be a successful long-term strategy (Aldrich and Meyer 2015; Imperiale and Vanclay 2020). On the other hand, we know that strengthening social infrastructure, or the places and systems that support social connectivity, can help to support longer-term flexibility and adaptation (Klinenberg 2015; 2018). Additionally, distinctive local characteristics contribute to community resilience and can help play a role in developing place-based strategies for hazard mitigation, and local-level engagement can help to develop sustainable hazard mitigation strategies (Tierney 2014; Mileti 1999).

Challenges in planning for disasters

As place-based phenomena that affect, and are affected by, the ways in which people inhabit the built environment, disasters have become a topic of increasing interest and study in urban planning (Schwab 2010). However, we have limited resources with which to plan for the future, and the timing, location and magnitude of disasters are often somewhat uncertain, which makes them difficult to plan for. Disaster preparedness projects often have to compete for attention and funding with other kinds of urgent needs like infrastructure and social programs. The result is a kind of tension between what we might think of as "everyday" urban planning, which is typically focused on community development and

improving quality of life, and hazards mitigation planning, which is typically focused on purpose-built structures that can be quite expensive.

This dissertation addresses these challenges by focusing on the scale of the community to understand how local factors, including both physical and social attributes, can contribute to the adaptability of place-based communities in a disaster scenario. Although the dissertation primarily addresses a specific, and catastrophic, disaster scenario, the goal is to seek lessons that planners and communities can use to develop resiliency to acute hazards while improving everyday well-being and quality of life by leveraging place-based social connectivity and local resources.

Key theories

In response to the inadequacy of approaches to building community resilience and improving disaster preparedness that rely on the strengthening of physical infrastructure, we join an alternative discourse among researchers focusing more closely on social factors as related to the causes of, and potential responses to, disasters.¹ The theoretical framework for this research draws upon two key bodies of literature: socioecological resilience theory, which has been broadly referenced in urban planning research (e.g., Wilkinson 2012; Ernstson et al. 2010; Goldstein et al. 2015; Davoudi 2012; 2018 and many others); and social network theory, which, despite its potential to help planners better understand social relationships, has been less widely explored in planning (Dempwolf and Lyles 2012). The socioecological resilience approach acknowledges the complexity and interconnectedness of community social systems, while the social network approach highlights the potential of social relationships to influence social outcomes.

Socio-ecological resilience theory

Originating in the discipline of ecology, socio-ecological resilience theory describes the behavior of multiscale complex adaptive systems, in particular the mechanisms that support a balance between stability and change within those systems. The key conceptual framework put forth in socioecological resilience theory is that of the Panarchy, a hierarchical set of nested systems that each experience cycles of growth, conservation, collapse, and renewal but that also have the ability to influence and support one another between scales (Gunderson and Holling 2002). From this perspective, resilience is defined as the ability of a system to respond to stresses and shocks while preserving its identity and primary system functions (Walker et al. 2004). Within the panarchy framework, those systems that are imbricated, having functional redundancy at multiple scales, are better able to adapt to change (C. R. Allen and Holling 2008).

¹ The first person plural was used throughout the dissertation to reflect the contributions of the entire research team.

Social network theory

Social network theory, which conceptualizes social networks as structures connecting people with shared characteristics, originated in the work of sociologists, social psychologists, and anthropologists seeking to describe the influence of social relationships and structures on social outcomes (Wasserman and Faust 1994). In social network structures, individuals or entities are described as “nodes” while the relationships between nodes are defined as “links” or “social ties.” Social ties function as channels for the transfer of resources, or social capital, which could be material resources, but also knowledge or different kinds of social support, and are used by individuals to facilitate purposive action (Coleman 1988; Lin 2001; 2002).

Social ties can also be described as strong (such as the relationship one might have with close friends and family members) or weak (such as the relationship one might have with acquaintances) (Granovetter 1973).

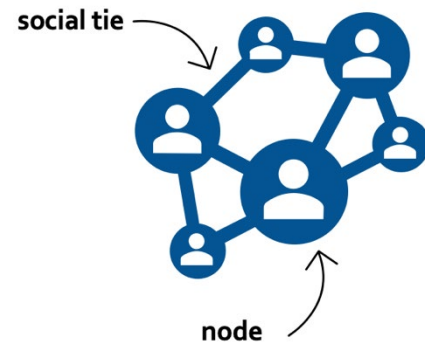


Figure 2: Nodes and social ties in a social network

A combined perspective



Figure 3: Community networks as the focal level in a complex adaptive system (Panarchy diagram adapted from Gunderson and Holling 2002)

By combining these two theoretical perspectives, this dissertation conceptualizes communities as place-based social networks composed of individual households and embedded within broader urban and/or regional systems. The place-based community is the focal system for the research described in the following chapters. The research questions posed assume a disaster scenario in which communities will be cut off from the larger scales of the system, needing to rely on local assets and social relationships in order

to carry out essential community functions. In order to extend lessons learned to inform the integration of hazards mitigation planning and urban planning practice and identify solutions with multiple benefits, we seek potential interventions that will improve community function and wellbeing not just during times of disruption, but also in everyday, “blue skies” circumstances.

Aims

Contributions

Societal susceptibility to disasters continues to increase, due both to patterns of human settlement in hazardous locations and the exacerbating effects of climate change. As we continue to learn more about, and to experience, the potential of hazards to disrupt essential everyday activities, we must also continue to develop strategies that can help society to become more adaptable in the face of change.

In many disaster scenarios, and particularly in the Cascadia Subduction Zone event that is the focus of this dissertation, the efforts of government agencies and aid-focused organizations will not be sufficient to connect individuals with essential resources in the period immediately following the disaster. Communities have begun to recognize this and are finding ways to organize for disaster preparedness and response on their own, providing a necessary supplement to the top-down and household-focused approach typically adopted by government agencies. This dissertation describes measures adopted in three Washington State communities as well as some of the challenges they have faced in trying to advance disaster preparedness at the local level. These kinds of stories are not well-represented in the disaster preparedness literature and can help to fill a gap in the study of grassroots preparedness efforts.

Disaster preparedness can also be a difficult topic for people to discuss, and it can be challenging to convince individuals to take actions in anticipation of a highly uncertain event. By approaching this topic from an asset-based perspective, and by focusing on local social ties and resources, this dissertation contributes to a growing literature that explores the integration of disaster preparedness and planning for community development, with a goal of normalizing the consideration of hazards planning as part of urban planning by seeking strategies that involve creative co-benefits (e.g., R. C. Freitag et al. 2014). It is also my hope that this research provides evidence, and perhaps a new perspective on, of the benefits of strong local social networks and access to a diverse range of local resources in “blue skies” everyday scenarios by looking at the alternatives available to communities through the lens of extreme disaster.

Methodologically, the dissertation demonstrates ways in which urban planning researchers and practitioners might use social network data to help inform the development of community-level disaster preparedness strategies. While there exists a sizeable body of literature focused on the characteristics of social networks and the resources embedded within them, the specific processes by which resources are accessed have received less attention, highlighting a gap in the literature (Van Der Gaag and Snijders 2005). This dissertation addresses this gap through the examination of the potential for the local self-sufficiency of communities in the immediate wake of a major disaster.

Additionally, the dissertation research involved the development and implementation of a new survey instrument for gathering such data that can be adapted for use in other communities, as well as the creation of a rich dataset comprising both quantitative and qualitative data on three characteristically different Washington State communities.

Research questions

Each of the three studies comprising the dissertation (*Chapters 4-6*) is motivated by an overarching research question (see below). The high-level goals of the dissertation are 1) to develop flexible methodologies that integrate socio-behavioral (relationships, attitudes) and contextual (built environment, social infrastructure) factors into disaster preparedness research at the community scale and 2) to identify lessons learned that can be used by community organizations and disaster preparedness agencies to help communities be better prepared for a wide range of disruptions, from everyday, “chronic,” disasters to extreme, “acute,” disaster scenarios.

- **Q1 (Chapter 4):** How can social ties and social networks help people accomplish essential everyday activities in both normal and disaster scenarios?

- **Q2 (Chapter 5):** What is the potential of social ties and social infrastructure to meet community members' essential needs in a disaster scenario?
- **Q3 (Chapter 6):** How do social and attitudinal factors shape community members' anticipated willingness to share essential resources in a disaster scenario?

We approach these questions using both quantitative and qualitative methods as described in the following section.

Overview of approach

To understand how communities might leverage local assets – place-based resources – and social networks to help respond in such a scenario, the research follows a mixed-methods, sequential approach (see Figure 4). First, we spent time getting to know the communities. This involved participating in meetings of community organizations and working together with collaborators to organize public workshops focused on resilience in the study communities. Knowledge gained from the workshops helped to inform the development of a community resilience sample survey focused on disaster preparedness and community social ties. Analysis of the quantitative survey data informed the development of the interview questions and focus group protocols in the qualitative data collection stage. Both the quantitative and qualitative findings of the research informed recommendations for policy and practice put forth in the individual studies as well as identified directions for future research in this area.

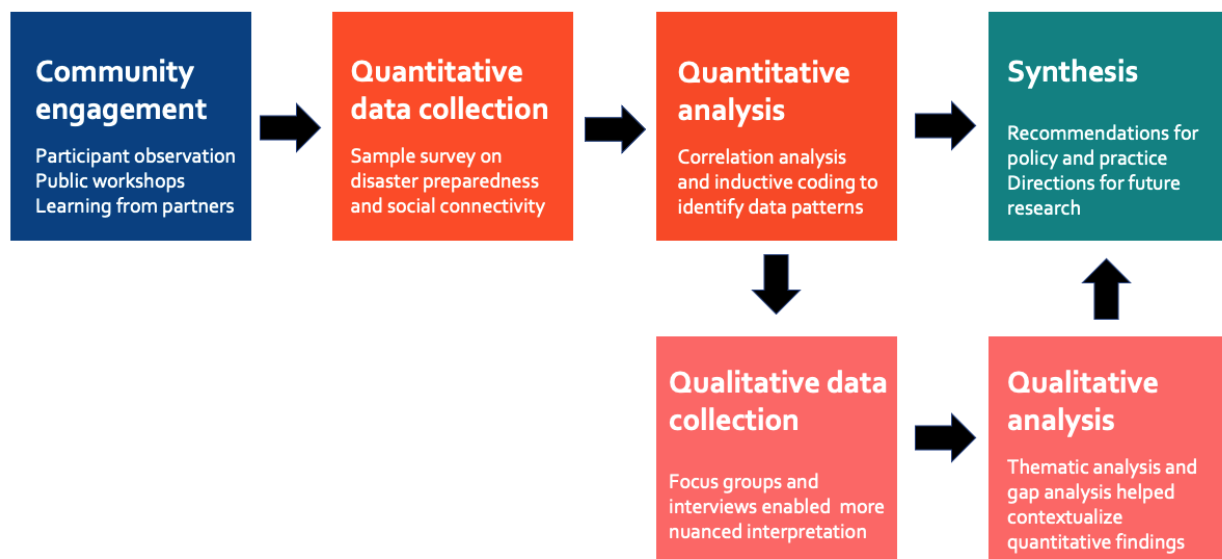


Figure 4: Mixed methods sequential research design

Community-engaged, asset-based research approach

Community-engaged approach

Engaging community in the research comprising this dissertation was important for a number of reasons. Involving people in both urban planning and disaster preparedness planning activates affecting their communities is widely acknowledged as best practice, as discussed below. Just as importantly, my own values as a researcher and personal experience as a community advocate drove me to include community engagement as an integral component of the research design and analysis. Although urban planners have expertise in the study of places, they rarely possess the kinds of expertise and local knowledge held by community residents whose lived experience is affected by urban planning research and action. Involving community stakeholders in helping us to better understand the values and context of the communities we were studying, as well as the data we ultimately gathered, helped to improve the overall quality of the research while simultaneously serving as an exercise in humility. Furthermore, although it is often difficult to influence broader social or political forces, working at the scale of the place-based community can present meaningful opportunities to affect change in quality of life and build greater resilience (Beatley 2004).

Although community engagement and participation in urban planning research and practice are commonplace, the meaning, form, and intensity of participation vary depending on the context of the community and the project at hand. Although numerous definitions of participation can be found in planning literature, its main purposes are often to involve people – and to give them voice – in decision-making processes and to promote a sense of community (Sanoff 2000). From a research perspective, collaboration between researchers and community partners can help to shape research questions to become attuned to important local issues (Halseth et al. 2016). More broadly speaking, participation has many benefits, including increased ability to meet social needs, more effective utilization of community resources, increased awareness of consequences associated with decision-making, and inclusion of more relevant information (Sanoff 2000).

The importance of community engagement in hazard mitigation planning and research has been widely recognized in the disaster resilience literature. Public participation at the local decision-making level can help to support successful implementation of mitigation strategies developed, and it can help communities to recover after a disaster (Pearce 2003; Newman, Beatley, and Boyer 2017). In addition, the consequences earthquakes or other disasters often extend far beyond physical damage, causing significant impact to community social fabric (Alesch, Arendt, and Holly 2009). It follows that understanding, leveraging, and strengthening place-based relationships in the process of planning for potential disasters can contribute to benefits for community social networks and infrastructures in addition to ensuring that physical assets are protected. Engaging with communities before, during, and after disasters can also aid visioning for longer-term community resilience strategies (Newman, Beatley, and Boyer 2017).

In the studies that follow, community engagement took the form of stakeholder participation in survey design and testing; stakeholder partnership in organizing and facilitating public workshops focused on community resilience and disaster preparedness; interviews with community partners and stakeholders to assist in quantitative data interpretation and to help generate ideas for future interventions; and involvement of community residents in focus groups to discuss within-community resource sharing. See *Chapter 2* for a detailed description of engagement with the three study communities.

Asset-based approach

This dissertation describes an asset-based approach to disaster preparedness and community resilience research rooted in the principles of asset-based community development and appreciative inquiry. Asset based community development (ABCD) is a community capacity-building approach that taps into local wisdom to center within-community relationships rather than focusing on outside support – a “client-based” model – to meet goals of the community (Kretzmann et al. 1993). ABCD, developed to help guide community revitalization efforts, works by leveraging the skills and resources of individual community members; social infrastructure such as community associations, community institutions and built environment assets; and the potential of the local economy.

While ABCD approaches focus on using place-based strengths to address problems, appreciative inquiry, a complementary approach, is a philosophy of change management that focuses on strengths rather than deficiencies. Developed for application in organizational management, appreciative inquiry methodologies focus on the strengths, rather than vulnerabilities, of an entity to help guide strategic, positive change (D. Cooperrider and Diana D. Whitney 2005). Appreciative inquiry identifies the “positive core” of systems – those assets, strengths, and resources that support an entity at its most vibrant – as the basis upon which to shape, and strive for, future goals (D. L. Cooperrider and Fry 2020). In a community setting, this positive core could be described as the kinds of assets valued in ABCD processes: local values, social capital, built environment, local wisdom, collective memory, partnerships, visions for the future, and place-based traditions.

The strengths-based approaches of ABCD and appreciative inquiry are applied in this dissertation research for two primary purposes. First, they provide a basis for the further integration of disaster preparedness and response planning with urban and community planning. Community planning involves the development of visions for the future of places and helps to lay out a road map for achieving those goals through policies, capital projects, and other actions. Integrating disaster preparedness and response planning into this process means using limited resources to identify strategies with co-benefits – those that can help make communities safer places to live while simultaneously supporting stakeholders’ long-range visions for the development of their community.

Secondly, strengths-based approaches such as appreciative inquiry can help to engage community members in meaningful and creative discussion about disaster preparedness in a process that begins with considerations of human wellbeing and the unique qualities of place (R. C. Freitag et al. 2014). Historically, disaster preparedness planning has been approached from a deficiency or vulnerability perspective, by first outlining the threat of disaster and then focusing on areas in which communities are lacking. In deficiency-based approaches, change tends to be slow, new visions are seldom developed, social connections are undervalued, and dialogues often generate defensiveness (D. Cooperrider and Diana D. Whitney 2005). This dissertation contributes to the further development of strengths-based methodological approaches to disaster preparedness planning by framing community resilience workshops from an appreciative inquiry perspective; by understanding the potential of context-specific resources to help shape disaster preparedness strategies; and by centering place-based social relationships.

Organization

Structure

Following this introduction, *Chapters 2 and 3* describe the community-engaged fieldwork and the sample survey that provide the basis for the empirical work that follows. Three distinct studies exploring the potential role of social networks in providing community self-support in an extreme disaster scenario comprise *Chapters 4-6*. A reflective synthesis of the study findings is presented in the conclusion.

Chapter 2, *Engagement with study communities*, describes the three study communities with which the team engaged in the community resilience research comprising this dissertation. A brief sketch of each community's historic and sociodemographic context is provided, as well as an overview of its built environment characteristics. The chapter also describes in detail the ways in which the research team worked with each study community and provides a summary of research-related engagement activities.

Chapter 3, *Community resilience sample survey*, describes the design, development, and implementation of the sample survey that constitutes the primary data set upon which the three empirical studies are based. The chapter also includes descriptive statistics from the survey for each study community.

Chapter 4, *A community social network conceptual framework for carrying out essential everyday activities in a disaster scenario*, discusses the theoretical basis of the dissertation in depth, describing the specific ways in which social socioecological resilience theory and social network theory can help to advance the study of community resilience, with a focus on the ways in which community members access resources. The chapter presents a series of conceptual exercises exploring the potential effects of a major earthquake on the systems that support essential everyday activities, which is synthesized into a conceptual framework for understanding community resource networks in a disaster scenario. The conceptual framework is then truth-tested using data from the community resilience sample survey. Observations from this analysis are synthesized in the conclusion, which presents the rationale for the two studies presented in Chapters 5 and 6.

Chapter 5, *Meeting everyday needs in a disaster scenario: the potential for resource sharing through local networks*, addresses the research question: What is the potential of social ties and social infrastructure to meet community members' essential needs in a disaster scenario? This study presents findings from the community resilience sample survey on household preparedness with essential resources as well as data describing where people expect to seek needed resources in a disaster scenario. We review the survey findings through interviews with stakeholders from the study communities to identify gaps and opportunities for enhancing community disaster preparedness. Potential interventions are presented in the conclusion, with a focus on the role of urban planners.

Chapter 6, *Anticipated willingness to share resources in a disaster scenario: the role of social ties*, explores community members' anticipated willingness to share resources in a disaster scenario. In this study, we present survey data describing respondents' willingness to share according to type of resource and strength of social tie with the recipient as well as analysis of provider attributes correlated with willingness to share. We build upon the quantitative findings through qualitative data collection by conducting a series of focus groups with survey respondents from the study communities to gather qualitative data on potential motivations behind anticipated willingness (or non-willingness) to share

different resources in a disaster scenario. The study findings are synthesized in a conceptual framework identifying key factors underlying anticipated willingness to share, which informs a set of recommendations for potential intervention.

The *Conclusion* presents a reflective synthesis of the findings from the three studies, summarizes the contributions and limitations of the dissertation, and identifies potential directions for extending the research in the future.

Appendices include copies of the survey instrument, interview guides, and focus group protocol.

Key terms

An introduction to the following terms will help to prepare the reader for the following chapters:

brittleness: susceptibility to system-wide disruption due to single points of failure (A. Townsend 2013)

community resilience: the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise (Magis 2010)

disaster: a sudden disruption of collective social routines due to perceived threats, leading to the need to adapt to and cope with the crisis (Quarantelli 2000)

imbrication: a robust, overlapping reinforcement of function (Gunderson and Holling 2002)

resilience: the ability of a system to respond to stresses and shocks while preserving its identity and main system functions (Walker et al. 2004)

social capital: resources embedded in a social structure which can be accessed and/or mobilized in purposive actions (Lin 2001)

social infrastructure: the physical places and organizations that shape the way people interact (Klinenberg 2018)

social network: a set of social relations among a set of network members

social tie: a relationship between two individuals

study community: a physical area defined by a combination of place-based social identity and well-established physical boundaries

2. Engagement with study communities

The team engaged three characteristically different Washington State communities: two Seattle neighborhoods, Laurelhurst and South Park; and Westport, a small city located on the Pacific coast in primarily rural Grays Harbor County (see Figure 6). Each of the three communities had expressed interest in the topics of disaster preparedness and community resilience. The team deliberately engaged communities varying along spectra of urban-rural context and economic status to gain insights relevant at the regional scale while enabling comparative study at the scale of the community.

We specifically chose these communities along spectra of urban-rural and higher and lower socioeconomic status in order to capture variation in both urban character and access to resources (see Figure 5). In terms of those criteria, each community represents a typology to some extent. However, each remains unique in terms of its local values and context.

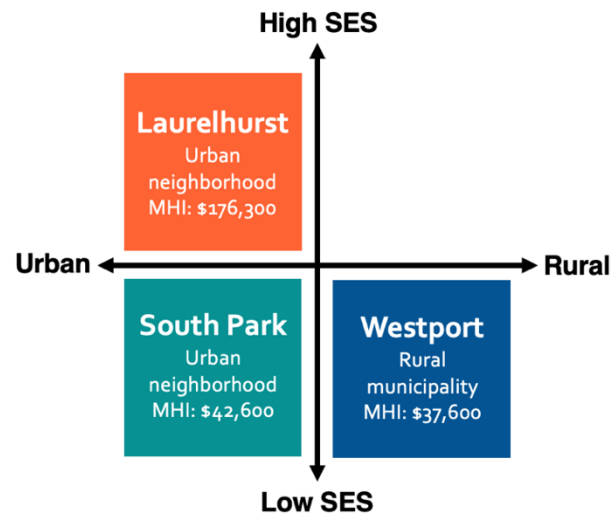


Figure 5: Socioeconomic and urban/rural characteristics of the three study communities (MHI = median annual household income)



Figure 6: Study community locations within the Pacific Northwest. Maps created using ArcGIS Online (Esri n.d.)

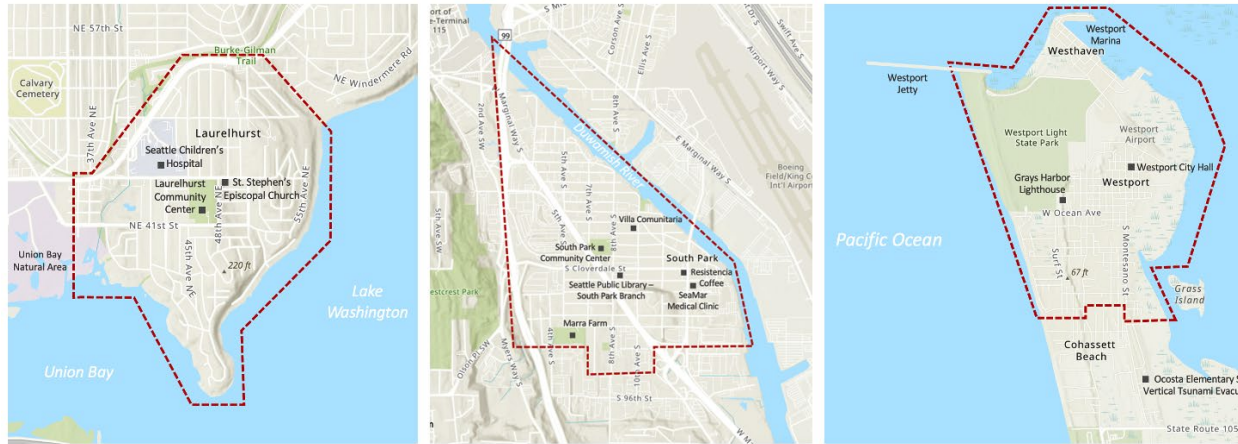


Figure 7: Study community boundaries. Maps created using ArcGIS Online (Esri n.d.)

The study communities

There are many definitions of community, although most include elements of social interaction, common ties, and co-residency (Brower 2011). For the purposes of this research study, community was defined by a combination of clear social identity and well-established physical boundaries. Each community is physically isolated to some extent (see Figure 7). Laurelhurst is located on a peninsula and bordered by several large institutional uses. South Park is separated from neighboring communities by a steep ridge, a major highway, and the Duwamish River. Westport is also located on a peninsula with few physical connections to outside areas.

The research methodology comprised two main components repeated across the three study communities: a public workshop with community members and a pilot sample survey. The sections that follow describe each of the three study communities in detail and chronicle the various engagement activities in which the research team participated as part of this study, and in some cases, in collaboration with related research studies. *(See more detailed sociodemographic tables in each community section below.)*

Table 1: Comparison of study communities – population, income, density, and ethnicity

	Laurelhurst	South Park	Westport
<i>Location</i>	Seattle (King County)	Seattle (King County)	Grays Harbor County
<i>Number of households</i>	1,753 ²	1,413	838
<i>Median yearly household income</i>	\$176,300	\$42,600	\$37,600
<i>Residents/sq mi</i>	3,718	2,240	565
<i>Population</i>	4,159 ³	3,719	2,091

² Estimates for number of households and population are based on fieldwork carried out to compile the sampling frame for Laurelhurst. All other estimates in the table come from U.S. Census data.

³ See above note.

Laurelhurst

Laurelhurst, the first community with which we worked, initially approached the research team with an interest in partnering on disaster preparedness research. The neighborhood's grassroots disaster preparedness organization, Laurelhurst Emergency Action Preparedness⁴ (LEAP), was in the process of establishing a community emergency hub to aid the neighborhood in disaster response as well as organizing each of its 1,753 households into a community-wide system of "clusters" for emergency networking and communication. LEAP works to increase awareness, knowledge, and connections within the community to help minimize the potential for injury and damage in the case of a major disruptive event, such as an earthquake. LEAP is an active participant in the Seattle Emergency Hubs network, a citywide coalition of neighborhood organizations that work together on strategies for disaster preparedness, response, and resilience.⁵ LEAP members indicated they would be interested in working together on designing and implementing a community resilience survey to help support their local organizing efforts.

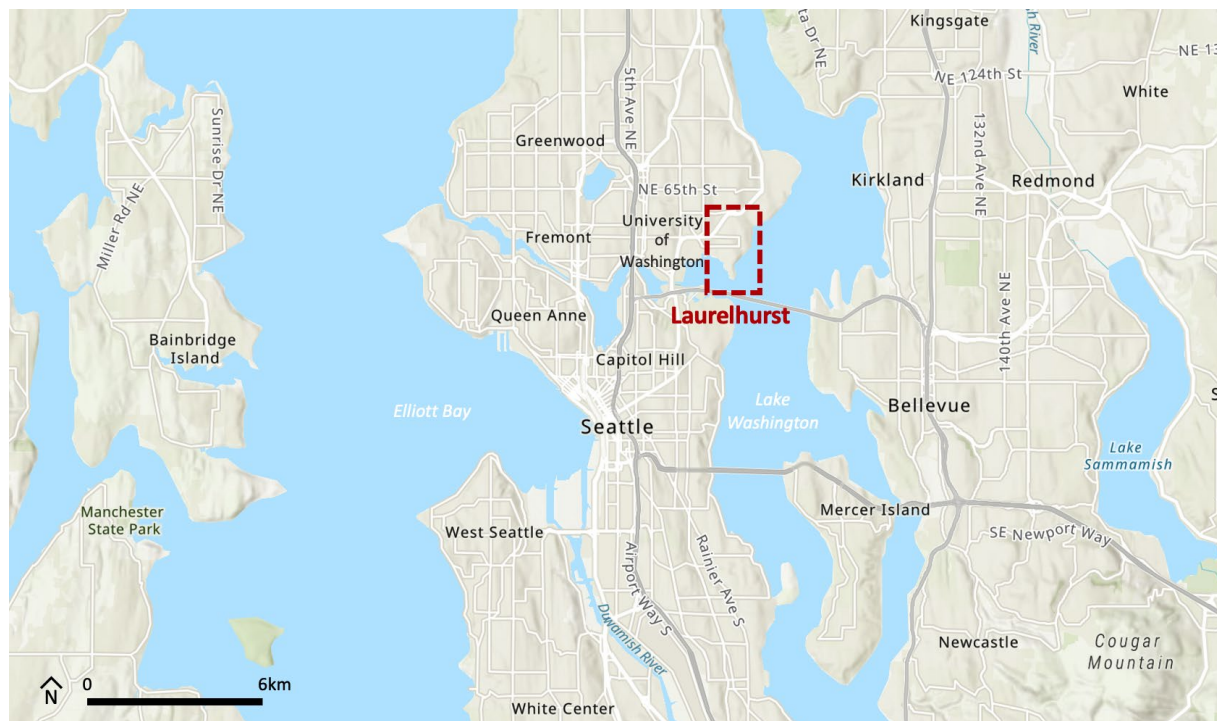


Figure 8: Laurelhurst's location within the greater Seattle area. Map created using ArcGIS Online (Esri n.d.)

History and sociodemographic context

Located in northeast Seattle adjacent to the University of Washington campus, Laurelhurst is a relatively wealthy urban neighborhood of approximately 5,000 residents (City of Seattle Office of Planning and

⁴ When the team began working with LEAP in 2017, the name of the organization was "Laurelhurst Earthquake Action Preparedness." In 2019, they changed the name to communicate their interest in focusing more broadly on disasters and disruptions beyond just earthquakes.

⁵ See <http://seattleemergencyhubs.org/about-us/mission/>

Community Development n.d.).⁶ Once a seasonal campground for the Duwamish native peoples, the wooded peninsula on which present-day Laurelhurst is located was christened by real estate developers in 1906 and annexed by the City of Seattle in 1910 (Rochester 2001). Laurelhurst developed as a primarily residential community known for its tight-knit character and the quality of its schools as well as its status as the residential choice for many prominent Seattleites, including the Gates family (Harville 2009). Many residents also have associations with nearby University of Washington, either as current or former administrators or faculty members. The Laurelhurst Community Club (originally the Laurelhurst Improvement Club) was founded in 1920 and is still active today, working to build community, address local concerns, and collaborate with civic and governmental organizations (Rochester 2001; Harville 2009). The Laurelhurst Community Club is the umbrella organization with which LEAP is associated.

Laurelhurst residents are highly educated and both economically and socially mobile. They are predominately White, with a median income of \$122,333 and a life expectancy among the highest of Seattle neighborhoods (City of Seattle Office of Planning and Community Development n.d.; Institute for Health Metrics and Evaluation, n.d.). Those living in the neighborhood have access to a range of health care services within and adjacent to the neighborhood, including specialist care. Located near the University of Washington's Seattle campus, the neighborhood is within close range of the University of Washington Medical Center, a nationally renowned hospital. Located within the neighborhood is the main campus of Children's Hospital and Regional Medical Center, one of the nation's top children's hospitals, as well as a handful of small businesses offering a range of health care services.

Table 2: Sociodemographic characteristics for Laurelhurst and Sand Point

2013-2017 American Community Survey 5-Year Estimates for Laurelhurst/Sand Point⁷		
Subject	Estimate	Percentage of neighborhood population
Gender and age		
<i>Male</i>	5,503	49.5%
<i>Female</i>	5,615	50.5%
<i>Median age (years)</i>	38.7	
Race and ethnicity		
<i>One race</i>	10,537	94.8%
<i>White</i>	8,830	79.4%
<i>Black/African American</i>	393	3.5%
<i>American Indian/Alaskan Native</i>	0	0%
<i>Asian</i>	1,271	11.4%
<i>Native Hawaiian/Pacific Islander</i>	16	0.1%
<i>Hispanic/Latino (of any race)</i>	204	1.8%
<i>Two or more races</i>	581	5.2%
Housing		
<i>Single family housing units</i>	2,912	68.4%
<i>Owner-occupied units</i>	2,891	67.7%

⁶ Because the boundaries of the Laurelhurst neighborhood as self-identified by its residents do not align precisely with designated Census tracts or block groups, it is not possible to obtain an exact population count.

⁷ See previous note regarding Census data for Laurelhurst; this data table includes both Laurelhurst and Sand Point.

<i>Renter-occupied units</i>	1,381	32.2%
<i>Median value (dollars)</i>	\$908,950	
Occupation		
<i>Management, business, science, arts</i>	3,951	74.8%
<i>Service</i>	408	7.7%
<i>Sales and office</i>	776	14.7%
<i>Natural resources, construction, maintenance</i>	58	1.1%
<i>Production, transportation, material moving</i>	87	1.6%

Built environment context

The neighborhood sits on a hilly peninsula that extends into Lake Washington and Union Bay, which bound the community on the east and south, respectively. Its western border comprises the University of Washington campus and the University Village shopping center, and the neighborhoods of Bryant and Windermere lie to the north. With views of Mt. Rainier and Lake Washington as well as relatively easy access to downtown Seattle, the University, top-tier medical facilities, and amenities such as parks, trails, and waterfront access, Laurelhurst residents enjoy a high quality of life.

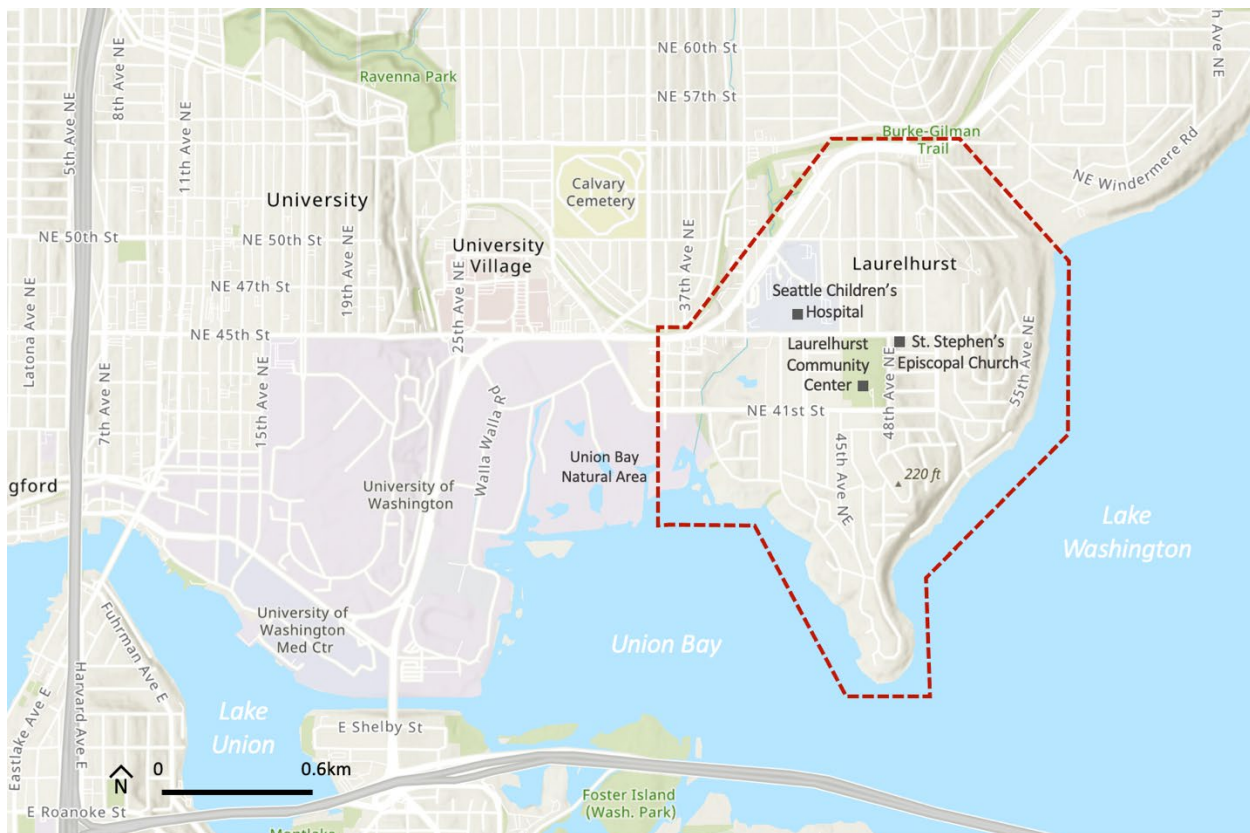


Figure 9: The Laurelhurst neighborhood of Seattle. Map created using ArcGIS Online (Esri n.d.)

There are approximately 1,890 households within Laurelhurst, more than 90% of which are single family homes.⁸ Many are large homes, and the median home value is \$908,950 (compared to \$663,000 for the city overall) (City of Seattle Office of Planning and Community Development 2019b; United States Census Bureau 2019). A handful of apartment buildings are located on the periphery of the neighborhood near Sand Point Way, and some condos and townhomes can be found in the northeast portion of the community. Land use within Laurelhurst is primarily residential, but some commercial uses are located nearby on Sand Point Way and within the University Village complex. Neighborhood institutional uses include Children's Hospital, the Villa Academy private school, the Laurelhurst Beach Club, and a handful of religious entities. Public amenities include Laurelhurst Playfield Park, Laurelhurst Community Center, the Union Bay Boglands, and a number of small parks that provide access to Lake Washington.

Surrounded primarily by water and a mix of institutional and region-serving commercial uses, Laurelhurst is a somewhat isolated neighborhood. Its street network comprises a mix of an orthogonal urban grid and winding suburban-style streets. Residents describe the community as a great place to walk and encounter neighbors, but anecdotes suggest that Laurelhurst can be difficult for non-residents to navigate. For example, drivers of the neighborhood's few bus routes sometimes get lost in the areas dominated by curving and meandering streets. Although the Husky Stadium light rail station is located relatively nearby on the edge of the University of Washington campus and provides access to high-capacity regional transit, it is not easily reached from the neighborhood by pedestrians.

According to the data provided by the Seattle Hazard Explorer, some areas of Laurelhurst near the shoreline are susceptible to either liquefaction or landslide hazards (City of Seattle 2015). In the event of a high-magnitude earthquake, areas near the shore might be affected by seiches (City of Seattle Office of Emergency Management 2021b). Because of its inland location and steep topography, Laurelhurst is unlikely to be affected by sea level rise. LEAP has been instrumental in designating a Community Emergency Hub – a designated place for neighbors to meet and share information in the event of a disaster – at St. Stephen's Episcopal Church, including the purchase of emergency communication equipment and supplies.⁹

Engagement activities with Laurelhurst

The research team first connected with LEAP members in the fall of 2016, at which time the two groups discussed their mutual interest in community-scale disaster preparedness. Discussions focused on better understanding how community assets can be leveraged to enable resilience in the face of disruptions (such as earthquakes) or other long-term changing conditions, in ways that also improve everyday community well-being. The research team began to join LEAP meetings, which led to collaboration on the design of a community workshop to learn more about assets and values within the Laurelhurst neighborhood.

⁸ The total number of households and percentage of households are based on sampling frame data gathered by the research team as neighborhood boundaries do not align precisely with Census blocks (see previous note).

⁹ For more on Seattle's Community Emergency Hubs, see <https://www.seattle.gov/emergency-management/prepare/prepare-your-neighborhood/community-emergency-hubs>

Participation in LEAP activities

Between the fall of 2017 and the spring of 2019, the research team participated in several of LEAP's monthly meetings. At these meetings, LEAP members discussed the planning and implementation of their ongoing disaster preparedness initiatives. At the time of the team's participation, these activities were focused on developing organizational structures for disaster-related information sharing within the neighborhood (which took the form of "clusters" of households), organizing educational workshops and trainings for the community, and establishing a community "emergency hub" at St. Stephen's Episcopal Church that would serve as a gathering place and resource center in the event of a disaster.¹⁰

The research team was invited to participate in the meetings and to share their perspectives on community resilience and disaster preparedness as well as contribute to the development of LEAP's initiatives and activities. Prof. Abramson was invited to give a public presentation of his research on community disaster preparedness and recovery, and lessons learned from communities around the world, including Christchurch, New Zealand, which experienced major earthquakes in 2010 and 2011. Members of the research team also participated in public disaster preparedness trainings and presentations organized by LEAP, including a general disaster readiness course provided by the City of Seattle and a "Stop the Bleed" workshop provided by local health care professionals. We also engaged LEAP in the development of several grant proposals for community disaster preparedness research.

Survey development

LEAP provided oversight during the process of developing the sample survey. The research team shared the draft survey with LEAP and facilitated a meeting in which LEAP members provided detailed feedback on the draft survey document, which helped to guide the development of the final survey instrument (see the section on *Survey Design and Development* in Chapter 3 for more details on this process). Before implementing the survey, the research team obtained formal approval for the survey project from the Laurelhurst Community Club, a long-standing neighborhood improvement organization with which LEAP is affiliated.

Organizational ethnography

Based on participant observation and interviews with LEAP members, undergraduate research assistant Jenny Phan developed an organizational ethnography of LEAP in 2018 (Phan and Idziorek 2018). The document describes LEAP's organizational goals, documents its history and culture, and its outreach activities and future trajectory. The ethnography was well-received by members of LEAP, who found it to be a useful documentation of the organization's early evolution and core activities.

Community workshop

The research team and LEAP partnered to plan and co-host a public disaster preparedness workshop, which took place on November 7, 2018. Held at the Laurelhurst Community Center, the workshop created a forum for neighborhood stakeholders to discuss, via participatory group activities, the qualities that contribute to a resilient community. The purpose of the workshop was twofold: 1) to help LEAP recruit new members by spreading the word about the community emergency preparedness work

¹⁰ In 2020, LEAP was successful in raising \$15,000 from neighbors to build and equip an emergency communications hub at St. Stephen's Church, which will operate using ham radios in the event of a catastrophic emergency.

they are doing; and 2) to build a better understanding of the unique community values and assets that might contribute to strengthening community resilience in Laurelhurst. Several community members, a handful of LEAP team members and the UW team participated in the workshop.

The planning and implementation of the studio provided an opportunity to engage UW students who were participating in Prof. Abramson's Fall 2018 community resilience urban planning studio. The studio students and teaching assistants helped to facilitate the workshop activities. LEAP member Amy Fouke visited the studio class in advance of the workshop to talk with the students about LEAP's general goals for community-led disaster preparedness as well as its neighborhood cluster strategy.

The workshop itself comprised three primary activities: asset mapping, zone mapping, and a disaster preparedness resource matching game. In the asset mapping activity, participants worked in small groups to identify, on a map, the assets that contribute to Laurelhurst's unique identity, quality of life, and strengths as a neighborhood. Participants were encouraged to think broadly about what might constitute a community strength or asset. The Community Capitals Framework (Emery and Flora 2006) was used as a prompt for participants to consider natural, cultural, human, social, political, financial and built capital in the exercise.

The zone mapping activity provided an opportunity for community members to determine how neighborhood clusters should be formed and organized into umbrella "zones" based on their knowledge about the physical and social characteristics of the neighborhood. Participants in this workshop activity were asked to consider how many clusters should make up a zone as well as the characteristics that should define a zone (e.g., topography, land use, distribution of resources, local hazards). Groups outlined potential zones by drawing on large maps of the neighborhood showing LEAP's already-designated clusters and were provided with additional maps showing local hazards and neighborhood topography to help inform the discussion and mapping.

The final activity involved a disaster preparedness card game in which groups worked as teams to creatively match skills and resources with hypothetical challenges that might arise in the case of a disaster. After the game, teams were asked to reflect on additional skills or supplies beyond those on the cards might be helpful in solving disaster challenges as well as which of the community's existing values and assets would help in solving the kinds of problems presented by the disaster challenges.

In the workshop's closing discussion, several broad themes emerged that could potentially help to inform future LEAP actions and initiatives. These included the need for better disaster preparedness through training; addressing vulnerability to the loss of power; providing education about health and sanitation practices in disaster scenarios; uncertainty about transportation and communication service availability in disaster scenarios; creating cluster-level resource inventories; and holding more social events within the neighborhood to further community-building. The workshop activities and outcomes were documented in detail in a summary report (Idziorek 2018) and shared with LEAP.

Gathering this information in the workshop helped the research team to better understand Laurelhurst's unique neighborhood context, which in turn helped to shape the survey instrument. For example, the different neighborhood "zones" outlined on a map contained within the survey instrument were created using guidance from a workshop conversation about how LEAP might organize its 20-household clusters into larger zones that could collaborate internally on disaster preparedness efforts. We were also able to learn about which places or establishments within the community are important

to community members and might serve as resources in a time of need. The information gathered during the workshop also helped with interpretation of survey responses, particularly in providing context for answers to some of the open-ended questions. After the workshop, the research team met with LEAP to review the survey instrument and received helpful feedback that was integrated into the questionnaire for the pilot study.

South Park

One of the goals of the research project was to work with communities across a range of spectra from urban to rural and from low to high socioeconomic status to better understand how issues and responses related to community disaster preparedness and longer-term resilience might vary based on community characteristics. The research team partnered with Matt Auflick, the Community Relations Manager within the City of Seattle's Office of Emergency Management (OEM), to engage South Park, an underserved urban community in southeast Seattle. OEM had historically had difficulties engaging South Park residents in disaster preparedness activities and so was interested in trying out a different approach to its typical preparedness trainings. The UW team provided support for community outreach as well as planning and facilitation support for the community workshop, and OEM was able to provide the translation and interpretation services needed for working within the multilingual South Park neighborhood as well as expertise in community-specific disaster preparedness.

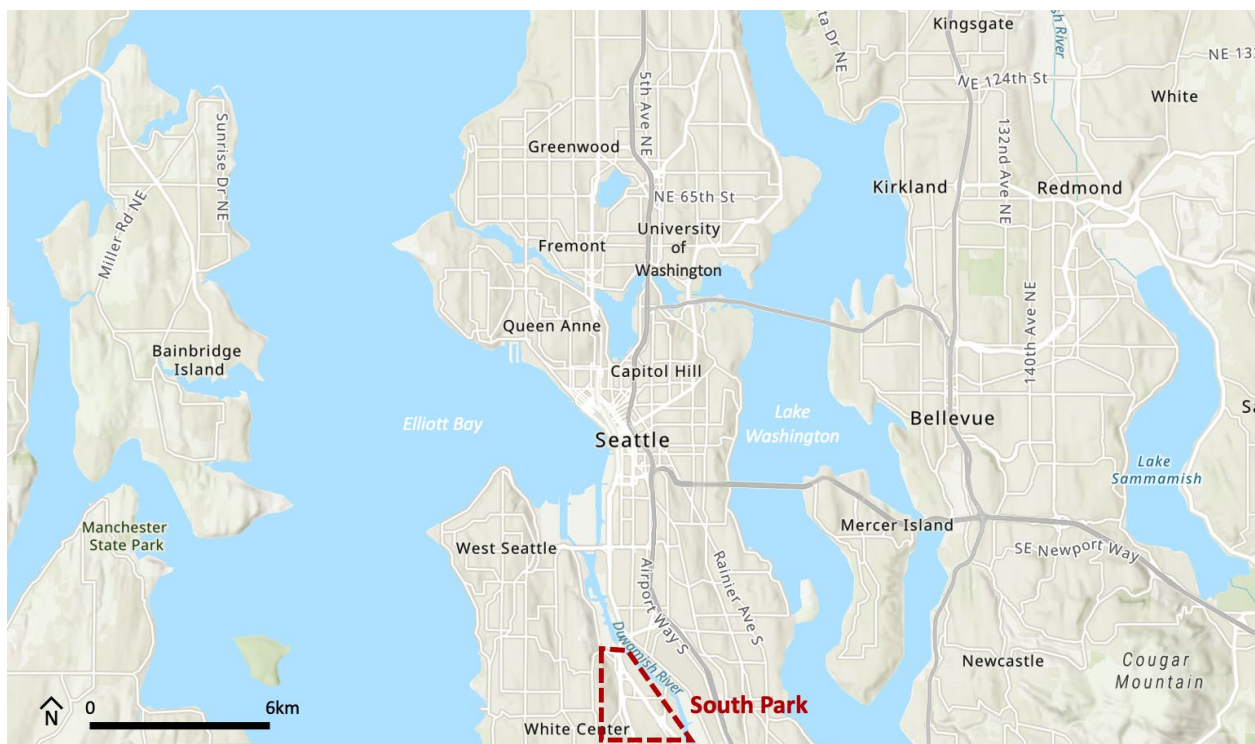


Figure 10: South Park's location within the greater Seattle area. Map created using ArcGIS Online (Esri n.d.)

History and sociodemographic context

Located on the west bank of the Duwamish River, the area currently known as the South Park neighborhood of Seattle was once home to the Duwamish tribe of Native Americans, who relied upon

the river and its surrounding habitat for sustenance over thousands of years (Wilma 2001). Settler-colonizers first staked claims to the land in 1851 (Veith 2009). The City of Seattle annexed South Park in 1907, and it was settled by Italian and Japanese farmers who sold produce at Pike Place Market (Wilma 2001). In 1913, the process of rechannelizing the Duwamish River began in an effort to control seasonal flooding, which enabled ocean-bound ships and barges to navigate the waterway and attracted industry to what had previously been a residential neighborhood. During World War II, the Boeing Airplane Company and several shipyards made the community of Georgetown, located just across the river from South Park, a major center of defense industry employment (Veith 2009). The neighborhood was rezoned for industrial use in the 1960s, but resident protests succeeded in changing the zoning designation to low-density residential (Wilma 2001), resulting in what today is an unusual combination of residential and industrial uses in close proximity to one another.

Today, South Park is an ethnically diverse community of approximately 4,000 residents, including many immigrants. Approximately 40% of the neighborhood's voting-age population are not U.S. citizens (City of Seattle Office of Planning and Community Development 2019a). More than 45% of residents identify as Hispanic or Latinx, and 50% speak languages other than English at home, including Spanish, Vietnamese, Somali, and many others (City of Seattle Department of Neighborhoods 2019). More than one quarter of the neighborhood's residents live on incomes below the poverty level, and 90% of the children living in the neighborhood qualify for free or reduced-price meals at school (City of Seattle Department of Neighborhoods 2019; Turnbull 2020). One of Seattle's most diverse communities, South Park has a history of social activism (Turnbull 2020) and is home to many neighborhood-based organizations, such as the South Park Area Redevelopment Committee, the South Park Arts Council, the South Park Housing Coalition, South Park Safety Partners, and the Urban Fresh Food Collaborative. The neighborhood also hosts a number of annual festivals, including Fiestas Patrias, the South Park Music Festival, and the Duwamish River Festival, during which community members come together to celebrate South Park's rich cultural heritage.

The legacy of pollution caused by area industry has had a profound effect on the quality of the environment in the Duwamish Valley as well as on the health and wellbeing of residents in South Park and other nearby communities. Over time, the activities of shipping and other industry in the area contaminated the Duwamish Waterway. Pollution control measures were enacted in the 1980s, and a 5.5-mile stretch of the Lower Duwamish was listed as a superfund site by the Environmental Protection Agency in 1991 (Veith 2009), prompting the development of the Duwamish River Cleanup Coalition, a grassroots organization with a mission centered on health and environmental justice.

Although contaminant levels have been reduced somewhat as a result of cleanup actions, health advisories remain in place as seafood from the waterway is not safe to consume (City of Seattle Office of Sustainability & Environment 2018). In addition, multiple studies have demonstrated that Duwamish Valley communities are exposed to higher levels of air and noise pollution and have lower life expectancies than most areas of the city – on average, South Park's residents live 13 fewer years than Laurelhurst's – while also experiencing less access to amenities like open space and basic necessities like healthy and culturally appropriate food (City of Seattle Office of Sustainability & Environment 2018; Nelson 2019).

In addition to detrimental effects on resident health caused by the contaminated waterway, noise pollution from the flight path overhead, and air pollution from adjacent highways, the neighborhood has

historically experienced a pattern of disinvestment in regard to City services and projects (City of Seattle Office of Sustainability & Environment 2018). In recent years, the City of Seattle and other public agencies have made efforts to address institutional racism and race-based disparities in South Park through initiatives such as the 2011 South Park Action Plan, a 2013 Health Impact Assessment, and the 2018 Duwamish Valley Action Plan.¹¹

Table 3: Sociodemographic characteristics for South Park

2013-2017 American Community Survey 5-Year Estimates for South Park		
Subject	Estimate	Percentage of neighborhood population
Gender and age		
<i>Male</i>	2,028	54.5%
<i>Female</i>	1,691	45.5%
<i>Median age (years)</i>	34.1	
Race and ethnicity		
<i>One race</i>	2,957	79.5%
<i>White</i>	1,697	45.6%
<i>Black/African American</i>	200	5.4%
<i>American Indian/Alaskan Native</i>	17	0.5%
<i>Asian</i>	362	9.7%
<i>Native Hawaiian/Pacific Islander</i>	156	4.2%
<i>Hispanic/Latino (of any race)</i>	1,285	34.6%
<i>Two or more races</i>	762	20.5%
Housing		
<i>Single family housing units</i>	1,010	65.5%
<i>Owner-occupied units</i>	561	39.7%
<i>Renter-occupied units</i>	852	60.3%
<i>Median value (dollars)</i>	\$287,100	
Occupation		
<i>Management, business, science, arts</i>	428	25.6%
<i>Service</i>	451	27.0%
<i>Sales and office</i>	352	21.1%
<i>Natural resources, construction, maintenance</i>	137	8.2%
<i>Production, transportation, material moving</i>	302	18.1%

Built environment context

The South Park neighborhood is located along Seattle's southern municipal boundary, bordered on the north and east by the Duwamish Waterway industrial corridor, on the west by WA State Route 509, and on the south by a zone of industrial land. Another busy highway, WA State Route 99, bisects the neighborhood. South Park and Georgetown, located to the northeast across the Duwamish Waterway, are Seattle's only two riverfront neighborhoods. South Park and Georgetown are among Seattle's

¹¹ For a more complete list of South Park planning initiatives, see <http://www.seattle.gov/Documents/Departments/Neighborhoods/Districts/Neighborhood%20Snapshots/South-Park-Snapshot.pdf>

the Duwamish Waterway to link the neighborhood to the City of Seattle to the north, and only two streets connect South Park to areas west – neither of which provides convenient access to resources or amenities. When the bridge is open or out of commission, as it was between 2010 and 2014 due to deterioration and earthquake vulnerability, the neighborhood is effectively isolated from the rest of the city. The neighborhood is served by only two bus routes, which are not always dependable in challenging weather. During a 2019 snowstorm, South Park went without public transit service because although the neighborhood is relatively flat, the bus lines that serve it traverse steep hills in adjacent areas and had to be re-routed (Lindblom 2019).

In addition to the chronic hazards faced by South Park residents in connection with the area's environmental vulnerability, the neighborhood is also vulnerable to a host of physical hazards. The neighborhood is located just to the north of a suspected fault line and most areas of the community are highly susceptible to both flooding and liquefaction as a result of the loose fill soils that lie under South Park's heavily engineered landscape (City of Seattle 2015). The neighborhood experiences ongoing drainage and flooding problems, which have prompted the City of Seattle to construct new drainage infrastructure and a pump station to divert stormwater runoff during high tide events (City of Seattle 2019).¹² South Park has two designated Community Emergency Hubs: one at the Marra Farm P-Patch, and one at the South Park Neighborhood Center. The South Park Neighborhood Center hub has emergency communication equipment and capabilities, but the Marra Farm one does not (City of Seattle Office of Emergency Management 2018).

Engagement activities with South Park

The research team first connected with OEM during the spring of 2019, based on a common interest of working with the South Park community on disaster preparedness issues. Through the partnership with OEM, we hoped to implement the community workshop and sample survey protocol that had been tested first in Laurelhurst and Westport. In part because neither the research team nor the Office of Emergency Management had close ties to the South Park neighborhood, engaging with the community at the level achieved in either Laurelhurst or Westport proved to be a challenge. We learned that members of the South Park community are often overburdened and tend to operate within their own, well-established community networks to address local issues rather than engage in city-led processes. Our team was also not able to support the sustained nature of engagement achieved in the other two communities in the South Park neighborhood. However, we did build some relationships with community members and organizations, laying the groundwork for future resilience-related engagement within the neighborhood.

Meeting with Promotoras and SPIARC

In July of 2019, OEM organized a meeting including City staff, members of the research team, South Park *Promotoras* (volunteer community health workers – typically women – who provide culturally competent education regarding issues of health and emergency response to members of the South Park Latinx community) and members of the South Park Information and Resource Center (SPIARC), a local nonprofit that seeks to respond to the diverse needs of the community, to discuss the possibility of

¹² These projects are in the planning stages as of early 2021.

implementing the workshop and survey protocol in South Park.¹³ Xochitl Garcia, a leader of the *Promotoras*, expressed interest in both the workshop and the survey and offered to help promote the event.

OEM and the UW team shared a tentative agenda and suggested the date of October 2, 2019 for the workshop, to be held at the South Park Community Center. The group discussed strategies for advertising the workshop and reaching potential attendees, including having a presence at the upcoming Duwamish River Festival and reaching out to local businesses. We also discussed logistics for the workshop, including the need to provide appropriate translation in both Spanish and Vietnamese as well as providing childcare and meals for attendees.

Tabling at Duwamish River Festival

On August 17, 2019, research assistant Asela Chavez Basurto represented the UW research team as part of a tabling outreach event at the Duwamish River Festival, an annual event organized by the Duwamish River Cleanup Coalition that celebrates the Duwamish River Basin community through river-related activities, cultural presentations, information booths, food, and entertainment. The City of Seattle's Office of Emergency Management took the lead in setting up an information booth to share disaster preparedness resources and to advertise the upcoming community workshop. The booth included an interactive mapping activity in which people who stopped by were asked to identify places that serve as important resources within the neighborhood and to describe values that characterize the South Park neighborhood.

Important places noted by participants included the local institutions such as the library, and community center; local parks, trails, and playfields; local businesses such as breweries, coffee shops, and stores; the local food bank, bus stops/routes, and the senior center. Neighborhood values identified included sense of community; arts and culture; diversity, family, resistance, pride, and Hispanic values, among others. Participants also noted the relative isolation of the neighborhood due to the scale of the infrastructure surrounding it and the lack of access to medical services. One participant that grew up in the neighborhood commented that she felt South Park was a tight-knit community, perhaps in part due to its isolation. Participants also stated a desire for better access to grocery stores and well-maintained open spaces (Chavez Basurto 2019).

Meeting with King County Public Health

On August 21, 2019, members of the research team met with two employees of Seattle King County Public Health who were familiar with the South Park community: Michelle di Miscio, a community health worker who lives in South Park, and Bradley Kramer, a health services Program Manager. Michelle, who has worked closely with the *Promotoras*, noted that the neighborhood was very interested in disaster preparedness issues as well as preparedness for other potential kinds of disruptions related to immigration issues (e.g., if a person or family needed to suddenly leave the community due to fear of deportation). The UW research team described the community resilience survey and workshop protocol, which Michelle and Brad felt would be appropriate for implementation in South Park. They made some suggestions regarding how to promote the workshop and the survey and suggested it would be important to share the results of the survey with the local community. The group also discussed the

¹³ For more information on the South Park *Promotoras* and the South Park Information and Resource Center (now known as *Villa Comunitaria*) please see <https://villacomunitaria.org/about-us/>.

possibility of using some of the research funding to pay the *Promotoras* to help with outreach related to the workshop and survey.¹⁴

Community workshop

The South Park Community Resilience Workshop was designed to engage community members in thinking broadly about what resilience means for their specific community, both in terms of disaster preparedness and as related to longer-term quality of life and well-being. The workshop was organized and co-hosted by the University of Washington's Department of Urban Design and Planning and the City of Seattle's Office of Emergency Management. Three University of Washington graduate research assistants assisted with facilitation. Two of those students conducted outreach in South Park as well as the nearby Georgetown neighborhood, distributing fliers to businesses and local institutions and organizations to promote the workshop. OEM provided interpreters for both Spanish and Vietnamese speakers, and all workshop materials were translated into Spanish and Vietnamese. Daycare and food were provided for workshop participants.

The workshop took place during the evening of Wednesday, October 2nd, 2019 at the South Park Community Center. The activities of the workshop were designed to gather information about assets within the South Park community, to identify gaps in disaster preparedness, and to build new social connections within the community while simultaneously building upon previous community planning work that had taken place within the neighborhood.

After introducing the workshop agenda and objectives, the facilitation team reviewed the community values maps and comments that had been gathered at the Duwamish River Festival event. Workshop participants validated the information, indicating they did not have anything to add or change. The facilitators then provided a brief overview of previous planning work that had taken place in the South Park/Georgetown community, sharing that previous plans had highlighted values such as creating a healthy environment, providing parks and open space, and supporting affordable housing.

The facilitators then asked the participants to work together in two small groups to map assets within the community, once again using the Community Capitals framework for guidance (Emery and Flora 2006). Participants located place-based assets on paper maps, and facilitators recorded lists of non-place-based assets that were mentioned in the conversation. Participants most frequently mentioned assets that fit within the built capital, human capital, and social capital categories. In some cases, assets provided more than one type of capital (e.g., specific locations/buildings like a school also provide social and human capital benefits). Participants emphasized the importance of institutions providing core services like education, health care, and community support, as well as local businesses and community leaders. Gaps that emerged during the discussion included a lack of local grocery stores, limited public transportation options, a lack of quality open space, and environmental pollution.

Matt Auflick from OEM then presented information about hazards to which South Park is particularly susceptible as well as likely effects of a major disaster and what the neighborhood should expect in terms of hazard response from the City of Seattle. Matt described the potential impacts of five hazards most relevant to the South Park neighborhood: flooding, sea level rise, earthquakes/liquefaction,

¹⁴ Although the research team later contacted the *Promotoras* regarding this idea, no response was received, and outreach was conducted primarily by UW research assistants and OEM.

tsunami inundation, and landslides. He then provided an overview of the types of impacts that might be expected from these types of hazards, including damage to infrastructure and utilities; scarcity of resources; and failure of utilities and communications. Matt suggested several strategies for improving household and community preparedness for these types of disasters, including becoming familiar with nearby community emergency hubs, carrying personal property insurance, stocking first aid supplies, and participating in emergency aid training.

Following the hazards presentation, groups worked on a resource matching exercise using the same community asset map from the previous exercise overlaid with potential hazard areas. Participants worked together to identify relevant community assets or strategies identified in the previous exercise that might be applied to help deal with communication, structural damage, and health and wellbeing impacts in the event of a disaster. At the end of the activity, groups summarized their discussions in the form of a narrative, or story, and shared them with participants from the other group. The first group noted that the neighborhood has both structural vulnerabilities (e.g., liquefaction, flooding) and assets in the form of places that would be accessible in times of emergency (e.g., Marra Farm) and expressed interest in designating more emergency hubs within the neighborhood. The second group described assets that could be built upon to help serve the neighborhood in a disaster, including a sense of neighborliness that could help to strengthen social networks within the community, as well as areas of vulnerability or opportunity such as strengthening technologically enabled networks like Facebook groups.

Several overall themes emerged during the workshop activities and discussions. South Park's relative isolation was discussed repeatedly, both in the physical sense, such as being dependent on bridges for access to grocery stores and basic services, but also in the social sense, due to challenges like language barriers. On the other hand, South Park's strong sense of community and its residents' ability to be adaptable, flexible and improvisational in the face of challenges was identified as an asset that could be leveraged in disaster response. Local businesses and institutions such as SPIARC and the SeaMar clinic were identified as organizations that could contribute to local disaster preparedness efforts. Participants also identified opportunities to strengthen community bonds and promote resource sharing through events like block parties and improved online communication among neighbors. The details of the workshop activities and discussions were summarized in a report and shared with OEM (Arjona and Chavez Basurto 2019).

Community outreach plan

As one response to the low community turnout for the workshop, Prof. Abramson and the author guided research assistants Asela Chavez Basurto and Andres Arjona in the creation of a Community Outreach Plan for Disaster Resilience in South Park, comprising a set of guidelines for conducting disaster preparedness outreach in the neighborhood (Arjona and Chavez Basurto 2019). Asela and Andres made multiple visits to the neighborhood, reviewed existing South Park planning documents, reviewed literature on outreach best practices, assessed current local and statewide outreach plans, and conducted phone interviews with liaisons involved in community outreach efforts in South Park and elsewhere in Seattle. The audience for the document includes public officials, organizations, and academics who would like to achieve an inclusive public outreach process in the South Park neighborhood.

The authors noted that an outreach plan for South Park is expected to take significant time to implement because of the attention that needs to be given to the various groups within the community, including Hispanic, Vietnamese, Khmer, and Somali immigrant groups. The recommendations of the outreach plan are grounded in information gathered from the interviewees who routinely engage in community improvement efforts in South Park. Primary recommendations include building relationships; engaging topics relevant to the community's realities; meeting the community where they are; paying people for their time; letting the community select the meeting location and amenities; assigning roles and responsibilities; and following up personally. Although our research funding and timeline did not allow for this kind of community engagement process, we recognize it as a best practice and an ideal to strive for in future work with this and other multiethnic communities.

Westport

The research team approached the City of Westport both because of its rural location and its distinction as the first location in North America to construct a tsunami vertical evacuation facility (Lubell 2016). During the summer of 2018, members of the research team met with Kevin Goodrich, Westport's Public Works director, to discuss a potential partnership with the City of Westport that would focus on integrating hazard mitigation planning and long-term community planning. Kevin and other community leaders, including the local Tsunami Safety Committee, viewed the research team's proposal to convene a public workshop and implement a local community resilience survey as aligned with their own long-term goals. Prof. Abramson also proposed developing a graduate-level urban planning studio course for the Fall of 2018 that could explore strategies for both short-term and long-term coastal resilience in the specific context of Westport. The Coastal Resilience studio course played a key role in helping to support the community engagement activities in Westport (see *Engagement activities* below). In addition, the research team began to build a relationship with the Shoalwater Bay Tribe, whose reservation is located



Figure 12: Westport's location on Washington's Pacific coast. Map created using ArcGIS Online (Esri n.d.)

in Tokeland, to the south of Westport on another low-lying peninsula. Although we did not work closely with the tribe in the activities outlined below, we did participate in their annual Yellow Brick Road Tsunami Health Walk, and members of the tribe participated in the community partners workshop described later in this section.

History and sociodemographic context

Located on the south shore of Grays Harbor on Washington State’s Pacific coast, the peninsula now known as Westport was once part of Chehalis tribal lands and may have been the location of an indigenous fishing village with a population of up to 5,000 individuals (McCausland 1998). Devastated by smallpox introduced by white settler-colonizers in the mid-1800s, Native peoples in the area were eventually forced to move to an inland reservation (Kershner 2014). Westport was incorporated in 1914. Westport’s connection to the Pacific Ocean has played a key role in shaping its identity throughout its history, as it has functioned as a destination for marine recreation, a lumber shipping hub, a Coast Guard outpost, and a base for commercial and charter fishing over the years. The community’s reliance upon the bountiful but often dangerous Pacific Ocean has resulted in a local culture of strong social connectivity and reliance on neighbors (Hutchison and Abramson n.d.). Fishing and maritime industries such as seafood canning have always been important to Westport’s economy. Beginning in the 1970s, legislation protecting Native American tribes’ salmon fishing rights limiting commercial fishing caused the city’s economy to diversify, including growth of recreational activities such as surfing and whale-watching (Kershner 2014; McCausland 1998). Westport Shipyard, Inc., which was founded in 1964 to build fishing boats, has expanded into the production of recreational and luxury vessels. Today, Westport’s economy is primarily based on tourism, commercial fishing, and seafood processing. Home to the largest coastal marina in the Pacific Northwest, the city boasts Washington State’s largest charter fishing fleet and the west coast’s top commercial fishing fleet by volume (Port of Grays Harbor 2021). Annual events and festivals such as the Blessing of the Fleet, Rusty Scupper’s Pirate “Daze,” and Santa by the Sea celebrate the area’s maritime heritage.

Westport is a community of approximately 2,100 year-round residents, but its population often swells in the summer due to seasonal tourism. U.S. Census data indicates that median annual household income in Westport is \$42,439 and that the city has a poverty rate of 17.5%. The median age in Westport is 49.7, more than ten years higher than the U.S. median age of 38.1 (United States Census Bureau 2018). The majority of Westport residents (94.6%) are White, and 98.4% of all residents report speaking English only at home (United States Census Bureau 2018). According to 2019 Washington State county health data, Grays Harbor County ranks 36 out of 39 in overall health outcomes; 35 out of 39 in social and economic factors affecting health such as income inequality and unemployment; and 38 out of 39 in health behaviors such as adult smoking and adult obesity (Robert Wood Johnson Foundation 2021). Westport’s percentage of residents with a disability (22.3%) is nearly double the national average of 12.6% (United States Census Bureau 2018).

Table 4: Sociodemographic characteristics for Westport

2019 American Community Survey 5-Year Estimates for Westport		
Subject	Estimate	Percentage of population
Gender and age		
<i>Male</i>	1,011	55.6%

<i>Female</i>	806	44.4%
<i>Median age (years)</i>	49.7	
Race and ethnicity		
<i>One race</i>	1,739	95.7%
<i>White</i>	1,718	94.6%
<i>Black/African American</i>	1	0.1%
<i>American Indian/Alaskan Native</i>	5	0.3%
<i>Asian</i>	15	0.8%
<i>Native Hawaiian/Pacific Islander</i>	0	0.0%
<i>Hispanic/Latino (of any race)</i>	78	4.3%
<i>Two or more races</i>	78	4.3%
Housing		
<i>Single family housing units</i>	936	59.2%
<i>Owner-occupied units</i>	527	62.4%
<i>Renter-occupied units</i>	317	37.6%
<i>Median value (dollars)</i>	\$188,900	
Occupation		
<i>Management, business, science, arts</i>	221	35.2%
<i>Service</i>	76	12.1%
<i>Sales and office</i>	127	20.3%
<i>Natural resources, construction, maintenance</i>	144	23.0%
<i>Production, transportation, material moving</i>	59	9.4%

Built environment context

Westport is located within the South Beach area of Washington State's Pacific coast, which also includes the communities of Ocosta, Grayland, North Cove, and Tokeland. The city itself is located entirely on a low-lying peninsula at the mouth of Grays Harbor, where the Chehalis River meets the ocean. Because of its sandy composition and relatively unprotected location, Westport's peninsula has historically experienced shifting landforms due to powerful tides and storms. As shipping and fishing became important to the local economy at the end of the 19th century, engineering, dredging, and fill projects, including jetties and breakwaters, were initiated to help stabilize both the land and shipping lanes (McCausland 1998). Many of these structures have experienced a cycle of failure and reconstruction over the years, and land loss due to coastal erosion continues to be an issue in the South Beach area today (Ruggiero et al. 2012).

Westport has a range of land uses, including residential, commercial, and industrial. Residential areas are located primarily on the southern and eastern parts of the peninsula, with some small beach-front communities and one multi-structure condominium development located along the Pacific coast. Most of the city's commercial development, including hotels, surf shops, the Shop'N Kart grocery store, and a range of other local businesses, is located along South Montesano Street and State Highway 105, Westport's primary north-south streets. The marina is located at the northernmost end of the peninsula facing Grays Harbor and serves as home to the commercial fishing fleet as well as the Washington Crab and Ocean Gold seafood processing plants. The northwest quarter of the peninsula is comprised of Westhaven and Westport Light State Parks, which total approximately 190 acres and feature public beach access as well as recreational trails among the dunes. The Grays Harbor Lighthouse, which began

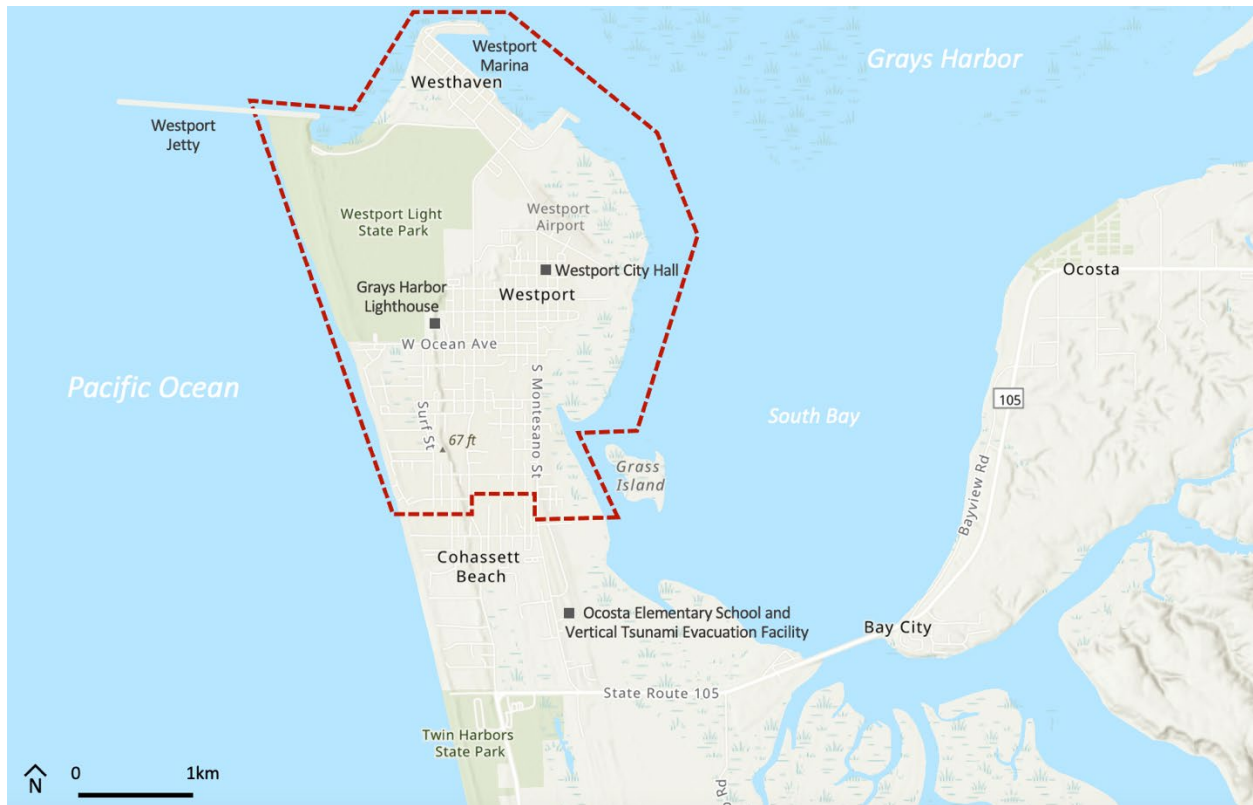


Figure 13: Westport, WA. Map created using ArcGIS Online (Esri n.d.)

service in 1898 is located near the southern edge of Westport Light State Park (McCausland 1998). Local institutions include the Westport Timberland Library, the South Beach Clinic, Westport Maritime Museum, and the Port of Grays Harbor.

Located on a peninsula between the Pacific Ocean and Grays Harbor, Westport is relatively physically isolated from surrounding communities. Aberdeen, the nearest city offering regional services such as a hospital, is located 20 miles northwest of Westport. The smaller South Beach communities of Grayland, North Cove, and Tokeland are located several miles to the south. The nearest high ground is located to the east in Ocosta, across a bridge over Grays Harbor's South Bay and along Washington State Route 105, the designated tsunami evacuation route.

Westport is served by Grays Harbor Transit Route 70, which provides limited daily public bus service to Aberdeen, Hoquiam, and Grayland. Grays Harbor Transit also provides Dial-a-Ride transportation as well as accessible Specialized Van Service within the fixed-route service area. Westport also has a single-runway public-use airport, which opened in 1963 to accommodate small planes. Owned by the City and located between the marina and the commercial district, the airfield is constructed on fill to avoid frequent flooding (McCausland 1998).

In addition to being vulnerable to the kinds of seismic events threatening communities across the Pacific Northwest, coastal cities like Westport faces tsunami hazards from both local Cascadia subduction zone and distant Pacific Rim earthquakes (B. Freitag, El-Anwar, and Kasprisin, n.d.). Approximately 1.2 square miles of Westport, comprising 99% of the city's development and home to 89% of its population, are located within the tsunami inundation zone (Washington State Emergency Management Division et al.

2013). In addition, like many other coastal communities in Washington State, Westport lacks high ground to which residents could evacuate quickly in the event of a tsunami (B. Freitag, El-Anwar, and Kasprisin, n.d.). Recognizing the potential long-term consequences of this exposure, the Ocosta School District, which serves Westport and much of the surrounding South Beach community, taxed itself to fund the construction of a tsunami vertical evacuation facility as part of a new elementary school (Doughton 2016).¹⁵ The structure, which was completed in 2015, can hold up to 2,000 people on its rooftop and is stocked with emergency food and supplies. Westport and the surrounding South Beach area, as the first community in North America to build a tsunami vertical evacuation structure, has demonstrated leadership and political will in the development and implementation of this forward-looking hazard mitigation strategy (“Localizing Hazard Mitigation: Recommendations for Westport’s Comprehensive Plan Update” 2018).

Earthquake and tsunami hazards are identified as the top two ranking hazards of concern in the City of Westport Annex to the 2018 plan, receiving a vulnerability rank of “high” (Bridegeview Consulting 2018). Other “high”-ranking hazards include shorter-term, chronic threats like flooding and erosion – in fact, nearby North Cove’s Washaway Beach is known as the fastest-eroding section of the entire U.S. west coast (Talebi et al. 2017). Severe weather is classified as “medium” and several additional hazards, including climate change, drought, volcano, wildfire, and landslides, receive a vulnerability ranking of “low.” The Westport Annex of the plan additionally identifies severe storms and semi-yearly flooding in the marina district as natural hazard events of concern that have occurred in Westport’s past.

Engagement activities

During the summer and fall of 2018, the City of Westport and the University of Washington Department of Urban Design and Planning (UW) developed a partnership to create recommendations for enhancing the resilience of the Westport/South Beach community. Engagement with the Westport community took many forms, including a presentation by visiting resilience scholars from Japan as well as a series of community meetings and dialogues.¹⁶ The focus of the engagement with Westport was manifested in the form of a quarter-long urban planning studio course held in the fall of 2018, which supported two public resilience workshops and an open house to share resultant recommendations. The team has presented this work and the further development of recommendations for integrating the Grays Harbor

¹⁵ The City of Westport is currently pursuing the design and construction of a second vertical evacuation facility located closer to the end of the peninsula to serve more of the city’s residents. This initial vertical evacuation project paved the way for other, similar coastal hazard mitigation projects. For more background on the design and implementation of vertical evacuation structures in Washington State, see the Project Safe Haven report at <https://mil.wa.gov/asset/5ba41ffbd444> (University of Washington College of Built Environments and Washington State Emergency Management Division n.d.).

¹⁶ On September 24, 2018, visitors from the International Research Institute for Disaster Science (IRIDeS) at Tohoku University shared tsunami recovery research and experiences from Japan in a public presentation at Ocosta Elementary School. The event was promoted broadly throughout South Beach to generate interest about tsunami hazard planning and to share information about the upcoming community resilience workshops. Presenters shared real life experiences and lessons learned from the 2011 magnitude 9.0–undersea megathrust earthquake and tsunami and engaged in conversation with community members about tsunami preparedness planning.

countywide hazard mitigation plan into the City of Westport's Comprehensive Plan update to Westport's City Council and its Planning Commission.

2018 Studio course

Prof. Abramson led the development of an urban planning studio course in which a multidisciplinary group of students would review Westport's existing long-term planning goals and the Grays Harbor County Hazard Mitigation Plan and find ways to adapt the county-wide hazard mitigation strategies specifically to Westport for integration into its Comprehensive Plan. The studio team collaborated with Westport area leaders to engage partners and community members in hazard resiliency planning. A key part of this process was the organization of a series of community workshops and open houses focused on building capacity for coastal resilience (see *Community workshops* below).

Shared goals for the studio's engagement with the Westport community were established in a Memorandum of Understanding, which was developed in collaboration with Kevin Goodrich and the Tsunami Safety Committee. The MOU was signed in September 2018 by Westport Mayor Robin Bearden and Prof. Abramson on behalf of the UW Department of Urban Design and Planning and studio team (University of Washington Department of Urban Design and Planning and City of Westport 2018). The goals outlined in the MOU included:

- Engaging a broad range of local community members as well as municipal and agency stakeholders, including residents, the City of Westport, Shoalwater Bay Tribe, Grays Harbor County, Pacific County, State and local emergency management agencies, Federal representatives, and other stakeholders representing coastal ecology, transportation, public health, education, local businesses and historic resources
- Supporting ongoing efforts to improve community resilience in the City of Westport and surrounding areas, including collaborative efforts among multiple coastal communities
- Identifying opportunities for integrating equitable and just localized hazards planning with general community development planning, urban design and public health via the City's Comprehensive Plan update and other infrastructural improvements, including transportation and telecommunications
- Learning from the successes won and challenges faced by the City of Westport and its residents to inform ongoing policy decisions around hazard planning and to share lessons learned with other communities both within our region and beyond

During September and October of 2018, the studio team participated in three planning meetings with a Westport-based Steering Committee to plan the public workshops and to discuss the studio deliverables. One of these meetings was held on-site in Westport, which enabled students to experience the community firsthand and meet with project stakeholders in person. The studio group was hosted on tours of the Westport Marina and the Ocean Gold seafood processing plant and also visited Westport Maritime Museum and Westhaven State Park.

Community workshops

The studio team, along with researchers from the M9 research team, planned and implemented two coastal resilience workshops that took place in Westport in November of 2018. In each workshop,

participants identified values and assets of the Westport/South Beach community; discussed scenarios of change and vulnerabilities related to potential hazards; and worked to envision creative strategies for adaptation. Workshop goals included:

- Building on the City of Westport’s prior earthquake and tsunami preparation efforts
- Helping the City of Westport to update its Comprehensive Plan to include local values and needs related to hazard mitigation
- Raising public awareness about hazard preparedness and encouraging community support of hazard mitigation efforts
- Discovering everyday value in preparing for rare and uncertain future events

The studio leaders trained the students to help run the workshop, and they took on the roles of facilitators, note-takers, and GIS technicians.

Community Partners Workshop

The first of the workshops, the partners workshop, took place on Friday, November 16, 2018. This workshop focused on making hazard mitigation more meaningful and actionable for the Westport community. Held at McCausland Hall, it engaged 24 hazard mitigation experts, including agency staff from the City of Westport, Grays Harbor County, and Washington State as well as representatives from the Shoalwater Bay Tribe, Ocosta School District, Westport’s Tsunami Safety Committee, among others. Participants discussed Westport’s values and assets, reviewed sea level rise projection scenarios and tsunami inundation maps, and discussed vulnerabilities as well as opportunities for adapt to such hazards. Workshop participants engaged in mapping activities using participatory GIS, specifically, a technology known as WeTable that enables participants to enter geocoded information on a projected map (Mikulencak and Jacob 2011).

Community (Public) Workshop

On the day following the community partners workshop, the team hosted a public workshop at Ocosta Elementary School open to all members of the Westport/South Beach community. More than 30 people attended the workshop, in which participants mapped community assets (on paper rather than using the WeTable), discussed opportunities for supporting and strengthening the community in ways that reflect local values, and identified ways to plan for and adapt to changing conditions. Participants also learned about emergency safety, shared stories from past hazard experience, participated in a raffle, and toured the vertical evacuation tower at the school. The workshop concluded with a storytelling exercise in which community members voiced visions for the future of Westport, building upon the local strengths and assets noted in earlier exercises and thinking forward to how future planning efforts might help to support long-term resilience and well-being.

What we learned

The workshops provided a valuable opportunity for community members to discuss and exchange ideas and for the project team to learn from members of the Westport community. The public workshop participants also indicated via a brief post-event survey that participating in the workshop helped them to gain a greater understanding of the possible impacts of sea level rise or a Cascadia subduction zone earthquake and tsunami on their community.

Key takeaways from the workshops included the following:

- *Values and assets:* Members of the Westport/South Beach community value their community for many reasons, including resilient people, strong social bonds, abundant natural resources, small-town character, and affordability. Many local assets support these values, including fisheries and aquaculture, parks, downtown businesses, and places – like schools and neighborhood gatherings – where people meet.
- *Vulnerabilities and uncertainty:* Community members discussed potential vulnerabilities in the community, highlighting transportation and communication systems as specific challenges. Participants also discussed the difficulties of planning for uncertain events like hazards.
- *Preparedness:* Workshop participants discussed plans for increasing outreach within the community to help encourage people to prepare for hazards. They also discussed practical approaches like gathering supplies and establishing meeting points.

Community open house and comprehensive plan recommendations

To conclude the studio engagement, the UW project team hosted a public open house at the Tackle Box in Westport on December 8, 2018. The purpose of the open house was to share preliminary recommendations for integrating hazard mitigation strategies into Westport’s Comprehensive Plan update. The recommendations were based on ideas and feedback from the workshops and other meetings with Westport/South Beach stakeholders. The students presented the recommendations in the form of posters that provided a discussion point during the open house and were then left with the City after the event for their own use and reference.

A final report documenting the studio work and the planning recommendations can be found online at: <http://mitigate.be.uw.edu/research-and-practice-2/research-and-practice/>. One of the students from the studio went on to develop the recommendations into a Comprehensive Plan Update proposal for the City of Westport as the focus of her Master of Urban Planning thesis project (Stanton 2019). The UW team presented the preliminary recommendations for the Comprehensive Plan update to Westport City Council in March of 2019.

Ongoing engagement

Of the three communities, the team’s engagement with Westport was the most extensive. It has been further reinforced through a subsequent studio course as well as additional synergistic activities carried out via related community resilience research initiatives involving members of the research team.

In the winter of 2021, Prof. Abramson partnered with Prof. Ken Tadashi Oshima of the UW Department of Architecture to lead a multidisciplinary Disaster Resilience studio building upon the previous studio work with a focus on community design for tsunami- and sea level rise resilient structures, landscapes, and urban systems in South Beach.

Synergistic outgrowth projects include an NSF Smart & Connected Communities Planning Grant “Socially-integrated Technological Solutions for Real-time Response and Neighborhood Survival After Extreme Events” research initiative;¹⁷ a pilot National Science Foundation Coastlines and People (CoPe) research initiative focused on “Coastal Hazard Planning in Time”;¹⁸ a Center for Safety Equity in

¹⁷ https://www.nsf.gov/awardsearch/showAward?AWD_ID=1951418

¹⁸ https://www.nsf.gov/awardsearch/showAward?AWD_ID=1940024

Transportation (CSET) community-embedded drone project;¹⁹ and an American Roundtable profile of South Beach.²⁰

Effects of the team's relationships with the study communities

The nature and basis of our team's relationships with the different study communities varied, which undoubtedly had an effect on the level of community engagement in our research activities and the subsequent outcomes of our research. As researchers from the University of Washington, we were in a sense outsiders in all three communities. However, one member of our research team is a resident of Laurelhurst, was the original point of contact for our connection to LEAP, and is the neighbor of one of our LEAP collaborators. Laurelhurst, being located very close to the University of Washington, is also the place of residence of many current and former University faculty and staff. Therefore, we were not as much outsiders due to our institutional identity in Laurelhurst as we were in the other two communities – particularly in Westport, outside Seattle. Additionally, Laurelhurst's physical proximity to the University of Washington made it easy to visit, and we were able to participate in regular meetings of LEAP as well as in other community activities.

Although the Westport/South Beach area is the most geographically distant of the three communities from the University of Washington, it has participated in a series of synergistic resilience and disaster preparedness research activities related to the work presented in this dissertation, such that some team members have formed personal connections to key stakeholders in the community. While our team may be outsiders in Westport as university researchers from a large urban center, many relationships exist between Westport stakeholders and University of Washington researchers due to this frequent and ongoing engagement. Additionally, one of our research assistants during the quarter in which we conducted the community planning studio and public workshops was a native of South Beach, which provided us with more personal access to a range of community stakeholders. However, the more than two-hour drive between Seattle and Westport inhibited the kind of participation in community activities we were able to achieve in Laurelhurst.

Unlike the other two communities, we had no strong connections to the South Park community at the beginning of our engagement there. We chose to work with the community in part because of its demographic diversity and difference from Laurelhurst, but also because it was a community the City of Seattle's Office of Emergency Management had previously had difficulty engaging in disaster preparedness educational efforts and activities. The White, middle/upper-middle class, and primarily English-speaking researchers and City officials who led the engagement with South Park shared fewer characteristics of identity with community stakeholders than we did with the other two communities. It is extremely likely this, and a limited capacity to do outreach with multiple language and ethnic groups, contributed to less representative participation in South Park than in the other two communities.

¹⁹ <https://cset.uaf.edu/research/year-5-projects/community-embedded-drone-program-for-improving-traffic-safety-of-rural-communities-in-washington-state/>

²⁰ <https://archleague.org/event/dynamic-landscapes-south-beach-washington/>

3. Community resilience sample survey

Sample surveys are widely used in empirical social science research to help provide a better understanding of complex societal characteristics and processes (Rossi, Wright, and Anderson 2013). Sample surveys, or probability surveys, entail the systematic collection of information about entities such as individuals, households, or organizations. Probability sampling enables the measurement and development of statistical inferences about the population of interest (Stopher 2012).

In order to build a nuanced, and as complete as feasible, understanding of the attitudes, actions, and social connections within our study communities, we designed and implemented a sample survey at the scale of the individual community. Because the effects of large disasters are inherently place-based, we are interested in understanding how information and resources might be shared via community-level social networks in the event of a disaster. Recognizing that although this survey strategy would allow us to generalize findings only to the specific community being surveyed, we engaged three characteristically different study communities in order to enable some level of comparison among communities of varying urban-rural character and/or socioeconomic status (see also Chapter 2).

The survey created as part of this dissertation research explores relationships between social relations, attitudes (such as trust and willingness to share), and community-level disaster preparedness. Exploratory in its nature, the survey instrument elicits information from community members not only about how they might be prepared for a disaster materially, but also about how their attitudes and social connections might contribute to preparedness at both the household and community scales.

Data from the sample survey informs all three studies that follow (Chapters 4-6). Studies 2 and 3 combine the analysis of the survey data with additional qualitative methods, such as interviews (Chapter 5) and focus groups (Chapter 6). The focus group and interview methodologies are described in their respective chapters.

Survey design and development

From the beginning of the survey development, the research team sought to include items of relevance and interest to the study communities. The survey instrument was developed with the help of feedback from members of the City of Seattle's Office of Emergency Management, the Northwest Healthcare Response Network, Washington State's Emergency Management Division, and the University of Washington Medical Center, as well as being reviewed by members of Laurelhurst Emergency Action Preparedness (LEAP) in Seattle and by Kevin Goodrich, Director of Public Works for the City of Westport. We reviewed draft versions of the survey together with these local and regional partners, incorporating their feedback regarding questionnaire content and question wording. The pilot survey (see *Survey implementation* below) was pre-tested with members of LEAP as well as with colleagues at the University of Washington.

Both the paper and online survey materials were designed following guidance from Dillman's *Tailored Design Method* in order to reduce nonresponse and measurement error (Dillman 2007). The questionnaire was formatted for legibility, ease of navigation, and interest to potential respondents. For the paper survey, we chose a booklet format as recommended by Dillman. We began with the questions about disaster preparedness, as that was the main topic of the survey and the topic we felt would most likely hold the greatest interest for potential respondents. Demographic questions, which can be less

interesting and sometimes sensitive for respondents, were included in the final module (see more on *Survey modules* below). A 12-point font was used to help make the survey easier to read.

Although the set of questions presented was nearly identical for each of the study communities, it was important to the research team to “brand” the questionnaire in order to communicate the importance of the specific study communities to the research project. A representative image of each community was included on the front page of the survey booklet, and the survey was co-branded with logos from both the University of Washington and our local partners (LEAP, the City of Seattle, the City of Westport) in order to highlight the partnerships supporting the survey. The survey materials were also translated to Spanish for distribution in South Park and Westport (see *Survey implementation* below).

The web survey was designed to match as closely as possible the style and format of the paper survey. The survey platform host was selected both for the security measures it provided as well as for the design flexibility it afforded to create a web survey that looked as similar to the paper version as possible. These design decisions helped to provide as similar a survey experience as possible to respondents regardless of whether they completed the online survey or the paper survey.

Survey modules

The survey instrument comprises 34 items, which are a mix of multiple selection and open-ended questions that takes respondents approximately 20 minutes to complete. The survey is organized into four modules: 1) Disaster preparedness, 2) Access to health care, 3) Community connections, and 4) Background information. The information gathered from the four survey modules provides a profile of community social connectivity and illustrates ways in which community members have prepared for a potential disaster, including community assets – both physical and social – that could potentially serve as resources in a time of crisis.

Module 1: Disaster preparedness

The disaster preparedness module asks respondents what preparedness items they have and how long they anticipate that supply lasting; what daily activities they are most concerned about carrying out if major utility services are lost; where they would go to get essential items in a disaster scenario if they did not have them; what disaster-related skills they have; and how willing they would be to share resources with other in a disaster scenario. The intent of this module is to create a picture of how concerned respondents are about the potential effects of a major disaster and to understand what material resources, skills, and social connections they have that might aid them in carrying out essential everyday activities (e.g., cooking, bathing, staying warm, communicating with family and friends) in a disaster scenario.

The survey instrument asks respondents to consider these questions in the context of a disaster scenario that would cause the loss of major utilities (water, electricity, and gas) for a week or more. We suggested in Laurelhurst and South Park that this kind of utility failure scenario might result from a large earthquake. In the case of Westport, we instead decided to suggest that the loss of utilities might result from a severe storm, as an earthquake near Westport would also likely cause a tsunami with the potential to devastate the entire city. Because we wanted respondents to think about how they could still access important resources when their options were limited to what was available within the community, we did not want Westport residents to have an earthquake and tsunami scenario in mind when answering these questions.

Some questions about from a previous City of Seattle survey on disaster preparedness (City of Seattle Office of Emergency Management 2015) were adapted to be used as part of the survey instrument in order to provide some level of continuity with previous survey work done on this topic in this area.²¹ These included questions about the number of days respondents' households are prepared to be on their own in a disaster for various emergency resources (e.g., food, drinking water, medications, warmth), sources of disaster preparedness information,²² and respondents' use of social media for finding information about disaster preparedness in their community.

Module 2: Access to health care

The second module asks respondents specifically about how they access health care services via different modes of transportation and communication, how far they travel to access health care services, and how their choice of health care provider might change from a normal, "blue skies" day to an emergency (disaster) scenario. The intent of this module was to better understand the level of access to health care resources within each community and whether participants feel they are able to access the kind of emergency care they might need in a disaster within their own community. Knowing that each of the study communities is somewhat isolated from a transportation perspective, and that access to health care in rural areas tends to be poor (Douthit et al. 2015), this data enables a comparison of the communities' level of access to both everyday and emergency health care services.

Module 3: Community connections

The third module focuses on respondent's local social ties as well as their attitudes about both people and place. To better understand the number and strength of respondents' place-based social ties, we asked them to provide the number of strong tie (friends/family) and weak tie (acquaintances) social connections they have within different areas of the neighborhood. To aid participants in answering this question, we provided a map of the community divided into several zones. The demarcation of the zones was determined based on input from community stakeholders as well as knowledge gained through the community workshops and site visits about existing community divisions and boundaries (such as major streets, land use changes, or significant topography). We also asked respondents to provide the number of hours spent in the past month participating in activities with other people in their neighborhood.

To better understand respondents' attitudes towards people and place, we included Likert item scales about place attachment and trust. This included adapting a four-item place attachment scale formulated for use at the neighborhood scale (Fornara, Bonaiuto, and Bonnes 2010). Place attachment, or the emotional and cognitive experience linking people to places, has been shown to affect people's perceptions of and responses to natural hazard risks (Bonaiuto et al. 2016). It has also been shown to motivate participation in cooperative efforts to improve one's community (Manzo and Perkins 2006), to build connections between individuals within a community (Payton, Fulton, and Anderson 2005), and to enhance social trust (Stefaniak, Bilewicz, and Lewicka 2017). Because our focus is place-based, and because place attachment has been shown to play a role in both social trust and disaster perception and response, we include it as one of our dimensions of study. Adaptations to the original scale included

²¹ Much of the survey was exploratory in nature, but we adapted existing and well-tested survey items when appropriate and feasible in order to minimize measurement error.

²² Although this question was included in the pilot survey, it was removed in the full survey.

changing some wording to include the specific names of communities and varying the four items so that two were positive statements and two were negative. We also included a social trust scale consisting of three items adapted from the General Social Survey to measure respondents' trust of others in general (T. W. Smith et al. 2018).

Module 4: Background information

The final module is designed to collect respondent background and demographic information, including household size and makeup, ethnicity, age, education, income, and rent/own status. This module also includes questions related to transportation behavior such as number of commute days per week, commute distance, number of household cars and bikes, and the number of people in the household with mobility limitations for different modes. Some transportation questions were included in coordination with a survey by the Tier I University Transportation Center for Teaching Old Models New Tricks (TOMNET) Attitudes Towards Emerging Mobility Options and Technologies survey (Khoeini et al. 2019), which was being developed contemporaneously with the survey described in this document, so that travel behavior comparisons between the two populations could potentially be made in the future.

Sampling

Sampling design

The intent of the sampling design was to implement a simple random sampling strategy. However, nuances of the three study communities resulted in a slightly different approach for each survey. For Laurelhurst, we adopted a stratified sampling strategy because so few multifamily residential buildings existed in the neighborhood compared to single family homes. Expecting that apartment-dwelling residents might potentially have different responses in terms of disaster preparedness and place attachment, we oversampled the multifamily units in Laurelhurst, including all of them in our sampling frame. In Westport, because our expected nonresponse and undeliverable proportions were so high, we needed to maximize the sample size and sent surveys to all addresses on the purchased sampling frame. In South Park, we drew a simple random sample using the *sample* package in R. Because the prevalence of multifamily units within South Park is much greater than in Laurelhurst (16.5% of all residential units in South Park vs. 4% of all residential units in Laurelhurst), and because we needed to sample nearly the entire sampling frame for South Park (1200 of 1383 households) in order to reach our target sample size (see *Sample size* below), we did not stratify the South Park sample.

Sampling frames

To construct the sampling frames for Laurelhurst and South Park, neighborhoods located within the City of Seattle, it was possible to use readily available data from the King County Assessor's Office accessed via their GIS-based Parcel Viewer tool (King County GIS Center 2021). For each individual property, Parcel Viewer provides the property address as well as information on the present use of the parcel (e.g., commercial, single family, industrial) and the number of units in condominiums and other multifamily residential buildings, among other data. For each property within the study community, we verified its use, selecting only residential property addresses for the sampling frame. Because apartment numbers are not provided as part of the Assessor's data, some on-the-ground verification was necessary to ensure correct addresses for multifamily buildings. The boundary of the Laurelhurst neighborhood was based on the community map adopted by the Laurelhurst Community Club. The boundaries of the

South Park neighborhood were defined based on the administrative boundary defined by the neighborhood by the City of Seattle.²³

It was not possible to use the same method to construct the sampling frame for Westport, which is located in Grays Harbor County. Assessor's data in this county is not as complete as that for King County, and it was not possible to construct a comprehensive list of all properties within the city relying only on the Assessor's data. Instead, we purchased a list of Westport addresses (based on the 98595 ZIP code, which aligns closely with the city's administrative boundary) from Experian, a company that provides marketing data to businesses and researchers. The list included both physical addresses and PO Box addresses, as many people in the Westport area receive their mail at P.O. boxes instead of at physical mailboxes located at their place of residence. The same level of verification achieved for the Seattle communities was not feasible in Westport due to the inability to match addresses with properties because of both the sparseness of the county-level data and the prevalence of P.O. box addresses. As a result, we experienced a higher percentage of returned surveys due to incorrect addresses for Westport than we did for either of the Seattle communities (see *Survey Response* below). It is also likely that coverage error due to incomplete identification of all households within the community is higher in Westport than in Laurelhurst or South Park.

Sample size calculation

In the community resilience survey, key variables such as household preparedness with different resources and willingness to share are measured using categorical variables ranging from two to five categories. Calculating the sample size based on the dichotomous variable (in this case, resource networks) yields the most conservative estimate of the necessary sample size (Bartlett, II, Kotrlik, and Higgins 2001). Following Dillman (Dillman 2007), we used the following formula for calculating the desired completed sample size for each community:

$$N_{s1} = \frac{(N_p) (p) (1-p)}{(N_p-1) (B/C)^2 + (p) (1-p)}$$

Where

N_{s1} = completed sample size

N_p = size of population (total households)

p = proportion of population expected to select a given answer (maximum = 0.5)

B = acceptable amount of sampling error (assumed 0.05)

C = Z statistic associated with the confidence level (1.96 corresponds to the 95% level)

Because the survey was exploratory in nature, we assume the greatest possible variance in response ($P = 0.5$) in order to generate a conservative estimate of the necessary completed sample size (Fox, Hunn, and Mathers 2007). This formula also includes the finite population correction factor, which takes into account when sampling without replacement from more than five percent of a finite population (Daniel and Cross 2019). Then, to account for the eventuality that not all surveys would be completed and that some addresses in the sampling frame would be incorrect, we included these factors in the calculation:

²³ The neighborhood boundary of South Park is shaped in large part by the Duwamish River as well as the highway infrastructure and industrial areas surrounding the community's residential and commercial uses.

$$M = \frac{N_s}{(R)(U)}$$

Where

R = anticipated response rate

U = anticipated undeliverable rate

The estimates for Laurelhurst were based on the pilot survey response rate. The estimates for South Park and Westport were assigned accordingly but adjusted for factors such as quality of the sampling frame and factors affecting the potential response rate. Although the response rate for the Laurelhurst pilot survey was quite high (37.5%), we did not feel we could assume the same response rate in South Park and Westport because we had weaker networks in those communities through which to promote the survey. We also felt the survey would likely be better received in Laurelhurst because of the neighborhood's proximity to the University of Washington and the many ties that exist between neighborhood residents and the University (e.g., many current and former faculty live in the neighborhood).

Table 5: Sample size parameters for full survey

<i>Parameter</i>	Laurelhurst	South Park	Westport
<i>Number of households in sampling frame (N_p)</i>	1890	1383	1243
<i>Assumed variance (p)</i>	0.25		
<i>Confidence level (C)</i>	0.95		
<i>Margin of error (B)</i>	0.05		
<i>Desired sample size (N_s)</i>	320	233	210
<i>Assumed response rate (R)</i>	35%	20%	20%
<i>Assumed undeliverable rate (U)</i>	5%	5%	20%
<i>Number of mailings needed (M)</i>	900	1230	1315

The size of the mailing for South Park was adjusted slightly to 1200 for cost reasons, and surveys were mailed to the entire sampling frame for Westport because the desired sample size was larger than the calculated number of mailings needed. In the case of Westport, we put in additional effort to promote the survey in the hopes of increasing the response rate.

Survey implementation

Survey implementation comprised two phases: a pilot survey and two waves of a “full” random sample survey with enough target respondents to support robust data analysis and interpretation (see section on *Sample size calculation* above). For all phases of implementation, both online and paper versions of the survey were created with the goal of first providing potential respondents an opportunity to take the survey online before mailing them a printed survey booklet. This strategy helped to decrease the total cost of the survey by saving on printing, postage, and data entry while also providing respondents with options for participation. Paper survey booklets were mailed to potential respondents who did not complete the online survey after receiving the initial letter and a reminder letter.

Pilot survey: April 2019 – June 2019

The pilot survey comprised a random sample of 200 Laurelhurst households. Residential properties were sampled from within the boundaries of the Laurelhurst neighborhood as defined by the Laurelhurst Community Club, the neighborhood civic organization with which LEAP is affiliated. Before mailing the survey to the pilot sample, we tested it with University of Washington colleagues and community stakeholder contacts. We adjusted the wording of some questions based on the feedback we received.

We first contacted potential respondents in April of 2019 via a letter explaining the importance of the project and directing them to a web-based survey hosted by the *Surveygizmo* platform.²⁴ Within the letter, each recipient was given a unique identification number for logging in to the survey website, and contact information was provided for those who preferred to request a paper survey. The unique identifier also functioned as a means of separating identifiable information from individual response records and for keeping track of which recipients had or had not yet responded to the survey. Consent language was included within the text of the survey letter.

Multiple contacts were made with each potential respondent. A reminder letter was sent to target respondents two weeks after the initial letter if they had not yet completed the survey, again describing how to access the online survey website and providing the option to request a paper survey. Finally, after another two weeks, those who had not yet completed the online survey were mailed a third letter requesting participation along with a paper copy of the survey booklet.

Of the 200 people contacted for the pilot survey, a total of 44 people completed the online survey, and 34 people completed the paper survey. Three incomplete responses were discarded for a total of 75 complete and useable responses, a 37.5% response rate. Responses were collected through June of 2019.²⁵

Incentive testing

Research on survey implementation has demonstrated that providing of a token financial incentive in the range of one to five dollars can significantly increase response rates, with the greatest benefit derived from providing the incentive up-front with the survey completion request (Dillman 2007). As part of the pilot survey, the research team tested two different incentives: 1) a one-time, two-dollar cash incentive included in the initial mailing; and 2) a five-dollar e-gift card received upon completion and return of the survey, which required respondents to both complete the survey and provide their email address.²⁶ Half (100) of the pilot respondents received the two-dollar incentive, and the other half received the offer of the promised five-dollar incentive. Survey response rates are shown in the table below.²⁷

²⁴ Surveygizmo was selected because it both met the security requirements of the University of Washington Institutional Review Board (confirmed via email communication) and because it provided the question design options needed to closely match the paper-based survey. Surveygizmo has since rebranded as Alchemer.

²⁵ Responses were considered incomplete if respondents did not fill out entire sections of the survey (e.g., Module 2 or Module 4) or if 75% or more of the questions were unanswered.

²⁶ Some respondents did complete the survey and requested the incentive but did not supply an email address, so a small number of physical gift cards were obtained and mailed to these respondents.

²⁷ Table totals reflect the number of substantially complete and usable survey responses received and to not include partial responses.

Table 6: Pilot survey response totals by mode and incentive strategy

<i>Incentive strategy</i>	Online survey responses	Paper survey responses	Total number of responses
<i>\$2 enclosed with letter</i>	27	12	39
<i>Offer of \$5 gift card</i>	16	20	36
<i>Total number of responses</i>	43	32	75

Although we found that the two-dollar incentive prompted a higher initial response as well as a slightly higher overall response, we ultimately chose to offer the five-dollar incentive in the full survey. The primary reason for this was the need to be able to track respondent payments for tax purposes, and the budget office with which we were working was not supportive of the cash incentive option, which was more difficult to trace. There were also some potential cost benefits to this strategy in that we did not provide an incentive to anyone who did not complete the survey, and some respondents chose to decline the offer of the incentive even though they had completed the survey.

We offered the same five-dollar incentive in each location but tailored them to the community with guidance from stakeholders. In Laurelhurst, we offered a five-dollar Amazon.com gift card because Amazon delivery is ubiquitous in this part of Seattle and there are few local businesses within the neighborhood. In South Park, we offered a five-dollar gift card to Resistencia Coffee, a local independent coffee shop and third place that is known for supporting grassroots community initiatives. In Westport, we offered a five-dollar gift certificate for Shop’n Kart, Westport’s primary grocery store and market.

Survey modifications based on the pilot study

Between the completion of the pilot survey and the full implementation of the survey in Laurelhurst and the other two study communities, the research team reviewed the pilot responses. Based on the nature of the responses received and respondent feedback on specific survey items, several adjustments were made to the survey instrument:

- The disaster scenario relevant to Module 1 was clarified (participants were asked to assume they would lose water, electricity and gas service for a period of a week or more instead of just electricity as described in the pilot survey).
- A question about where participants had learned about disaster preparedness in the past year was removed as it was not considered central to answering the primary research questions.
- A question about participant protective actions (e.g., having earthquake insurance) was removed as it was not considered central to the primary research questions.
- Two questions about commute distance and commute frequency were combined into a single question for purposes of simplicity and clarity.
- A question was added asking participants whether they themselves have a range of disaster preparedness-relevant skills and whether they have social connections within their neighborhood who have those skills.
- A question about respondent race and ethnicity was added that was missing from the demographic section of pilot survey.
- A question about secondary languages spoken in the household was added based on stakeholder feedback.

- One question about disaster preparedness in relation to local context was modified to be appropriate to each community. In the Laurelhurst survey, this question asks about respondent familiarity with LEAP; Westport residents were asked about their familiarity with the vertical evacuation facility at Ocosta Elementary School, and South Park residents were asked about their familiarity with City of Seattle disaster preparedness trainings and resources.

In addition to making question adjustments based on preliminary data review as described above, the pilot survey also enabled us to estimate the survey response rate; work out logistical issues associated with survey design, ordering and mailing; and test incentive strategies before launching the full survey in all communities.

Full survey (September 2019 – November 2019 and March 2020 – April 2020)

In the fall of 2019, the survey was implemented in Laurelhurst (the site of the pilot survey) and Westport, a small coastal community in southwest Washington State. The research team had been working closely with both of these communities on resilience-related topics (see *Chapter 2*) and was able to leverage these relationships to conduct outreach to promote the survey (see *Survey outreach* below).

A second wave of the survey was implemented in the South Park neighborhood during the spring of 2020. Because the survey was mailed to potential respondents as the COVID-19 epidemic was unfolding, we realized that earthquake may not be the disaster at the top of potential respondents' minds. We included a statement acknowledging the pandemic in the introductory letter and asking respondents to answer the survey with the earthquake disaster scenario described in the survey instrument in mind. We also added a question to the end of the survey to ask respondents about whether their experience with the COVID-19 pandemic had affected their thoughts and actions regarding disaster preparedness.

Survey translation

In Laurelhurst, the survey was administered only in English as that is the primary language spoken at home for most households. Approximately 95% of households in the Laurelhurst/Sand Point area speak English only or speak English "very well" if multiple languages are spoken in the household (City of Seattle Office of Planning and Community Development 2019c). Based on interactions with community residents and City of Seattle employees, we believe that the percentage of English language only households is likely higher in Laurelhurst alone than in the joint Laurelhurst/Sand Point geographic area defined by the Census.

For South Park and Westport, which have more residents that speak languages other than English – primarily Spanish – the research team opted to distribute materials in two languages.²⁸ Spanish speakers are less likely to respond to surveys that are provided in English only, and providing the survey in both languages has been shown help to improve response rates among Spanish speakers (Brick et al. 2019). The survey materials were translated by *Interpret This, Inc.*, a consultant recommended by the City of Seattle's Office of Emergency Management. Two English-Spanish bilingual graduate students in the

²⁸ Although other languages are spoken in both of these communities, particularly in South Park, the survey budget allowed for interpretation of materials into only one language. After English, Spanish is the most commonly spoken language in both South Park and Westport.

University of Washington’s Master of Urban Planning program reviewed the translated surveys and provided feedback regarding tone and content as appropriate to an urban planning research survey.

According to American Community Survey data, less than one percent of Westport residents are Spanish-speaking (United States Census Bureau 2018). However, the research team learned from working in the community that many of the area’s seasonal workers speak Spanish and are likely underrepresented in the Census data, as are Latino communities generally in the U.S. (Center on Poverty and Inequality 2019). Because we wanted the Spanish-speaking population to be included in our sample, the survey letters were provided in both English and Spanish, and the online survey was made available in both languages. The final survey booklet was sent only in English for cost reasons, but participants were encouraged, in Spanish, in the letter, to request a Spanish language copy if so desired. No Spanish language materials were requested. One respondent completed the Spanish version of the online survey but answered all of the open-ended questions in English.

In South Park, 32% of households speak languages other than English, Spanish being the most common (20% of households) and approximately 60% of Spanish-speaking households do not speak English “very well” (City of Seattle Office of Planning and Community Development 2019d). For survey deployment in South Park, all materials, including the letters, booklets, and online survey, were translated into Spanish. Both English and Spanish language versions of all materials were sent to potential respondents in all mailings. We received seven responses to the printed Spanish language survey, and no responses to the online Spanish language survey.

Survey outreach

In Laurelhurst, the research team conducted outreach primarily through LEAP, which sent out emails encouraging its network to respond, and also through the public community resilience workshop held in November of 2018 (see *Chapter 2: Engagement with study communities*), in which the facilitators mentioned the upcoming survey. In South Park, outreach primarily consisted of promoting the survey during meetings with community stakeholders and through the community workshop. The research team attempted to coordinate community outreach efforts with the *Promotoras*, but they were already engaged in resilience outreach with the Office of Emergency Management (OEM) and suggested we coordinate with them. We contacted OEM to do so and did not receive a response.

In Westport, the research team conducted several public activities to engage the local community around the broader topic of community resilience (see also *Chapter 2*) and described the upcoming survey to community and stakeholder workshop participants. Members of Westport’s Tsunami Safety Committee agreed to promote the survey via their personal networks, and the survey team posted an announcement encouraging participation in the survey on the Westport research project’s Facebook page.²⁹ We also sent home bilingual fliers with students at Ocosta Elementary and Junior/Senior High Schools describing the survey and encouraging participation.

Mailing strategy

We adopted the same multi-contact mailing strategy used in the pilot survey for the full survey. In Laurelhurst and South Park, two letters providing a link to the online survey were mailed approximately

²⁹ See <https://www.facebook.com/coastalresilience/>

three weeks apart. Those who did not respond to the online survey were then mailed a paper copy of the survey booklet.

In Westport, because the initial response to the online survey was very low after the first round of mailings, the team opted to send the paper survey booklet in the second mailing instead of sending a reminder mailing promoting the web-based option. Issues of note that likely contributed to a lower response rate in Westport (see Table 7) include less reliable internet service, a more transient population, the need to rely on a purchased mailing list, and the fact that many residents have P.O. boxes instead of mailboxes at their homes and are less likely to check their mail regularly.

Survey response: comparative descriptive statistics

Table 7: Survey response rates by study community

	# Households contacted	Online survey response	Paper survey response	# Returned undeliverable	Total # of responses	% Response
<i>Pilot</i>	200	43	32	10 (5.0%)	75	37.5%
<i>Laurelhurst</i>	733	143	90	29 (4.0%)	233	31.8%
<i>South Park</i>	1200	118	93	100 (8.3%)	211	17.6%
<i>Westport</i>	1243	65	129	223 (17.9%)	194	15.6%

Table 8: Survey response to demographic questions by study community

	Laurelhurst	South Park	Westport
Mean respondent age (18+ only)	56 years	46 years	62 years
Respondent gender identity			
Female	49.2%	63.2%	62.1%
Male	48.8%	34.9%	31.1%
Other	0.0%	1.0%	0.0%
Decline to state	0.0%	1.0%	2.6%
N/A	0.4%	0.0%	4.1%
Respondent race/ethnicity			
White/Caucasian	86.4%	60.3%	91.8%
Black/African American	0.0%	0.0%	0.5%
Asian American	0.4%	6.2%	1.5%
Native American/Pacific Islander	1.6%	9.1%	0.5%
More than one	4.3%	10.0%	3.1%
N/A	2.3%	3.3%	2.6%
Hispanic/LatinX	5.0%	11.0%	0.0%
Primary language spoken at home			
English	98.1%	87.1%	98.5%
Spanish	0.0%	6.2%	0.0%
Vietnamese	0.0%	2.4%	0.0%
Chinese	0.4%	1.5%	0.0%
Korean	0.0%	0.0%	0.5%
Amharic	0.0%	0.5%	0.0%
Cambodian	0.0%	0.5%	0.0%
Khmer	0.0%	0.5%	0.0%
Lao	0.0%	0.5%	0.0%
Gaelic	0.4%	0.0%	0.0%
Turkish	0.4%	0.0%	0.0%

N/A	0.7%	0.8%	1.0%
Level of education			
Some grade/high school	0.0%	4.8%	3.1%
Completed high school or GED	0.0%	5.3%	16.9%
Some college/technical school	5.0%	29.7%	45.6%
Completed bachelor's degree/s	34.1%	36.8%	15.9%
Some graduate school	8.9%	4.3%	2.6%
Completed graduate degree/s	51.9%	17.7%	13.8%
N/A	0.0%	1.5%	2.1%
Annual household income			
Less than \$25,000	5.0%	12.9%	24.6%
\$25,000 - \$49,999	3.1%	15.3%	24.6%
\$50,000 - \$74,999	7.4%	13.4%	17.9%
\$75,000 - \$99,999	7.8%	14.4%	10.3%
\$100,000 - \$150,000	14.0%	25.8%	9.7%
More than \$150,000	51.6%	14.8%	5.6%
N/A	11.2%	3.4%	7.2%
Home ownership			
Own	79.8%	67.9%	81.5%
Rent	18.6%	30.6%	15.9%
Provided by others	1.2%	1.4%	2.1%
N/A	0.4%	0.0%	0.5%
Mean total household size	2.6 people	2.5 people	2.0 people
% households with members in each age group			
Children 0-5	7.8%	9.1%	10.3%
Children 6-17	28.7%	20.6%	9.7%
Adults 18-64	69.0%	86.6%	54.9%
Adults 65+	34.9%	18.7%	55.4%
Housing type			
Stand-alone house	83.7%	78.5%	68.7%
Apartment	10.9%	12.0%	4.6%
Attached home/townhouse	1.9%	6.7%	0.5%
Condominium	2.7%	1.4%	3.6%
Mobile home	0.0%	0.0%	21.0%
Other	0.4%	1.4%	1.6%
N/A	0.4%	0.0%	0.0%
Average regional and local tenure, by scale			
Current home	16.3 years	10.1 years	10.2 years
Community (Laurelhurst, South Park, Westport)	18.1 years	10.8 years	15.5 years
City/county (Seattle or Grays Harbor County)	29.6 years	20.9 years	18.5 years
Region (Pacific Northwest)	36.6 years	37.0 years	44.0 years

Table 9: Laurelhurst/Sand Point respondent characteristics compared to 2017 ACS 5-Year Estimates

	Laurelhurst	2017 ACS (Laurelhurst/Sand Point)
Respondent age	56 years (mean, 18+ only)	38.7 years (median)
Respondent gender identity (18+ only)		
Female	49.2%	50.3%
Male	48.8%	49.7%
Other	0.0%	---
Decline to state	1.5%	---

N/A	0.4%	---
Respondent race/ethnicity		
White/Caucasian	86.4%	79.4%
Black/African American	0.0%	3.5%
Hispanic/LatinX	5.0%	1.8%
Asian American	0.4%	11.4%
Native American/Pacific Islander	1.6%	0.0%
More than one	4.3%	5.2%
N/A	2.3%	---
Level of education		
Some grade/high school	0.0%	3.5%
Completed high school or GED	0.0%	3.5%
Some college/technical school	5.0%	8.7%
Completed bachelor's degree/s	34.1%	38.9%
Some graduate school	8.9%	---
Completed graduate degree/s	51.9%	45.4%
N/A	0.0%	---
Annual household income		
Less than \$25,000	5.0%	5.5%
\$25,000 - \$49,999	3.1%	4.4%
\$50,000 - \$74,999	7.4%	9.2%
\$75,000 - \$99,999	7.8%	5.3%
\$100,000 - \$150,000	14.0%	12.4%
More than \$150,000	51.6%	63.3%
N/A	11.2%	---
Home ownership		
Own	79.8%	67.7%
Rent	18.6%	32.3%
Provided by others	1.2%	---
N/A	0.0%	---
Mean total household size	2.6 people	2.6 people

Table 10: South Park respondent characteristics compared to 2017 ACS 5-Year Estimates

	South Park	2017 ACS
Respondent age	46 years (mean, 18+ only)	34 years (median)
Respondent gender identity (18+ only)		
Female	63.2%	45.8%
Male	34.9%	54.2%
Other	1.0%	---
Decline to state	1.0%	---
N/A	0.0%	---
Respondent race/ethnicity		
White/Caucasian	60.3%	45.6%
Black/African American	0.0%	5.4%
Hispanic/LatinX	11.0%	34.6%
Asian American	6.2%	9.7%
Native American/Pacific Islander	9.1%	4.7%
More than one	10.0%	20.5%
N/A	3.3%	---
Level of education		

<i>Some grade/high school</i>	4.8%	18.7%
<i>Completed high school or GED</i>	5.3%	28.3%
<i>Some college/technical school</i>	29.7%	28.2%
<i>Completed bachelor's degree/s</i>	36.8%	18.9%
<i>Some graduate school</i>	4.3%	---
<i>Completed graduate degree/s</i>	17.7%	6.0%
<i>N/A</i>	1.5%	---
Annual household income		
<i>Less than \$25,000</i>	12.9%	34.0%
<i>\$25,000 - \$49,999</i>	15.3%	24.6%
<i>\$50,000 - \$74,999</i>	13.4%	19.3%
<i>\$75,000 - \$99,999</i>	14.4%	9.8%
<i>\$100,000 - \$150,000</i>	25.8%	9.1%
<i>More than \$150,000</i>	14.8%	3.3%
<i>N/A</i>	3.4%	---
Home ownership		
<i>Own</i>	67.9%	39.7%
<i>Rent</i>	30.6%	60.0%
<i>Provided by others</i>	1.4%	---
<i>N/A</i>	0.0%	---
Mean total household size	2.5 people	

Table 11: Westport respondent characteristics compared to 2019 ACS 5-Year Estimates

	Westport	2019 ACS
Respondent age	62 years (mean, 18+ only)	38 years (median)
Respondent gender identity (18+ only)		
<i>Female</i>	62.1%	50.3%
<i>Male</i>	31.1%	49.7%
<i>Other</i>	0.0%	---
<i>Decline to state</i>	2.6%	---
<i>N/A</i>	4.1%	---
Respondent race/ethnicity		
<i>White/Caucasian</i>	91.8%	75.4%
<i>Black/African American</i>	0.5%	3.8%
<i>Hispanic/LatinX</i>	0.0%	12.7%
<i>Asian American</i>	1.5%	8.5%
<i>Native American/Pacific Islander</i>	0.5%	2.0%
<i>More than one</i>	3.1%	5.9%
<i>N/A</i>	2.6%	---
Level of education		
<i>Some grade/high school</i>	3.1%	8.7%
<i>Completed high school or GED</i>	16.9%	22.0%
<i>Some college/technical school</i>	45.6%	33.3%
<i>Completed bachelor's degree/s</i>	15.9%	22.4%
<i>Some graduate school</i>	2.6%	---
<i>Completed graduate degree/s</i>	13.8%	13.6%
<i>N/A</i>	2.1%	---
Annual household income		

<i>Less than \$25,000</i>	24.6%	8.9%
<i>\$25,000 - \$49,999</i>	24.6%	15.6%
<i>\$50,000 - \$74,999</i>	17.9%	16.8%
<i>\$75,000 - \$99,999</i>	10.3%	15.5%
<i>\$100,000 - \$150,000</i>	9.7%	20.9%
<i>More than \$150,000</i>	5.6%	22.8%
<i>N/A</i>	7.2%	---
<i>Home ownership</i>		
<i>Own</i>	81.5%	63.0%
<i>Rent</i>	15.9%	37.0%
<i>Provided by others</i>	2.1%	---
<i>N/A</i>	0.5%	---
<i>Mean total household size</i>	2.0 people	2.6 people

4. A community social network conceptual framework for carrying out essential everyday activities in a disaster scenario

Introduction

Resilience is defined by Walker et al. as the ability of a system to respond to stresses and shocks while preserving its identity and main system functions (Walker et al. 2004). In the case of a shock manifested in the form of large-scale disaster like a Cascadia Subduction Zone earthquake, many of the systems upon which communities typically depend for carrying out essential everyday activities – their main system functions – would be affected and likely disabled. Individuals would be unlikely to be able to reach resources outside the community in the immediate aftermath of such an event, and even access to people and resources within the community is likely to be compromised to some extent.

The premise of disaster preparedness strategies outlined by agencies such as FEMA is that households will be isolated and need to prepare to be self-sufficient in a disaster scenario. In addition, communities' physical vulnerability to disasters has long been the dominant paradigm in disaster preparedness planning, an approach that assumes a top-down view of problem solving through hierarchy and authorities (Fordham et al. 2013). While it is certainly important for individual households to prepare for disasters, and while physical interventions can contribute to the resilience of communities, less attention has been paid to strategies based in the social realm, strategies that rely on a bottom-up, community-based approach to problem solving.

In approaching the question of how disaster preparedness planning could better address ways in which individual households might work together as a community to share resources in a time of need, we argue that adopting an urban planning perspective is necessary to understand the factors affecting system identity and function when the system in question is a community. Kristen Magis takes Walker et al.'s description of resilience one step farther in her definition of *community* resilience: "the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise," acknowledging community *members* and community *resources* as key components of the community system (Magis 2010, 401).

Urban planning is a discipline that has long been associated with the shaping both the physical form and social function of communities through policy and the regulation of the built environment. The characteristics of one's community are well-known to play an important role in determining one's health and well-being. The Centers for Disease Control and Prevention have identified the social determinants of health as "conditions in the places where people live, learn, work, and play that affect a wide range of health and quality-of life-risks and outcomes," which include community cohesion, civic participation, and built environment factors that affect access to resources (Centers for Disease Control and Prevention 2021). These types of social factors have also been closely associated with vulnerability to disasters (Deborah S. K. Thomas and Phillips 2013). Accordingly, recognition of the need to better integrate urban planning and hazards mitigation planning has received increased attention in recent decades (Burby et al. 2000; Schwab 2010). Because individuals' access to resources during a disaster will depend both on the nature and extent of the disaster as well as on the resources that were available and the social ties that were established before the event took place, it is important that these two disciplinary realms be considered in tandem when approaching questions of community resilience.

Thus, the goal of this chapter is to lay out a conceptual framework for understanding the ways in which communities can be resilient during the transformation that will occur in the critical weeks following a major disaster. More specifically, we seek to understand the specific roles played by social ties and social networks in helping people accomplish essential everyday activities in both normal and disaster scenarios. The primary academic contribution of this study is the systematic development of a conceptual framework for approaching resilience research at the scale of the community. This conceptual framework draws upon two fields of theory that are relevant to dynamic, multi-scalar systems like communities: socioecological resilience theory and social network theory.

Socioecological resilience theory, which originated in the field of ecology, has since been applied in a range of disciplinary contexts, including hazards planning and urban planning. The panarchy, a nested hierarchy of adaptive cycles, is a key concept of resilience describing the ability of socioecological systems to evolve via recurring cycles of change (Gunderson and Holling 2002). We explore the applicability of the panarchy concept to the study of community resilience with a particular focus on the ways in which the roles of the actors within the system – in this case, a community – complement one another to carry out essential system functions. We then review some examples of applying the panarchy concept to community systems.

Understanding the social relationships and networks in which we are all embedded is important for improving communities and larger social systems (Neal and Christens 2014). Strong social networks – social networks with many connections and strong ties – have been recognized as having the potential to help communities remain functional during times of disaster and to thrive under normal circumstances (National Research Council 2003). Social ties, individual relationships within social networks, provide members of the network with access to resources, often described as social capital. The transfer of social capital between members of the network depends on a range of factors, including the strength of the social ties connecting the provider and the recipient. We conclude this section by looking at applications of social network thinking in urban planning and provide an overview of how the study of communities has been approached from a network perspective.

In the following sections of the chapter, we explore the role of social ties in connecting people to essential resources in a disaster scenario through two series of conceptual diagrams, noting interdependencies among the social and technological systems and the ways in which the dynamics of resource sharing via social connections might evolve in the event of a disaster. We then use a selection of data from the community sample survey to illustrate exchange patterns – including challenges and opportunities – that might be observed in a geographically limited resource matching network. The observations gained from these exercises are then synthesized with the findings from the literature review into a conceptual framework for studying the ways in which community members might access essential resources in a major disaster, such as a large earthquake. The chapter concludes with suggested areas for further study.

Literature review

Socioecological resilience theory and urban planning

When socio-ecological resilience was emerging as a new field of study, Holling & Goldberg suggested that structural similarities between complex ecological systems and complex urban systems might enable cross-pollination between socio-ecological resilience theory and planning practice (Holling and

Goldberg 1971). Over time, the resilience literature has expanded to include more socio-centric applications of resilience theory applicable in an urban planning context. Although much of the resilience-building literature relevant to urban planning has been dominated by hazards planning and a focus on sudden, catastrophic events (Davoudi 2012; Newman, Beatley, and Boyer 2017), the concept of socio-ecological resilience is also being more widely applied in the broader planning literature (Wilkinson 2012; Petrișor 2017; Afriyanie, Akbar, and Suroso 2018).

In some regards, the concept of resilience has been welcomed in the field of urban planning as useful for filling gaps in theoretical frameworks and research approaches for addressing complex urban problems. For example, the socio-ecological resilience concept has been recognized as having the potential to fill gaps in urban planning scholarship on environmental and ecological processes (Wilkinson 2012). The emphasis on the value of diversity and local knowledge in resilience theory has provided a foundation for methodological approaches to planning research that incorporate critical learning, include multiple voices and enable self-organizing processes (Goldstein et al. 2015). Socio-ecological resilience concepts have also been used as a framework for guiding urban governance decisions about how to leverage innovation and experimentation to navigate unexpected shocks (Ernstson et al. 2010). The systems perspective of resilience has proven to be a meaningful lens for framing planning studies of rural areas, which are often deeply dependent on local natural resources (Scott 2013).

There are, however, vocal critics of the ways in which the concept of resilience has translated from natural to social systems for use in urban planning. Scholars have noted the lack of a clear and consistent terminology for describing resilience or the development of a shared understanding of its precise meaning across disciplines (Jabareen 2013; Davoudi 2018). One point of contention is the inconsistent use of “resilience” as referring to either “equilibrium resilience” or “evolutionary resilience” (I. White and O’Hare 2014), or what Holling refers to as “engineering” and “ecological” resilience, respectively (Holling 1996).

Holling described “engineering” resilience as a concept shaped by the physical sciences and engineering that emphasizes efficiency, constancy and predictability, while “ecological” resilience, a concept shaped by the biological sciences, is characterized by persistence, unpredictability and change (Holling 1996). Within the urban planning literature, there is some confusion between the two meanings of resilience and tension between the desire to “bounce back” after a disruption (the engineering resilience paradigm) and the aspiration to evolve and adapt urban systems to be able to be more flexible and responsive in the face of change (the ecological resilience paradigm) (Davoudi 2018).

White and O’Hare argue that the vague – yet optimistic – use of the term has tended to reinforce the dominant and techno-rational equilibrist interpretation of resilience over the more transformative, evolutionary understanding (I. White and O’Hare 2014). According to Davoudi, the lack of agreement on a shared understanding of resilience, combined with its extensive popularity with institutional and organizational bodies has caused resilience to become a “buzzword” of the moment, used as a blanket strategy for responding to a wide range of crises (Davoudi 2018). In a special issue of *Planning Theory and Practice*, she raises concerns about the assumptions made regarding desired outcomes when translating the concept of resilience from the natural to the planning context, noting that in the self-aware social world structured by power dynamics, “resilience has as much to do with shaping the challenges we face as responding to them” (Davoudi 2012, 305).

The panarchy

Noting these criticisms, we aim to be specific in our focus on resilience as a specific property of complex adaptive systems and to situate the development of this conceptual framework within the evolutionary resilience paradigm. The conceptual model of the panarchy, described in detail below, provides a theoretical framework within which to consider how socioecological systems (including the technologies upon which social systems rely) facing abrupt change such as a major disaster might function at different scales, with a focus on the scale of the community. Gunderson and Holling's concept of the *panarchy*, a term derived from the name of the Greek god Pan and associated with unpredictability, provides a theory describing the ability of socioecological systems to evolve via recurring cycles of change (Gunderson and Holling 2002).

Gunderson and Holling identify three key features of ecosystem structure and function based on a model of system evolution and adaptive change: potential, connectedness and resilience. *Potential* describes the limits of what is possible for the system; *connectedness* describes the extent to which a system can control future change; and *resilience* describes how vulnerable the system is to unexpected change.

The model of the adaptive cycle describes the stages through which a system moves as it responds to change. The relationship between system sustainability and scale is conceptualized as a set of nested adaptive cycles: the "panarchy". Thus, the panarchy is a nested hierarchy of adaptive cycles within which cycles at different scales are able to influence one another as the system experiences change.

The direction and development of the overall system can be influenced by instances of *remembrance* and *revolt* between the levels at key points in the adaptive cycle. The remembrance instances occur when a change or disruption that occurs in one level of the panarchy is influenced by the organizational structure of the level above it, and elements of systemic memory are incorporated into the resulting adaptation. Revolt occurs when a change that occurs in one level of the panarchy is transmitted to a higher level when the higher level's resilience is low. In this way, it is possible for small events to overwhelm larger ones in the system hierarchy when the timing is right. If levels of the system become cut off from one another, they are no longer able to draw upon the remembrance of those levels, nor the potential for change provided by the mechanism of revolt.

Brittle systems are those that have become maladaptive; they have a kind of perverse resilience, stuck in what Holling calls a *rigidity trap* (Holling 2001). Systems of this kind have lost the ability to adapt or foster novelty and therefore "carry the seeds of their own destruction" in their potential for system-wide failure (Holling 2001, 401). Without innovation and novelty, systems become overconnected and essentially "locked," rendering the stored capital they contain unavailable (C. R. Allen and Holling 2008). Novelty and innovation are required to keep existing complex systems resilient and to create new structures and dynamics following system crashes (C. R. Allen and Holling 2008).

In social systems such as communities, the ability to shape change and avoid traps is supported by a range of adaptive characteristics, including local knowledge and social practices supported by institutional memory (Folke, Colding, and Berkes 2002). However, society often relies upon brittle systems that lack the kinds of overlapping functional structures – a quality described as imbrication – that support the ability of natural systems to adapt (Gunderson and Holling 2002).

Categorical interdependence and imbrication in complex adaptive systems

The set of relationships among members of a community and resource providers can be conceptualized as a network in which community members procure needed resources from providers. Bates and Pelanda describe two types of relationships among units in a network: those of unit-specific interdependence, and those of categorical dependence (Bates and Pelanda 1994). Instances in which an individual within the system is dependent upon a single provider for a needed resource illustrates *unit-specific interdependence*, represented by a persistent tie between the two entities. *Categorical interdependence*, then, occurs when there is dependency between units in a system without any structural specification that dictates relationships necessarily form between specific entities.

The authors illustrate this point with the relationship between families within a community and grocery stores. Each family needs groceries, but it can obtain them from any store falling within the category of grocery stores or food markets. Therefore, there is no controlling structure resulting in fixed patterns of association between families and stores that supply food. Typically, relations between consumers and providers fluctuate with changing factors within the community, resulting in a contingent network (Bates and Pelanda 1994). This example holds up as long as families have options. In communities with only a single grocery store or market, or in an instance in which access to providers is limited, patterns of dependence may be more unit-specific than categorical.

By design, components of ecological networks tend to be in categorical dependence with one another, as a diversity of species have the potential to fulfill different ecological niches, thereby providing the system with a kind of “insurance” against shocks. Two different types of diversity contribute to the resilience of a system. Within-scale diversity means that multiple entities within the same scale can fulfill the same function. Between-scale diversity means that a function can be fulfilled by entities at different scales. In this sense, different entities that can carry out the same function within the system are able to substitute for one another. The authors of *Panarchy* refer to this robust, overlapping reinforcement of function as *imbricated redundancy* (Gunderson and Holling 2002). Socio-ecological imbrication is different from the concept of redundancy used in engineering in that different species perform similar but not identical functions, potentially at different scales, and are differently sensitive to change (C. R. Allen and Holling 2008). In an engineering context, redundancy measures are often approached through the creation of duplicate systems at similar scales and with similar, if not identical, functions.

From an urban systems perspective, we could think about within-scale entities as components of the immediate community and between-scale entities as those at different urban scales relative to the community (e.g., household, community, city, region). If we take provision of power as an example, this function could potentially be fulfilled at the household scale by rooftop solar panels, at the community scale by a local microgrid,³⁰ or at the city/regional level by a conventional “macro” power grid.

Applying the panarchy framework to social systems and community scale research

Panarchy theory has been applied to social systems in a range of contexts. The authors of *Panarchy* identify key differences between social and ecological systems, including the ability of social systems to transcend geographic boundaries using abstract symbolism (e.g., monetary systems); to be reflexive; to

³⁰ See: <https://carbontrack.com.au/blog/community-microgrid/>

exhibit forward-looking behavior; and to exploit a variety of scales through the development and use of technology (Gunderson and Holling 2002). In this context, the network structure of social systems and the ways in which they are shaped by technological tools play a key role in the transformation of socio-ecological systems. Reciprocity, or personal exchange, within social networks is recognized as an important means of achieving transformation within social systems.

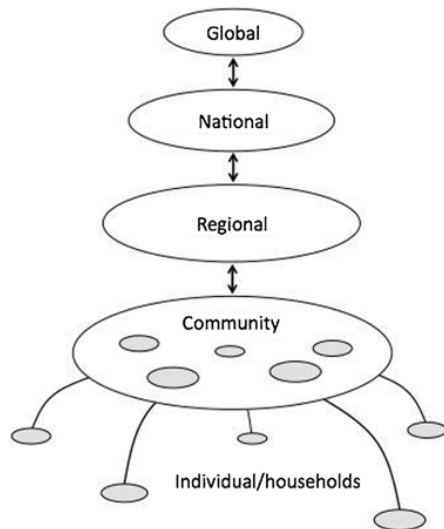


Figure 14: A schematic illustration of the panarchy concept applied in a community resilience context (figure reprinted from Berkes and Ross 2016 with permission – see footnote)

The panarchy is not a typical hierarchy in that control can be exerted both by larger-scale, top-down processes as well as small-scale, bottom-up processes, a system dynamic that has important implications for understanding resilience (C. R. Allen et al. 2014). In a community context, top-down processes might be influenced by national or regional policy, while bottom-up influences might comprise the actions of individual households or grassroots efforts. Of course, influence at any scale – for example, the community scale – can also come from within, facilitated by community organizations or other place-based institutions. However, it should be noted that due to the power dynamics in social systems, more influence on the community level is likely to be imposed by higher-order systems than can be brought to bear by individuals, households, or even within-community organizations (Calderón-Contreras and White 2020).

Berkes and Ross propose a preliminary framework for the application of panarchy theory to communities of place (see Figure 14)³¹, noting that the model oversimplifies the networked complexity of relationships likely to exist within and between

levels of the system as well as flows of social capital and social relationship characteristics like trust, reciprocity, cooperation, and social norms (Fikret Berkes and Ross 2016). With this acknowledgment in mind, we turn next to social network theory and explore its potential for enriching the conceptual sketch provided here.

Social network theory

Social networks consist of a set of social relations, or ties, among a set of network members, or nodes. Nodes can be people, organizations, or other types of entities. Ties represent connections between nodes and can be based on shared attributes, social relations, interactions or flows between the members of the network. Social network research is based on the premise that the characteristics of a social network structure, and a node's position within that structure, determine the opportunities and constraints that node will face, thereby influencing its outcomes (Borgatti et al. 2009; Prell 2012). Social network analytical techniques focus on discovering, describing and analyzing the patterns of relationships between and among social entities and the implications of those patterns (Wasserman and Faust 1994; Wellman 1999).

³¹ Figure 11 reprinted from *Environmental Science & Policy*, Vol 61/July 2016, Fikret Berkes and Helen Ross. Panarchy and community resilience: Sustainability science and policy implications, Pages 185-193, Copyright (2016), with permission from Elsevier.

Social networks are typically studied at the level of the ego (a network comprising an individual node and all of its social ties) or the complete network (a bounded set of interrelated nodes and ties), but they can also be studied at the level of the dyad, triad, or network subgroup. A network is characterized as a one-mode network if all actors comprise a single set; two-mode networks comprise two connected sets of actors. In two-mode analysis, not all actors need be social entities; for example, this approach can be used to understand connections between people and events or people and technical systems (Wasserman and Faust 1994; Jacobs and Cramer 2017).

Understanding the structure of a community's social networks can provide access to a wealth of information about community interconnectedness at different scales (Kornbluh and Neal 2016). While much research is focused on the characteristics of social networks themselves and the resources embedded within them, less attention has been paid to the specific processes by which resources are accessed, highlighting a potential direction for the expansion of social network research (Van Der Gaag and Snijders 2005). This dissertation addresses this gap within the specific context of examining the potential for local self-sufficiency in the immediate wake of a major earthquake disaster.

Social network concepts relevant to community-scale resilience research

Although the study of social networks encompasses a broad range of concepts and methods, we focus two specific concepts relevant to local self-sufficiency: resource sharing via social networks and strength of social ties.

Social networks and resource sharing

Relationships, or social ties, between people constitute the channels via which resources can be shared within social networks. Social ties provide access to social capital, those resources embedded within social networks that can be accessed and used by individuals to facilitate purposive action (Coleman 1988; Lin 2001; 2002). As opposed to personal, or first-order, resources, social capital resources accessed via social ties can be thought of as second-order resources that belong to others in one's social network (Lin, Ensel, and Vaughn 1981). Social capital comprises physical resources as well as intangible resources such as information, knowledge, and social support.

A wide range of benefits have been associated with access to social capital at both the individual and community levels. Social capital can help enable people to achieve goals of personal well-being while also supporting collective action for change (Rainie and Wellman 2014). Increased social capital has been associated with positive outcomes in education, health, personal welfare as well as the development of other forms of capital, such as human, financial, physical, and environmental capital, and increases in social trust (Robert D. Putnam 2001; Emery and Flora 2006; Borgatti et al. 2009; Kadushin 2012). Generally speaking, the larger one's social network, the more access one has to resources such as social support and information (Rainie and Wellman 2014).

Characteristics of social structures, including trust and social norms, can facilitate the access and mobilization of social capital by individuals (Robert D. Putnam 2001; Green and Haines 2016). However, trust alone does not guarantee access to resources; the resources must be present in the network to begin with, and access can be enabled by trusting relationships (Kadushin 2012).

It is important to note that although it is often associated with the receipt of benefit, social capital has a dark side. Very dense and strong network connections that are useful for protecting social capital and

sharing it within a group can also limit access to those outside the group (MacGillivray 2018). However, as Rebecca Solnit documents in her book, *A paradise built in hell: the extraordinary communities that arise in disaster*, community members often respond altruistically in disasters, building upon social ties to participate in mutual aid and share resources (Solnit 2010).

In addition to being associated with a host of socioeconomic and sociodemographic factors in non-disaster or times, social capital and local assistance provided via community social networks constitute important resources during times of disaster (Russell R. Dynes 2005; R. R. Dynes 2006). Stronger social networks and higher levels of social capital have also been recognized as playing a positive role in post-disaster recovery outcomes (Aldrich 2012; Sadri et al. 2018). Grassroots participatory efforts that build community networks and the establishment of community-based disaster preparedness organizations have been associated with higher levels of engagement in disaster preparedness activities and actions (K. M. Allen 2006; Mimaki, Takeuchi, and Shaw 2009).

In an extensive literature review of social capital research in disaster studies, Michelle Meyer notes that the majority of social capital research in disaster focuses on recovery or resilience, and that relatively little is devoted to disaster preparedness or mitigation (Meyer 2018). This suggests that further understanding of the role played by social networks in sharing resources among community members could provide a meaningful contribution to disaster research.

Strength of social ties

Ties in a network can be characterized in many ways: by quality, quantity, multiplexity (plurality of connections) or symmetry (bidirectionality). One characteristic that is often used to describe a social tie is the measure of its relative strength. Mark Granovetter, in his 1973 treatise on social ties, proposed four dimensions by which the strength of a tie between two nodes can be measured: amount of time (both spent together and elapsed since initial encounter); intimacy (mutual confiding); emotional intensity; and reciprocity (Granovetter 1973). Some researchers have since suggested adding multiplexity, or the layering of distinct social connections, as an additional dimension of strength (Degenne and Forsé 1999). According to these measures, family and close friends typically constitute an ego's strong ties, while acquaintances comprise its weaker ties.

One of the most well-known theories in social network analysis is Granovetter's argument about the strength of weak ties. Granovetter posits that an ego's strong ties will tend to interact with one another, forming a closely bound group that is not likely to receive information from, or be socially connected to, outsiders (Granovetter 1973). Weak ties, on the other hand, have the potential to form bridges to more distant areas of the social network, thereby connecting egos to novel opportunities, information, and/or resources. At the level of the network, this suggests that systems with few weak ties will become fragmented and less able to mobilize effectively for collective action; strongly bonded, internally connected networks with few bridges have low potential for innovation because the nodes contained within are likely to have access to similar kinds of resources and information.

The strength of social ties has implications for the extent and speed of sharing. Although weak ties present opportunities for sharing novel information and resources, sharing tends to happen more readily along strong tie connections, and information shared along strong ties travels faster than along communication channels associated with weaker ties (Lai and Wong 2002; Larson 2017). Strong ties also tend to persist longer than do weak ties. Strong ties will remain dormant in a network if not actively

used, while weaker ties are more likely to dissolve with disuse (McPherson, Smith-Lovin, and Cook 2001; Jack 2005).

The strength of social ties is also often associated with geographical location. Homophily, a social network phenomenon associated with tie strength, refers to the tendency of nodes preferring to form social ties with others who are similar to themselves (Prell 2012). Strong ties tend to be homophilic, while weak ties are typically heterophilic. One well-documented result of this phenomenon is that people with similar sociodemographic backgrounds tend to live in the same neighborhoods, resulting in relatively homogeneous communities in terms of resident race and ethnicity, education, age, and religion (McPherson, Smith-Lovin, and Cook 2001). Similar nodes are also more likely to be connected with each other if they are geographically proximate (Kadushin 2012).

Social network applications in urban planning

The importance of social networks to urban life is not a new topic within the field of planning. Urban planning scholar Melvin Webber observed more than 50 years ago that due to shifting patterns of settlement brought about by midcentury changes in technology, social interactions were becoming more interdependent and networked – and no longer reliant on propinquity (Webber 1963).³² Decades later, Manuel Castells' text, *The Rise of the Network Society* (2000), which contrasts the historically dominant paradigm of the “space of places” with the emergent, network-enabled “space of flows,” was published and has been widely cited in the field.³³ Jean Hillier (2000) notes the importance of networks in influencing planning outcomes as well as everyday events. She defines networks as complex sets of social relations along which energy flows, and she highlights the role of planning in directing the power associated with such flows. Judith Innes describes networks as potentially “the defining concept of the emerging era” (2007, 57), acknowledging a need to build planning thought relevant to the network society, embracing the dynamics of complex systems and developing a better understanding of potential network outcomes like social cohesion, improved opportunity via social linkages, and increased participation in civil dialogue.

Understanding “community” from a network perspective

Place-based communities defined by administrative boundaries have long been the explicit focus of planning actions and processes (Myers 2005). However, sociological research tells us that communities have changed with 20th century advances in communication and transportation technology, becoming more networked and breaking free of spatial boundaries. Rainie and Wellman describe the response to the combination of widespread connectivity, weaker group boundaries, and increased personal autonomy as the “Social Network Revolution.” They claim this phenomenon has shaped a new world of “networked individualism” in which communities have transcended local boundaries, emerging as fluid and fragmented personal networks, as opposed to static, neighborhood- or family-based groups (Rainie and Wellman 2014).³⁴ Community researchers now distinguish between communities of *place*

³² Webber's prescient suggestion that urban planning switch its focus from land use planning to guiding the alignment of change in the spatial and social environments has yet to be fully realized.

³³ A Google Scholar search for “urban planning” among citations of *The Rise of the Network Society* returns more than 13,000 results.

³⁴ Rainie and Wellman describe the later coalescence of social networks, widespread internet use, and mobile technology as the “Triple Revolution,” which was preceded and enabled by the Social Network Revolution.

comprising relationships based on place of residence and communities of *interest* encompassing those based on a common set of interests (Flora and Flora 2013; Green and Haines 2016).

Robert Putnam suggests that one result of the shift toward a more networked society has been a trend of decreased participation in place-based civic and community groups in the U.S., signaling a decline in social capital (R. D. Putnam 1995). He notes that although people are increasingly joining communities of interest, this kind of participation does not foster the kind of face-to-face interaction needed to support civic cohesion and build social trust. Although community has not been “lost,” as these findings might suggest, a more accurate accounting might describe community as less locally-based and locally-observed than in the past as society increasingly turns from place-based to interest-based networks (Wellman 1999).

Although this shift of the basis of community enables the development of social ties across broader geographies, those social ties do not necessarily have the same characteristics as those developed in communities of place. As social relationships have become less place-bound, uncertainty about whom and what information sources to trust has increased (Rainie and Wellman 2014). Communities of place also develop relationships based on dealing with a broader and more divergent set of issues and interests than do communities of interest, which tend to be narrowly focused on a shared topic or activity (Green and Haines 2016).

The physical spaces that a community shares also help to support relationship-building. Hampton et al. find that community interaction in public spaces is important for building social network diversity and linking people to a broader range of resources (Hampton, Lee, and Her 2011). However, social infrastructure, which comprises the public spaces in which people can interact with diverse others and build skills for civil collaboration, has seen disinvestment amid the new landscape of socially networked communities of interest (Klinenberg 2018).

Networks and relationships are an integral component of settings, neighborhoods, communities, and larger social systems (Neal and Christens 2014). The question for urban planning is not whether place is important, but how its importance for planning has changed and might continue to change as society becomes more and more technologically networked. It is with this question in mind that we transition to the development of a conceptual framework to understand the potential role of place-based social networks in an extreme disaster scenario.

Essential everyday activities and interdependent infrastructure systems

In this section, we will examine an essential everyday activity – making a hot meal – to illustrate the range of options for accomplishing the activity as well as the interdependencies between components of the various delivery systems. While we do not claim that this example can stand in for all essential everyday activities, obtaining food is essential to personal health, comfort, well-being, and, over the

long term, survival. The set of diagrams below illustrates six scenarios in which an individual might go about obtaining a hot meal under “normal” circumstances.

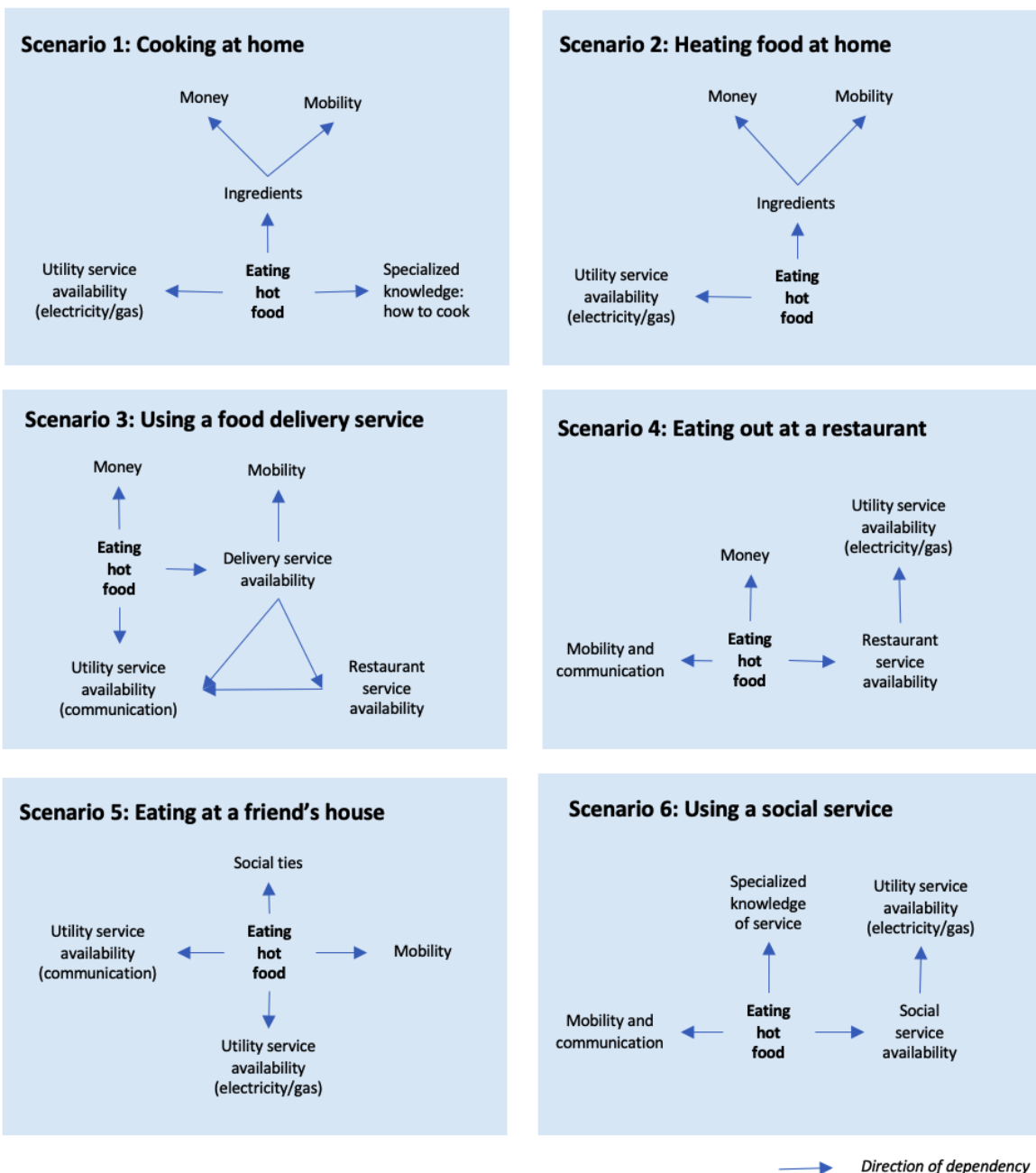


Figure 15: Interdependencies between resources needed for obtaining a hot meal

The diagrams in Figure 15 reveal that while there are many options available regarding *how* to obtain a hot meal, most of them rely on large scale infrastructure systems such as power, communication, and transportation. The services to which individuals might turn to provide a hot meal in lieu of making it themselves (e.g., restaurants, social service providers, food delivery services) rely upon those same systems.

Effects of a major earthquake on interdependent infrastructure systems

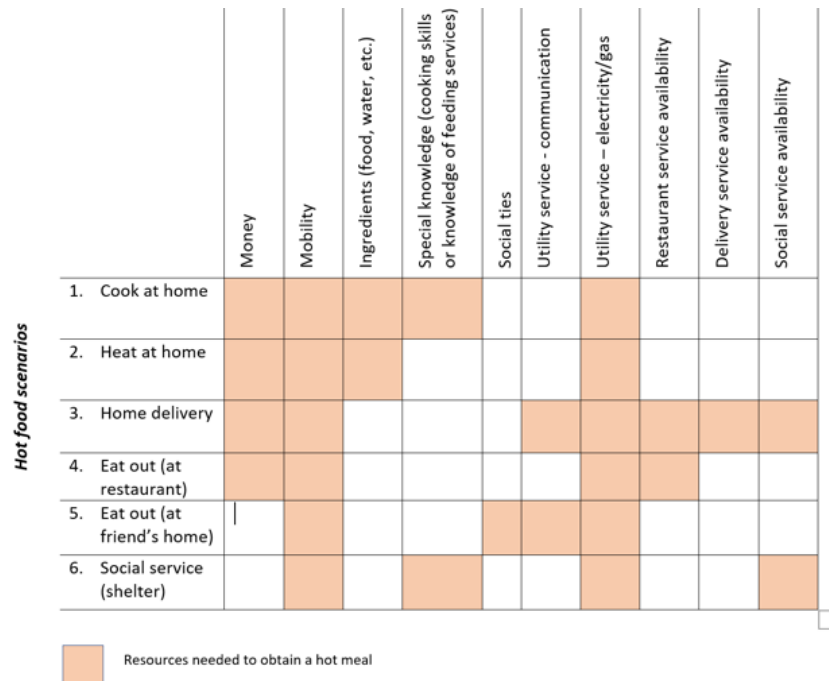


Figure 16: Resources needed for obtaining a hot meal in “normal” circumstances

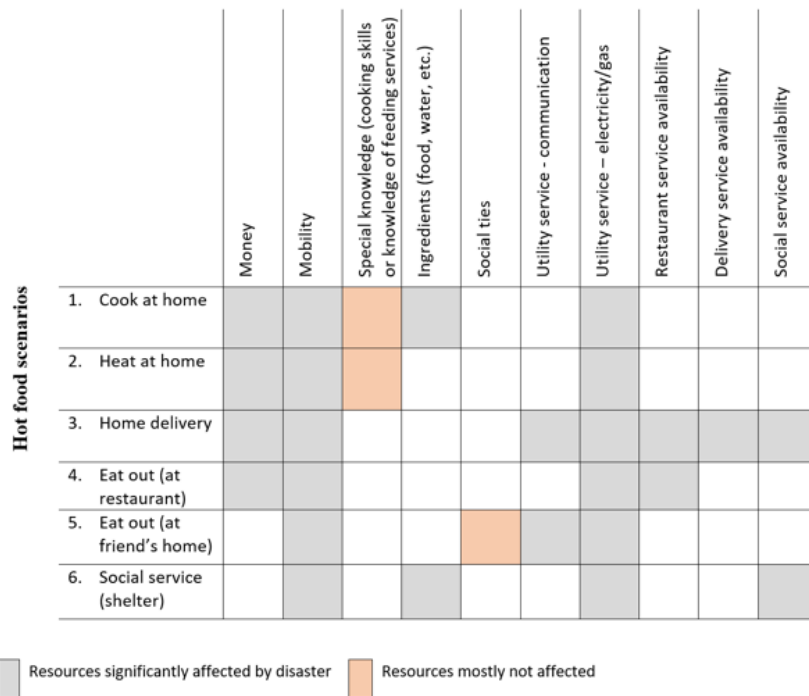


Figure 17: Potential effects of a disaster on resources needed for obtaining a hot meal

The increasing reliance of cities and urban-rural regions on complex and interdependent infrastructures has heightened their vulnerability to all scales of natural and man-made threats. In both urban and rural areas, new smart cities systems have contributed to increasing societal dependence on the brittle infrastructure of cell phones, cloud computing and GPS-reliant devices – technologies that are susceptible to system-wide failure (A. M. Townsend 2013). People exist deeply embedded in these sociotechnical systems, dependent on interdependent infrastructures for myriad everyday tasks and activities, not to mention critical services such as health care. Despite the risk and uncertainty associated with new technologies, people often trust them even though they often fail (Li, Hess, and Valacich 2008; A. M. Townsend 2013). In addition, the disrepair of physical infrastructure systems is a problem in the U.S., with the nation’s critical facilities and infrastructure receiving a grade of “D” in 2008 (Flynn and Burke 2011).

As we can see from the exercise above, society depends heavily upon interdependent infrastructures to obtain basic resources and carry out essential everyday

activities, such making a hot meal, in normal times. In a large disaster, some of these resources may be affected partially, and others totally. The means by which their loss might be overcome depends on the degree to which they are affected and the potential substitutions available. In a large disaster, the large-scale utilities and services would most likely need to be replaced or supplemented by personal resources. The most recent national household disaster preparedness survey administered by FEMA suggests that only 57% of adults in the U.S. have taken three or more basic preparedness actions, such as making an emergency plan, gathering supplies, or seeking information on preparedness (FEMA 2018). Furthermore, a report issued by the Oregon Seismic Safety Policy Commission estimates that it will take many months, and in some cases years, to restore utilities and services like electricity, drinking water, highways, and telecommunications after a large Cascadia Subduction Zone event (Oregon Seismic Safety Policy Advisory Commission 2013). Figures 16 and 17 illustrate the effect that a Cascadia Subduction Zone event would likely have on the systems that support obtaining a hot meal under normal circumstances. Access to roads will likely be blocked by damaged buildings, water, and other debris, transforming hyperlocal area into islands cut off from other areas (James 2018).

Because communities will likely be self-reliant for some period of time, sharing of personal resources will be an important means of helping people to complete important daily activities such as cooking food. Having social ties and specialized knowledge about the location and availability of resources in place before a disaster occurs might also be helpful in helping people to pursue alternative strategies for obtaining a hot meal.

This analysis makes a number of assumptions:

- 1) In this exercise, “disaster” refers to a large earthquake that is likely to cause significant damage to infrastructure systems, greatly disrupting the ability of people to carry out everyday activities.
- 2) Large systems (utilities, transportation, communication, food distribution and storage) would likely be affected by the disaster and would become unavailable. As a result, items or other systems that rely on those systems for functionality (monetary exchange, appliances) would become unusable.
- 3) The ability to use money, appliances and communication devices is tied to the functionality of utility systems. If major utilities (electricity, cell phone service) fail, “normal” modes of using money and communicating will not be available. Devices that rely upon electric power will not work unless alternate power is supplied.

As we can see illustrated in the diagrams above, individuals’ knowledge and social ties will be relatively unaffected by the disaster. However, the extent to which they will be able to communicate with social ties outside their local area is likely to be affected. Societal dependency on these kinds of large scale, interdependent and brittle infrastructure systems can be likened to the rigidity trap in the panarchy – in many ways we are “locked in” to these systems without built-in alternatives. Although partial function of some large-scale infrastructure systems may be possible, knowledge and social ties – the “soft” infrastructure – are the only components of the overall system that are likely to remain fully intact. Furthermore, in a large-scale event that damages transportation and communication systems, the scope within which knowledge and ties can operate to obtain needed resources will be geographically limited. In an emergency, we can assume that it will not be just our fuel sources that are severely limited.

The effects of a disaster are likely to change the configuration of community members' social networks as the disaster unfolds. Varda et al. present one conceptualization of how social networks might evolve over the course of a disaster. As the various stages of the disaster unfold, network members will have variation in access and interaction with their pre-disaster networks; may form ad hoc social networks based on trusted relationships during the disaster; and may develop emergent networks post-disaster during recovery (Varda 2016). In addition to affecting one's social network, the disaster will also restrict the broader resource network to which an individual typically has access, including providers supported by transportation, communication, and other large scale service networks.

The role of social networks in obtaining hot food

Given that reliance on local social connections and resource providers are likely to become more important for carrying out everyday activities to those involved in a disaster, we continue the example of procuring a hot meal in an attempt to understand the different ways in which social ties might support one's ability to carry out this activity, first under "normal" (everyday) circumstances and then in a disaster scenario.

Existing social ties can enable knowledge sharing

People learn cooking skills from social contacts. They also learn about where to go to get food (restaurants or grocery stores) from people they know. Unlike physical resources, knowledge resources can be shared without being depleted. Once knowledge is transferred from one node to another, the receiving node is then able to share it with other nodes to whom it is socially connected. Sharing is most likely to occur where social ties already exist. The figure below illustrates how skills and knowledge (node attributes) can be shared among people (nodes) within a social network (see *Figure 18*).

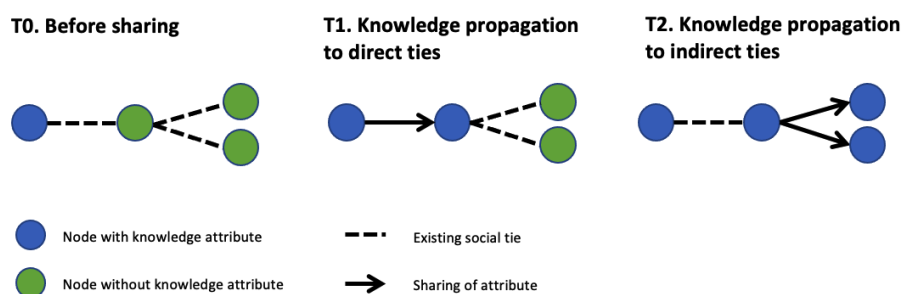


Figure 18: Knowledge sharing in a social network (everyday scenario)

Existing social ties can facilitate resource-sharing

For example, neighbors cook and/or enjoy meals together in their homes, strengthening existing social ties and building trust. Family members cook and eat together, strengthening their core social networks. People also obtain hot food directly from members of their social networks – for example, one might bring a friend or neighbor a hot meal when she is sick. In normal conditions, food resources (shown in *Figure 19* as node attributes) are depleted when they are shared but can typically be renewed; in a disaster scenario, it may be much more difficult to replenish depleted resources.

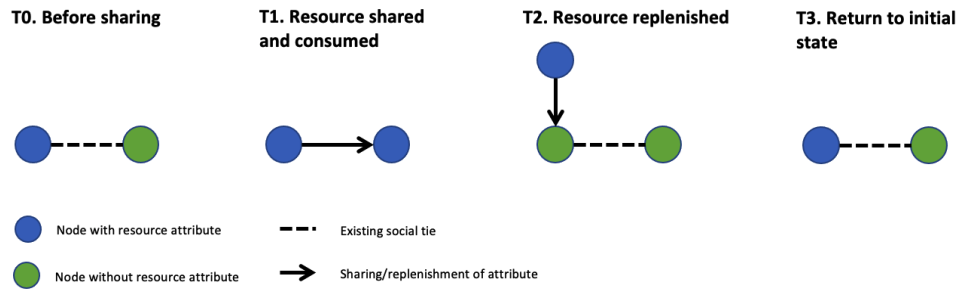


Figure 19: Resource sharing in a social network (everyday scenario)

Social ties can be created and/or strengthened through shared experience

Community activities involving the sharing of food, such as block parties, provide social networking opportunities for neighbors and help them get to know one another better. People might also form social connections outside of purposeful gatherings when they encounter one another in public settings (e.g., at the park, on the sidewalk, on transit). Under normal conditions, people are less likely to share resources (such as food) directly with people to whom they are not connected socially. Creating the opportunity to form new social ties through shared experiences can help to enable new social connections, which in turn may facilitate the future sharing of resources.

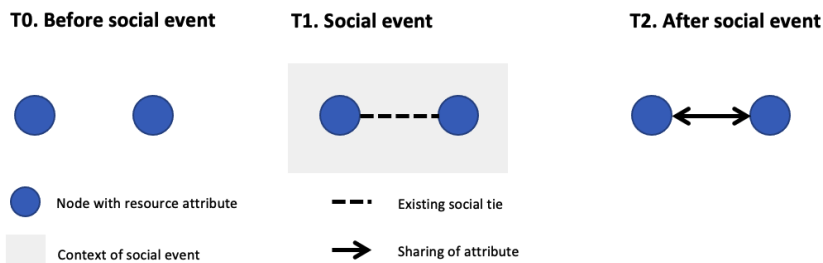


Figure 20: Building social ties through shared experiences (everyday scenario)

Obtaining hot food in a disaster context

Disasters are inherently geographical; mobility and communication tend to be limited after a catastrophic event, and affected communities often become reliant on local resources when municipal and agencies become overwhelmed. In the state of Washington, for example, the Emergency Management Division encourages individuals and families to be prepared to spend up to two weeks without outside assistance after a disaster (Washington State Emergency Management Division n.d.).

In a disaster scenario (in this example, an earthquake), a large segment of the population may suddenly become unsheltered, effectively losing access to the resources upon which they are accustomed to relying to obtain a hot meal. In such a scenario, people must rely upon a combination of factors to meet basic needs like getting a hot meal, which might include institutional support (e.g., emergency shelters), the local availability of excess resources, and/or the willingness of others to share. In the Laurelhurst pilot survey, when asked about their level of concern regarding carrying out eight different types of everyday activities, respondents rated “cooking” as the item of third-highest concern (after staying warm in cool weather and communicating with family and friends).

Food delivery and commercial dining options may not be available due to a variety of factors (general disruption, damage to buildings, damage to transportation/communication networks, disruption of monetary exchange, gas/power outages). Refrigeration of perishable items would be difficult if a sustained loss of power occurred, further limiting available food options. Goals for cooking in an emergency context might include sustenance, social comfort and feeding others. In an emergency context, alternatives may include receiving food (or any of the components required for cooking) from an emergency shelter or from neighbors who have extra resources and who are willing to share. Below, we return to the conceptual diagramming exercise to explore the ways in which the role that social networks play in supporting essential everyday activities might change in a disaster scenario.

Existing social ties can enable knowledge sharing

The pattern of knowledge propagation is likely to remain the same in a disaster because the resources in question are embodied. However, the knowledge of individual community members becomes much more important in a disaster scenario because typical means of communication are likely to be disrupted. Therefore, communities will likely need to rely on the embodied knowledge that exists within the community. Although new social contacts could still be made during a disaster scenario, knowing people with relevant skills within one's community before the disaster happened is more likely to facilitate the flow of needed information and rapid application of skills than would occur in a situation with no prior social connection (and therefore no prior knowledge of other nodes' skills or knowledge attributes).

In a disaster scenario, the function of social ties might be affected by a range of factors, including stress or anxiety; scarcity of resources; or difficulty in connecting with others. Below we illustrate some potential roles of social ties in a disaster scenario, noting how resources and information might be distributed over time (T0 -> T1 -> T2). Social ties that existed before the disaster occurred could potentially help to enable a faster transition from T0 to T1 and from T1 to T2. Based on the review of the literature, it is also reasonable to suggest that stronger ties might enable more and faster sharing than might weak ties, depending on the geographic distance between the provider and the recipient and their ability to communicate. Social ties could potentially be strengthened as a result of sharing.

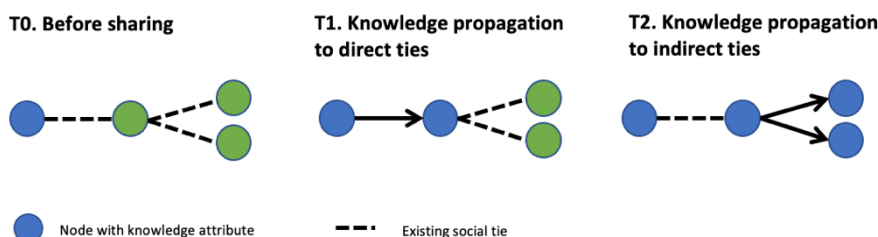


Figure 21: Knowledge sharing in a social network (disaster scenario)

Existing social ties can facilitate resource-sharing

As noted in the “normal” scenario, the replenishment of resources that most take for granted on an everyday basis may become very difficult in the case of disaster due to loss of power, disruptions to the transportation network, and other challenges that are likely to arise. Community members will need to rely on food resources that they have stored themselves or that might be available elsewhere in the

community (food bank, potentially stores for a limited time). Scarcity of resources and strength of social ties may or may not affect willingness to share certain kinds of resources. Social ties may play a role in helping people to replenish diminished or depleted resources. Based on a review of the literature, it is likely that having more, and stronger, social ties is likely to increase access to resources, providing more options for replenishment and potentially enabling them to be replenished more quickly.

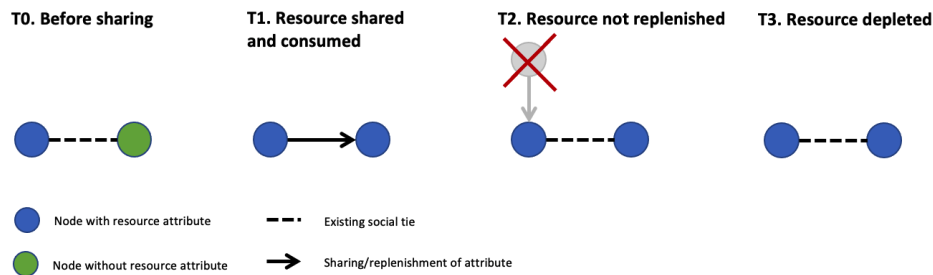


Figure 22: Resource sharing in a social network – cooking a hot meal (disaster scenario)

Social ties can be created and/or strengthened through shared experience.

In normal circumstances, organizing community gatherings like block parties or other social events might provide an opportunity for community members to get to know one another and establish social ties. In a disaster scenario, it is unlikely that any community social events would occur. However, people may gather together as they meet to share shelter, resources, and/or information, which might support the development of new social connections and cooperative networks – albeit under stressful circumstances, as described in Rebecca Solnit’s book, *A Paradise Built in Hell* (Solnit 2010). Interventions in the form of social gatherings have the potential to create and strengthen social ties between, and build social networks among, community members. As illustrated earlier, having established social ties can enable both knowledge and resource sharing, which will be useful in a disaster scenario. Strengthening community connections could potentially have a longer-term effect by influencing community norms. If social gatherings are “built in” to normal community functions and culture, sharing of knowledge and resources may become more commonplace in everyday interactions among community members.

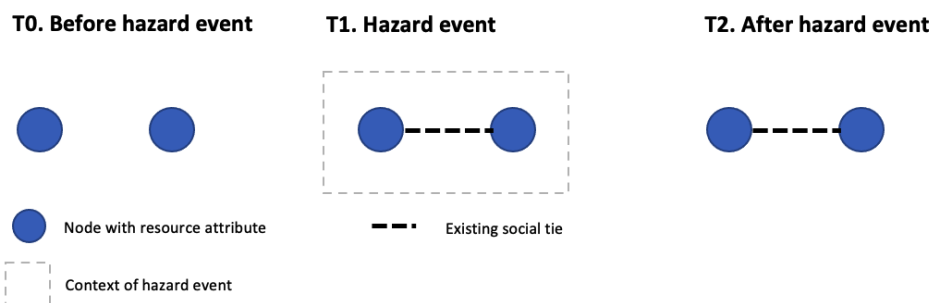


Figure 23: Building social ties through shared experiences (disaster scenario)

Three contributions to the conceptual framework have been identified and described in the example illustrated above: 1) the role of social ties as providing conduits for knowledge and skill sharing; 2) the role of social networks in facilitating the sharing of material resources, and 3) the role of social gatherings in building and/or strengthening social networks. At the community network level, patterns

of social connectivity would influence the extent to which resources and information are shared (how much?) as well as how broadly they might be shared (with whom?). In the next section, we construct the conceptual framework, combining these social network functions with geographic and temporal dynamics that are likely to be introduced during a large-scale earthquake.

A conceptual framework for understanding community resource networks in a disaster scenario

So far, we have established that social ties have the potential to substitute for other means of access to resources in a disaster scenario, and that the ability of individuals to meet their essential needs will depend on the nature of those ties as well as the nature of the resources in the network. In this section, we present the conceptual framework by defining the community disaster network boundaries and considering how the dynamics of resource access might be affected in a disaster scenario.

Relevant scales of place

Drawing upon the concept of interconnected scales illustrated by the nested levels of the panarchy, we define the relevant scales of place for the conceptual framework as the household, the community, the city/region, and the global sphere (see Figure 24). Individual households constitute the smallest decision-making units regarding sharing of resources, while the community level describes the geographic range to which individuals would likely be limited in a large-scale disaster. The city/region scale describes the range within which an individual might be able to physically access resources during normal times, and the global scale constitutes the range from which individuals might access resources during normal times via the internet.

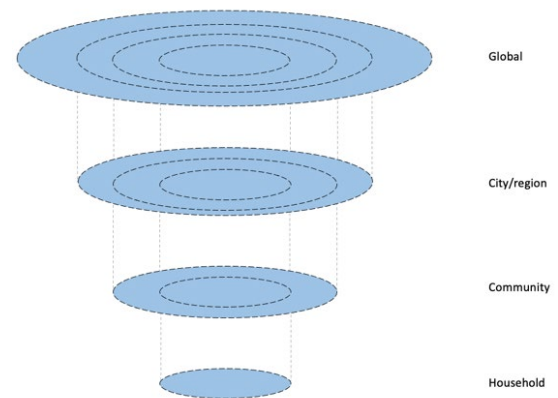


Figure 24: Nested scales of place relative to the community scale

In order to study a social network, the researcher must identify the system of interest and define its boundaries (Wasserman and Faust 1994; Degenne and Forsé 1999). There are three common approaches to setting network boundaries: by characteristics or formal membership criteria; by participation in an event or activity; or based on social connectedness (Carrington, Scott, and Wasserman 2005). In the case of a large disaster in which communities are essentially isolated, the boundary condition would be defined by characteristics – geographically, at the level of the community scale. Thus, we define the *potential* network of local social ties and resources as those residing within the community.

Community network characteristics

The boundaries of the potential network have been defined geographically. Next, we turn to the characteristics of the network components, beginning with nodes. Because the kinds of essential resources might be accessed either directly (an individual obtains a physical resource to which they have direct access) or indirectly (the needed resource is accessed via a social tie with another person), we will

define two types of nodes: *spatially embedded* resources and *socially embedded resources*.³⁵ Spatially embedded resources are physical, shared resources located within the community, such as a community garden, water tank, or community center. Socially embedded resources can be either physical (e.g., extra food, water bottles, or batteries) or intangible (e.g., knowledge, skills, or social support). Thus, the network of interest can be described as a *two-mode network* in which the two categories of nodes have potential overlap in their function (e.g., drinking water might be accessed via a spatially embedded resource like a water tank or via as a socially embedded resource obtained from a neighbor).

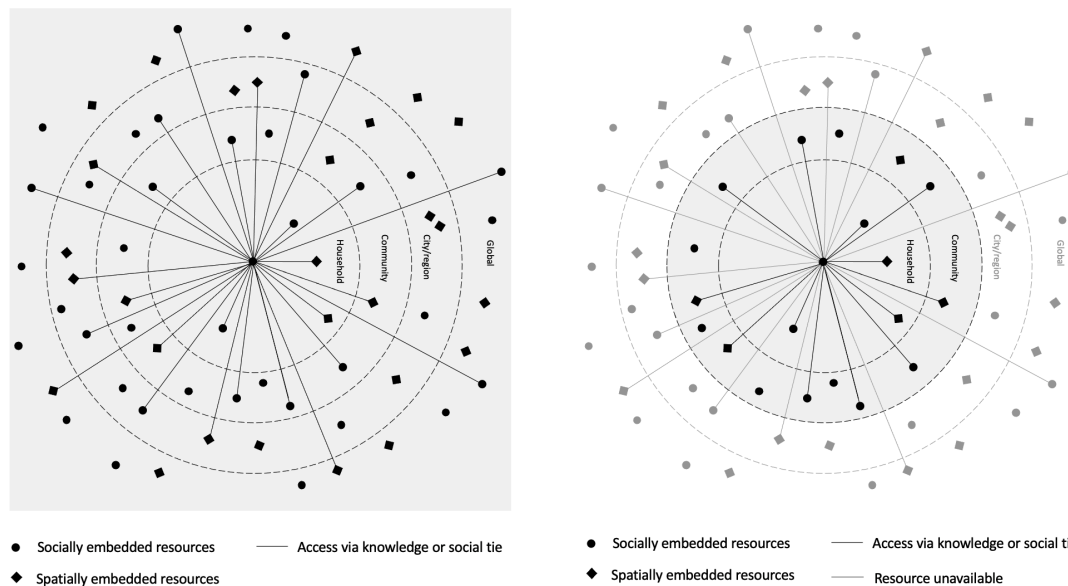


Figure 25: Evolution of the two-mode network during a disaster

Figure 25 above illustrates the two-mode network of potential resource access and its transformation in a disaster scenario from the perspective of an individual ego. In a large disaster, resources will no longer be available from the scales above that of the community. Individuals may have access to some resources within their immediate household, and they may also need to seek resources within their immediate community. Whether or not those resources will be available depends on the degree to which categorical substitution can occur to provide individuals with locally accessible resources that they would typically obtain outside their immediate community setting (e.g., can an individual access food locally even though they might typically obtain food at a grocery store outside their community?).³⁶ Whether or not individuals are able to obtain those resources will depend on their *knowledge of local resources* as well as their *social connections* to others with needed resources. The potential network comprises the potential set of nodes and ties, while the realized network comprises only those nodes and ties that are actually connected.

³⁵ While the socially-embedded resources are limited to the same spatial constraints in this scenario, their most salient characteristic is that they are accessed via a social relationship.

³⁶ For the purposes of the exercise, we assume that all local resources are potentially accessible to community members during a disaster even though in reality access to certain resources is likely to be compromised.

Network dynamics: resource matching and sharing

As mentioned above, access to spatially embedded resources is dependent on local knowledge as well as presence and availability of the resource. Access to socially embedded resources is also dependent on presence of the resource. From a network perspective, we could conceptualize socially embedded resources as having certain node attributes that indicate the presence of a resource. For example, an individual who had extra stores of food and water would be considered a node with food and water attributes. For an individual to access such a resource attribute, they would need to have knowledge of the attribute and a social connection to the node with the attribute (see Figure 26). The node must then be willing to share the attribute with the recipient in order to enable sharing to occur, a topic to which we will return.

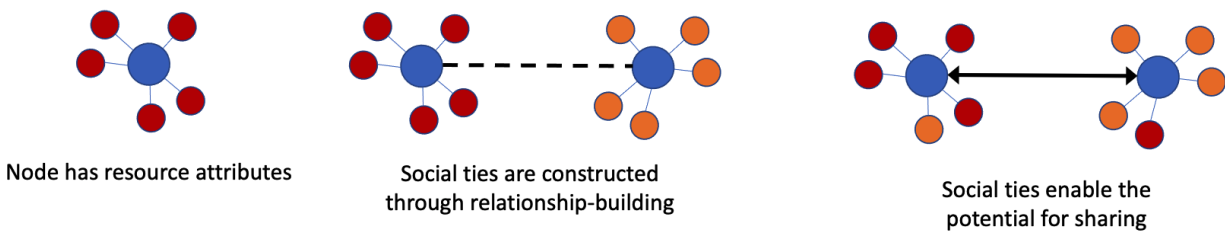


Figure 26: Social ties enable sharing of resources between nodes

Conceptual framework

In summary, the community social network conceptual framework for carrying out essential everyday activities in a disaster scenario comprises the following components:

1. The potential network of local social ties and resources is defined by geographic community boundaries
2. The potential network of interest is a two-mode, heterogeneous network comprising spatially embedded resources and socially embedded resources
3. Connections within the potential network are realized when access to resources is enabled by local knowledge and social ties
4. Access to spatially embedded resources is dependent on local knowledge and resource availability
5. Access to socially embedded resources is dependent on recipient attributes and willingness to share

Community resource matching using real-world social network data

Using a selection of data gathered from the community resilience survey, we illustrate some of the ways in which sharing could occur within a geographically defined network. Using real-world data helps to identify some of the issues that could potentially arise in regard to sharing in a disaster scenario as well as highlights potential opportunities for intervention.

I begin by constructing a community network.³⁷ In the sample survey, respondents were asked to identify the “zone” within their neighborhood in which they live by choosing the appropriate area of a map (designated as Zones A-G in Laurelhurst). In the Laurelhurst community, LEAP has attempted to organize the entire neighborhood into “clusters,” or small groups of households within which disaster preparedness information can be shared and plans coordinated. The larger zones are each comprised of several clusters. Using the survey data collected from Zone E, which comprised 23 respondents, we mapped each respondent to the location of the closest intersection they identified in the survey.³⁸ In some cases, multiple respondents provided the same nearest intersection.

Because the survey data represents only a small number of people living within this zone, and because we do not have complete information about social connectivity among all members of the community network, we proceeded to make some assumptions about social connectivity within the illustrative network. For any group of respondents (nodes) that indicated they lived near the same nearest intersection, we assumed strong tie connections among all nodes within that group (nodes E1-E6; E7-E11-E12; E3-E8-E17-E-19-E23). We also assumed strong tie connections between nodes located within the same cluster (E9-E20). Then, we assumed weak tie connections between respondents and any nodes located within clusters adjacent to the nearest intersection identified by that node. These node adjacencies are illustrated in Figure 27. The resultant illustrative network is shown in Figure 28.

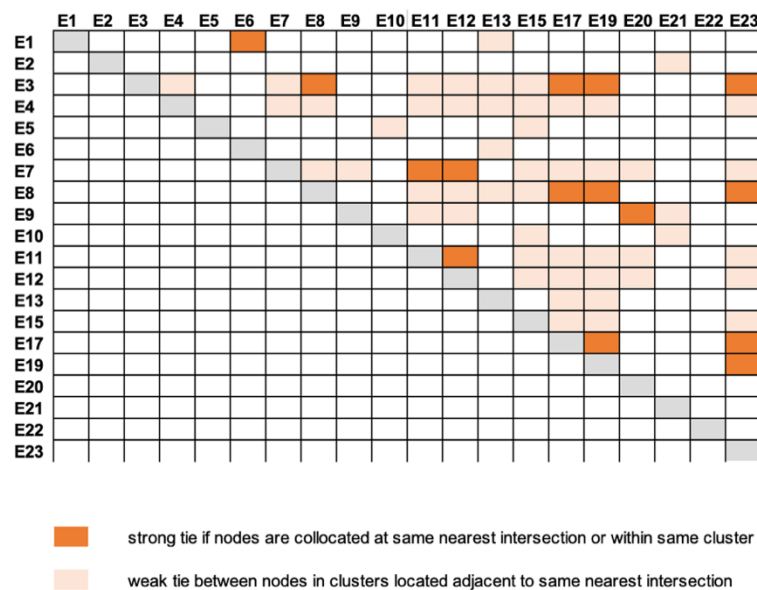


Table 12: Node attribute coding

ID	water	comm	sanitation	power	shelter
E1					
E2		0	3		0
E3	0			0	0
E4			0		1
E5	1		0		
E6	0	3			0
E7		0	3	0	
E8		3			3
E9		1	1	1	
E10					
E11					
E12					
E13	3		3	3	
E15				0	0
E17					0
E19		3	3		
E20					0
E21	0			0	3
E22	3	3	3	3	3
E23	3				3

Figure 27: Node adjacency matrix

³⁷ We chose to use Laurelhurst in the example because we have more information about community-defined zones and clusters that allowed me to make some assumptions about social connectivity that are not otherwise supported by the data gathered through the survey.

³⁸ Although we collected data on 23 respondents who identified as living in Zone E, three of the respondents provided nearest intersection locations that did not fall within Zone E. Those three respondents have been removed from this exercise, resulting in 20 respondents/nodes in the illustrative network.

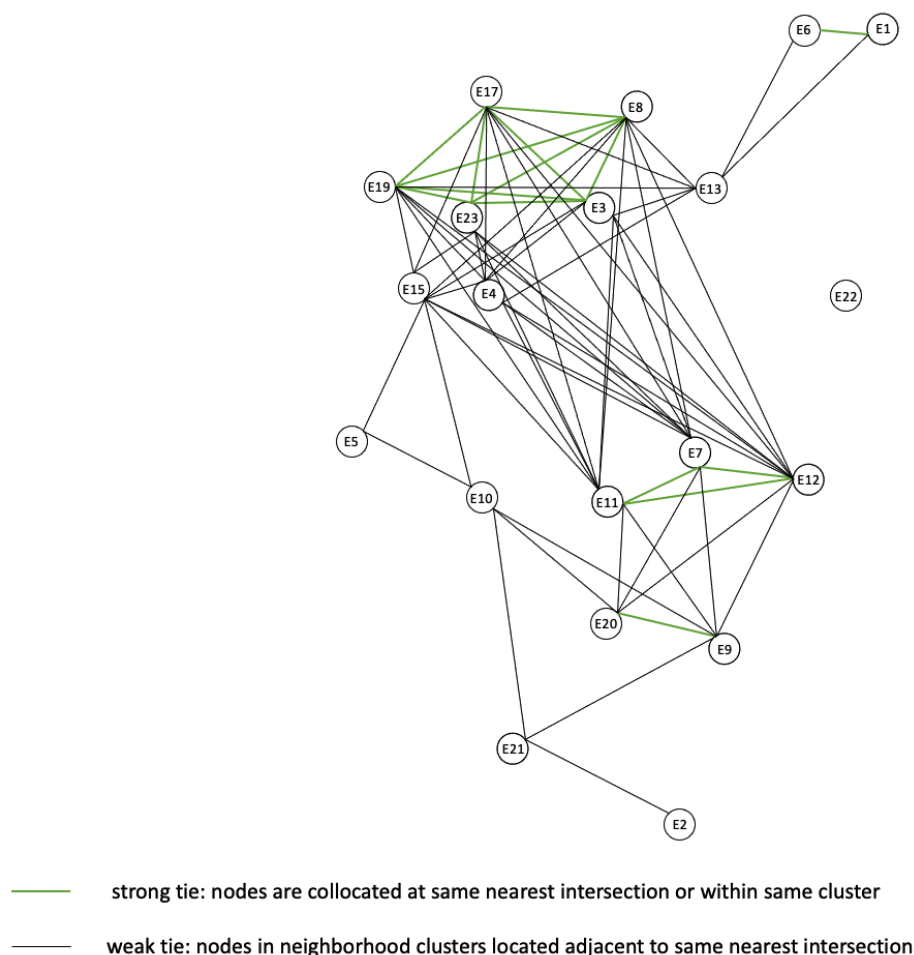


Figure 28: The illustrative network. Nodes within Zone E are connected by social ties whose strength is determined by proximity and cluster membership.

Next, we determined the attributes of each node in regard to preparedness with ten essential items (food, water, shelter, power, sanitation, medications, first aid supplies, communication, transportation, and warmth) based on their stated preparedness in the survey. Those who indicated being prepared with 7+ days of a stated resource were assigned that resource as an attribute (providers). Those who indicated being prepared with 0 days of a stated resource were assigned the attribute of needing that resource (recipients). For the purposes of the exercise as well as ease of illustration, resource attributes were not assigned to those indicating they had between 0 and 7+ days of the resource available. Then, for those nodes who had the resources in question, a willingness to share activation threshold was assigned to that particular resource according to how that individual responded on the survey regarding willingness to share with either no one; strong ties only; strong or weak ties; or anyone. For those willing to share with strong ties only, the attribute was coded with “1;” for those willing to share with weak ties or anyone at all, the attribute was coded with “3” (see [Table 12](#) for attribute coding). Nodes needing the resource were assigned with a “0.”

Within this set of twenty nodes, only five of the ten resource categories were needed by individual members, so only those five categories are illustrated on the following pages (water, communication, sanitation, power, shelter) for the purposes of illustrating the potential for resource matching. In order

for sharing to occur, an existing tie is required between the provider node and the recipient node. If the provider node has a limited willingness to share (coded “1”), sharing occurs only if the two nodes are connected by a strong tie. For those nodes in need of a resource that are not able to find a match within the local social network, their stated alternative provider for the relevant resource is shown (depicted as triangles in Figures 29-33).

The communication resource matching network is shown in Figure 29. Within this network, there are two nodes, E2 and E7 that need communications resources. Nodes E6, E8, E9, E19, E22 have the communications attribute and could potentially share communications resources. Nodes E8, E9, and E19 all share ties with E7, but node E9 is only willing to share with nodes to which it has a strong tie, which it does not with node E7. Therefore, E7 could potentially obtain communication resources from either node E8 or E19. Although node E2 is in need of communication resources, it is not connected to a node that can provide that resource, and there is no match. In addition, E2 indicated in the survey they did not know where they would obtain communications resources in the event of an emergency. On the other hand, node E22 has communications resources it is willing to share, but it is not connected to other nodes and therefore does not share.

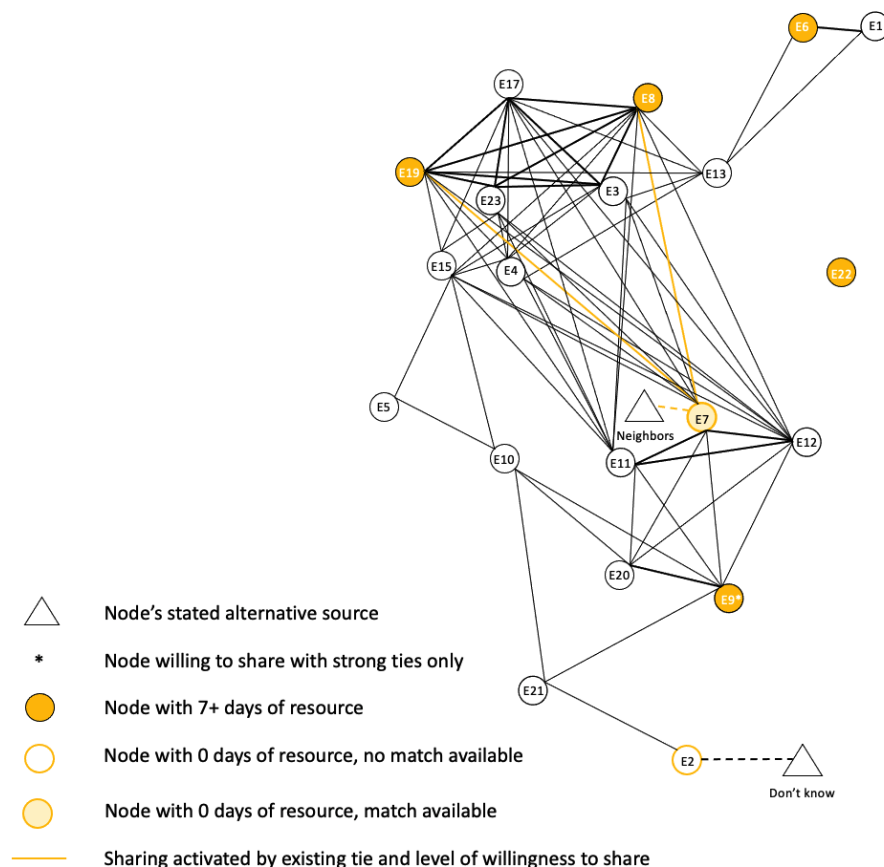


Figure 29: Communication resource matching

In the sanitation resource matching network, several nodes within the network have resources to share (see Figure 30). However, only one of the two nodes that need sanitation resources are matched with willing providers. Node E5 is not connected to another node with sanitation resources to share, nor does it know of an alternative provider. Node E22 again is able to share the resource but is isolated from the network and unable to share.

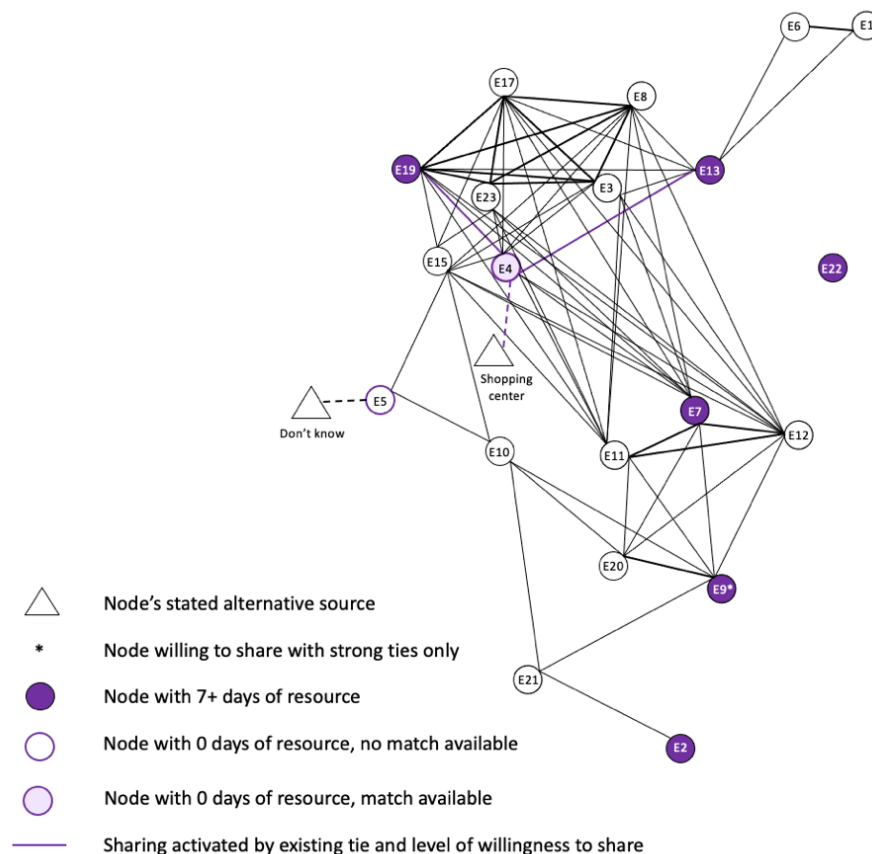


Figure 30: Sanitation resource matching

In the shelter resource network (see Figure 31) four of the six nodes in need of shelter resources are matched with potential providers. Although node E4 shares ties with nodes E3, E15, and E1, it does not share because its willingness to share depends upon a strong tie connection to the potential recipients, which it does not have. Therefore, nodes E3, E15, and E17 are left with two potential providers, nodes E8 and E23. Neither E2 nor E6 are connected to nodes with shareable shelter resources. While E6 plans to seek shelter from friends, E20 does not know where they would turn for shelter in a disaster scenario. Node E22 again is willing to share but cannot as an isolate.

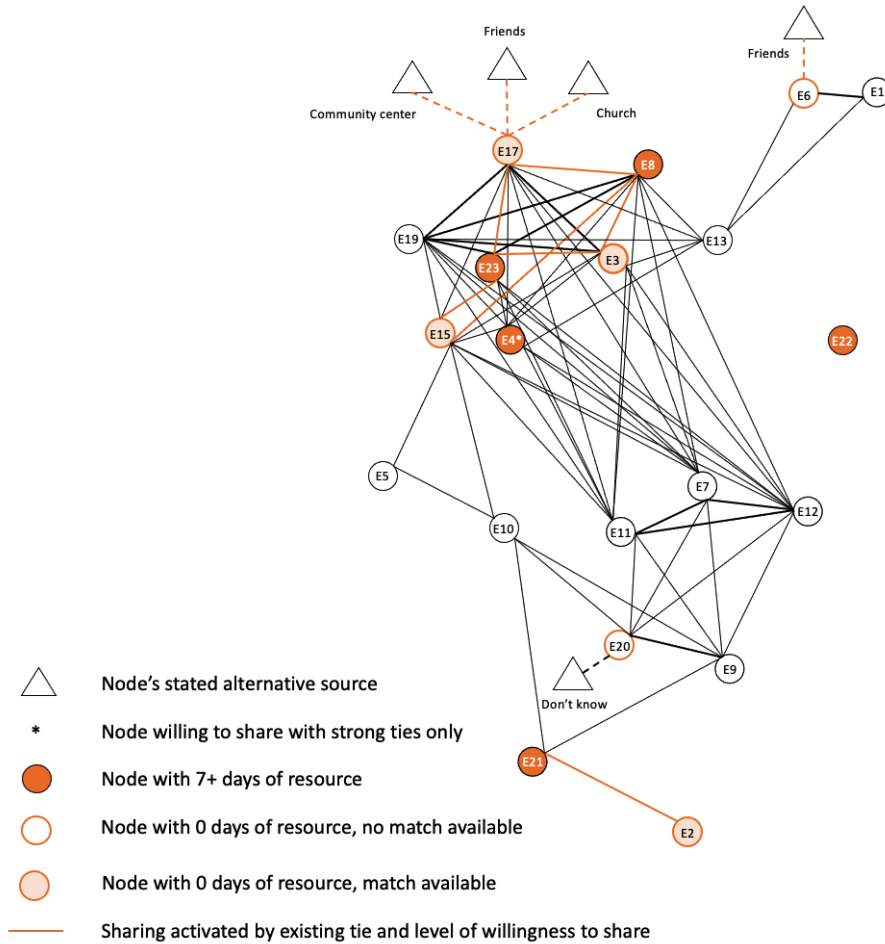


Figure 31: Shelter resource matching

In the water resource network, only one node, E21, is not matched with a potential provider (see Figure 32).

Finally, in the power network, three nodes without power resources remain unmatched (see Figure 33). Node E13 is able to share with E3. While E9 shares a weak tie connection with both E7 and E21, node E9 is willing to share power with strong ties only.

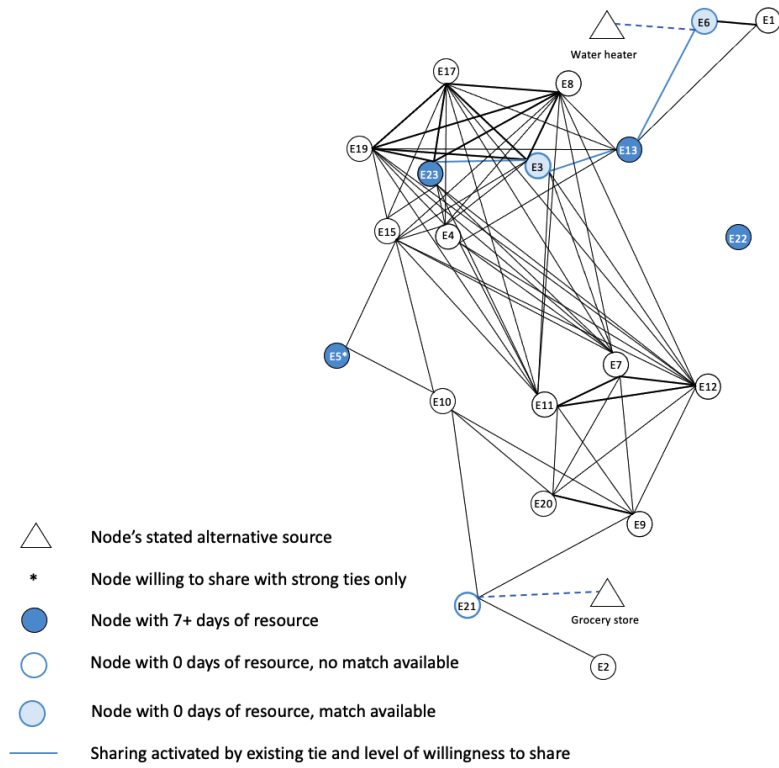


Figure 32: Water resource matching

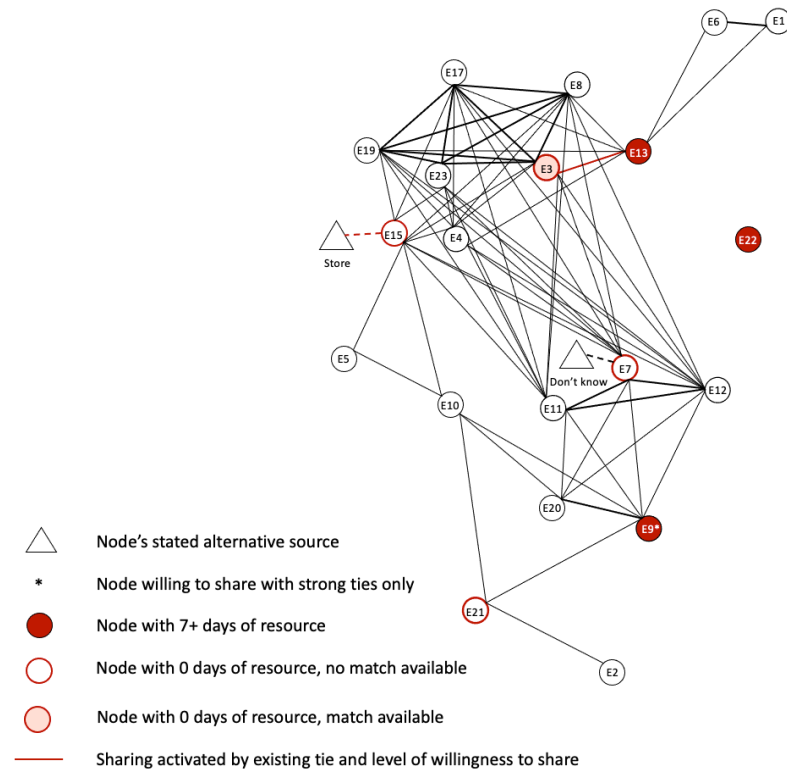


Figure 33: Power resource matching

In summary, this illustrative exploration of local sharing networks suggests there is great potential for matching needs and resources within a geographically limited network. Although assumptions were made about the strength of ties, it is reasonable to imagine that the networks in question do share some manner of ties. We also assume that a household with 7+ days of a given resource has enough to share and have omitted households with between 1-6 days' worth of items in order to illustrate matching potential in the most extreme cases. In reality, the actual network would be much more complex, and the type and strength of its constituent social ties would be more diverse and nuanced. However, populating the network with real-world data about preparedness and willingness to share, simplified though it is, reveals a number of patterns that could help to inform community disaster preparedness efforts:

- *Many potential opportunities for sharing exist within a limited geographic area.* As already stated, there appears to be potential for sharing via local social networks as many individuals are prepared with items and willing to share, whereas others anticipate seeking essential resources in a disaster.
- *Potential matches are limited by connectivity and tie strength.* There are several instances in which increased social connectivity or strong ties might help to facilitate a match, sometimes in cases where the potential recipient does not know where to go for the needed resource. In addition, some nodes have resources to share but are not connected to the network.
- *Many matches can be accomplished via the local social network as opposed to relying on outside resources.* This observation relies on an assumption that there are enough resources within the network to sustain all parties for the needed period of time, but the idea that an individual might be able to rely on neighbors for resources in a disaster is supported.
- *There are few opportunities for reciprocal exchange within the network.* Within this small network, there are no cases in which a single provider and recipient pair can directly trade resources to accomplish a needed match. This suggests that resource matching needs to rely on principles of generalized exchange as opposed to reciprocal exchange (see Chapter 6). This observation also assumes that the only resources being exchanged are the ten in question; in reality, reciprocal behavior could potentially involve additional resources, including intangibles like social support or knowledge.
- *Some nodes with surplus resources may be matched with multiple nodes in need of resources, potentially limiting their willingness to share.* It should be noted that individuals who are not 7+ days prepared with resources (but also not 0 days prepared) were omitted from this exercise. The potential need is likely greater than what is illustrated here. Although the shelter resource network was the only one in which we observed a need to provider ratio greater than 1:1, it is possible this situation might occur. Improved network connectivity could potentially enable more matching options.

Conclusion

In this chapter, we have adopted a multi-scalar social network perspective to develop a conceptual framework for understanding how a community might be transformed by a large disaster – and potentially by preparing for a large disaster. Although people are often encouraged to prepare for disasters on their own, there is latent potential in local networks comprising community resources and social connections to enable community members to help support one another in a disaster scenario. By tapping into a broader network, people have the potential to access skills and resources complementary

to their own. Taking this potential into account before a disaster occurs could help to increase the efficacy of community disaster preparedness efforts. It has become clear through the development of the conceptual framework that both the built environment setting of a community and its social fabric have roles to play in helping communities to adapt when a large-scale disaster occurs. In addition, realizing more potential connections between community members and resources, both social and material, has the potential to provide broader benefits to communities that extend beyond disaster preparedness.

While the conceptual framework described in this chapter lays a foundation for investigating the potential for local resource matching in a disaster scenario, many questions remain about the ways in which it might actually be carried out. In the chapters that follow, we address two topics that follow that line of inquiry, one related to the role of local knowledge and the built environment in a disaster scenario, and one related to the dynamics of interpersonal resource sharing.

Resource matching through local networks

Each community has its own unique combination of local assets and social resources that could potentially be leveraged in the event of a disaster. Although redundancy enables the immediate replacement of lost function, heterogeneity within resource categories enables more adaptive responses over long time scales and has the potential to reduce functional susceptibility to specific hazards (C. R. Allen and Holling 2008). Resilient infrastructures, both social and physical, make greater use of localized and diverse means of providing essential services while simultaneously building capacity to respond to a range of different hazards (Eraydin and Taşan-Kok 2013). Whether or not the needed resources exist within communities – and whether community members have local knowledge of them – is another matter. An investigation of where people expect to turn for needed resources in a disaster scenario can help to inform both shorter-term disaster preparedness efforts as well as longer-term urban planning initiatives. This exploration is the subject of Chapter 5.

Willingness to share resources

Social networks have the potential to connect people to a range of resources through their social ties to others. People with more extensive social networks have broader access to social capital and have better outcomes in terms of health and well-being (Beatley 2004). In addition, having social networks in place before a disruption occurs generally enables actors to engage more quickly in collective problem-solving (Bodin et al. 2019). Although there seem to be many potential benefits to building strong social networks within communities, the ways in which those networks might function in a disaster – particularly one that leaves a community isolated for an extended period of time – are unclear. People may have social ties to others in their neighborhoods, and those people might have resources, but we cannot assume they will be readily shared in a stressful and potentially risky disaster scenario. Nor are all social ties equal. Some are stronger than others, which has potential implications for sharing. Chapter 6 investigates the motivations behind individuals' anticipated willingness to share different kinds of resources in a disaster scenario.

5. Meeting everyday needs in a disaster scenario: the potential for resource sharing through local networks

Historically, disaster preparedness efforts have focused on hardening physical infrastructure and encouraging stockpiling of resources within individual households. More recently, community social infrastructure – shared spaces and local organizations that support community life – and strong social networks have been recognized for their importance in disaster preparedness, response, and recovery. However, despite this potential, community organizations and other forms of social infrastructure are not necessarily involved in disaster preparedness efforts, nor is the building of community social networks addressed in the standard, top-down approaches to preparedness. Social capital, mobilized via social ties, and social infrastructure serve as a kind of “backup” for physical infrastructure when it fails (R. C. Freitag et al. 2014; Klinenberg 2015). As managers, shapers and regulators of public space, planners have an important role to play in strengthening the state of social infrastructure in communities. In this study, we explore the potential for community-level disaster preparedness, consider how it might intersect with more standard household-focused approaches, and reflect on the role of urban planners as stewards of social infrastructure.

Situated in Washington State, this study is focused on a potential earthquake scenario such as a magnitude 9.0 Cascadia Subduction Zone event, which would cause significant disruption to conventional modes of resource access and likely cause communities to become dependent upon local resources. We approach community disaster preparedness planning from a resource-matching perspective, by understanding what resources people might need in the case of a disaster and how they expect to access resource they might not have in the case of a disaster. Using data gathered from a sample survey implemented in three Washington State communities, we explore respondents’ expectations regarding where they might turn for essential resources in a disaster scenario in the context of resources (both material and social) that are likely to be available locally. We find that while preparedness with specific resources varies somewhat between communities, all three exhibit similar trends in terms of where people expect to turn for needed resources in a disaster, with a strong anticipated reliance on social ties and stores. Few people anticipate turning to social infrastructure – community spaces, institutions, and organizations – to access needed items.

Following the initial quantitative analysis of the survey data, we interviewed disaster preparedness planners, community volunteer organizers, and business owners in the three study communities in order to understand their interpretation of the survey data and to identify potential gaps and opportunities for improved future disaster preparedness. Despite the communities’ different approaches to organizing for disaster preparedness, dependence on large-scale infrastructure was a common theme, and participants recognized that the role of community organizations and social infrastructure could be expanded to help make disaster preparedness more relevant to everyday community life. Interviewees also discussed their communities’ experiences during the COVID-19 pandemic and shared valuable lessons learned that could be applied to future preparedness efforts.

The effects of disasters are geographic and socially determined, and community members often serve as first responders. In large-scale disasters, such as an anticipated Cascadia Subduction Zone event, communities are expected to be self-reliant for two weeks or more. By better understanding the

potential roles of social networks and social infrastructure in a large-scale disaster, this study highlights opportunities for planners to help support critical community networks in advance of a disaster.

Research question

Our primary research question involves an exploration of the potential for resource matching at the local level in the event of an acute disaster – what is the potential of social ties and social infrastructure to meet community members’ essential needs in a disaster scenario? To answer this question, we investigate patterns related to resource needs and anticipated resource-seeking behavior across three communities, asking the following sub-questions, paying particular attention to the role of local social networks and social infrastructure:

- With which essential resources are people most (and least) prepared?
- Where do people anticipate turning to obtain needed resources – those with which they are *not* prepared – in the event of a disaster?
- How can integrated community planning and hazard mitigation planning interventions address potential gaps and help to facilitate resource sharing at the local level?

Literature review

The role of social ties and social capital in disaster scenarios

In disasters, people often turn to people they know – their social networks – for help.³⁹ Social networks constitute of a set of social relations (or ties) among a set of network members (or nodes) (Wasserman and Faust 1994). Nodes can be people, organizations, or other types of entities. Social ties represent connections between nodes and can be based on shared attributes, social relations, interactions, or other kinds of flows between members of the network. In the event of a large-scale disaster such as a Cascadia Subduction Zone earthquake that is likely to cause widespread damage to communication and transportation infrastructure, people may need to rely upon their place-based social networks – their neighbors – for assistance.

Within the disaster resilience and hazard mitigation literature, social ties and the social networks they constitute are often discussed in terms of their ability to provide people with access to social capital. James Coleman defined social capital as a set of resources embedded in a social network that can be accessed and used by individuals to facilitate collective action (Coleman 1988). In a disaster scenario, social capital resources might include physical resources, such as disaster preparedness supplies, as well as information, knowledge, or social support. Certain characteristics of social structures, such as trust and social norms, are understood to assist in the access and mobilization of social capital (Green and Haines 2016). Investment in social capital is critical to the development of other forms of community capital that support everyday community resilience, such as human, financial, physical, and environmental capital (Borgatti et al. 2009; Emery and Flora 2006). Measures of social capital have been linked to outcomes in education, health, personal welfare (Robert D. Putnam 2001).

³⁹ Although this is often the case generally speaking, reliance on different entities for assistance during a disaster may vary according to political or cultural context. In Japan, for example, citizens might tend to rely more on the government (or on government-supported community networks) than on their social ties for disaster assistance because of the robust disaster response programs that have been developed in that country (for example, *jishubo* “voluntary disaster prevention” organizations are standardized throughout Japan).

In addition to being associated with a host of socioeconomic and sociodemographic factors in non-disaster or times, local assistance provided via community social networks constitutes an important resource during times of disaster (R. R. Dynes 2006). Stronger social networks and higher levels of social capital have also been recognized as playing a positive role in post-disaster recovery outcomes (Aldrich 2012; Sadri et al. 2018). Grassroots participatory efforts that build community networks and the establishment of community-based disaster preparedness organizations have been associated with higher levels of engagement in disaster preparedness activities and actions (Mimaki, Takeuchi, and Shaw 2009; K. M. Allen 2006).

It should be noted, however, that stronger social networks and higher levels of social capital do not constitute a panacea for communities experiencing disaster. Research suggests that in order to serve as a meaningful resource in times of disaster, social capital needs to be supported financially and otherwise to be effective (Elliott, Haney, and Sams-Abiodun 2010). Also, like the concept of resilience, social capital has a “dark side,” meaning that very dense and strong connections can potentially make a system less flexible or adaptable to change (Rogers and Jarema 2015). However, as Rebecca Solnit documents in her book, *A paradise built in hell: the extraordinary communities that arise in disaster*, community members often respond altruistically in disasters, building upon social ties to participate in mutual aid and share resources (Solnit 2010).

In an extensive literature review of social capital research in disaster studies, Michelle Meyer notes that the majority of social capital research in disaster focuses on recovery or resilience, and that relatively little is devoted to disaster preparedness or mitigation (Meyer 2018). This suggests that further understanding of the role played by social networks in sharing resources among community members could provide a meaningful contribution to disaster research.

The potential of social infrastructure in disaster scenarios

In his book, *Palaces for the People: How Social Infrastructure Can Help Fight Inequality, Polarization, and the Decline of Civic Life*, sociologist Eric Klinenberg defines social infrastructure as “the physical places and organizations that shape the way people interact,” (Klinenberg 2018, 5). These include public institutions, such as libraries, schools, and community centers; public spaces like sidewalks, parks, plazas, and community gardens; community organizations with dedicated spaces for gathering, such as churches, civic associations, and farmers markets; and to some extent “third spaces” like bookstores or coffee shops.⁴⁰ For Klinenberg, social infrastructure is not the network of social ties that enable the flow of social capital, but rather the physical conditions of place that provide the setting for the development of social ties and the cultivation of social capital. Social infrastructure constitutes the spatial component of place-based networks.

Definitions of social infrastructure in other disciplines expand to include physical utility equipment (Grum and Kopal Grum 2020) and a broader scope of social and public services related to health, education, and community development (Atkociuniene, Vazoniene, and Pakeltiene 2015; Davern et al. 2017). Here we focus on a definition of social infrastructure that is in alignment with Klinenberg’s: the

⁴⁰ While Klinenberg recognizes that commercial establishments that take the form of “third places” also contribute to a city’s social infrastructure, he notes that market-driven social settings such as coffee shops and restaurants that require payment for the privilege of access are less inclusive than truly public forums.

places and spaces of the built environment that support community-building and the formation of social ties.

Social infrastructure benefits communities on an everyday basis. It contributes to overall quality of life, providing residents with a range of choices and alternatives for satisfying their needs (Vaznonienė 2015). Social infrastructure contributes to more socially, environmentally, and culturally viable communities by providing a physical framework within individuals use to interact and build trust and reciprocity (Geis 2000). The public spaces comprising social infrastructure also provide settings in which chance encounters, relationship formation, and the practice of civic behaviors can take place (Klinenberg 2018). Social infrastructure also supports inclusion and equity in communities by providing spaces in which anyone is welcome to participate. For example, infrastructure like public transportation facilities can help to facilitate personal interaction, support social inclusion and build social networks (Ritchie 2017). Likewise, other types of public buildings such as community centers, recreational facilities and schools facilitate the creation of formal and informal networks by providing a place for social gathering and interaction (Green and Haines 2016), as do shared open spaces like parks and playfields.

Many of the facilities and spaces that comprise a city's social infrastructure fall squarely within the purview of everyday urban design and planning practice. Walkable neighborhoods that offer a variety of amenities to residents have been shown to encourage the development of social capital during non-disaster times (Carpenter 2015). Mixed-use development is associated with the provision of social infrastructure due to its potential for diverse facilities and services that in turn provide the opportunity for diverse social interactions among community members (Brown and Barber 2012). Built environment characteristics influence the degree to which people are involved in their communities, affecting their ability to build and strengthen social ties and capital – an area that remains underexamined in built environment research (Leyden and Goldberg 2015).

Although we recognize social infrastructure to be beneficial to communities on an everyday basis and have established its relevance to urban planning practice, it can also support community resilience and recovery in acute disaster scenarios and should be considered in planning for hazard mitigation and longer-term resilience. Social infrastructure provides a spatial framework within which individuals can interact to build social capital and strengthen community resilience. When hard infrastructure fails in disaster scenarios, “it’s the softer, social infrastructure that determines our fate” (Klinenberg 2018, 15; see also Freitag et al. 2014). Immediately after Mexico City’s 2017 earthquake, for example, people congregated in the city’s parks and public spaces, which were adaptable and multifunctional. Those facilities also served to support social familiarity before the earthquake even happened, facilitating the construction of social ties that would later help people to deal with the consequences of the disaster (de Jong 2017).

Likewise, a study of flooding resilience and recovery during and after Hurricane Harvey found that as familiar and trusted community institutions, public libraries in Houston were able to contribute to the support of vulnerable communities both through the extension of their normal business operations but also through the provision of daycare services for public employees (Yelvington 2020). In one of the best-illustrated accounts of the importance of social infrastructure to disaster resilience, Klinenberg studied two adjacent and socioeconomically similar Chicago neighborhoods that had drastically different mortality outcomes as a result of the 1995 heatwave, finding that a key factor benefitting the

community that fared better was greater participation in social life as a result of built environment characteristics conducive to public sociability (Klinenberg 2015).

In a paper detailing the importance of social infrastructure for facilitating social connection and public life in cities, Lathan and Layton argue for its protection and development (Latham and Layton 2019). However, despite the potential benefits, there has been little public dialogue about investing in community social infrastructure as a disaster resiliency measure (Sadri et al. 2018). Social infrastructure tends to be forgotten in disaster preparedness planning, despite its potential for both easing chronic challenges faced by communities as well as for saving lives in a sudden disaster (R. Sampson 2013). In fact, there may be reason for concern about the loss of the social infrastructure that currently exists.

Some scholars claim that social infrastructure is in decline as society turns away from place-based community activities and towards aspatial communities of interest facilitated by new technology (Robert D. Putnam 2001; Rainie and Wellman 2014; Webber 1963). Interaction in public spaces is important for building social network diversity, which in turn provides people with access to more diverse resources and serves as a precursor to participation in more traditional (place-based) public activities (Hampton, Lee, and Her 2011). However, in contemporary communities, social gatherings are increasingly moving from public spaces to private homes (Wellman 1999), which provides less opportunity within communities for the kind of continual, face-to-face interaction that builds social networks (Rogers and Jarema 2015; Whitham 2018; Urry 2012; Audirac 2005). Rural communities in particular are experiencing strain due to a reduction in social infrastructure (Swanson 1996). The decline in the availability and quality of social infrastructure has resulted in decreased social participation and a decline in social trust (Klinenberg 2018) – critical ingredients for community well-being and adaptive capacity.

[Integrating urban planning and hazards planning: spatial planning and social networks](#)

Historically, disaster management planning and urban planning have been separate pursuits. Over time, as the incidence of disasters has increased, associated economic losses have mounted, and more and more people have been affected by their consequences, researchers have called for the integration of the two fields in order to support a more sustainable approach to hazard mitigation (Mileti 1999; Pearce 2003). Indeed, integrating hazard mitigation planning with urban planning at multiple scales has been shown to reduce hazard vulnerability for both people and the built environment (Berke et al. 2015). Land use planning, or planning for the spatial organization of urban environments, has become a key point of this integration as governments at the local, state, and federal levels have become aware of its importance in the reduction of harm done by disasters, including loss of life and property (Burby et al. 2000).

Efforts to formalize the integration of hazards planning and urban planning have advanced in recent years. Recognizing the need to explore the full range of available tools that could be used to promote the safe growth and development of cities, the Federal Emergency Management Agency (FEMA) and the American Planning Association (APA) partnered to produce a report detailing the ways in which hazard mitigation strategies could be integrating into local plan-making (Schwab 2010). The report defines mitigation as “taking sustained actions to reduce or eliminate the long-term risks to people and property from hazards,” noting its importance for furthering resilience and community sustainability (Schwab 2010, iii). The report outlines the roles planners should play in the mitigation process, including facilitating public participation in the planning process; comprehensive vision and goal setting;

influencing policy; and land use regulation. Although the report recognizes that plan implementation tools such as building codes, zoning, and land use plans can play important roles in hazard mitigation, its discussion of these tools is focused primarily on the physical separation of development from hazard risk (i.e., keeping future development out of known hazard areas and keeping hazards from affecting existing developed areas) and strengthening physical infrastructure to resist hazards.

Shortly after the joint report described above was released, FEMA launched its Whole Community Resilience initiative, which signaled a philosophical shift toward embracing a broader network of community stakeholders in emergency management planning (Federal Emergency Management Agency 2011). One of the six strategic themes outlined in the report is strengthening social infrastructure, which it describes as “align[ing] emergency management activities to support the institutions, assets, and networks that people turn to in order to solve problems on a daily basis” (Federal Emergency Management Agency 2011, 18). In this context, social infrastructure is defined as existing community social networks, and their spatial locations or properties are not explicitly considered.

As formal disaster preparedness policy and planning practice have moved further toward integration, researchers have continued to explore the potential for integrating both the spatial and social fabrics of communities into hazard mitigation planning in more nuanced ways. Freitag et al.’s incorporation of health and wellbeing concerns into mapping community hazard risk resulted in findings suggesting that local assets and neighborhood-scale social organization should be taken into account when considering adaptation strategies (R. C. Freitag et al. 2014). Pfefferbaum et al. argue that effective disaster management relies on social networks to connect and support communities in hazard mitigation planning, and that the planning process itself has the potential to build social capital (Pfefferbaum, Van Horn, and Pfefferbaum 2017). Koch et al. found discrepancies between FEMA’s Whole Community Resilience concept and its application, noting that involving local organizations, particularly in marginalized communities, is critical – but that it rarely happens in practice (Koch et al. 2017).

Setting

Please refer to *Chapter 2* for a description of the three study communities.

Methods

This study investigates the ability of local resources, including social networks, to serve as potential substitutes for more brittle, failure-prone infrastructure in times of crisis. To explore this question, we adopted a sequential, mixed-method approach based on an initial analysis of the quantitative survey data. We then conducted follow-up interviews to understand how respondents’ anticipated resource-seeking behaviors could help to inform both social and spatial disaster preparedness efforts at the community scale.

Community resilience sample survey

See *Chapter 3* for a detailed description of the community resilience sample survey.

Interviews

Qualitative interviews provide descriptions of phenomena that cannot be learned about in other ways (Weiss 1995). Interviews provide a structured and systematic means of finding out what people might feel about, perceive, or react to in particular situations or scenarios while also leaving some flexibility for

open-endedness and spontaneous discussion (Zeisel 2006). In addition, engaging community partners in data analysis can help to improve the validity of the data and its usability for local partners (Creswell and Poth 2018). To gain deeper insight into the quantitative survey findings, we held semi-structured interviews with three categories of stakeholders in roles relevant to facilitating disaster preparedness and local resource matching in each of the three communities: 1) community leaders from grassroots disaster preparedness organizations and community service/mutual aid providers, 2) hazard planners working for municipalities or regional agencies, and 3) local business owners (see Table 13).⁴¹

Before meeting with the interviewees, we shared with them the aggregated survey data on household preparedness and resource seeking within their community (or communities). During the interview, we used this same data as a basis for discussion about resource seeking patterns within the community, resultant gaps, and potential interventions. The purpose of the interview was to understand, from a variety of perspectives on community disaster preparedness, the potential for resource matching within the study communities, as well as to enlist the assistance of community stakeholders with deep local knowledge in the interpretation of the survey data. We developed an interview protocol to serve as a guide for the conversations, which included questions about the observed resource seeking tendencies (are respondents' answers realistic?); how potential gaps could be filled (what alternative places could people turn to obtain certain resources?); opportunities for future collaboration on disaster preparedness within communities and/or between communities and agencies; and how their experiences during the COVID-19 pandemic may have shaped their thoughts about community disaster preparedness strategies. In some cases, the protocol was adapted slightly based on the nature of stakeholder expertise.⁴² The interview protocol is included in an Appendix to this document.

Table 13: Interviewees

Interviewee	Community
Community Relations Manager, Seattle Office of Emergency Management	Laurelhurst/South Park
Lead coordinator, Seattle Emergency Hubs	Laurelhurst/South Park
Volunteers, Laurelhurst Emergency Action Plan (LEAP)	Laurelhurst
Local business owner	Laurelhurst
Local business owner and community organizer	South Park
Board member, Cultivate South Park	South Park
Deputy Director of Emergency Management, Grays Harbor County	Westport
Director of Public Works, City of Westport	Westport
Local business owner and volunteer, Westport Tsunami Safety Committee	Westport
Volunteer, Westport Tsunami Safety Committee	Westport

The interviews were conducted using the Zoom videoconferencing platform. Relevant survey data was shared in advance via email as previously noted. All interviews were one-on-one with the exception of

⁴¹ Although we did reach out in an attempt to interview the owner of Westport's sole grocery store, and initial interest in meeting was expressed on their part, we were ultimately unable to successfully schedule an interview with them. One of the Westport interviewees does own a local real estate business, but we did not interview a store owner in that community as we were able to in Laurelhurst and South Park.

⁴² For example, when interviewing the business owners, we focused more on the role of their business within the community and the resource seeking patterns that were most relevant to their specific business. We took a similar approach with the mutual aid coordinators.

the two LEAP members, who are currently working closely together on community disaster preparedness initiatives and who preferred to join the same interview. The conversations were recorded within Zoom, and we transcribed each of them, resulting in a text document associated with each interview. The interview transcripts totaled 80 pages of single-spaced text.

To analyze the interview data, we used a coding procedure adapted from Auerbach and Silverstein, in which an iterative approach is used to 1) identify text relevant to the research question; 2) identify repeating ideas within the relevant text; 3) group the repeating ideas into themes; and 4) develop a resultant narrative (Auerbach and Silverstein 2003). The interview protocol served to provide an initial structure to the data as respondents were asked specific questions about the research topic, including questions about gaps between where people expect to seek resources according to the survey data and where they might actually be available; potential strategies for intervention to address those gaps; and disaster preparedness lessons learned through experiences with the COVID-19 pandemic. We read through all of the interviews to develop a set of initial codes identifying repeating topics and ideas within the categories of “gaps” and “opportunities.” Themes under “gaps” included challenges to communication about existing plans as well as holding dialogue about disaster preparedness in general; general challenges to preparedness; reliance on stores; and reliance on large-scale infrastructure. Under “opportunities,” themes emerged around the topics of communication and coordination; the built environment; and social infrastructure.

We then used the technique of code charting to reformat the data into a matrix organized by interviewee (rows) and by initial code (columns) (Saldaña 2016). Initially, we copied and pasted the relevant quotes from the interview transcript into the code chart. We then reviewed the contents of the code chart and summarized quotes into key ideas where possible. Some data was left as verbatim quotes where we felt the quote captured the interviewee’s intent or expression more accurately than would a summary statement. Next, working within the columns of the code chart, we synthesized similar ideas to develop the interview narrative (see Findings). Additional themes that did not fit explicitly within the categories of “gaps” and “opportunities” but that nonetheless provide important contextual information are discussed in the Conclusion.

Findings

Resource preparedness

In the survey module on disaster preparedness, we wanted to gain a basic understanding of what kinds of preparedness resources people had at their disposal within their own households and what patterns of preparedness could be understood across the three communities in terms of specific preparedness items. We asked respondents how prepared their households were in terms of ten items necessary for carrying out essential everyday activities in a disaster:⁴³ food, drinking water, power, shelter, warmth, first aid supplies, medications, sanitation, transportation, and communication. We asked survey participants to respond in terms of the number of days their household was prepared to be on its own in a disaster scenario (0 days, 1-3 days, 4-6 days, 7+ days, don’t know).

⁴³ The list of resources was adapted from an existing City of Seattle disaster preparedness survey (City of Seattle Office of Emergency Management 2015).

Laurelhurst households were the least prepared of the three in several categories, including food, transportation, communication, sanitation, and shelter. South Park households were least prepared in terms of water, power, and first aid supplies. Westport households were at least as prepared as the other two communities in all ten categories, perhaps owing to the community's history of regularly dealing with extreme coastal weather events that sometimes result in long-term utility outages. Laurelhurst's preparedness in terms of medications may be in part supported by the close proximity of several clinics and medical institutions. The urban communities were noticeably less confident in being prepared with power in the event of a disaster, likely because they do not have a backup plan if the grid system were to fail. Approximately half or fewer of the households in any of the communities are prepared to be on their own for at least a week in terms of water, food, communication, sanitation, power, or shelter.

While the general trends suggest that Laurelhurst residents are the least prepared overall, followed by South Park, and then Westport, Figures 34-36 provide more detail on the specific number of days households in the three communities report being prepared with the ten resources in question. While there are some between-community differences, as highlighted above, the overarching pattern shows that most households are not prepared for even a week with many of these ten essential resources, while current guidance from the Washington State Emergency Management Division suggests that households should be prepared to be on their own for two weeks or more in the event of a major disaster (Washington State Emergency Management Division 2020).

A very small percentage of the households surveyed are prepared for seven days or more with all ten resources: 1.9% in Laurelhurst, just under 2.9% in South Park, and 8.7% in Westport. We point this out not to downplay the importance of households being prepared with some resources, but rather to point out that most households will likely be in need of assistance in meeting essential everyday needs, especially if communities are without outside help for an extended period of time. Understandably, many residents in all three communities reported not knowing how prepared they were with some resources, particularly transportation, communication and shelter. This is likely due to the many uncertainties associated with the extent of damage a large earthquake might cause – predicting the

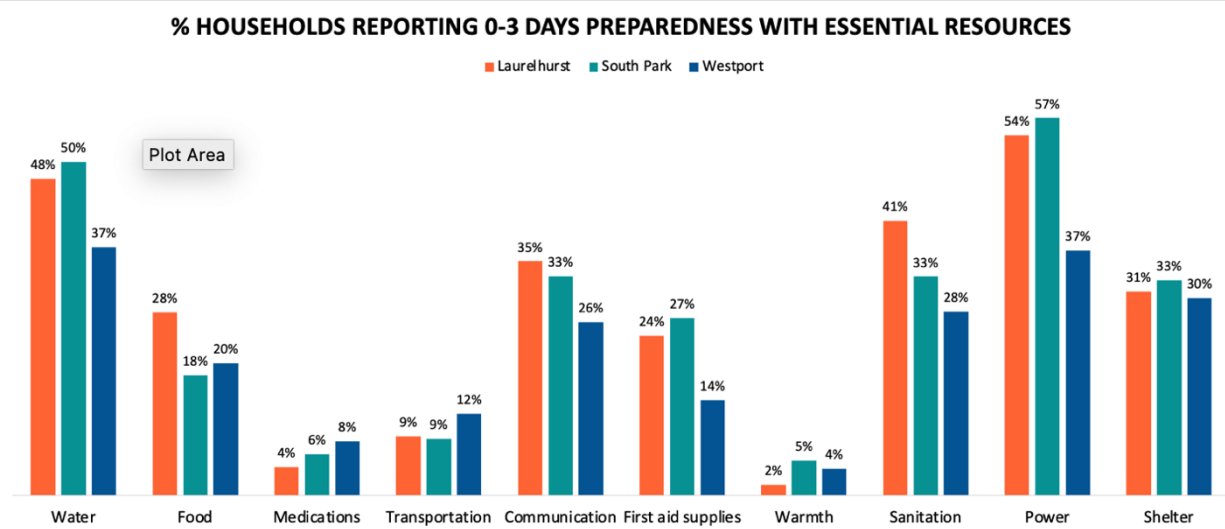


Figure 34: Percent of respondents prepared with 0-3 days' supply of essential resources, by community

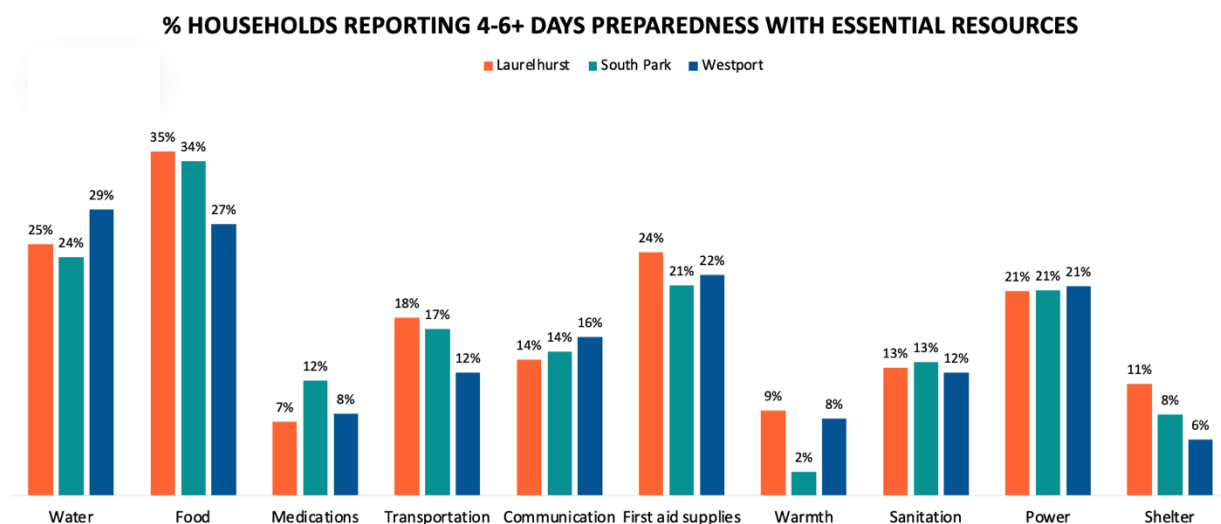


Figure 35: Percent of respondents prepared with 4-6 days' supply of essential resources, by community

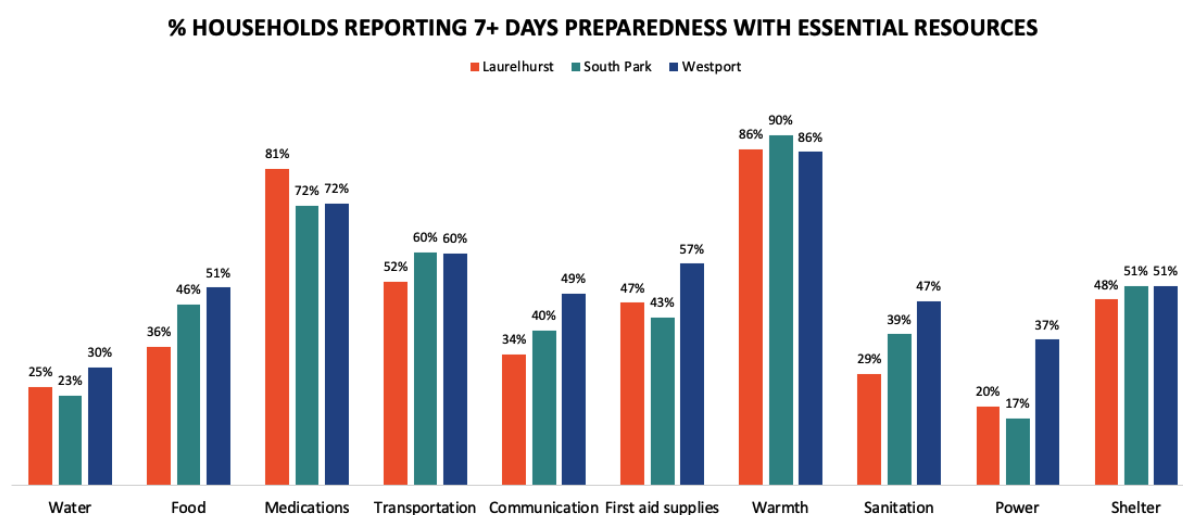


Figure 36: Percent of respondents prepared with 4-6 days' supply of essential resources, by community

extent to which transportation and communication systems will be intact is difficult, as is knowing the extent to which buildings will be damaged and become unsuitable to use as shelter.

Resource seeking

To understand anticipated resource seeking behavior in a disaster, we asked respondents where they expected they would turn to obtain those same ten resources *if they did not have them* in a disaster scenario. This was posed as an open-ended question with an answer blank for each resource.⁴⁴

⁴⁴ Initially, this question was designed as multiple-choice. However, consultation with an experienced community disaster preparedness organizer prompted us to change the question design to an open-ended format. The organizer felt that by presenting respondents with choices (e.g., fire department, police), we might be inappropriately suggesting that respondents *could* or *should* go to those institutions for assistance in a disaster, which is not necessarily the case. We found that by leaving the question open-ended, we received a wide range of answers that is broader in scope than what we might have included in the initial, multiple-choice question design.

Respondents could choose to write in any number of answers they wished. The total number of individual responses across all items and communities was 5,733.

Table 14: Number of resource-seeking response items, by resource and community

Resource	Total number of answers		
	<i>Laurelhurst</i>	<i>South Park</i>	<i>Westport</i>
Food	235	216	161
Drinking water	290	250	183
Power	210	183	142
Shelter	231	206	175
Warmth	192	173	140
First aid supplies	220	195	157
Medications	198	182	148
Sanitation	220	194	148
Transportation	230	176	143
Communication	200	186	149
Total	2226	1961	1546

In order to organize the responses into useable categories for analysis, individual answers to this question⁴⁵ were compiled into a corpus for thematic analysis. Thematic analysis is a qualitative data analysis method based on the identification of recurring themes or patterns in a data set (Riger and Sigurvinsdottir 2016). We took an inductive, iterative approach to coding, reviewing each individual response and assigning it an initial categorical code. Knowledge about the communities gained from the workshop discussions and asset mapping activities helped to inform the coding and categorization by familiarizing the research team with the range of local assets and resources that might be available in each community in the event of a disaster.

Using *Atlas.TI* (version 9.0.7) qualitative analysis software and an inductive approach to coding, we grouped the open-ended responses into representative categories, starting first with very specific codes. Responses indicating that respondents would rely on resources they already had were discarded, as we had specifically asked about resource seeking in a case where respondents did *not* have the resources listed. In the first round of coding, we kept the coding categories as narrow as possible while still grouping very similar answers into like categories (e.g., clinics identified by name were grouped together with answers that simply replied “clinic” into a single category called “clinic”). That initial set of codes was then grouped into categories that described similar community functions (e.g., the initial “clinic” and “hospital” categories were grouped together into “Hospital or clinic”). Resultant categories that contained 35 or fewer answers and that did not fit together with any other categories were grouped into an “Other” category (171 items total across all three communities).

The answers we received also provided us with more contextually specific information than we would have been unlikely to capture by using a set of predetermined answer choices.

⁴⁵ Each place or resource listed was counted as a separate answer. For example, if a respondent replied with three different alternatives for where they might turn for an item, each of those three responses was counted as a separate answer in the corpus.

The resultant thirteen categories were:

- Social ties (neighbors, family, friends)
- Store (includes both specific stores named and answer simply indicating “the store”)
- First responders (includes fire, police, 911, county emergency, first responders)
- Hospital or clinic
- Pharmacy
- Local social services (food bank, clothing bank, Goodwill, Salvation Army, shelter)
- Natural environment (bodies of water, waterways, rainwater)
- Outside emergency aid (FEMA, Red Cross, Coast Guard, other agency relief aid)
- Social infrastructure (churches, university/schools, libraries, community centers, parks, community gardens)
- Transportation modes and services (walking, bicycle, private vehicle, public transportation, boat, taxi, ride share)
- Outside of community
- Don't know (includes “I don't know,” “not sure,” “unknown,” and “?” answers)
- Other (e.g., employer/workplace, local government, hotel/motel, delivery/Amazon)

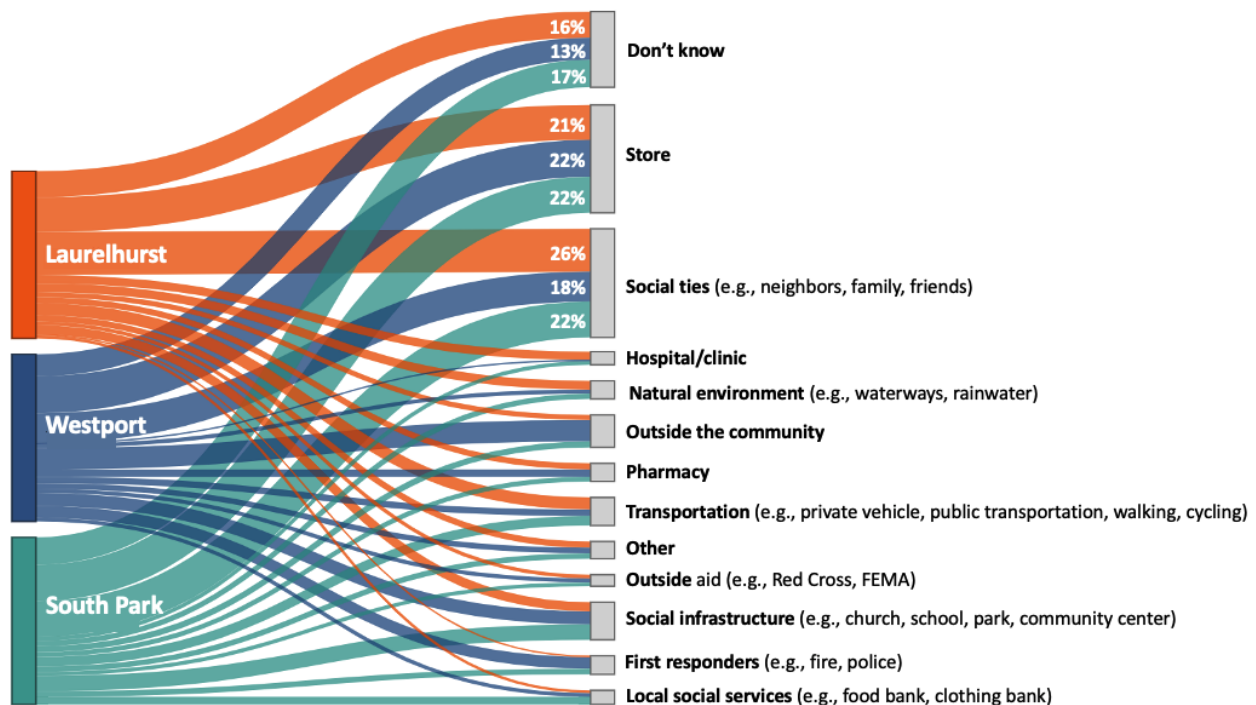


Figure 37: Where respondents expect to turn for needed resources in a disaster scenario (by community)

Because the question about resource-seeking was open-ended in nature, some respondents provided multiple responses for each item. The results illustrated here indicate the percentage of *responses* that fall into each of the coded categories, illustrating community-specific trends rather than generalizable anticipated behavior. Figure 37 above illustrates the percentage of responses received from each community indicating where the respondents would be likely to seek the set of ten essential resources

in the event of a disaster. The three most common answers across all resources and communities were “don’t know,” “the store,” and “social ties.” These trends indicate a large potential role for both social ties and stores in terms of supplying community members with needed resources in a disaster; they also indicate that many people don’t know where they would turn to access essential resources in a disaster. Tables 15-17 provide resource-specific detail about anticipated resource seeking behaviors for all items.

Table 15: Expected sources for essential items in a disaster (Laurelhurst, % responses)

	Communication	First aid supplies	Food	Medications	Power	Sanitation	Shelter	Transportation	Warmth	Water
Don't know	23%	12%	7%	25%	27%	19%	18%	16%	16%	8%
First responders (fire, police)	8%	10%	2%	1%	2%	2%	2%	1%	3%	3%
Social ties (neighbors, friends, family)	32%	20%	14%	7%	22%	20%	36%	23%	31%	15%
Hospital/clinic	1%	10%	0%	12%	0%	0%	1%	0%	0%	0%
Local social services (food bank, clothing bank)	1%	1%	15%	2%	2%	2%	3%	1%	12%	5%
Natural environment (waterways, rainwater)	0%	0%	1%	0%	0%	10%	2%	0%	1%	15%
Outside emergency responders (FEMA, Red Cross)	0%	3%	2%	3%	2%	3%	1%	1%	6%	2%
Pharmacy	0%	7%	0%	24%	1%	0%	0%	0%	0%	0%
Social infrastructure (school, church, library)	17%	6%	8%	3%	7%	17%	15%	2%	8%	7%
Store	10%	24%	44%	19%	29%	19%	4%	1%	17%	38%
Transportation	3%	0%	0%	0%	1%	0%	5%	50%	0%	0%
Outside of community	3%	3%	4%	3%	2%	2%	10%	2%	1%	4%
Other	3%	3%	2%	3%	5%	5%	5%	2%	3%	2%

■ > 25%
 ■ 20-25%
 ■ 15-20%
 ■ 10-15%

Table 16: Expected sources for need items in a disaster (South Park, % responses)

	Communication	First aid supplies	Food	Medications	Power	Sanitation	Shelter	Transportation	Warmth	Water
Don't know	25%	9%	11%	22%	24%	23%	12%	15%	14%	7%
First responders (fire, police)	1%	2%	0%	1%	1%	0%	1%	1%	1%	0%
Social ties (neighbors, friends, family)	33%	28%	22%	7%	23%	22%	45%	21%	48%	13%
Hospital/clinic	4%	17%	1%	15%	4%	4%	1%	0%	3%	3%
Local social services (food bank, clothing bank)	2%	1%	1%	1%	1%	2%	3%	0%	3%	1%
Natural environment (waterways, rainwater)	0%	0%	1%	0%	0%	15%	1%	0%	0%	27%
Outside emergency responders (FEMA, Red Cross)	2%	2%	4%	1%	3%	1%	3%	0%	3%	3%
Pharmacy	0%	13%	0%	25%	2%	0%	0%	0%	0%	0%
Social infrastructure (school, church, library)	8%	2%	4%	0%	4%	11%	15%	0%	4%	6%
Store	12%	19%	50%	25%	28%	11%	6%	3%	19%	34%
Transportation	4%	1%	0%	0%	2%	0%	3%	55%	0%	0%
Outside of community	3%	3%	3%	2%	2%	3%	7%	2%	3%	2%
Other	6%	5%	2%	2%	5%	6%	4%	1%	3%	3%

■ > 25%
 ■ 20-25%
 ■ 15-19%
 ■ 10-14%

Table 17: Expected sources for need items in a disaster (Westport, % responses)

	Communication	First aid supplies	Food	Medications	Power	Sanitation	Shelter	Transportation	Warmth	Water
Don't know	22%	9%	5%	16%	18%	18%	15%	21%	9%	5%
First responders (fire, police)	12%	19%	4%	4%	8%	2%	3%	3%	6%	9%
Social ties (neighbors, friends, family)	23%	16%	15%	7%	16%	10%	28%	27%	29%	10%
Hospital/clinic	0%	1%	0%	4%	0%	0%	0%	1%	0%	0%
Local social services (food bank, clothing bank)	2%	2%	5%	0%	2%	1%	3%	1%	5%	2%
Natural environment (waterways, rainwater)	0%	0%	1%	0%	0%	13%	1%	0%	0%	7%
Outside emergency responders (FEMA, Red Cross)	4%	4%	1%	2%	2%	2%	3%	2%	5%	2%
Pharmacy	1%	13%	1%	27%	2%	2%	1%	1%	2%	1%
Social infrastructure (school, church, library)	6%	4%	7%	3%	6%	21%	14%	3%	9%	5%
Store	13%	20%	48%	16%	35%	17%	5%	6%	16%	40%
Transportation modes & services	1%	0%	0%	0%	0%	2%	6%	28%	1%	1%
Outside of community	12%	12%	16%	20%	12%	7%	13%	7%	15%	15%
Other	4%	1%	0%	2%	1%	8%	10%	2%	1%	4%

> 25%
 20-25%
 15-20%
 10-15%

Beyond the similarities in the broad trends of anticipating seeking resources from social ties or stores and not knowing where to turn, we did observe some variation in anticipated resource seeking behavior among the three communities. In Laurelhurst and South Park, for example, 27% and 15% of the answers, respectively, indicated respondents planned to turn to the natural environment for drinking water in a disaster.⁴⁶ Both communities are located near bodies of water. Laurelhurst sits on the shores of Lake Washington, while South Park is situated along the Duwamish Waterway. However, in Westport, which is bordered on two sides by saltwater and on another by the brackish water of the Grays Harbor estuary, fewer responses (7%) indicated people would be likely to turn to natural sources for drinking water.

One difference that stood out in particular was the percentage of responses in Westport indicating that people felt they would need to leave the community in order to access resources like medications (20%), food (16%), water (15%), and even warmth (15%). Westport is served by a single grocery store, a single clinic, and a single pharmacy, which limits residents' options for obtaining these resources on a daily basis and would likewise limit them in the event of a disaster. Westport residents may also be more accustomed to accessing needed resources outside their community on a regular basis.⁴⁷

⁴⁶ The City of Seattle's Office of Emergency Management does not view obtaining drinking water from a nearby waterway as a viable option in the wake of a disaster as water sources are likely to be polluted with substances that cannot be filtered out using camping equipment.

⁴⁷ It is also possible that because the disaster scenario we proposed for Westport was a severe storm instead of an earthquake, people might think they will be able to travel outside the community for needed resources – although we did see a higher percentage of "I don't know" responses for transportation in Westport than in Seattle.

Table 18: Anticipated sources for essential resources with which households are the least prepared (by % households not prepared with 7+ days of resources listed)

Resource	Community	% households <u>not</u> prepared for 7+ days (or don't know)	Expected source	% responses
Water	Laurelhurst	75%	The store	34%
			The natural environment	27%
			Social ties	13%
	South Park	77%	The store	38%
			The natural environment	15%
			Social ties	15%
	Westport	70%	The store	40%
			Outside of the community	15%
			Social ties	10%
Communication	Laurelhurst	66%	Social ties	33%
			Don't know	25%
			The store	12%
	South Park	60%	Social ties	32%
			Don't know	23%
			Social infrastructure	17%
			The store	10%
	Westport	51%	Social ties	23%
			Don't know	22%
			The store	13%
			Outside of the community	12%
Sanitation	Laurelhurst	71%	First responders	12%
			Don't know	23%
			Social ties	22%
			Natural environment	15%
			Social infrastructure	11%
	South Park	61%	The store	11%
			Social ties	20%
			Don't know	19%
			The store	19%
			Social infrastructure	17%
	Westport	53%	Natural environment	10%
			Social infrastructure	21%
Power	Laurelhurst	80%	Don't know	18%
			The store	17%
			The natural environment	13%
	South Park	83%	Social ties	10%
			Don't know	24%
			Social ties	23%
	Westport	63%	The store	29%
			Don't know	27%
			Social ties	22%
			The store	35%
			Don't know	18%
			Social ties	16%
			Outside of community	12%

Table 18 above provides more detail on where people in the study communities expect to seek the four resources with which the communities are the least prepared: water, communication, sanitation, and power. All resource categories receiving 10% or more of the survey responses for that resource are listed in the right-hand column of the table. Both social ties and “the store” are included as expected sources in each category for all three communities. For communication, sanitation, and power – services typically provided by utilities and not “storable” in the same way that water can be stored – the most commonly identified resource seeking categories also all include “don’t know.” This data indicates that for the resources with which communities are least prepared, social tie and stores are expected to play a key role in providing people with those needed resources in a disaster. Social infrastructure, on the other hand – places like schools, churches, and community centers – were seldom mentioned as a destination for resource seeking and were mentioned by respondents primarily as locations from which to seek shelter or toilet facilities (sanitation).

Chi square analysis

To better understand the variation in resource-seeking behavior between the study communities, we carried out a Chi square test of independence for each pair of communities in each resource category. The Chi square statistic enables the analysis of group differences when the dependent variable is measured categorically (McHugh 2013), as are the resource-seeking behaviors of the three study communities. A statistically significant outcome indicates that differences in the distributions between the two communities are not due to chance, but rather that they are associated with the characteristics of that particular community. We also examined the magnitude of the contribution of the various resource-seeking categories to the observed differences in distributions. In the tables that follow, categories in which a community had a higher-than-expected reliance on a particular resources-seeking category are marked with a (+) and coded in orange. Categories in which a community had a lower-than-expected reliance on a particular resources-seeking category are marked with a (-) and coded in blue. Each table is followed by an interpretation and brief discussion.

Table 19: Chi Square test of independence – pairwise comparison of resource-seeking distributions - communication

Communication		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	<i>Laurelhurst</i>	<i>South Park</i>
0.522	---	---
	<i>Laurelhurst</i>	<i>Westport</i>
0.031*	Hospital/clinic, pharmacy, & first responders (-11%)	Hospital/clinic, pharmacy, & first responders (+13%)
	Outside of community, outside emergency responders (-20%)	Outside of community, outside emergency responders (+25%)

	South Park	Westport
0.011*	Social services & social infrastructure (+10%) Outside of community, outside emergency responders (-26%)	Social services & social infrastructure (-12%) Outside of community, outside emergency responders (+31%)

* Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of communication, statistically significant differences in resource seeking behavior were found between both urban communities and Westport, highlighting Westport respondents' expected reliance on first responders and resources from outside the community.

In the comparison between Laurelhurst and Westport, Laurelhurst respondents indicated a lower-than-expected reliance on hospitals, clinics, pharmacies and first responders as well as on outside emergency responders or other resources outside the community to obtain communication resources. Westport respondents indicated a higher-than-expected reliance on resources from those same two categories.

In the comparison between South Park and Westport, South Park respondents indicated a higher-than-expected reliance on social services and social infrastructure to obtain communication resources and a lower-than-expected reliance on outside emergency responders or resources obtained from outside the community. Westport respondents indicated a lower-than-expected reliance on social services and social infrastructure and a higher-than-expected reliance on outside emergency responders or resources obtained from outside the community to communicate with family and friends in a disaster scenario.

Table 20: Chi Square test of independence – pairwise comparison of resource-seeking distributions - first aid supplies

First aid supplies		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.007**	First responders (-16%) Social services, social infrastructure (-10%)	First responders (+16%) Social services, social infrastructure (+10%)
	Laurelhurst	Westport
0.000***	First responders (-16%) Hospital/clinic (+13%)	First responders (+19%) Hospital/clinic (-16%)
	South Park	Westport
0.011*	Hospital/clinic (+15%)	Hospital/clinic (-19%)

Outside of community, outside emergency responders (-12%)	Outside of community, outside emergency responders (+15%)
---	---

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of communication, statistically significant differences in resource seeking behavior were found in all three pairwise comparisons, highlighting the variation among the communities in respondent expectations of seeking first aid supplies in a disaster scenario.

In the comparison between Laurelhurst and South Park, Laurelhurst respondents indicated a lower-than-expected reliance on first responders, social services, and social infrastructure to obtain communication resources. South Park respondents indicated a higher-than-expected reliance on resources from those same two categories. These differences suggest that Laurelhurst residents may feel more prepared with first aid resources than South Park residents and highlights the difference in the presence and use of social services and social infrastructure in the two communities.

In the comparison between Laurelhurst and Westport, Laurelhurst respondents indicated a lower-than-expected reliance on first responders and a higher-than-expected reliance on hospitals and clinics to obtain first aid supplies. Westport respondents indicated a higher-than-expected reliance on first responders and a lower-than-expected reliance on hospitals and clinics for first aid supplies. These differences may arise due to the presence of several medical facilities within the Laurelhurst community and a relative lack of such facilities in Westport, where residents often rely on first responders for medical aid.

In the comparison between South Park and Westport, South Park respondents indicated a higher-than-expected reliance on hospitals and clinics to obtain first aid resources and a lower-than-expected reliance on outside emergency responders or other resources obtained from outside the community. Westport respondents indicated a lower-than-expected reliance on hospitals and clinics and a higher-than-expected reliance on outside emergency responders or resources obtained from outside the community to obtain first aid supplies. These findings may reflect the presence of the SeaMar clinics in South Park as a potential resource for first aid supplies as well as a lack of expectation of receiving aid from outside the community, as is observed in some of the other resource categories.

Table 21: Chi Square test of independence – pairwise comparison of resource-seeking distributions - food

Food		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	<i>Laurelhurst</i>	<i>South Park</i>
0.000***	Social services & social infrastructure (-40%)	Social services & social infrastructure (+37%)
	<i>Laurelhurst</i>	<i>Westport</i>
0.002***	Outside of community, outside emergency responders (-15%)	Don't know (-11%)

		Social services & social infrastructure (+12%)
		Outside of community, outside emergency responders (+19%)
	South Park	Westport
0.006**	Social services & social infrastructure (+12%)	Social services & social infrastructure (-17%)
	Outside of community, outside emergency responders (-22%)	Outside of community, outside emergency responders (+30%)

^{*} Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of food, statistically significant differences in resource seeking behavior were found in all three pairwise comparisons, suggesting differences in respondent expectations of seeking sustenance in a disaster scenario among the three communities.

In the comparison between Laurelhurst and South Park, Laurelhurst respondents indicated a lower-than-expected reliance on social services and social infrastructure to obtain food, while South Park respondents indicated a higher-than-expected reliance on those same resources. Fewer social service and social infrastructure providers exist in the Laurelhurst community than in South Park, and Laurelhurst residents are most likely less accustomed to relying on those kinds of providers for basic needs like food than are South Park residents.

In the comparison between Laurelhurst and Westport, Laurelhurst respondents indicated a lower-than-expected reliance on outside emergency responders or resources outside the community. Westport respondents indicated a higher-than-expected reliance on social services, social infrastructure, outside emergency responders, and other outside resources for obtaining food. Westport respondents also responded they “don’t know” where to get food in a disaster at a lower-than-expected rate, suggesting people in the neighborhood are well-acquainted with alternative options for obtaining food.

In the comparison between South Park and Westport, South Park respondents indicated a higher-than-expected reliance on social services and social infrastructure and a lower-than-expected reliance on outside emergency responders or other resources obtained from outside the community. Westport respondents indicated a lower-than-expected reliance on social services and social infrastructure and a higher-than-expected reliance on outside emergency responders or resources obtained from outside the community to obtain food. These findings indicate that South Park residents are more likely to turn inward to find food resources in an emergency, while Westport residents instead plan to rely more on resources from outside the community.

Table 22: Chi Square test of independence – pairwise comparison of resource-seeking distributions - medications

Medications		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.454	---	---
	Laurelhurst	Westport
0.000***	Hospital/clinic (+10%)	Hospital/clinic (-13%)
	Outside of community, outside emergency responders (-26%)	Outside of community, outside emergency responders (+35%)
	South Park	Westport
0.007**	Hospital/clinic (+11%)	Hospital/clinic (-15%)
	Outside of community, outside emergency responders (-25%)	Outside of community, outside emergency responders (+35%)

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of medications, statistically significant differences in resource seeking behavior were found between both urban communities and Westport, highlighting the urban communities' expected reliance on local hospitals and clinics and Westport's expected reliance on outside resources and outside emergency responders for medication resources in a disaster scenario.

In both the comparison between Laurelhurst and Westport and the comparison between South Park and Westport, the urban communities indicated a higher-than-expected reliance on hospitals and clinics to obtain medications and a lower-than-expected reliance on outside emergency responders or other resources from outside the community. Westport respondents, on the other hand, indicated a lower-than-expected reliance on hospitals or clinics and a higher-than-expected reliance on outside emergency responders and other resources outside the community for medications. These differences likely reflect the lack of medical facilities within the Westport community as compared to the urban communities, which both have multiple clinics and/or hospitals within their boundaries.

Table 23: Chi Square test of independence – pairwise comparison of resource-seeking distributions - power

Power		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
0.553	Laurelhurst	South Park
	---	---
0.047*	Laurelhurst	Westport
	Outside of community, outside emergency responders (-14%)	Outside of community, outside emergency responders (+19%)
	Other (+14%)	Other (-19%)
0.005**	South Park	Westport
	Hospital/clinic, pharmacy, first responders (-14%)	Hospital/clinic, pharmacy, first responders (+17%)
	Outside of community, outside emergency responders (-13%)	Outside of community, outside emergency responders (+17%)
	Other (+10%)	Other (-12%)

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of power, statistically significant differences in resource seeking behavior were found between both urban communities and Westport, highlighting the urban communities' lower-than-expected, and Westport's higher-than-expected, reliance on outside resources for power in a disaster scenario. Both urban communities also indicated a higher-than-expected reliance on "other" resources, indicating their strategies for obtaining power in a disaster might be more diverse or diffuse than that of Westport respondents, who indicated a lower-than-expected reliance on the "other" category.

In the comparison between South Park and Westport, South Park respondents indicated a lower-than-expected reliance on hospitals, clinics, pharmacies and first responders for power, while Westport respondents indicated a higher-than-expected reliance on the same category for obtaining emergency power. This is possibly due to the more general everyday reliance of Westport and South Beach residents on first responders for emergency resources, or potentially to the difficulty in providing backup power or repairing a damaged power grid in an isolated rural location.

Table 24: Chi Square test of independence – pairwise comparison of resource-seeking distributions - sanitation

Sanitation		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.151	---	---
0.028*	Laurelhurst	Westport
	Social ties (+19%)	Social ties (-25%)
		Social services & social infrastructure (+10%)
0.227	South Park	Westport
	---	---

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

The only statistically significant comparison in the sanitation category was between Laurelhurst and Westport. While Laurelhurst respondents indicated a higher-than-expected reliance on social for sanitation, Westport respondents indicated a lower-than-expected reliance on social ties and a higher-than-expected reliance on social services and social infrastructure. This difference might indicate that Laurelhurst respondents feel more comfortable approaching neighbors to use toilet facilities or that it might be easier for Laurelhurst residents to share with one another because of the relative nearness of neighbors in its higher-density built environment.

Table 25: Chi Square test of independence – pairwise comparison of resource-seeking distributions - shelter

Shelter		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.577	---	---
	Laurelhurst	Westport
0.094	---	---
	South Park	Westport
0.530	---	---

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

No statistically significant outcomes were found in the pairwise comparisons regarding shelter resources, suggesting that the three communities exhibit similar resource-seeking patterns for this category and that shelter-seeking behavior is not highly dependent on community characteristics.

Table 26: Chi Square test of independence – pairwise comparison of resource-seeking distributions - transportation

Transportation		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.948	---	---
	Laurelhurst	Westport
0.000***	Transportation modes and services (+17%)	Outside of community, outside emergency responders (+11%) Transportation services (-30%) Other (+15%)
	South Park	Westport
0.009**	Transportation modes and services (+21%)	Outside of community, outside emergency responders (+12%) Transportation modes and services (-28%) Other (+13%)

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of transportation, statistically significant differences in resource seeking behavior were found between both urban communities and Westport, highlighting the urban communities' expected reliance on everyday transportation modes and services and Westport's expected reliance on outside resources, outside emergency responders, and other resources for post-disaster mobility.

In both the comparison between Laurelhurst and Westport and the comparison between South Park and Westport, the urban communities indicated a higher-than-expected reliance on everyday transportation modes and services such as walking, biking, buses, and driving for transportation. Westport respondents, on the other hand, indicated a lower-than-expected reliance on everyday modes and a higher-than-expected reliance on outside emergency responders, resources outside the community, and other resources for transportation. These differences may reflect the more extreme isolation of Westport relative to the other two communities as well as its lower-density built environment, which necessitates longer travel times. In addition, many Westport respondents indicated having personal mobility challenges as compared to the other two communities, which might also be a factor in the differences observed.

Table 27: Chi Square test of independence – pairwise comparison of resource-seeking distributions - warmth

Warmth		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.098	---	---
	Laurelhurst	Westport
0.032*	Social ties (+13%)	Social ties (-13%)
	Outside of community, outside emergency responders (-24%)	Outside of community, outside emergency responders (+24%)
	South Park	Westport
0.098	---	---

⁺ Only categories with a contribution of 10% or more to the Chi square statistic are shown

The only statistically significant comparison in the warmth category was between Laurelhurst and Westport. While Laurelhurst respondents indicated a higher-than-expected reliance on social ties and a lower-than-expected reliance on outside emergency responders or other outside resources for warmth, Westport respondents indicated a lower-than-expected reliance on social ties and a higher-than-expected reliance on outside emergency aid or other outside resources. This difference might indicate that Laurelhurst respondents feel more comfortable approaching neighbors to share clothing and other warmth-related items, that they have more of those items to share, or that it might be easier for Laurelhurst residents to share with one another because of the relative nearness of neighbors in its higher-density built environment.

Table 28: Chi Square test of independence – pairwise comparison of resource-seeking distributions - water

Water		
<i>p-value</i>	<i>Relative contribution of resource-seeking categories for statistically significant outcomes⁺</i>	
	Laurelhurst	South Park
0.122	---	---
	Laurelhurst	Westport

0.000***	<i>Natural environment (+21%)</i>	<i>Natural environment (-28%)</i>
	<i>Outside of community, outside emergency responders (-14%)</i>	<i>Outside of community, outside emergency responders (+19%)</i>
	South Park	Westport
0.001***	<i>Outside of community, outside emergency responders (-16%)</i>	<i>Natural environment (-10%)</i>
		<i>Outside of community, outside emergency responders (+20%)</i>

* Only categories with a contribution of 10% or more to the Chi square statistic are shown

In the category of water, statistically significant differences in resource seeking behavior were found between both urban communities and Westport, highlighting the urban communities' expected reliance on local bodies of water (i.e., the natural environment) and Westport's expected reliance on outside resources and outside emergency responders. Although Westport is located on the coast, its surrounding water bodies are predominately salt water or brackish, limiting residents' ability to obtain drinking water from local natural sources.

In both the comparison between Laurelhurst and Westport and the comparison between South Park and Westport, the urban communities indicated a lower-than-expected reliance on resources from outside the community or outside emergency responders for water supplies. In addition, Laurelhurst respondents indicated a higher-than-expected reliance on natural resources, likely due to the proximity of Lake Washington, a large body of fresh water. Westport respondents indicated a higher-than-expected reliance on outside emergency responders and resources from outside the community in the comparison with Laurelhurst and a lower-than-expected reliance on the natural environment in both pairwise comparisons.

Interview findings: Gaps and opportunities

In the following section, we provide some background about the three study communities' varying approaches to disaster preparedness organization as an introduction to the preparedness gaps and opportunities identified in the stakeholder interviews.

Community context: Varying approaches to disaster preparedness

The three study communities have adopted different means of preparing for disaster. Laurelhurst's LEAP group participates in the citywide volunteer organization of the Seattle Emergency Hubs, a network of community leaders working to prepare their neighborhoods specifically for an earthquake scenario. They promote the concept of neighborhood "emergency hubs," which are designated locations at which volunteers would gather to establish emergency communications and share information in the event of a major earthquake. LEAP has established a local emergency hub on the grounds of a community church and has worked to organize the entire Laurelhurst neighborhood into "clusters" comprising a grouping of neighbors. Each cluster has a cluster captain, who works to build connections within their own group and who is responsible for liaising between the cluster and the LEAP organization. In Seattle, emergency managers strongly encourage individual preparedness in the hopes that households that have the means to purchase and store extra supplies will do so and not drain resources from others who might

not have the same means to prepare. They see the role of City responders as focusing on “those populations that didn't have what they needed the day before the [disaster] happened.”

Westport’s approach to disaster preparedness is motivated in large part by the threat of a large coastal earthquake, such as a magnitude 9.0 Cascadia Subduction Zone event, and resulting tsunami. Because it is one of many coastal communities facing a similar threat and has limited resources to devote to such an effort, Westport’s effort to prepare for such an event is coordinated with the surrounding South Beach community; other cities and tribal nations along the coast; and county, state, and military partners. Among these entities, Westport distinguished itself as a leader in coastal earthquake preparedness when the Ocosta School District, which serves Westport and the broader South Beach community, taxed itself to construct a tsunami vertical evacuation facility integrated into a new elementary school project, which was completed in 2016. As one interviewee noted, “the South Beach community has that kind of 'can-do, we're going to take care of this, nobody's going to do it for us' attitude.” The community’s goal is to ultimately build four vertical evacuation structures with the combined capacity to shelter nearly the entire population of Westport.

While South Park does not have an organization dedicated to earthquake disaster preparedness, it has a deeply embedded culture of providing assistance and needed resources through mutual aid networks. For example, Cultivate South Park, which was incorporated in 2018, is a locally based nonprofit organization that works to create connections among neighbors and increase resident participation in community life. The organization has no specific agenda other than to build community capacity and to provide organizational infrastructure to neighbor-led projects, which they are able to do at a very low cost. Cultivate South Park sponsors programs such as the Urban Fresh Food Collective, which works to improve access to fresh food in South Park; the Arts and Culture Collective, which connects neighbors through the arts; and youth programming like writing circles and the Wolfpack baseball team. Although one of the leaders of Cultivate South Park had “no idea” if anyone was doing disaster preparedness outreach or training in the community, there are many efforts underway in the community to help connect people to one another and with essential resources on an everyday basis. In addition, these organizations grew out of community relationships that had developed over the years. “I’m hopeful that if any disaster were to happen now, we would be more consolidated and ready to mobilize more people,” noted one community leader. The network of relationships could also potentially be leveraged for that specific purpose: “There is a little bit of [social] infrastructure that was created through the pandemic that we could definitely tap into if there was a group that wanted to organize around disaster preparedness.”

Gaps

In order to gain an in-depth understanding of the issues facing disaster preparedness planners, volunteers, and business owners in these three communities, we asked them to provide their own interpretation of the survey results and to talk about both opportunities and challenges to disaster preparedness in their own local context. While the nature of the gaps varied by community, some common themes did surface, including communication of existing disaster preparedness plans; reliance on stores; challenges that inhibit individuals from preparing for disasters; difficulty in talking about disaster preparedness; and reliance on large-scale infrastructure like water, communication, sanitation, and power.

Communication of existing plans

Interviewees across all communities were concerned about the proportion of “I don’t know” answers to the resource seeking survey question. While some were more surprised to see the dominance of this answer than others, many agreed it demonstrated the need for additional disaster-related preparation, education, and information sharing.

One gap in communication was an apparent lack of awareness about planned response measures in the Seattle communities at the level of both the community and the city, including Laurelhurst residents not being aware of their community hub and its emergency communications capabilities. One volunteer suggested people might be more inclined to take positive action toward disaster preparedness if they had a better understanding of both the planned City response and the potential for uncertainty within those plans.⁴⁸ Some Seattle volunteers also suggested that the City of Seattle ask community groups for more help in addressing gaps in education about preparedness and planned response measures to take better advantage of communication through local networks.

With a small city staff and only one and a half full-time employees staffing Grays Harbor County Emergency Management, there is limited support for the coordination work required for disaster preparedness and communication for a population of 75,000 people. The county relies heavily on outside partners such as the National Guard, the Red Cross, and the Washington State Emergency Management Division for assistance in its disaster preparedness and response efforts.

Reliance on stores

The survey data revealed a similar dependency on stores across all three communities. Interviewees noted that in a major event stores would be just as subject to damage as other kinds of structures, and although they often serve as natural gathering places, people shouldn’t expect to continue to rely on them to readily provide resources, particularly sustenance items like food and water. People responding to the survey also identified stores as a potential source for sanitation facilities. Some interviewees interpreted the expected reliance on stores for resources in a disaster event as an effect of living in a “consumer society” in which people generally expect to be able to purchase everything they need at their convenience.

Several interviewees noted the interdependence of stores on utility infrastructure systems like electricity, water, and sewer. Stores also rely upon an open supply chain and the communication and transportation networks that enable supplies to be replenished and distributed. In addition, employees might live outside the area and be unable to staff stores for a variety of reasons, from physical access to the need to be present with their own families and communities.

In Westport, which has a single grocery store, interviewees were particularly concerned about survey respondents’ planned reliance on a single point for resources. There are similar challenges in other Grays Harbor communities, where many other small towns have only one grocery store. Aberdeen, the largest city in the county, has three grocery stores that serve 17,000 people.

The local business owners we interviewed in the Seattle communities both viewed their stores as important gathering places within the community. One described their business as “a neighborhood

⁴⁸ The City of Seattle does plan to provide some resources to communities in the event of a disaster

institution” and “the meeting place for a lot of folks, especially this last year with COVID,” while the other described theirs as “an anchor to the population.” Both business owners view their role as helping to serve the community in the case of a disaster to the extent feasible, including as a location for providing shelter or as a site for resource distribution. The South Park business whose owner we spoke with is a neighborhood coffee shop that regularly hosts community events, while the Laurelhurst business described is a homeware store that sells a wide variety of items ranging from hardware to clothing to gardening supplies. Neither interviewee had disaster response plans for their business, nor had they spoken to other area business owners about disaster preparedness.

In viewing the survey results, the Laurelhurst business owner expressed worry about what might happen if “suddenly everyone in the neighborhood descends upon the store.” They noted that in a disaster, the store would likely close immediately and remain closed for some period of time until employees were able to staff it and may potentially be able to re-open under the condition that the building was secure, had power, and was operable. They also noted that if there were any kind of run on an item (e.g., batteries), they would likely be sold out in a couple of hours and not replaced for a while. “We’re not Home Depot - we don’t have pallets and pallets of stuff sitting in the back room, so things would go pretty quickly. We certainly have them, but they wouldn’t last very long and wouldn’t go very far.”

Challenges to preparedness

Interviewees from all three locations acknowledge that their communities are underprepared for a major disaster such as a CSZ earthquake. As one disaster preparedness planner noted, getting people to take steps toward preparing for a rare disaster with uncertain timing is incredibly difficult. In addition, interviewees noted that people generally are not very good about storing needed items. Storing extra supplies can be expensive and takes up space. Some supplies might also get used up in a moment of need and not be replenished, or people might not know how to store certain kinds of supplies correctly. Some interviewees worried that people without prior experience of earthquakes, or who had moved to the area recently from elsewhere, might not understand they need to be prepared for such an event.

Additionally, several interviewees voiced concern that people don’t realize how many supplies they would actually need to store in order to sustain their household for two weeks. Members of both the Seattle and Westport communities recalled times in the past when a smaller-scale disaster had struck, and people found themselves ill-prepared. When Grays Harbor County experienced a two-week power outage due to a windstorm, Westport residents had to leave the area in order to get basic supplies like gas, food, and generators. During a recent snowstorm in Seattle, the Laurelhurst business owner stated that, “Nobody had anything. We had 150 people in line, and we had to limit people’s quantities, and you know, the phone’s ringing off the hook.”

Challenges to disaster preparedness communication

Uncertainty about the severity and nature of the potential disaster and how long communities might be on their own make it difficult for disaster preparedness organizers and planners – not to mention community members – to anticipate precisely what an individual’s or a community’s needs will be in such an event. In regard to earthquake preparedness in the Pacific Northwest, messaging often focuses on an extreme scenario like a Cascadia Subduction Zone earthquake because, as one Westport interviewee stated, “If you’re prepared for the worst, you’re ready for anything.”

However, engaging people in dialogue about extreme scenarios and challenges that might arise after a major earthquake can be quite difficult for disaster preparedness planners and organizers because the information can be frightening, and sometimes “people get overwhelmed and can’t function.” As one interviewee put it, “nobody wants to talk about the bad stuff,” making it difficult in some cases to build a case for funding disaster preparedness initiatives. Some community members in Westport/South Beach have expressed a fear that discussing the potential for a future earthquake and tsunami could “scare people away,” whether they be potential residents or the tourists that are so important to the local economy. In response to this sentiment, Westport’s Tsunami Safety Committee has adopted the perspective that transparent planning, preparation, and communication for regarding potential disasters will help people feel more comfortable coming to the area, “knowing that as much as we can, we try to create a safe environment.”

In Seattle, LEAP has had trouble publishing information to help inform community members about sanitation preparedness because multiple local publications don’t want to print material dealing with human waste disposal, even though this knowledge could potentially help to avert a public health crisis. Correct disposal of human waste also bears directly on the quality of local water source available in a disaster, which is a resource identified by survey respondents as a place they might turn for drinking water in an emergency. However, emergency sanitation is “one of those topics people don’t want to talk about,” which makes the work of disaster preparedness planners and organizations even more difficult.

Dependency on infrastructure

Some interviewees noted that the items with which people were least prepared with according to the survey were those they typically rely upon utility infrastructure and services to obtain, including water, communication, sewer, and power.

Water

As previously noted, many people responding to the survey indicated a potential reliance on local bodies of water as a potential source of water in an emergency. Interviewees also noted that most households did not have an adequate supply of water stored for even a week. This was widely viewed as a communication gap, as both disaster preparedness planners and volunteer coordinators recognize that water bodies might become polluted with toxins and potentially fecal matter after an earthquake, rendering them unsuitable to serve as a source of drinking water. One planner hoped that local bodies of water would be used only as a “last-resort source” of drinking water.

Communication

Post-earthquake communication was also noted as a gap. Interviewees were concerned about the ability of people to get and share information. Some noted that ubiquitous reliance on cell phones and the increasing rarity of landline telephones means that people are reliant on both the power grid and cellular networks for day-to-day communication. In addition, it can be difficult for volunteer organizations to know which communication system to adopt and learn (e.g., ham radio vs. General Mobile Radio Service), as agency guidance has changed over time. Although Grays Harbor County Emergency Management strongly encourages area residents to have NOAA weather radios for emergency communication, they noted that the radios are not particularly easy for people to use.

Interviewees in all communities noted the general dependency on cell phones and internet-based communication, voicing concern that people might not have alternative means to communicate. In the absence of cell towers and cable, Westport anticipates relying on the regional fire district and emergency management services to connect with the outside world. South Park volunteer coordinators, whose primary form of communication with local residents is text messaging, were unsure how they would reach their community in the event of a disaster: "I have no idea. I mean, probably [we would be] biking around and reaching out to people."

Sanitation

In regard to sanitation, interviewees from all of the communities noted that not having a plan for handling human waste in a disaster constituted a serious gap in preparedness given that many survey respondents indicated they might use the outdoors in the absence of a plumbed facility. In Seattle, Seattle Public Utilities previously gave guidance for people to do exactly that, albeit providing they buried their waste in a proscribed manner. However, the thinking on this has changed, and the messaging has yet to catch up. Interviewees in all communities were concerned about the potential public health problems that might arise if local waterbodies were to become contaminated by human waste.

Power

Providing backup power poses a challenge for communities, and interviewees noted that people will want a place to charge items like phones or potentially medical devices in an emergency. While many interviewees had considered getting generators, they are a somewhat complicated alternative because they are relatively expensive and require fuel. In addition, they present some potential safety risks, such as carbon monoxide poisoning, fires, and burns. LEAP members noted they had been exploring a battery generator option as an alternative to a gas-powered generator. Westport interviewees observed that while some residents have backup residential power systems, no options currently existed for community-wide backup power.

Many noted the widespread reliance on systems that typically support the distribution of essential resources, such as cold food storage, on power. Another critical service that relies on power is the distribution of medications through pharmacies. One Seattle volunteer noted that pharmacies are unable to distribute prescription medications without power systems in place.

Potential interventions

Communication/coordination

Messaging to the public

Several interviewees believed the survey data could help to support disaster preparedness education and coordination in the study communities. Some suggested that if the public were aware that a large number of people within their community also planned to rely upon the store for essential resources in a disaster they might think more carefully about the state of their own household's preparedness. They also saw value in clarifying to the public how some of the decisions they might make in a disaster might have unintended consequences – for example, how human waste is disposed of has a direct effect on water quality. Westport interviewees in particular suggested it would be useful to share the results with governing bodies and organizations that would play a role in disaster response, including the City

Council, Chamber of Commerce, County administrators, the Coast Guard, the State Patrol, first responders, the VFW, and churches.

Outreach to vulnerable populations

Interviewees also noted the need for special outreach to vulnerable populations such as the elderly, who may have issues using technology and accessing information about preparedness; low-income ethnic minority communities who are more likely to live in vulnerable structures susceptible to damage in an earthquake; and undocumented persons who might be frightened of interacting with government agencies or asking for help. In Westport, which hosts thousands of tourists at a time during some parts of the year, preparedness information also needs to be communicated to those visiting the area who might not be familiar with local hazards. This could potentially be accomplished through outreach to campgrounds and restaurants as well as motels and other tourism-based businesses.

Coordination with utility providers

Westport interviewees in particular felt it would be a good idea to have a conversation with the local utility district to understand how resilient the city's power grid might be in the event of a disaster. They also noted the need to research realistic power alternatives. One Seattle interviewee saw an opportunity for including messaging about both preparedness and how alternative services might be provided after a disaster into regular communications from utility departments, such as monthly billing statements.

Coordination with businesses

Building relationships with the business community has been a key aspect of South Park's mutual aid work of connecting people with local resources. Laurelhurst volunteers have recognized the value in involving business owners in preparedness organizing and have begun to do outreach to this end, hoping to appeal to their values of community responsibility while also demonstrating the potential mutual benefit of working together with LEAP. The City of Seattle's Office of Emergency Management is also beginning to engage in outreach with community businesses to talk about disaster preparedness.

Conducting an inventory of local businesses could help to identify potential alternative sources of essential resources within each community. For example, South Park is home to a portable toilet supply company, which could potentially help to arrange for alternative sanitation facilities after a disaster. Some interviewees also noted that vacant warehouse space presented an opportunity for storing emergency supplies.

Interviewees pointed out that although grocery stores and restaurants might not have power service available, they would still have supplies of food that could be distributed in an organized manner. Municipalities could develop MOUs with local store and restaurant owners that could help enable them to open their doors and share what was available, potentially with a "limited supplies policy" to prevent stockpiling. One Westport interviewee noted that in the absence of panicked buying, the city's lone grocery store might potentially sustain the city's population for up to one week.

Stores were also recognized as natural gathering places and good locations for sharing information and communications because they are, as one interviewee put it, "where the grapevine is going to grow." One Seattle store owner offered to post any communications that come to the local emergency hub on

their windows and reader board, suggesting that if stores are the places people anticipate going in a disaster, they should also be among the places to receive emergency communications.

Coordination with community organizations

The City of Seattle's Office of Emergency Management is in the process of developing a more robust community outreach process that includes facilitated discussions with communities to get local input on plans and fill in education gaps. They see value in helping local organizations like food banks and churches to provide the services they already provide on a daily basis so they can serve their constituent populations in the case of a disaster, noting that the emergency hubs concept adopted by many Seattle neighborhoods is not relevant to all places. In addition, although the idea of hubs has been around for more than a decade, they have never needed to activate and so remain a somewhat abstract concept. The City is interested in broadening the concept of the emergency hubs in a way that empowers existing community organizations that are already well-known to locals to serve as a kind of emergency hub, potentially providing education and training relevant to disaster preparedness but also useful in an everyday context, such as CPR and bleeding control. In addition, it would likely be easier to connect residents with local organizations that already serve a variety of needs within their community, including disaster preparedness, than with an organization dedicated to the sole purpose of preparing for disasters that might not feel as relevant to everyday life.

Cultivate South Park has already demonstrated the potential value of this kind of approach. Their primary strategy in connecting people with needed resource was to invest in community networks before focusing on procuring material resources. As one interviewee stated, "because we focused more on the organizing than on the relief, we have a really great network that is being activated." Nonetheless, Cultivate South Park and other local organizations feel their capacity could be expanded into areas like disaster preparedness outreach and education with sustained support from the City of Seattle to help staff some of their efforts, so they are not reliant solely upon the generosity of volunteers and donors.

Westport interviewees expressed establishing a version of community hubs similar in nature to Seattle's existing emergency hubs – designated locations at identified gathering places in different sectors of the community where people could gather to support one another and share information. These hubs could then be supported by pre-established community taglines coordinated to relay information in the event of a disaster.

Built environment

In Seattle, on the other hand, interviewees identified two opportunities for incentivizing steps toward a more resilient built environment. One suggested further incentivization of residential seismic retrofits, noting that homes that haven't been retrofitted are more likely to sustain utility damage and/or become uninhabitable in a disaster scenario. Another suggested incentivizing the inclusion of resilience features in new construction in much the same way that sustainability features that support energy savings and improved indoor air quality. This could take the form of including a continuously circulating water storage tank in a lower-level storage area or parking structure and could be demonstrated as a pilot project with Seattle Public Utilities.

In Westport, the construction of specialized facilities that can elevate people above the destruction of a potential tsunami have been a primary focus of local disaster preparedness efforts. The community is

currently in the process of applying for FEMA funding for a second vertical evacuation facility that could be constructed in the city's business district and near areas heavily used by tourists – areas from which it might not be feasible for people to reach the existing vertical evacuation facility in a short amount of time. Although the facilities are built with a specific purpose in mind, they are intended to be multifunctional. The first vertical evacuation facility was integrated with a new elementary school and sits atop the gymnasium roof. The new vertical evacuation structure will be designed to accommodate a shortwave radio system and communications antenna as well as storage space for needed equipment, water, and food supplies for people who take refuge there. A third potential facility could be integrated into a new municipal building housing city administration, City Council, the Police Department, and public space that could accommodate emergency sheltering and supply storage. Additional future structures have also been identified as natural places in which to store preparedness supplies. In order to help with the financial strain of the design and construction of the new facilities, one interviewee suggested considering a public-private partnership model for financing future structures, which might include the integration of a revenue-producing experience. Such a model could act as an investment in the future safety of the community as well as increase awareness of local hazards and disaster preparedness measures.

Social infrastructure

The interviewees generally expressed surprise that more people did not indicate they expected to turn to local social infrastructure – places like community centers, libraries, churches, or schools, in the event of a large-scale disaster. They recognized such institutions as places to potentially access power or Wi-fi, to share information, or to seek shelter or restroom facilities. One interviewee pointed out, however, that community institutions tend to have limited staff and resources, which might pose a barrier to opening those facilities to the public in the event of a disaster.

Churches were identified as community institutions that are in some cases in the midst of a transition away from the center of community social life and could potentially be approached to play an expanded role in community disaster preparedness and response. The physical infrastructure of the church could potentially be used to provide emergency shelter and feeding. The social infrastructure of the church could provide a setting for the dissemination and discussion of disaster preparedness information as well as potentially help to identify and help develop plans to support people who might be in need of extra assistance in an emergency scenario.

Another community institution that holds promise for potential coordination around local disaster preparedness is schools. In Westport, the elementary school is the center of community life as well as the site of the tsunami vertical evacuation structure, the city's most prominent manifestation of preparedness. Generally speaking, schools contain gyms and classrooms that could shelter large numbers of people; kitchens and food supplies that could potentially help to feed the community; and showers and sanitation facilities that could be shared in a time of need. However, this would require cooperation and partnership on the part of the school district, which would likely require an investment in relationship-building. In Seattle, for example, such a partnership has not yet been established.

COVID experiences of the study communities

It is perhaps impossible to consider preparedness for or response to any kind of disaster at this point in time without framing it in the context of the ongoing COVID-19 pandemic. This study began before the

onset of the COVID-19, and the surveys were administered before the crisis developed into a global pandemic. However, these interviews took place nearly a year into the pandemic, at a time when our current and ongoing experience with the effects of COVID-19 has given us much to think about in terms of how to prepare for and respond to any future disaster. As one interviewee put it, “[the pandemic] was a bit of a ‘dress rehearsal’ – a mini disaster.” Many interviewees shared that their planned disaster preparedness work had been derailed by the pandemic, particularly in the areas of public outreach and coordination.

Although some online social platforms like Nextdoor developed tools with the intention to help people to connect, LEAP found that once those tools became available, “the clusters sort of stepped back from [connecting people with resources] in our neighborhood,” suggesting that while the online platforms might be providing a valuable service, they might also be taking the place of relationship-building efforts that would otherwise occur more directly between community members. LEAP members also found that the pandemic disrupted their work significantly, and that outreach and messaging have been difficult. They have also found that in-person meetings are important for effective communication. “COVID year just isn’t a normal year,” lamented one interviewee.

South Park residents expanded mutual aid efforts to help meet community need during the pandemic. When local institutions like the school, community center, and library closed at the beginning of the pandemic, Cultivate South Park organized a food market in the parking lot behind Resistencia Coffee, a local coffee shop and valued neighborhood institution. A combination of grant funding and donations from Food Lifeline have helped to stock the market, and local businesses have chipped in to donate food to the volunteers staffing the effort. Cultivate South Park has organized 200 families in a bilingual text messaging system to alert them about food opportunities in the neighborhood. In order to support local food security beyond the weekly market, a group of neighbors joined together to form the Urban Fresh Food Collective (UFFC), whose mission is to increase access to healthy food in South Park by mobilizing neighborhoods resources. The organization instituted a neighbor-to-neighbor food sharing system that stocks food and hygiene products at five volunteer-managed locations throughout the neighborhood. They also provide regular “community dinners,” prepared hot meals three nights a week available for pickup or delivery. UFFC raised more than \$20,000 to sustain the effort through a Venmo account funded by the community.

Westport interviewees described the initial stages of the pandemic as a period of adjustment; schools adapted, the medical community adapted, and the stores were able to stay open and stocked. Area churches, food banks, senior centers, the local Community Emergency Response (CERT) team, and the school all worked to deliver meals to people who needed them, and volunteers gave people rides to their doctors’ appointments. Perhaps the biggest challenge faced by Westport community members was the influx of people from outside areas traveling to the community for its outdoor recreational amenities. Restaurants and motels scrambled to make adjustments in order to accommodate the unexpected numbers of visitors, and resources in area stores were stretched thin.

COVID lessons learned

Several interviewees felt the experiences of their communities during the COVID-19 pandemic offered lessons learned that could be applied in other disaster scenarios. Said one, “I think it will have permanently changed the way that we think about things like being prepared for a disaster.” Among the themes that stood out in our discussions were realizations of how much could be accomplished through

community organization, renewed appreciation for the ability of local institutions to reach a wide range of people, and the recognition that the pandemic presents an opportunity for rethinking standard approaches to disaster preparedness.

Doing a lot with a little

South Park's UFFC has been feeding 375 families five times a week for the past year "on a shoestring," supported by neighbors, volunteers, two paid organizers, and a text messaging system. Although the effort has been successful in connecting neighbors with food, organizers admit it will be difficult to continue the food sharing in the long term – after the pandemic is over – due to the effort required to keep it up and running. But the effort was borne out of necessity, and community members feel it foreshadows what is likely to happen in an earthquake scenario: "It took too long for people to come help with food in this neighborhood, you know? And it will be exactly the same with water and shelter and medical supplies [after an earthquake], all of those things. For folks to think differently...won't be helpful at that time. We can do better as a neighborhood to more fully support each other."

Appreciation for local institutions

Interviewees noted the key role local institutions and organizations have played in connecting people with essential resources during the pandemic. In Westport and the South Beach community, food banks rose to the challenge, which demonstrated "how much community-engaged groups are really what keep the community going because they have the [social] ties, and they already have a reputation within the community." Schools also expanded their role by delivering food, providing families with educational resources and support, and in some cases helping to connect families with mental health or medical care. Local institutions are already established in people's daily lives, and they are also able to reach some groups of people, including higher-risk individuals that might not otherwise ask for help, more effectively than can government and larger organizations.

Seizing the opportunity of COVID

In both Seattle and Westport, interviewees suggested it would be helpful for communities to come together and discuss ways in which experiences from the pandemic could be used productively, potentially in community forums or other kinds of collective learning forums. "It's a moment to capture, to say, 'here's what we've learned,' so that we can share how we can go forward," noted one community volunteer. Some interviewees voiced a desire to work on rebuilding relationships and re-engaging in preparedness initiatives that were disrupted during the pandemic, but with a more holistic focus on community well-being.

In 2020, the City of Seattle's Office of Emergency Management administered a survey asking people in Seattle about their experiences with the COVID-19 pandemic. They found that while 63.6% of the 3,327 people surveyed participated in at least one activity with neighbors during COVID, 27.5% wished they had created an emergency plan with their neighbors before the pandemic occurred, but only 7.9% actually did so (City of Seattle Office of Emergency Management 2020). One challenge moving forward will be leveraging the immediacy of the pandemic to encourage people to take preparedness actions that could yield benefits in a range of disaster scenarios, from pandemics to earthquakes to other kinds of disruptions, and not slip back into the pattern of focusing primarily on catastrophic scenarios. Said one interviewee, "I think the challenge is that despite the fact that this [pandemic] just happened, people

will quickly go back to, 'it will never happen again.' For me, I think it's re-framing a lot of our messaging about how [disaster preparedness actions] can be practical in the day-to-day."

Conclusion

The role of social ties in disaster preparedness

Social ties can connect people with needed resources in the event of a disaster, whether those resources be material, knowledge-based, or expressed as social support. The survey findings indicate that people in the study communities do expect to leverage their social networks in a time of need – social ties was one of the top responses for resource seeking across all resources, with the exception of medications. In particular, people plan to use social ties to access the resources with which they are the least prepared, such as power, water, sanitation, and communications – services typically provided through utility infrastructure. Whether or not people will have enough of those resources to spare, which the survey findings suggest is not likely, and whether they will be willing to share them are important questions (see *Chapter 6* for an exploration of willingness to share). Additionally, in order to leverage local social ties, those ties must be established in advance of a disaster.

Existing social connectivity varies among the study communities, and social networks have supported disaster preparedness in different ways. Interviewees from both South Park and Westport described their communities as strongly socially connected and were not surprised to see interview respondents' anticipated reliance on social ties. In terms of social capital, one South Park interviewee proudly noted, "We're through the roof!" It is possible that South Park's physical isolation might in some ways bolster its social connectivity. "People are super friendly here because there isn't much of a reason to come to South Park," explained one interviewee. "So, if you're here, you either live here or work here or something, right?" The community has been successful in pulling residents together to contribute to mutual aid networks benefitting neighbors in need during the COVID-19 pandemic.

Westport interviewees described their community as "tight knit," and a good context in which to prepare for disasters because, "people all already look out for one another." Indeed, members of the community pulled together and voted to tax themselves to build a vertical tsunami evacuation structure at the local elementary school when they were unable to obtain FEMA funding to do so. Westport interviewees also noted the small size of the community and the presence of multi-generational residents as potential assets in a disaster scenario.

While Laurelhurst volunteer organizers viewed the survey responses indicating dependence on neighbors, family, and friends as a positive sign regarding social cohesion, they wondered whether social ties would actually serve to connect people to the resources they might need in a disaster. They were "not sure how far the social ties [might] stretch" in such an event. However, social ties can provide other kinds of support beyond connection to material resources. The Laurelhurst business owner to whom we spoke believed that if his employees were unable to get to his store in a disaster scenario, neighbors would be likely to step in and help.

Access to local resources and disaster preparedness

Because disasters are inherently geographical, the availability of local resources shapes the options available to community members for accessing resources in a disaster, which can be illustrated by looking at the example of where respondents expected to turn for food in a disaster scenario. From the

survey, we found that although all three communities anticipated turning to the store, their secondary and tertiary alternatives differed. In Laurelhurst, these were social ties and “don’t know;” in South Park, they were local social services and social ties; and in Westport, they were “outside of the community” and social ties.

Interviewees also observed that the available options for accessing the listed resources within the study communities likely had bearing on the survey results. For example, Laurelhurst has no food bank, but it has several grocery stores, and many respondents indicated they would indeed seek food from the store. In South Park, which has no grocery store but is home to a food bank and is served by mutual aid efforts such as Cultivate South Park and the Urban Fresh Food Collective, there was higher reliance on local social services to provide food – although many respondents still listed “the store” as a potential resource. South Park’s nearest grocery stores are outside the immediate community and not readily accessible without transportation. As one interviewee stated, in terms of local alternative for access to food, “There’s no safety [net] – anything – set up.” During the COVID-19 pandemic when local food security was threatened due to the closure of public institutions, South Park residents organized to provide make sure those in need had hot meals by drawing upon resources from within the local community. Westport, which has only one grocery store, also has a food bank but does not have the kind of robust mutual aid networks that have been developed in South Park. Interviewees noted that people in the area might have additional options for accessing food due to local knowledge about obtaining sustenance by fishing, clamming or crabbing. These activities might be possible in the wake of less severe disasters, such as a major storm, but whether they might be viable in the aftermath of a tsunami is uncertain.

The places respondents indicated they would access medications and first aid supplies also reflected the resources available in the community. Laurelhurst residents, who have multiple hospitals and clinics nearby, indicated the strongest potential reliance on hospitals and clinics for medications, followed by South Park, which has a couple of clinics in the neighborhood, followed by Westport, which has a single clinic. Likewise, the communities also differed in terms of their options for accessing alternative sources of water. Access to food, water, and medications has direct bearing on everyday quality of life. When communities have limited options for accessing these kinds of resources locally, they need to spend time and money to gain access to them. This disparity of access is clearly illustrated in the options available to the three study communities. Likewise, research on disaster impacts in communities suggests that gas stations, food markets, and healthcare clinics are essential to community functioning (Alesch, Arendt, and Holly 2009). South Park and Westport, which have relatively limited access to these resources on an everyday basis, will also have fewer options available to them in a disaster scenario.

Reliance on infrastructure

While the survey results confirmed a strong reliance of all communities on physical infrastructures such as the power grid and water and sewer systems, it was clear that the communities expected much less to be able to turn to local social infrastructure – places like community centers, schools, and churches – for resources in the event of a disaster. Both of these findings were identified as gaps by the interviewees – both the over-reliance on utility infrastructure in a disaster and the under-reliance on social infrastructure.

Sustainability advocates focused on overcoming fossil fuel dependence have called for governments to develop decentralized strategies such as distributed infrastructure to enable greater local self-

sufficiency in regard to basic needs such as energy, water, and food (Newman, Beatley, and Boyer 2017). Pursuing more localized alternatives to accessing these basic resources would give communities options for places to turn in a disaster while accomplishing longer-term sustainability goals. Smaller measures, like the resilience development incentives mentioned by one of the Seattle interviewees, could also help to reduce reliance on utility systems in emergencies.

While over-reliance on physical infrastructure systems poses one type of concern, under-reliance on social infrastructure poses another. Nearly all interviewees envisioned an expanded role for community organizations and institutions in a disaster scenario while also recognizing that these organizations have limited resources with which to extend services to the community. Social science research has recognized the important role community spaces play in encouraging interactions among community members (Brower 2011). However, social infrastructure is not receiving a level of support that is commensurate with the role it plays in enhancing community life (Klinenberg 2018).

When designing the survey, we did not anticipate that “the store” would be one of the most common answers to the question about where people thought they might turn for essential resources in a disaster. Local stores and restaurants often serve as community gathering places, and businesses can also play an important role in disaster response and recovery (E. C. White 2010; Solomon and Forbes 2020). While it should be recognized that stores rely upon the same utility infrastructure systems that are likely to fail in a large-scale disaster, they could potentially serve as meeting places and as locations for sharing information within communities.

“We’re on our own”

In an extreme event like a Cascadia subduction zone earthquake, it is very likely that communities will be isolated and will need to work together in such an event. Nearly all interviewees noted that the survey response indicated people did not expect to turn to outside aid in the event of a major disaster, which was generally regarded as a positive outcome and an “enlightened response,” as one interviewee stated. This finding was regarded as evidence that messaging from disaster preparedness agencies and other organizations about needing to be “two weeks ready” had been effective, and people generally don’t expect outside help to show up immediately in the event of a major disaster. As one South Park interviewee articulated, “You have to be able to support from within. There’s nobody that’s going to come out and help you.”

The sentiment of being “on our own” was particularly strong in Westport, where the bridge connecting the community with outside areas is likely to fail in the event of an earthquake. Preparedness strategies developed within the community are evidenced by the successful construction of one large-scale vertical tsunami evacuation facility and plans for a second. The structures are designed to be as self-contained as possible in order to provide water, shelter, sanitation facilities, and food for those sheltering there while the community faces the destruction likely to accompany a large-scale earthquake and resulting tsunami. Leaders voiced uncertainty about being able to provide supplies for the Westport’s population of 2,000 people over an extended period of time, noting that the storage and maintenance⁴⁹ of water supplies alone would present a logistical challenge. The thought of being cut off from the outside world

⁴⁹ Bottled water intended for use as drinking water has a 2-year shelf life, so supplies would need to be rotated.

can feel overwhelming at times. "You could easily go, 'why does it matter?' We're just going to be stranded," voiced one interviewee. "But it does matter."

While it may be true that communities would be isolated to some extent, households within communities will not necessarily be isolated from one another. Working together to prepare as a community and bolstering shared resources could help to the community to become more prepared for disaster overall while providing households with another option for resources if others in their community do not have enough resources to share. Investing in community-level infrastructure such as food caches or backup power sources could provide an alternative source of essential items during times of disruption.

The role of urban planning in promoting disaster preparedness

In this study, we argue that as the integration of hazard mitigation planning and community planning advances, attention should be paid to the social aspects of mitigation – building social networks and supporting community social infrastructure – as well as to making improvements to the built environment and physical infrastructure that can enhance the ability of communities to adapt when needed. Urban planners have a role to play in supporting the strengthening of community social networks, as advocates for supporting community organizations and institutions as well as helping to create conditions, through spatial design and programming, under which social connections can be created and flourish. The experiences of individuals involved in both professional and volunteer disaster preparedness planning suggest there is some urgency to build upon insights gained during the COVID-19 pandemic, including the need to plan for adaptability, the importance of contextually relevant approaches, and the benefit of making disaster preparedness more relevant to everyday life.

Planning for change

Urban planning has historically been more concerned with minimizing disturbance than supporting adaptation. A more resilient approach would shift planning priorities from those that seek to control change to those that could increase the capacity of the system to adapt to change (Eraydin and Taşan-Kok 2013). While the analysis of the survey data uncovered many potential gaps in community disaster preparedness, the interviews elicited a number of opportunities for enhancing community adaptability and planning to cope with change, including coordination between governments and local utility companies to strategize about alternative service; developing MOUs with local restaurants and other businesses who could provide needed resources; supporting community organizations to build place-based social networks; and expanding the role of local institutions and facilities in planning for disaster preparedness.

Community-scale and community-led strategies

Social policy focused on supporting community infrastructure has been shown to be more effective at addressing inequality than interventions targeted at individuals (R. J. Sampson 2012). However, although the community organizations that provide services for vulnerable populations are often inherently resilient and adaptive, they are often overwhelmed by day-to-day demands and are themselves not well-prepared for disaster (Tierney 2014). The findings from this study suggest that a top-down, one-size-fits-all approach to disaster preparedness is not appropriate and that strategies should be developed from the ground up in order to appropriately address community needs and leverage existing social networks. This kind of approach would entail building capacity in community organizations so they

could take on a more prominent role in connecting people with information about disaster preparedness as well as be able to supply them with needed resources in a disaster scenario.

Making disaster preparedness more relevant to everyday life

The COVID-19 pandemic has served as a stark reminder that disaster, although its effects may be differentiated socially and geographically, can affect everyone. It also might arrive in a form we do not expect and have not planned for. Learning from challenges faced during the pandemic could help to normalize both disaster preparedness planning and help to overcome the kinds of communication hurdles identified by the interviewees. Disaster preparedness planners can work together with local organizations and businesses, leveraging their networks and reputations within communities while supporting broader community outreach about disaster readiness.

6. Anticipated willingness to share resources in a disaster scenario: the role of social ties

Introduction

In a disaster response and recovery context, most of the current research on resource sharing assumes a top-down, centralized approach to resource allocation. There is a gap in knowledge in terms of how to share resources among community members when those resources belong to individual community members as opposed to being located in a centralized location. In this context, community members' willingness to share becomes an important factor for exploration. Willingness to share is especially relevant given the isolating effects of certain types of disasters, such as large-scale earthquakes, on communities and the subsequent need for localized self-sufficiency. Understanding personal motivations, as well as personal and household characteristics, influencing willingness to share is important given the diversity and potential complementarity among households in terms of the resources they possess.

Through this study, we aim to better understand context-specific factors influencing willingness to share that could help to inform community-based disaster preparedness efforts. We specifically explore the relative importance of the strength of the social ties connecting the resource provider with the potential recipient as well as attitudinal factors such as trust and household characteristics. We address the gap in knowledge about willingness to share household resources using a mixed-methods approach informed by a sample survey and follow-on focus groups with survey participants in three characteristically different Washington State communities. This research builds upon a pilot project investigating willingness to share and social ties within one of the three study communities (Idziorek, Chen, and Abramson 2020).

Our motivation for working at the community scale is driven in large part by the anticipation of a large seismic event in the Pacific Northwest. In the case of such an event, communities will likely be on their own for an extended period of time with limited ability to carry out everyday activities, and they may need to rely on local resources for meeting basic needs. The community scale is also relevant because many government-led disaster preparedness campaigns target the individual or household level and do not address preparedness actions that people might take collectively to prepare their community for disaster. We ask participants about their anticipated willingness to share a range of resources needed to carry out essential everyday activities, in order to understand how willingness to share might differ by resource. Based on a synthesis of our quantitative and qualitative findings, we present a conceptual model of factors influencing willingness to share resources in a disaster scenario.

It is human nature to share, even – and perhaps particularly – in the aftermath of a large-scale disaster (Solnit 2010). However, clear gaps exist in the understanding of social behavioral responses to resource scarcity in a disaster scenario, including resource-sharing within communities (J. A. Thomas and Mora 2014). This study contributes to advancing this exploration by focusing in more detail on anticipated willingness to share specific types of disaster resources. In addition to addressing this gap in the literature, our findings can be applied practically by disaster preparedness planners and community-based organizations seeking to prioritize the distribution or development of disaster preparedness resources within community settings.

Research questions

To explore willingness to share from the perspective of a community network of actors, social ties, and resources, we investigate the social and attitudinal factors that shape community members' anticipated willingness to share essential resources in a disaster scenario by asking the following questions:

- How does the strength of the social tie connecting the provider and the receiver affect the provider's anticipated willingness to share different types of essential preparedness items with others in their community in the event of a disaster?
- What provider attributes related to disaster preparedness and social connectivity (such as household preparedness, local social network size, time spent with neighbors, and trust) are correlated with anticipated willingness to share?

The answers to these first two questions are derived from a three-community sample survey (see *Chapter 3*). To help us better understand the potentially nuanced answers to the final question, below, we convened a focus group in each of the three study communities. Through these focus groups, we gathered qualitative data on potential motivations behind anticipated willingness (or non-willingness) to share different resources in a disaster scenario.

- What motivations and beliefs underlie people's anticipated willingness (or non-willingness) to share essential resources with others in their community in a disaster scenario?

Literature review

Willingness to share in disasters

In a large earthquake scenario, people are likely to have limited access to – and a limited supply of – resources needed to carry out essential everyday activities. These resources range from items that provide sustenance, like food and water, to systems that enable transportation and communication. In this study, we examine specifically the differences of community members' willingness to share various items needed to carry out essential everyday activities and the role that strength of social ties plays in that willingness to share. While the sharing of resources among non-profit and disaster response organizations has received much attention (Pazirandeh and Maghsoudi 2018; Setiawan 2016; Kapucu and Garayev 2011; Hossain and Kuti 2010), there is little mainstream urban planning research that addresses willingness to share resources needed for disaster preparedness from the perspective of community members or the potential implications for planning practice.⁵⁰

Some studies have addressed willingness to share resources at the organizational level. In one study of interagency cooperation during disasters, researchers found communication and trust building to be critical pre-work for the support of effective decision making and sharing of resources (Kapucu and Garayev 2011). After the 2010/2011 earthquakes in Canterbury, New Zealand, the exchange of information and resources between organizations in a post-disaster context was found to be facilitated and encouraged by trust (Stevenson and Conradson 2016). In another study of interactions between organizations, researchers found that resource sharing across organizations can help to support

⁵⁰ In searches of JAPA, JPER, and JPTP, the phrase "willingness to share" does not turn up any articles about resource sharing in a disaster context (and few articles in total).

coordination, and that organizations with complementary resources are both more interdependent and more willing to share resources (Pazirandeh and Maghsoudi 2018).

In a consumer behavioral context, willingness to share personal items (e.g., as part of the sharing economy) decreases as social distance increases (Schreiner, Pick, and Kenning 2018). Although the same might be true of individuals in disaster situations, it is possible that different behavior patterns might occur given the uniqueness and unpredictability of the situation. In one study of people's anticipated post-disaster social behaviors and expected survival adaptations in New Zealand, researchers employed a simulated scenario, finding that as time passed after a simulated disaster, people anticipated being less likely to offer assistance to or share resources with others and more likely to ask for help or to lie about their personal level of resources (J. A. Thomas and Mora 2014).

In a qualitative study of disaster preparedness among aging populations in Australia, Blakemore and Bevis found that older people tend to be willing to share both experience and resources in disaster scenarios, highlighting their role as critical community assets (Howard, Blakemore, and Bevis 2017). While this study identified willingness to share as a theme of discussion relevant to disaster preparedness research, it did not present empirical findings specific to the topic of resource sharing. Researchers comparing patterns of resource sharing in tsunami-affected Indian communities found that sharing networks comprising kin were not as successful as those that were more corporate (non-kin) in nature (Chandi, Mishra, and Arthur 2015), suggesting that willingness to share might be enhanced by the presence of more broadly defined social structures beyond the family or household.

The concept of willingness to share is being explored in a developing area of research on the potential of the sharing economy to provide temporary shelter and/or transportation resources in the case of a large-scale disaster. A series of studies on the potential role of transportation network companies (e.g., Lyft, Uber) and home sharing platforms (e.g., Airbnb) in disasters has explored experiential and attitudinal factors related to willingness to share via these types of sharing platforms in evacuation scenarios. A study of 645 people impacted by Hurricane Irma in 2017 found that some respondents would be willing to offer transportation before evacuating (29.1%), transportation while evacuating (23.6%), and shelter (19.2%) via sharing platforms in a future disaster (Wong, Walker, and Shaheen 2020). In a study of people who actually evacuated from Hurricane Irma in 2017, spare capacity was found to have a positive but insignificant impact on sharing, while families with children were found to be less willing to share and people with previous experience sharing homes were found to be more willing to share (Wong et al. 2021). In a survey of individuals impacted by the 2017 Southern California Wildfires, high trust in neighbors and strangers, past disaster volunteer experience, and community organization membership were found to increase willingness to share shelter and transportation, while spare capacity of resources (seatbelts and beds) were found to be insignificant (Wong, Walker, and Shaheen 2021). Although the sharing economy has the potential to supplement some public resources in the case of a disaster, many vulnerable groups still have challenges procuring basic resources, such as transportation and shelter (Wong, Broader, and Shaheen 2020).

While this last series of studies sheds some light on both practiced and anticipated sharing behavior in disaster scenarios, they are focused on evacuations. In a large-scale earthquake scenario, the infrastructure on which sharing economy platforms rely may not be functional. However, some lessons learned from this research have the potential to also be relevant in an earthquake scenario, such as the effect of trust and other behavioral factors on willingness to share.

Social trust, social ties, and sharing

Trust plays a key role in the functioning of society and provides a necessary precondition for sharing and exchange. In his book *Social Networks and Trust*, Buskens argues that in modern society, trust serves three functions: facilitating cooperation between individuals, maintaining social order through the development and enforcement of norms, and reducing the complexity of modern life (Buskens 2002). This reduction in complexity is increasingly necessary as society becomes more and more dependent on abstract and networked sociotechnical systems. These abstract systems embody the expertise that lies beyond any one person's individual grasp, but upon which we depend in order to engage in day-to-day activities (Giddens 1997). Therefore, as society has become more complex, social trust has become more important (Earle and Cvetkovich 1995). Trust can help to build social capital, thereby enabling societal flexibility and creating the conditions necessary for the enhancement of adaptive capacity, or the ability to adapt to change (Adger 2003). In a society that is becoming organized more informally (horizontally) than hierarchically (vertically), trust is particularly important as an enabler of collective action (van Ark and Edelenbos 2005).

Trust supports cooperation at the network level by facilitating actions of sharing and exchange. Trust influences outcomes for actors in a network based on the extent to which it is able to facilitate sharing or exchange, making it a core component of social capital (Prell 2012; Leyden and Goldberg 2015). Trust is both a necessary condition and an outcome of cooperation (Hardin 2001), and trust among members is necessary for the emergence and subsequent maintenance of social networks (Blumberg, Peiro, and Roe 2012). Although trust involves risk-taking in situations of interdependency (Buskens 2002), it also enables individuals to develop relationships with strangers by reducing transaction costs for collaboration in the absence of personal familiarity (Torche and Valenzuela 2011).

Sharing can take different forms in a group or community setting. Transactions in which a person gives something of value without direct reciprocation (but with an expectation of being paid back in the future in some way by someone else) can be characterized as generalized exchange (Whitham 2018). Generalized exchange occurs when people place trust in a social system (such as a community) and its associated norms rather than on any particular individual. Practices of generalized exchange enhance social capital and reinforce prosocial behavior at both the individual and collective levels. While the indirect reciprocity that occurs as part of generalized exchange does not require a personal relationship between the provider and the recipient, it is often reinforced by shared social identity (Whitham 2018) – living in the same neighborhood, for example.

Reciprocal exchange occurs when individuals trade resources with one another directly. At the level of the individual, investment in social relations can help to build mutually reinforcing patterns of trust and reciprocity within a social network that in turn build and strengthen social capital (Lin 2001; Green and Haines 2016). People tend to trust those with whom they have ongoing relationships, and reciprocity occurs in networks in which social ties have already been established (Hardin 2001). The occurrence of reciprocal behavior is a sign that social ties have been strengthened and that relations between strangers have been transformed into personal relationships (Torche and Valenzuela 2011).

The conditions of social trust that facilitate exchange are also supported by connections between people and place. 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, to build connections between individuals within a community, and to enhance social trust (Payton, Fulton, and

Anderson 2005; Manzo and Perkins 2006; Stefaniak, Bilewicz, and Lewicka 2017). Longer community tenure supports the development of larger neighborhood social networks and a stronger sense of community, which in turn leads to greater willingness to cooperate and increased participation in community initiatives (Brower 2011).

Methods

This study followed a sequential mixed methods research design comprising a primarily quantitative sample survey followed by a series of focus groups designed to collect qualitative data on willingness to share.

Sample survey

See *Chapter 3* for details regarding the design and implementation of the sample survey.

Focus groups

Focus groups offer an efficient approach for expanding one's understanding of a situation (Zeisel 2006) and can be used to better understand the complex values and beliefs that underlie behavior, motivation, and decision-making (M. A. Carey and J. Asbury 2012; Krueger and Casey 2015). In this study, focus groups were used to further elaborate upon the data gathered from the community resilience sample survey. In particular, we were interested in understanding individuals' motivations for being willing – or not willing – to share resources in a disaster scenario. Although the focus groups were originally planned to take place in person, we moved to an online format due to the circumstances of the COVID-19 pandemic and the importance of not exposing any research participants or anyone on the research team to potential risks associated with in-person gatherings. The recommended number of participants for online focus groups is 4-6 people, a slightly smaller number than for typical in-person groups, because it is more difficult to keep track of participants who cannot be seen (Bloor et al. 2001).

Online focus groups have some advantages in that they tend to take less overall time and cost less than in-person focus groups. They are also more convenient for researchers and participants because they don't involve travel – which also increases the potential to reach dispersed or immobile populations that might otherwise be difficult to gather for a group discussion (Barbour and Morgan 2017; Rupert et al. 2017). Online videoconferencing platforms used for focus groups often have built-in data transcription tools, which can ease the task for researchers.⁵¹ Because of the relatively distanced interaction between the facilitator and the participants compared to in-person focus groups, online focus groups tend to reduce the potential for “interviewer effect” – the influence on response caused by the interviewer's social presence and questioning style – and may encourage people to reveal more information on sensitive topics (Bloor et al. 2001; Gaiser 2008).

Weaknesses of online focus groups include the fact that they require technical competence and familiarity with the online platform being used, and thus cause the study to inherit the population biases of internet users (Bloor et al. 2001). In online focus groups, it can also be somewhat more difficult for the moderator to detect nonverbal cues, and it can be more difficult to establish rapport with participants (Gaiser 2008).

⁵¹ Although we did use Zoom's built-in transcription tool as a starting point, we reviewed each of the transcripts in detail and edited them for accuracy.

Focus group recruitment and implementation

Focus group members were recruited from the set of survey respondents who had indicated they would be willing to be contacted for a follow-up interview and who provided an email address. We held four focus groups in total – two focus groups in Laurelhurst and one each in South Park and Westport.⁵² We planned to target between six and ten participants for each focus group.

Potential participants were sent an email invitation to participate in a 90-minute focus group. The invitation contained the date and time of the focus group, an update on the project, consent information, and the offer of a \$100 Amazon.com gift card incentive for participation. Invitees were informed that they must be at least 18 years of age to participate and must not have received more than \$500 for participating in any University of Washington research studies within the past year.⁵³ Those who replied indicating they were interested in participating received a Zoom invitation as well as reminder emails one week and two days before the scheduled focus group.

Between four and seven people participated in each online focus group.⁵⁴ The focus groups were all conducted in English and took place online, limiting the potential range of people who could participate from a linguistic and technological perspective. We chose to hold most of the focus groups on a weeknight evening, which we acknowledge might also prohibit people who work in the evenings or who might have childcare responsibilities from participating. However, using a videoconferencing format did not require people to travel in order to take part, which potentially enabled people who would not have been able to travel to an in-person focus group to participate.

Table 29: Focus group scheduling and number of participants

Community	Date & time	Number of participants
Laurelhurst	Thursday, March 25 7:00PM	5
Laurelhurst	Saturday, March 27 1:00 PM	7
South Park	Thursday, April 1 7:00PM	5
Westport	Thursday, April 8 7:00 PM	4

⁵² One additional focus group was held in Laurelhurst as a test of the protocol and questions in case adjustments needed to be made, however, no changes were needed. We used Laurelhurst as the pilot because it was the community for which we had the largest list of email contacts, and we felt confident we could populate two focus groups using this list.

⁵³ This screening criterium is motivated by the fact that the University of Washington must report payment of research participants totaling \$600 or more as Miscellaneous Income to the Internal Revenue Service for federal income tax purposes. For more information, see <https://www.washington.edu/research/hsd/special-topics/subject-payment/>

⁵⁴ Although we originally had between six and ten people signed up for each focus group, the actual participation numbers were a bit lower. The author felt that five, or possibly six, people was an ideal number of participants in order to enable everyone to participate meaningfully while still being able to manage the conversation and keep track of individual participation. Although more participants could have added additional perspectives, the group of four people still had lively and engaging conversations and shared of a range of ideas and views. The group of seven people was manageable, but each individual's contribution was somewhat limited due to the larger number of participants. These experiences were consistent with Bloor et al.'s recommendation of 4-6 people for online focus groups.

The focus groups were conducted using the videoconferencing platform Zoom and Miro, an online whiteboard platform that enables remote visual collaboration.⁵⁵ The author facilitated the focus groups, and research assistant Cristina Cano-Calhoun served as scribe to capture participant comments in Miro. Each focus group began with an introduction from the moderator, which included background information about the research, contact information for the research team, technical guidance, and a set of ground rules for participation. Participants provided statements of informed consent either verbally or typed into the chat. The focus group began with participant introductions and a statement of each person's favorite thing about living in their community. This was followed by a warm-up exercise that introduced participants to the Miro interface and asked them to talk about what kinds of things neighbors in their community might share under normal circumstances. After the warm-up exercise, participants were asked to respond to a series of questions about factors that might affect their willingness to share different kinds of resources in a disaster scenario.

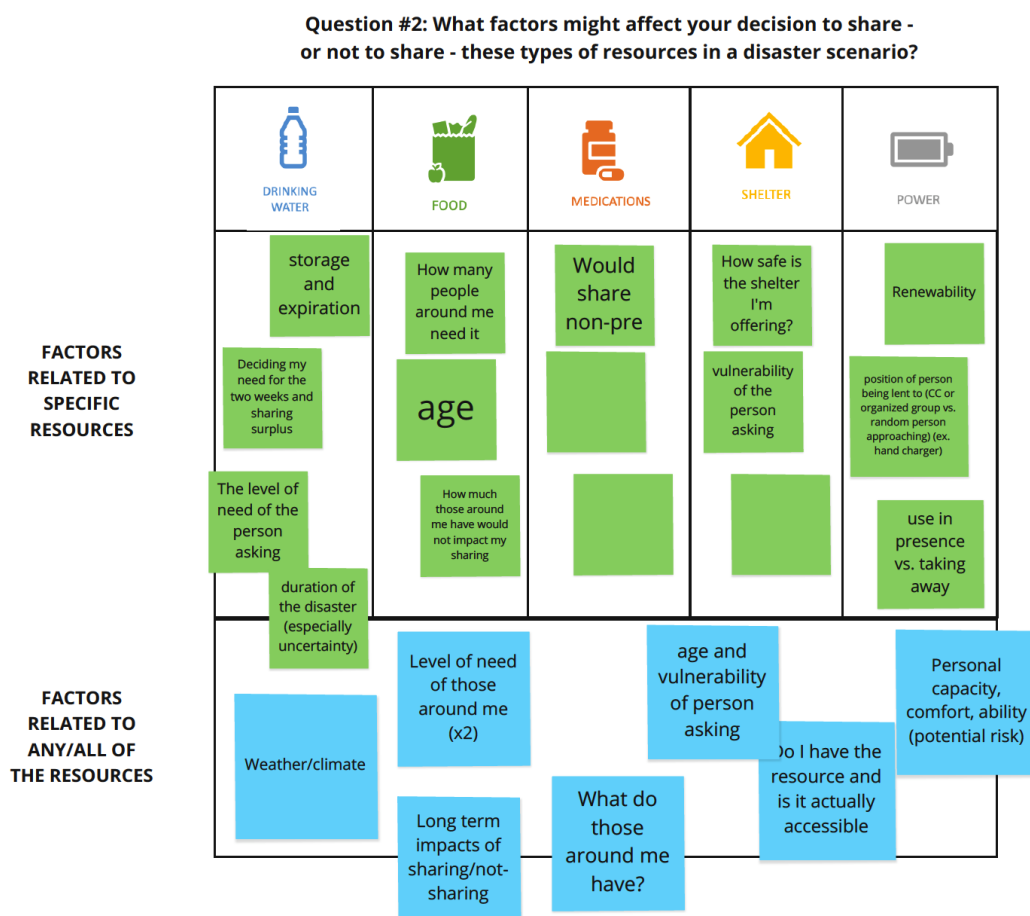


Figure 38: Screenshot of the Miro post-it board from one of the focus groups

While the focus group conversation took place in Zoom, the scribe recorded each comment on a post-it note in Miro and shared her screen so that Zoom participants could see the recorded comments. The facilitator ensured that each participant had the opportunity to provide input for each question. Participants who had not yet spoken up regarding a particular question were invited to do so, and

⁵⁵ <https://zoom.us/>, <https://miro.com>

participants were prompted to elaborate on any answers that required further clarification or explanation. Comments were organized according to a pre-developed matrix of resource types (see Figure 38). In recording the comments, the scribe took note of which comments applied to specific resources and which applied to any or all of the resources being discussed. After each focus group, the facilitator and scribe held a debriefing session, discussing themes of note and assessing whether adjustments might be needed before subsequent focus groups.

Focus group participants were invited to take a brief survey following the focus group. Participants expressed that they generally enjoyed discussing the topic of preparedness and had fun brainstorming ideas about sharing with others. Two participants noted that the groups could have been more diverse to capture a wide range of perspectives.⁵⁶ Only one participant noted they had trouble hearing some of the other participants, but stated they had no problem hearing the moderator. Most of the participants said they planned to take disaster preparedness actions, including stocking supplies, preparing with renewable resources (e.g., water filtration equipment), speaking with neighbors about preparedness, and getting to know their neighbors better. Participants were interested in learning more about who in their neighborhood might have special skills that might be useful in a disaster (e.g., medical expertise) as well as learning more about disaster preparedness in general.

Open coding

The conversation was recorded automatically within the Zoom videoconferencing platform. It was then transcribed, resulting in 71 single-spaced pages of text, and coded according to thematic content. Thematic coding provides a means of identifying and synthesizing qualitative content relevant to the research questions at hand (Bernard, Wutich, and Ryan 2017). We adopted an open coding approach, which allows for the identification of emergent themes that support theory development, as opposed to beginning with a predetermined set of themes (Khandkar 2009).

While coding, we used a multi-stage, iterative approach to 1) identify text relevant to the research question; 2) identify repeating ideas within the relevant text; 3) group the repeating ideas into themes; and 4) develop a resultant narrative (Auerbach and Silverstein 2003). The focus group protocol provided an initial structure to the data as respondents were asked specific questions about willingness to share.

In the first round of analysis, we identified selections from the focus group dialogue that related specifically to factors affecting participants' decision-making processes about sharing resources in a disaster scenario. A topical code was applied to each statement, which included information about the specific resource being discussed, if applicable. This process resulted in the creation of 86 unique codes.

In the second stage of analysis, we created code groups comprising like topics (e.g., "safety-transportation" and "safety-communication" were grouped together under "safety"), resulting in 17 code groups and 29 remaining individual codes. These codes and code groups were then organized into themes encompassing closely related content, resulting in 11 preliminary themes: familiarity, borrow vs. take, outside guidance, length of commitment, level of need, having extra, organized sharing,

⁵⁶ The author agrees with this sentiment. Less diversity in the focus groups was a product of both selecting participants from among the survey participants and holding the focus groups online. A broader recruitment strategy would be appropriate for a follow-on study investigating differences in sharing motivations among different groups. Similar themes arose in each of the four focus groups, which could provide the conceptual framework for such a study.

renewability, resource management, resource matching, and safety. The codes and quotations comprising each of these themes were visualized in a network structure within ATLAS.ti (see Figure 39).

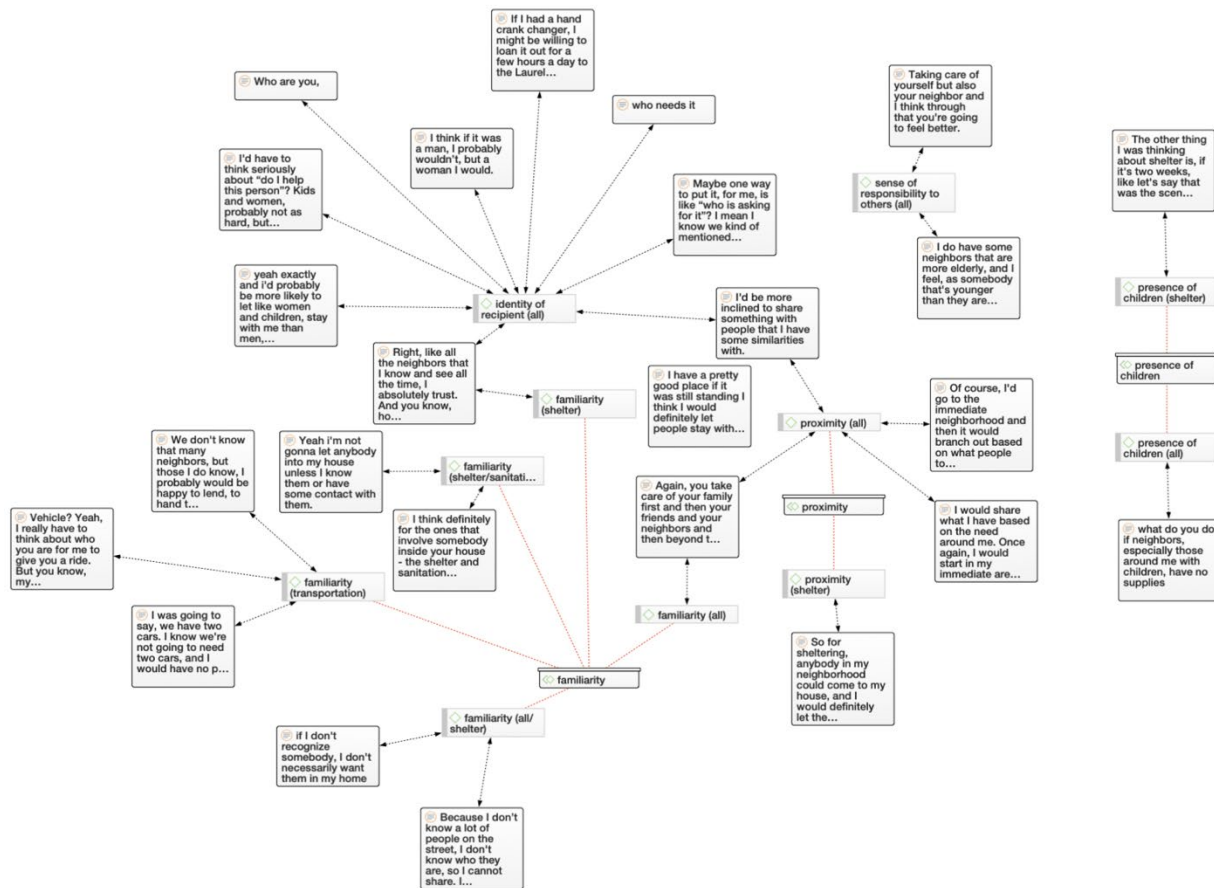


Figure 39: Example of a code network for the preliminary theme "familiarity" as visualized in ATLAS.ti

We then reviewed the content of each network diagram and created a memo for each. Memos and diagrams are working documents that serve as tools for synthesis and analysis of qualitative data (Corbin and Strauss 2008). Within each memo, we made notes about potential relationships between codes, observations about which focus groups were involved in discussion about specific topics, and suggestions for combining related themes. During this process, individual quotes were reviewed in their original context within the transcript to ensure preservation of their original intent.

Some themes were combined in the process of memo-writing. It also became clear through this process that the preliminary topical themes could be further organized into a set of overarching themes (attributes of provider, recipient, and resource; situational factors, and factors related to exchange structure), which provided the structure for the resultant conceptual model and focus group narrative.

Findings

Quantitative analysis

Community social profiles

We began the quantitative analysis by comparing community social factors (see Table 30). For the questions that were evaluated using Likert scales (e.g., willingness to share, trust, place attachment), we summed the individual responses for each item to create a continuous scale variable. Generally speaking, Laurelhurst and Westport respondents tended to exhibit somewhat more pro-social and socially-connected behaviors and attitudes than South Park respondents, with larger neighborhood social networks, more time spent with neighbors, and a greater degree of place attachment, on average. Both South Park and Westport respondents had a negative average trust index score. Laurelhurst and Westport tended to discuss disaster preparedness with more neighbors than did South Park, but this measure was very low in all three communities – people reported having spoken to less than one person about disaster preparedness in the past month, on average.

Table 30: Community social profiles

	Laurelhurst	South Park	Westport
Mean total neighborhood network size (number of people)	30	12	21
Average number of hours spent engaging in social or civic activities with neighbors in the past month	7.4	2.7	10.1
Trust index (mean, scale of -6 to 6)⁵⁷	1.48	-0.07	-0.04
Place attachment index (mean, scale of -8 to 8)⁵⁸	2.08	-1.41	2.03
% respondents who felt they could stay with a neighbor if needed in a disaster scenario	51.9%	31.6%	39.5%
Average number of people with whom respondents had discussed disaster preparedness in the past month	.77	.34	.77

Willingness to share resource profiles

To learn about the role of social ties in willingness to share, we asked survey respondents with whom they would be willing to share each of ten essential resources in a disaster scenario. The answer choices were categorized by strength of the social tie between the provider and the recipient. Respondents were asked whether they would share each resource 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 preexisting social ties). Figure 40 and Figure 41 illustrate the resultant willingness to share profiles for each resource and indicate what percentage of respondents from each of the three communities responded in each social tie answer category for each resource.

⁵⁷ Trust measures adapted from the General Social Survey (T. W. Smith et al. 2018)

⁵⁸ Place attachment measures adapted from Fornara et al. (Fornara, Bonaiuto, and Bonnes 2010)

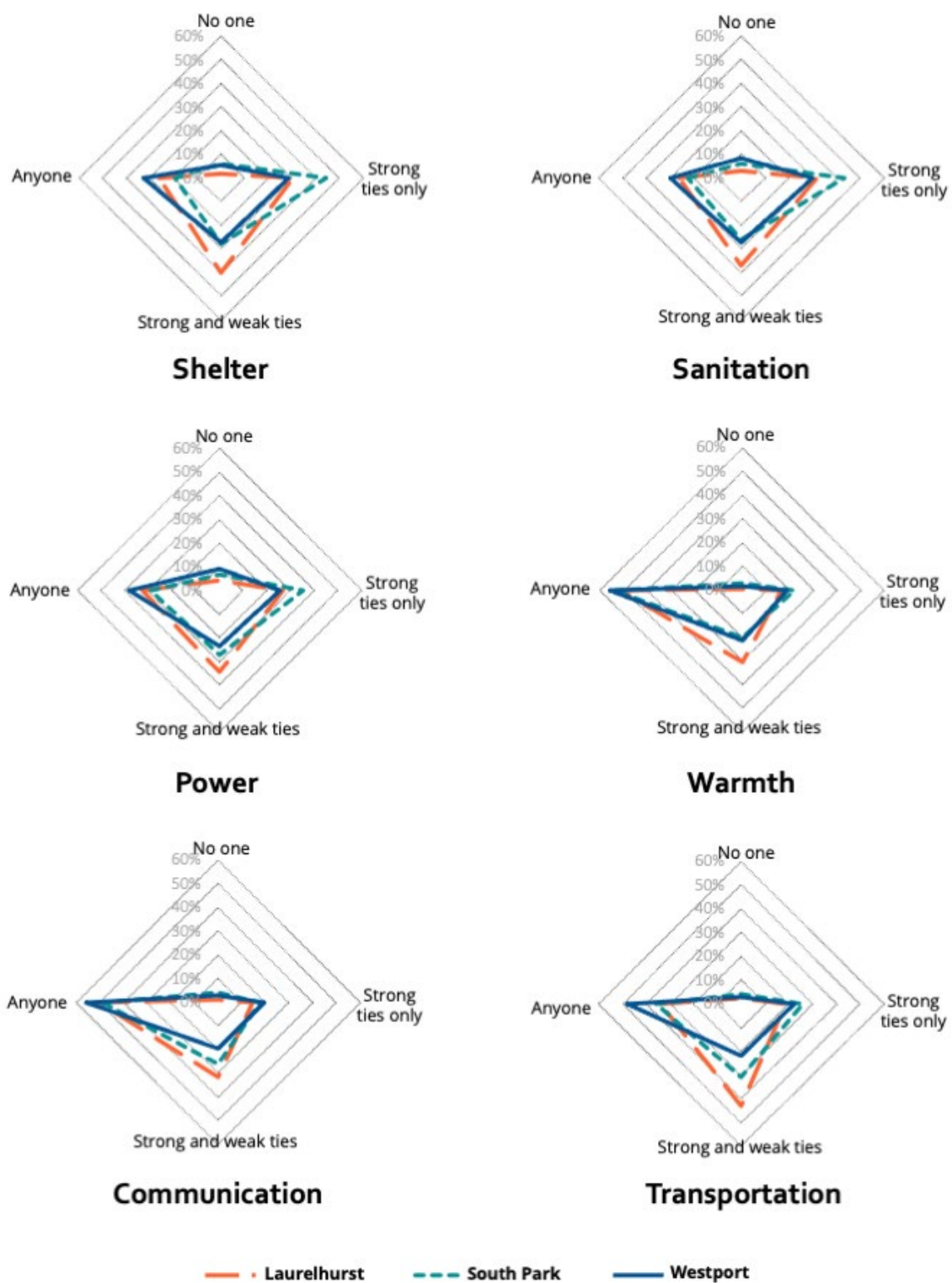


Figure 40: Willingness to share resource profiles by % respondents

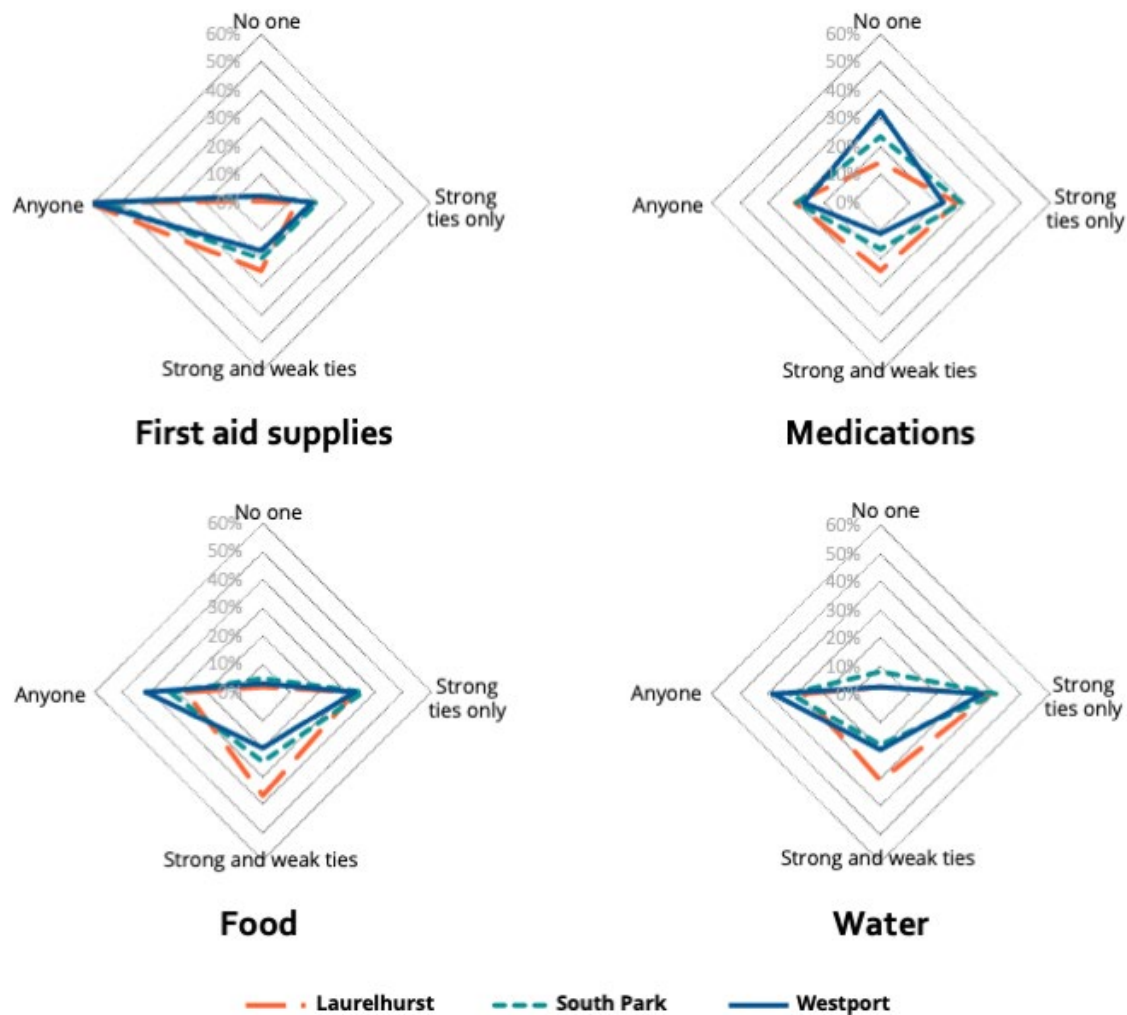


Figure 41: Willingness to share resource profiles by % respondents (continued)

The survey responses indicated that people anticipated being willing to share resources differently depending on the type of resource and the nature of their social tie to the recipient, with similar willingness to share profiles emerging for some groups of resources and some differences in willingness to share across communities.

Warmth, communication, transportation, and first aid supplies

In all three communities, most people anticipated being willing to share these four resources with anyone in need. This might be because these resources are not as critical to survival as others like food, medications, or water, and sharing them would likely not necessitate inviting people into one's home. The greatest differences can be seen in transportation, where social ties were somewhat more important for sharing this resource in Laurelhurst than in the other two communities.

Shelter, sanitation, and power

Sharing these three resources would likely entail inviting people into one's home, and responses to the survey reflect less willingness to share with people to whom the provider does not have a preexisting social tie. Having a strong social tie to the recipient was somewhat more important in South Park than in the other two communities for sharing these resources, while slightly more Laurelhurst respondents responded that having either a strong or weak social tie was sufficient for sharing. Responses from Westport residents were more evenly balanced across the social tie categories.

Food and water

Food and water are the two resource categories in which respondents were most clearly divided between willing to share with anyone and willing to share only with people they knew well – strong ties. South Park residents had a slightly higher percentage of responses in the “strong ties only” category, while slightly more Westport residents responded in the category “anyone in need.” Laurelhurst residents were more divided in their responses, with a higher share in the “strong or weak social ties” category than either of the other two communities.

Medications

Medications was the only resource category in which a relatively large percentage of respondents (14.7% in Laurelhurst, 23.4% in South Park, and 32.8% in Westport) anticipated not being willing to share with anyone. Differences between communities may have to do with area health profiles, reliance of respondents on prescription medications, and local availability of medications from hospitals, clinics, or pharmacies.

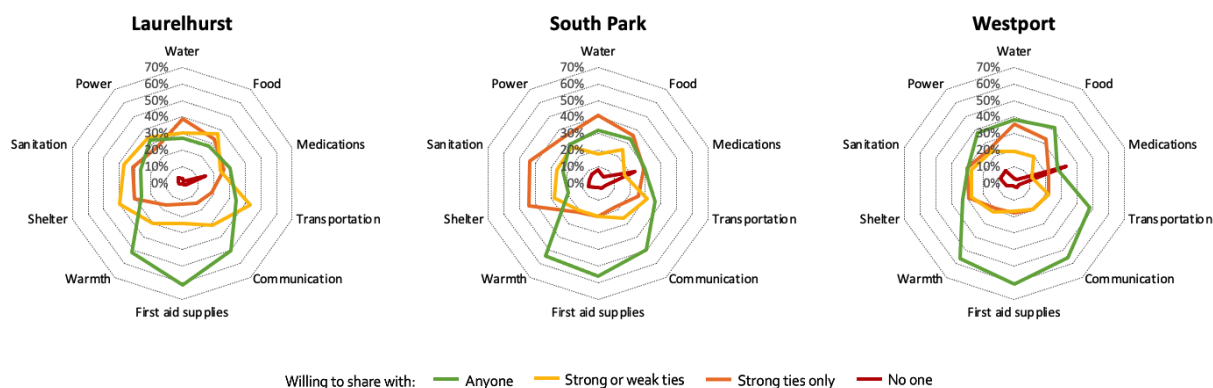


Figure 42: Willingness to share community profiles

Figure 42 illustrates the combined willingness to share profiles for all resources by community. Across all three communities, respondents were most willing to share warmth, first aid supplies, and communication with anyone in need, regardless of strength (or presence) of social tie. We can also see again that medications are the resource that people are the least willing to share with others, although only in Westport is the percentage of respondents who anticipate not being willing to share medications higher than the percentage of responses in any one of the other categories.

A comparison of the graphs indicates that a larger share of Westport respondents would be willing to share resources with anyone in need than in the other two communities (42.9% of all responses across

all resources in Westport, compared to 36.8% of all responses in Laurelhurst and 36.1% of all response in South Park). Laurelhurst had a higher share of responses in the “strong or weak ties” category (33.2%) than either of the other two communities (23.8% in South Park and 20.1% in Westport), suggesting that for situations in which the presence of a social tie is important for sharing, the strength of social tie is less important for Laurelhurst respondents than for those in the other two communities.

Correlation of individual and household factors with willingness to share

We then looked correlations between respondents’ personal characteristics and anticipated willingness to share resources (see Table 31). We evaluated the strength of association between the variables using Pearson’s product-moment correlation calculation, in which Pearson’s r indicates a weak association at 0.1-0.3, a moderate association at 0.4-0.6, a strong association at 0.7-0.9, and a perfect association at 1.0 (Dancey and Reidy 2007).

Trust was important across all communities, indicating it plays a key role in willingness to share with people to whom the respondents have varying strength of social ties. The relevance of social network characteristics varies by context; only in South Park was the association between the two variables statistically significant. The role of network size in willingness to share varies across the communities. It is possible that in South Park, where we observed lower levels of trust and social connectedness, having a larger social network is a more important factor in willingness to share resources. Place attachment had a statistically significant association with willingness to share in both South Park and Westport, but the association in South Park was weak and negative, suggesting that those who have a stronger attachment to place in South Park are actually slightly less likely to share with people they know less well than are individuals whose responses indicated a lower degree of place attachment.

Table 31: Pearson’s product-moment correlation – individual factors

	Laurelhurst		South Park		Westport	
	r	p -value	r	p -value	r	p -value
Age	.003	.959	-.133	.919	.086	.246
Gender female	.024	.702	.091	.194	.019	.800
Trust	.338	.000***	.305	.000***	.259	.000***
Time spent with neighbors	-.001	.986	.104	.144	.026	.734
Total network size	.025	.691	.203	.004***	-.019	.346
Strong network size	.012	.841	.156	.027*	-.019	.805
Weak network size	.029	.644	.169	.016*	.081	.280
Community tenure	-.038	.555	-.063	.375	0.119	.108
Place attachment	.086	.168	-.253	.000***	.148	.040*

Strength of association (r) 0.5 = moderate positive relationship. 0.2 = weak positive relationship. Correlation is statistically significant at the .05 level*; .01 level**; .005 level*** (2-tailed)

In order to understand the relationship between household preparedness with each of the ten essential resources and respondents’ indicated willingness to share those resources with a range of social ties, we calculated the Spearman correlation coefficient, r_s , which can take values from +1 to -1, between each pair of variables (e.g., “willingness to share food” and “preparedness with food;” see Table 32). The Spearman coefficient measures associations between ordinal variables – in this case, respondent reported preparedness with resources and willingness to share. A r_s of +1 indicates a perfect association, while a r_s of zero indicates no association and a r_s of -1 indicates a perfect negative association. For the most part, there was not a statistically significant correlation between preparedness with an item and

willingness to share it with others. In South Park, preparedness with water, medications, and warmth were positively (though weakly) correlated within willingness to share those items, as was preparedness with shelter in Laurelhurst. This analysis suggests that additional factors beyond household preparedness play important roles in individuals' willingness to share resources in a disaster scenario.

Table 32: Spearman's rank correlation – preparedness and willingness to share

Variable	Laurelhurst		South Park		Westport	
	r_s	p -value	r_s	p -value	r_s	p -value
Food	.011	.865	.065	.357	.136	.062
Water	.024	.701	.155	.027	.041	.587
Shelter	.190	.004	.134	.068	-.032	.682
Power	.051	.429	.185	.010	.106	.156
Medications	.039	.556	.087	.239	.014	.862
First aid supplies	.075	.241	.122	.100	.094	.209
Communication	.088	.207	.082	.277	.113	.139
Transportation	.124	.079	.030	.692	.060	.451
Warmth	.045	.455	.202	.004	.062	.403
Sanitation	.003	.965	.112	.136	.125	.107

Strength of association (r) 0.5 = moderate positive relationship. 0.2 = weak positive relationship

Correlation is statistically significant at the .05 level*, .01 level**, .005 level*** (2-tailed)

We also looked at some specific household composition factors that could potentially affect willingness to share: the presence of children in the household, single-person households, single female households, and senior-only (65+) households. In Westport, we found a tendency for people to be generally less willing to share across all resources in households with children (see Table 33). In Laurelhurst, we found a statistically significant correlation between single-person households and willingness to share, but the association was positive, indicating that single-person households are somewhat more willing to share than households comprised of multiple people.⁵⁹

Table 33: Pearson's product-moment correlation between household characteristics and willingness to share

Variable	Laurelhurst		South Park		Westport	
	r	p -value	r	p -value	r	p -value
Children in household	.003	.962	-.082	.240	-.178	.013
Single person household	.153	.014	.050	.471	.116	.109
Single female household	.117	.062	.042	.552	.065	.368
Senior-only household	-.111	.075	0.005	.942	.087	.229

Looking in more detail at this trend relative to specific resources, some patterns can be observed regarding willingness to share (see Table 34). For seven of the ten resources, Westport respondents in households with children anticipated being less willing to share than households without children. Across all three communities, respondents from senior-only households anticipated being less willing to share medications than those from households that included younger adults or children. There were also some groups that appear to be more willing to share in some situations (e.g., single-person households in Laurelhurst and Westport anticipate being somewhat more willing to share food).

⁵⁹ This part of the analysis was done based focus group findings indicating that certain population segments might feel vulnerable in a disaster scenario and therefore less willing to share.

Table 34: Pearson's product-moment correlation household characteristics and willingness to share (resource)

	Laurelhurst		South Park		Westport	
	r	p-value	r	p-value	r	p-value
Food						
Children in household	-.063	.319	-.085	.226	-.269	.000***
Single person household	.152	.015*	.066	.346	.227	.002***
Single female household	.132	.035*	.076	.276	.152	.037*
Senior-only household	-.007	.918	.000	.995	.211	.003***
Water						
Children in household	-.094	.133	-.101	.148	-.248	.001***
Single person household	.119	.057	.032	.651	.206	.005***
Single female household	.079	.208	.021	.767	.113	.122
Senior-only household	-.016	.797	.036	.611	.139	.056
Shelter						
Children in household	.003	.962	-.082	.240	-.178	.013*
Single person household	.153	.014*	.050	.471	.116	.109
Single female household	.117	.062	.042	.552	.065	.368
Senior-only household	-.111	.075	0.005	.942	.087	.229
Power						
Children in household	-.041	.513	-.063	.369	-.185	.011*
Single person household	.122	.052	.007	.916	.101	.168
Single female household	0.76	.229	.055	.434	.018	.812
Senior-only household	-.032	.613	.050	.474	.101	.169
Medications						
Children in household	.131	.040*	-.075	.283	.002	.977
Single person household	.167	.008**	.062	.376	-.012	.877
Single female household	.132	.037*	.021	.761	-.008	.912
Senior-only household	-.264	.000***	-.142	.042*	-.160	.031*
First aid supplies						
Children in household	.094	.132	-.026	.714	-.138	.056
Single person household	.024	.702	.029	.682	.071	.328
Single female household	.034	.587	.070	.320	.031	.667
Senior-only household	-.199	.001***	-.032	.648	.019	.790
Communication						
Children in household	.016	.797	-.064	.365	-.119	.103
Single person household	.041	.515	.038	.590	.085	.246
Single female household	.085	.178	.002	.983	.040	.582
Senior-only household	0.042	.506	-.064	.363	.063	.385
Transportation						
Children in household	.021	.735	-.022	.753	-.199	.006**
Single person household	.127	.044*	.067	.340	.158	.030*
Single female household	.105	.096	-.006	.932	0.99	.177
Senior-only household	-.010	.880	.063	.371	.060	.416
Warmth						
Children in household	0.02	.975	-.094	.178	-.189	.010**
Single person household	.039	.538	.068	.331	.155	.033*
Single female household	.004	.947	.086	.219	.066	.366
Senior-only household	-.086	.170	-.030	.672	.123	.090
Sanitation						
Children in household	-.043	.500	-.008	.912	-.155	.034*
Single person household	.140	.026*	-.015	.831	.098	.182
Single female household	.116	.067	.014	.843	.006	.932
Senior-only household	-.109	.083	.011	.876	.012	.867

Correlation is statistically significant at the .05 level*; .01 level**; .005 level*** (2-tailed)

Qualitative analysis: willingness to share motivations

We designed the focus groups to build upon the willingness to share information gathered in the sample survey and to provide more nuance about the kinds of factors people might consider when deciding whether – and with whom – to share essential resources in a disaster scenario. To begin the focus groups, participants were asked to introduce themselves and to share their favorite thing about living in their community. Participants from all communities mentioned social, experiential, and physical/amenity attributes of their communities they valued (see Table 35). The qualities named by the focus group participants in many ways echoed the responses elicited in the earlier community workshops when we asked participants to describe their community’s values and assets (Idziorek 2018; “Localizing Hazard Mitigation: Recommendations for Westport’s Comprehensive Plan Update” 2018; Arjona and Chavez Basurto 2019).

Table 35: Focus group introductions - participants' favorite attributes of their communities

	Laurelhurst	South Park	Westport
<i>Social</i>	Neighbors, friendly community	The people, the community, neighbors	The people, friends in the community
<i>Experiential</i>	Quiet, walkable, little traffic, vibrancy of University of Washington (UW) nearby	Walkable, small town feel, familiar people at local establishments	Everybody knows everybody
<i>Physical/amenities</i>	Vegetation, accessibility, underground utilities, access to nature and water, nearby schools and parks, near UW campus	Vegetation	Marina facilities, recreational opportunities, ability to live on the beach

Next, as a warm-up activity and introduction to the topic of sharing, participants were asked to list things typically shared by neighbors within their community. Topics listed included information or conversation; looking out for others; services (e.g., childcare, pet care); tools and equipment; experiences (e.g., block parties, trash cleanups, festivals); and items like food or plants (see Table 36).

Table 36: Focus group warm-up activity – within-community sharing

	Laurelhurst	South Park	Westport
<i>Information/conversation</i>	Information (e.g., recipes, tips)	N/A	Talking about the weather, local news, similar interests/hobbies
<i>Looking out for others</i>	Checking in on elderly neighbors, watching neighbors’ homes while away, putting away trash cans, watching for packages	Returning escaped chickens	Returning escaped dogs, watching neighbors’ homes while they are away
<i>Services</i>	Childcare, pet care	Childcare, dog sitting, giving people a ride	Dog walking
<i>Tools & equipment</i>	Tools, vehicles, gardening tools, ladder	Tools	Tools

<i>Experiences</i>	Block parties, meals	Trash cleanups, painting the local skate park	BBQs, festivals
<i>Food and other items</i>	Food, cup of flour, flowers	Food, beers, plants, household items no longer needed (e.g., furniture, electronics), marijuana	Seafood/fish, seeds, plants

Factors affecting willingness to share

The central question addressed by the focus groups was that of factors affecting anticipated willingness to share resources in a disaster scenario. We asked the focus group participants to comment on those factors that might make them more – or less – willing to share the ten essential resources we asked about in the survey. The ten resources were discussed in two groups of five resources each, beginning with the five that survey respondents reported being most willing to share in each community followed by the five resources survey respondents had reporting being less willing to share.⁶⁰ The factors discussed by the respondents fell into five overarching categories: resource factors, provider factors, recipient factors, situational factors, and exchange factors (see Figure 43 and Table 37).⁶¹

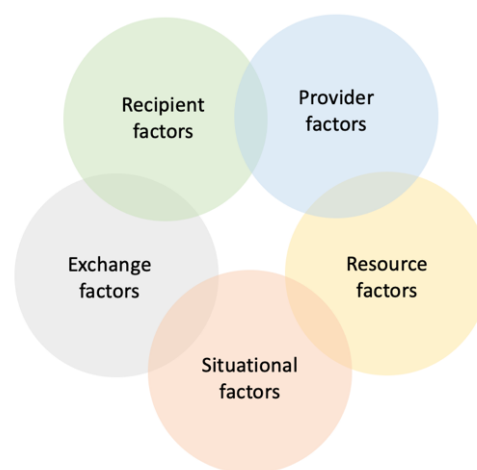


Figure 43: Factors affecting willingness to share

Resource factors

Many of the decision-making factors discussed by participants had to do with the abundance and viability of the resource itself. Participants noted being more willing to share resources that were functional (e.g., a charged electric bicycle, a working sanitation system) and being less willing to share resources that were not functional or that were approaching overuse (e.g., overloaded sanitation systems). Participants were more likely to share resources they believed to be locally abundant and less willing to share items they perceived of as scarce.

Availability of alternatives was also an important factor. Participants felt they would be less willing to share personal resources if they knew there were viable alternatives. For example, one South Park participant indicated being less likely to share toilet facilities because of the presence of a porta-potty company in the neighborhood that could potentially provide alternative facilities for people to use. However, people indicated being more willing to share a resource as a last resort if no viable alternatives existed: “I would definitely let them in my house if my house were the only one standing and they need a place to stay,” noted one participant. People also indicated being less willing to share if they felt the resource or service (e.g., transportation) could be better provided by others. For example,

⁶⁰ For South Park and Westport, the first group (more willing to share) of five consisted of communication, transportation, food, first aid supplies and warmth, and the second group (less willing to share) consisted of sanitation, water, medications, shelter, and power. For Laurelhurst, food was in the first group, and sanitation was in the second group.

⁶¹ Although there is overlap between some categories, we did our best to assign each factor according to its primary focus.

one person felt he would be less willing to share transportation because others' vehicles might be more suited to navigating post-earthquake conditions, for example. Also, some older participants felt that younger people might be better able to provide help with transportation and they therefore felt less willing to share that particular resource.

Resources that were replaceable were easier for participants to anticipate sharing. "We can always buy a new tent," noted one participant. People also felt they would be more willing to share resources that could be replenished (e.g., drinking water could potentially be replaced by filtering water) or recharged (e.g., solar-powered items) and less willing to share items requiring fuel that might not be easy to find in a disaster scenario (e.g., gas-powered vehicles or generators).

Participants felt it would be easier to share items of lower monetary value than a higher-value items (e.g., an old, beat-up bicycle vs. a new bicycle). The use value of an item was also an important factor. Focus group participants felt it would be easier to share over-the-counter medications than prescription medications that might be critical to the provider's health. People also indicated being less willing to share vehicles for transportation because they could also potentially be used as shelter if needed.

Provider factors

Provider preparedness with the resource in question was the most commonly noted factor among focus group participants. Participants indicated being willing to share most resources if they felt they had extra, or redundant, resources beyond what was needed for themselves and their families. One participant recalled the common airline safety instruction, "Put on your own mask before assisting others," as summarizing their thinking about sharing. If participants felt they had more than enough for their own families, they would then consider sharing the excess resource.

Focus group participants felt they would be less willing to share certain items due to reasons of personal discomfort, compromised health, or lack of ability. For example, older people might feel less comfortable biking somewhere to get something if that were the only mode of transportation available. People would likewise be less willing to share if they were ill or injured.

Several female participants described concerns about sharing due to gender-based feelings of vulnerability, noting they would be more willing to share if they were not alone (e.g., a male presence would increase willingness to share). "I think if my husband or my father-in-law were home, I'd be more comfortable letting people in to use the toilet, for sure," said one participant. Females also anticipated being less willing to let groups of people into the home (e.g., to share shelter or sanitation) if they were alone due to the potential risk of losing valuable resources. In particular, they felt it might be more difficult to share resources with men, as opposed to other women or children. "I'd have to think seriously about 'do I help this person?'," noted one participant. "Kids and women, probably not as hard, but males? Because you are a female, and you have a lot of... I have a lot of things prepared for [a disaster], and somebody could come in and take what I have, which I think would be the scariest thing." Female respondents also cited the presence of children in the household as a reason they might be less willing to share resources that involved inviting others into one's home.

Finally, providers' sense of responsibility toward others was also an important factor. "Taking care of yourself [is important], but also your neighbor, and I think through that you're going to feel better." Some younger participants noted a feeling of responsibility to help elderly neighbors in a disaster scenario.

Recipient factors

Focus group participants also spoke about several factors related to the characteristics of the potential resource recipient that might affect their willingness to share. The primary factor discussed was the level of need of the potential recipient. People anticipated being more willing to share a resource (e.g., medications) if it were critical to the recipient's survival. "I think it all depends on whether a person needs it to survive themselves," noted one participant. People also cited the relative need of the recipient – whether they needed the resource more than the provider – as an important factor in sharing. In some cases, it was important that the recipient's need be verifiable (e.g., recipient is ill or injured) and that the intended use of the resource was acceptable to the provider (e.g., using a generator to charge a phone vs. charging a video game console).

Recipient identity was also important. Recipient reliability or reputation was noted as a potential factor affecting willingness to share. For example, some participants felt it would be easier to share first aid supplies with a medical professional or someone from a community organization who they knew would use the resource effectively. People were also more willing to share resources with recipients they perceived as belonging to vulnerable populations and indicated they would prioritize sharing accordingly: "Children will be the first. Children, the elderly, anyone injured, anyone in need;" "the neediest; the small, the vulnerable, the elderly."

Participants noted that both their social and physical distance from the participant could potentially factor into their willingness to share. They felt it would be easier to share if the recipient were known and trusted, even by reputation (e.g., a friend of a friend), particularly for in-home sharing or transportation: "If I don't recognize somebody, I don't necessarily want them in my home." Social distance was also noted as a means of sharing prioritization, "You take care of your family first and then your friends and your neighbors and then beyond that," as was physical proximity to the potential recipient: "I'd go to the immediate neighborhood and then would branch out."

Situational factors

Some factors noted by participants were associated with the circumstances of the disaster scenario, including the availability of outside information and the safety of the surrounding environment, as well as weather and seasonal factors. In regard to information availability, participants noted that having information about the length of time they would likely need to be self-sufficient (e.g., from government sources) would help them to gauge what amount of which resources they would be able to share, and with whom. "If there's no timeline, and you don't know how long it's going to be, then you're going to hold onto everything and not really share." Knowing generally how much of the resource in question was available in the immediate area would also be helpful information for people to have.

Safe conditions were also important. Participants anticipated being less likely to share their home for shelter if they felt the building was unsafe, or to share transportation if the road network were severely damaged. They were generally not willing to venture into unsafe conditions or to put themselves at risk in order to share.

Weather was noted as potentially being a contributing factor to willingness to share, as some items (e.g., clothing) might be more valuable to the provider in winter, while some resources (e.g., rainwater, garden produce) might be more abundant in the spring or summer and therefore easier to share.

Exchange factors

Finally, focus group participants observed that the condition of exchange involved in sharing could potentially be important. They felt they could be more willing to share resources if the sharing occurred within an organized framework (e.g., overseen by community volunteers) that could potentially enable a more efficient and effective use of resources. They also felt it might be easier to share a resource if it was provided in the form of a service rather than the exchange of an asset (e.g., giving someone a ride vs. borrowing a car, or letting someone listen to a radio vs. giving it away) or if they could trust that a resource borrowed to the recipient would be returned.

Table 37: Summary of willingness to share factors

Resource factors Viability/functionality of resource Participants would be more willing to share if the resource itself was viable and would become less willing to share if use of the resource resulted in reduced viability or overuse. Abundance or scarcity of resource Participants would be more willing to share if they believed the resource to be locally abundant; they would be less willing to share items they perceived of as scarce. Availability of alternatives Availability of viable alternatives decreases willingness to share some resources; willingness to share increases if there are no alternatives. People are less willing to share resources they feel could be better provided by others. Replaceability/renewability of resource Participants would be willing to share resources that are easily replaceable or that could be easily replenished or recharged; they would be less willing to share items that consumed fuel, which could not easily be replaced. Value of the resource Participants felt it would be easier to share a low-value item than a high-value item; in this context, value could be understood as monetary value (cost), use value (e.g., prescription medications), or personal value (phone).	
Provider factors Provider preparedness with resource People would be more willing to share resources of which they have “extra” or a backup (e.g., second car). Provider level of comfort sharing or ability to share Participants were more or less willing to share some resources based on their level of comfort or ability. Perceived risk to self/personal safety In particular, female participants indicated being less willing to share due to feelings of vulnerability. Presence of children Participants felt they might be less willing to share resources, especially shelter, if children were present. Condition of provider/physical health People anticipated being less willing to share if their health were compromised or if they were injured. Sense of responsibility to others Participants felt that having a sense of responsibility to help neighbors would make them more likely to share.	Recipient factors Level of recipient need People anticipated being more willing to share those whose need was verifiable and greater than that of the provider. Participants indicated being more willing to share with those with greater demonstrated need. Recipient identity People felt it would be easier to share with someone from an organization with a reliable reputation as well as people belonging to groups perceived to be more vulnerable: children, the elderly, people ill or injured. Social distance of recipient People felt it would be easiest to share with known and trusted recipients, prioritizing family first, then friends and neighbors, then others. Physical location of recipient Participants felt they would prioritize helping people who lived nearby before those living farther away.
Situational factors	Exchange factors

Availability of contextual information People would be more willing to share if they knew for how long they might need to be on their own. Safe conditions Willingness to share certain resources might depend on safe conditions (e.g., shelter, transportation). Season/weather Weather or the seasons might affect willingness to share certain items (e.g., clothing). Some items might also become more abundant during certain seasons.	Organized sharing/generalized exchange Participants expressed more willingness to share if they knew they were contributing to an organized effort that was collecting and distributing resources. Alternative modes of sharing In some cases, participants felt they would be more willing to provide a service in lieu of sharing a valuable asset (e.g., giving a ride vs. borrowing a car, or letting someone listen to a radio vs. giving it away).
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Influence of others' anticipated sharing behavior on preparedness actions

After finishing the willingness to share discussion, we next showed each focus group a graph illustrating how willing others in their community were to share the same ten resources (see Figures 44-46). The responses were categorized as willing to share with 1) nobody, 2) someone I already know (strong or weak ties), or 3) anybody. We asked participants whether knowing this information would change their own disaster preparedness behavior. Some common themes emerged across the focus groups, as discussed below.

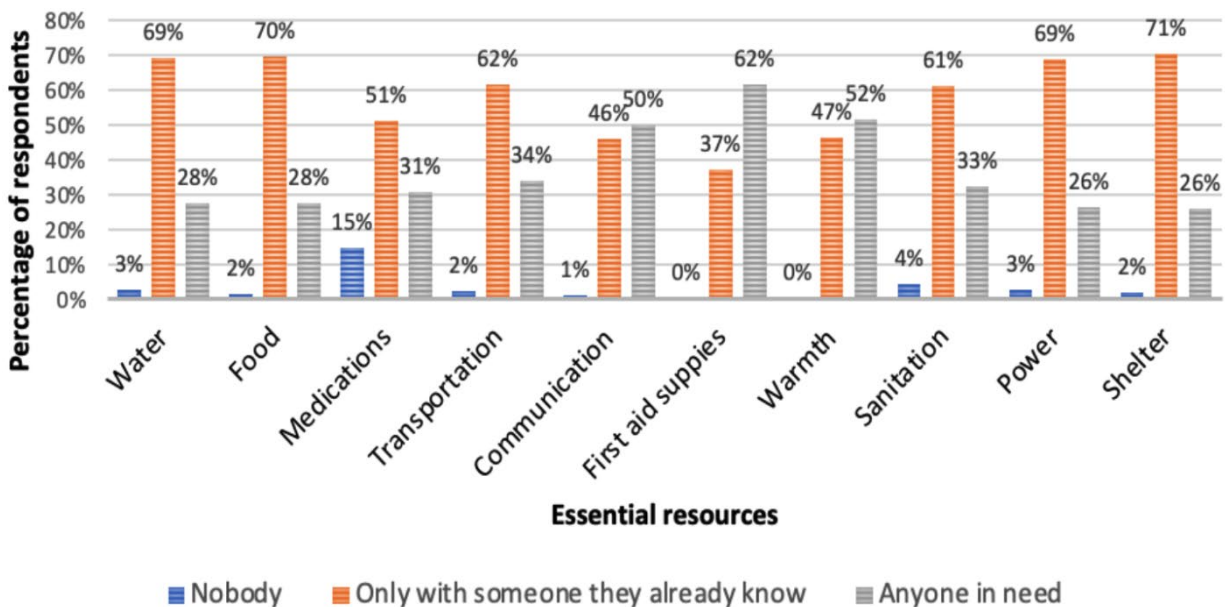


Figure 44: Survey responses indicating willingness to share essential resources – Laurelhurst

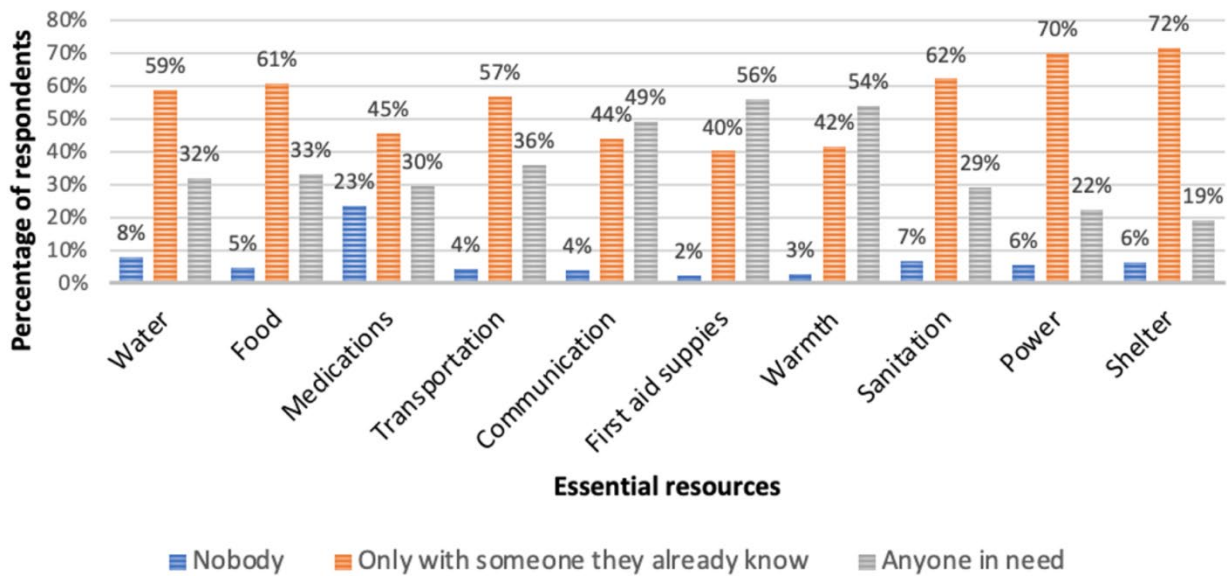


Figure 45: Survey responses indicating willingness to share essential resources – South Park

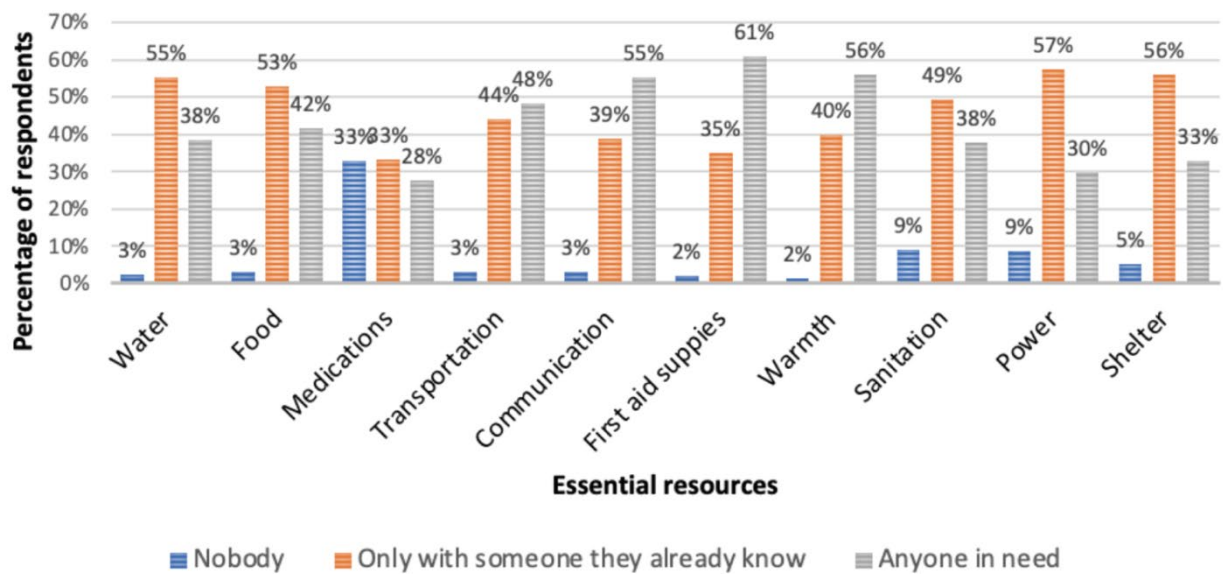


Figure 46: Survey responses indicating willingness to share essential resources – Westport

Self-reliance

Many respondents noted they felt under-prepared and stated a goal of wanting to be self-sufficient in terms of the kinds of resources discussed in the focus group. Participants felt a need to be responsible for themselves and not rely on others. "I don't think I would rely on other people, like I don't think it's their job to be prepared for me...I would prefer to be prepared than to rely on other people," noted one South Park participant. One Westport participant suggested that sharing the willingness to share

information could also be helpful for encouraging individual preparedness: “Hopefully it would make everyone prepare so they aren't so dependent on their neighbor.”

Prioritizing preparedness actions

Some participants suggested that knowing the anticipated sharing behavior of others could help them to prioritize what to gather first as they prepared for themselves. “If I know that people are less willing to share in some areas, then I may want to put an emphasis on making sure that I'm setting myself up in those areas first,” stated one Laurelhurst participant. Some also suggested knowing what others were more or less willing to share might motivate them to prepare extra resources that they know others might be reluctant to share so that they themselves would be able to share those resources.

Organized sharing

Although we did not ask participants whether knowing this information would influence their willingness to share, nearly all participants offered thoughts on this point as well, likely because it had been the topic of the previous 40 minutes of discussion. Most participants across all groups did not feel that knowing more information about the willingness of others in their community to share different resources would have an impact on their own individual willingness to share. However, in the three Seattle focus groups, participants mentioned that knowing what others in their community were willing to share might be useful for informing a collective sharing effort, either among a cluster of close neighbors or at a larger scale. Said one South Park participant, “This made me think of ‘hubs.’ If there was a neighborhood disaster preparedness group, I would probably trust them a lot and if I knew that they had some things, I would probably be more likely to donate to it. I'd be more likely to give if it was an organized, pre-established hub of people who knew what they were doing.”

Discussion and recommendations

While the results of this study suggest that the factors underlying willingness to share resources in a disaster scenario are complex and nuanced, the findings from both the survey and the focus groups indicate that the existence of social ties, and the strength of those ties between the provider and the recipient, matter, mirroring sharing trends observed in the context of the sharing economy (Schreiner, Pick, and Kenning 2018). We also saw clearly across all communities that higher levels of trust were associated with increased willingness to share resources. As in previous studies, the survey results suggested that trust was a more important factor in willingness to share than were spare resources (Wong, Walker, and Shaheen 2021). However, focus group participants suggested that being prepared oneself and having enough of a resource to share would factor into their sharing decision making.

Not all resources were considered equal in terms of willingness to share for a variety of reasons. In the focus groups, people noted that resource sharing involving inviting others into one's home, such as sharing shelter or sanitation was strongly dependent on familiarity with the recipient. People also indicated being more willing to share some resources, such as transportation and communication, in the form of a service rather than in the form of an asset (e.g., borrowing or shared use as opposed to giving). And although people were generally very prepared with medications, they were least willing to share these in many cases because of their critical importance to the health of the provider.

The survey findings revealed some variation in willingness to share was observed across the three communities. While 33% of Westport residents reported not being willing to share medications with

anyone, regardless of social ties, this percentage was smaller in South Park (22%) and Laurelhurst (15%). Westport survey respondents were oldest on average (62 years old compared to 46 for South Park and 56 for Laurelhurst) and have the poorest access to medical facilities of the three communities. Westport residents were also more willing to share transportation with anyone regardless of social ties than respondents in the other two communities. All three communities reported having a similar average number of vehicles per household – approximately two – and Westport respondents reported having fewer bicycles (1.2 per household compared to 1.6 for South Park and 2.2 for Laurelhurst), so the difference is not due simply to resource supply and could benefit from further investigation.

Generally speaking, the topics that arose in the focus group were very similar across the three communities, suggesting that although the survey revealed some between-community differences in willing to share different resources with different types of social connections, the factors involved in decision-making regarding willingness to share might not vary significantly from one community to the next.

Recommendations for intervention

Previous research has shown that in circumstances of disaster, people tend to display adaptive and socially beneficial behavior and are more willing to help one another than during normal, non-disaster times (Tierney 2014). Our survey results support these previous findings, as they indicate that most people across all study communities anticipate being willing to share at least some types of resources with others in their communities. The focus group findings also provided further information regarding factors that could be addressed to enable increased and more effective sharing following a disaster. Although willingness to share resources in a disaster is not a topic that has been addressed in the urban planning literature, we can identify many opportunities for planners to help support willingness to share within communities by addressing these identified conditions before a disaster occurs. In this section, we present recommendations for intervention based on the five willingness to share factors categories developed previously: exchange factors, provider factors, recipient factors, situational factors, and exchange factors. While these recommendations do not address all of the willingness to share factors raised by the study, they provide a jumping-off point for approaching both disaster preparedness planning and urban planning from a sharing perspective.

Resource factors: Targeted disaster preparedness efforts and renewable resource audits

Previous research has demonstrated significant overlap between hazard mitigation planning and sustainable development, and some suggest that disaster resilience is a required attribute of sustainable urban systems (Rodriguez-Nikl 2015; Asprone and Manfredi 2015). Sharing has also been identified as a meaningful strategy for helping to support more sustainable urban development (Beatley 2004; McLaren and Agyeman 2015). Study participants indicated being more willing to share resources that were locally abundant and renewable. Targeted household disaster preparedness efforts could help to emphasize the potential benefit of preparedness with items like water filters or solar-charged batteries, while scaling these kinds of strategies up to the level of urban development incentives could present an opportunity to help facilitate resource sharing while supporting sustainable urban development. Community members could work together with local disaster preparedness planners and urban planners in an audit of their local environment to identify opportunities for incorporating renewable resource provision into future development and/or capital projects.

Provider and recipient factors: Building and enhancing community social networks

Beyond more standard approaches to encouraging household disaster preparedness with essential items, our findings indicate that increasing and enhancing social connectivity among community members could help to facilitate sharing in a disaster scenario. Facilitating proximity, chance encounters, and informal communication within communities can help neighbors to get to know one another and to more effectively assist one another in times of need (Halegoua and Johnson 2020). Supporting the development and maintenance of social infrastructure, such as public spaces and community organizations, can help to support this goal (Klinenberg 2018). Beyond providing supportive spatial conditions, disaster preparedness planners and urban planners could coordinate to develop programming to help build social connectivity, such as creative community visioning and disaster-related problem-solving exercises. Both spatial and programmatic outreach efforts should be tailored to be inclusive of potentially vulnerable populations (e.g., based on age, gender, language, or other factors).

Exchange factors: Coordinating organized sharing

Another finding that emerged from the focus groups was the suggestion that coordinated post-disaster sharing could increase willingness to share resources within communities. Study participants indicated they did not need to engage in direct reciprocity, but they did feel they would be more comfortable sharing their resources with a coordinated group who could then distribute the resources efficiently and effectively – basically, a system of generalized exchange. Generalized exchange structures are reinforced by shared social identity, such as living in the same neighborhood (Whitham 2018). This kind of community-based sharing structure could help to overcome some of the barriers associated with lack of familiarity as identified by the study participants. Prior research has demonstrated that people with previous experience sharing are more willing to share in a disaster scenario (Wong et al. 2021). In addition, exchange strategies improve with experience (Markovsky et al. 1993). Therefore, putting locally based generalized exchange systems in place in advance of disasters could provide additional benefit. Institutionalizing sharing, and practicing sharing in ways that establish local social connections can also build community and strengthen bonds to place (Beatley 2004).

Situational factors: Focusing on communication capabilities

Previous research suggests that willingness to share may decrease as time goes on and resources are depleted (J. A. Thomas and Mora 2014). Having real-time information during the critical period between the occurrence of the disaster and the mobilization of outside response may be particularly important for informing sharing behaviors. Focus group participants noted that having updated information about how long they will be expected to be on their own would be a helpful guide in their resource sharing decision making process and wondered whether they would be able to receive such information in a disaster scenario. Ensuring that communications capabilities are in place so that individuals can receive situational updates could help inform resource sharing decision-making. This could take the form of personal radios or other emergency communications devices shared among neighbors, or it could entail a broader strategy such as that employed by Seattle’s Emergency Communications Reserves, who provide amateur radio support to a network of community volunteer organizations (Seattle Emergency Hubs 2014; City of Seattle Office of Emergency Management 2021a).

Study limitations

We acknowledge several limitations to this research. One is that we asked the study participants about their *anticipated* behavior in the event of a disaster, which, for a variety of reasons, may not match their actual behavior. One contributor to this limitation is social desirability bias, which we did our best to address in the wording of the willingness to share question in the survey. We worded this question carefully to explain to respondents that we wanted their honest answer and to acknowledge that there might be many legitimate reasons why they might not want to share resources. We did observe a difference in willingness to share between different kinds of resources, which indicates that we were at least somewhat successful in this regard. There is also, of course, inherent uncertainty in all disaster research. Neither we nor the study participants know exactly what will happen in the event of a disaster or how much damage will occur to the systems upon which we rely to meet our everyday needs.

Conclusion

In this study, we investigated the conditions shaping anticipated willingness to share essential resources in a disaster scenario in three Washington State communities. We found that people's willingness to share resources varies by both the type of resource in question and the nature of the social relationship between the provider and the recipient, and that patterns of willingness to share vary by community. This finding suggests that developing an understanding of local preparedness with, and willingness to share specific resources could help to inform more targeted disaster preparedness efforts.

Through focus group discussions, we explored specific motivations behind willingness to share and developed a conceptual framework of factors likely to influence individuals' decision-making process about sharing resources after a disaster. The findings from the focus group contribute to the literature gap regarding socio-behavioral responses to perceived scarcity in disaster scenarios. Among the recommendations that emerged from this research are suggestions for strengthening local social networks and incorporating local sharing mechanisms into the practice of everyday community life.

Some forms of sharing have become more commonplace over the last few decades. The growth of the sharing economy has brought with it new modes of decentralized and commercialized technologically enabled sharing providers and services, such as home sharing (e.g., Airbnb, VRBO), ride sharing (e.g., Uber, Lyft). In addition, "buy nothing"⁶² groups hosted on social media platforms like Facebook offer non-commercialized and decentralized options for sharing among neighbors. Although these kinds of platforms can increase access to a range of resources and services, they do not necessarily build social connectivity, and they are reliant upon centralized infrastructure that could potentially fail in the event of a major disaster.

However, other modes of sharing, many of which are supported by the public realm, have become less commonplace. In his book *Native to Nowhere: Sustaining Home and Community in a Global Age*, Timothy Beatley notes that the private, individual realm has become increasingly strengthened as evidenced by the increased use of single-occupancy vehicles, growing popularity of gated communities, and increased time spent engaging in isolated online activities. However, "places, real places," writes Beatley, "need people who need each other, and who interact with and care about others" (Beatley 2004, 6). He argues that community institutions should work to support opportunities and conditions for

⁶² <https://buynothingproject.org/>

sharing within the public realm as a means of building more socially vibrant and sustainable communities.

McLaren and Agyeman also argue that the “so-called” sharing economy’s narrow focus on economic transactions leaves much on the table in regard to the potential for mutual support through sharing within communities (McLaren and Agyeman 2015). In a call to action aimed at urban planners and city officials, they advocate for a shift to a “sharing paradigm,” involving increased opportunities for sharing assets, services and experiences within communities that would in turn help to enhance trust, rebuild social capital, and increase social investment in public goods and the public realm.

We echo this call for developing a better understanding of the opportunities and limitations that come with different modes of sharing. This study provides an additional perspective on the potential benefits of a broader conception of sharing – that of planning for disaster preparedness at the community scale. Despite the level of uncertainty associated with planning for disaster, we believe the findings from this study provide evidence that community-level preparedness involving the enhancement of local social networks, communication capabilities, renewable resources, and organized sharing networks could provide benefit in a disaster scenario beyond strategies involving individual and household preparedness with specific resources.

7. Conclusion

This final chapter summarizes and integrates the findings from the empirical studies described in Chapters 4, 5, and 6. We then discuss the implications of the integration of urban design and planning and disaster preparedness research and policy. We conclude with reflections on the research process and the presentation of a future research agenda.

Summary and integration of findings

The role of community social networks in disaster scenarios

Chapter 4 presented a conceptual framework identifying the ways in which social ties and social networks can help to connect people with local resources following a disaster. Drawing upon socio-ecological resilience theory and social network theory, we analyzed the ways in which interdependencies between social and technological systems connect people with essential resources on an everyday basis and explored the ways in which those systems might evolve in the event of a disaster. The conceptual framework identified the characteristics of the network and social exchange dynamics relevant to the study of localized resource sharing during a major disruption. The conceptual framework was then tested using survey data, confirming that social ties have the potential to connect people with needed resources in a disaster, as long as those social ties are present and activated.

The development of the conceptual framework demonstrated that both the built environment setting of a community and its social fabric can contribute to adaptive response when a large-scale disaster occurs. We also found that realizing more potential connections between community members and resources, both social and material, has the potential to provide broader benefits to communities that extend beyond disaster preparedness. This study provided the foundation for Chapters 5 and 6, which comprised more detailed examinations of the potential for local resource matching and motivations underlying willingness to share resources in a disaster scenario.

Resource matching via local networks

Chapter 5 described a resource-matching analytical assessment of the potential of social ties and social infrastructure to meet community members' essential needs in a disaster scenario. Using data gathered from an open-ended survey question, we explored respondents' expectations regarding where they might turn to seek a range of essential resources in the immediate wake of a disaster. The survey findings served as the basis for interviews with disaster preparedness planners, community volunteer organizers, and business owners in the three study communities to identify potential gaps and opportunities for improving preparedness for future disasters.

The survey findings indicated that members of the study communities expect to leverage their social networks in a disaster scenario, particularly to access the resources with which they are the least prepared, such as power, water, sanitation, and communications – services typically provided through centralized utility infrastructure. We also find that respondents anticipate going to “the store” to obtain many needed resources in a large-scale disaster. Few people anticipated turning to social infrastructure to access needed items. Despite the communities' different approaches to organizing for disaster preparedness, interviewees from all three places believed the role of community organizations and social infrastructure could be expanded to help make disaster preparedness more relevant to everyday community life.

Understanding anticipated willingness to share resources in a disaster scenario

Chapter 6 detailed a study of factors influencing the anticipated willingness of study community members to share essential resources in a disaster scenario. Through the sample survey, we gathered data on the relative importance of social tie strength between the provider and the recipient as well as household characteristics and individual attitudinal factors, such as trust and place attachment. We then conducted follow-on focus groups with survey participants from the three study communities to uncover specific factors likely to inform people's decision-making process about sharing – or not sharing – resources immediately following a disaster.

We found that people's willingness to share resources varied by both the type of resource in question and the nature of the social relationship between the provider and the recipient. People reported being more willing to share resources like communication, warmth, first aid supplies, and transportation with a wider range of people regardless of social tie strength and less willing to share resources like water, medications, shelter, and power unless they already knew the recipient. Patterns of willingness to share varied by community, suggesting that understanding local preparedness with, and willingness to share, specific resources could help to inform targeted disaster preparedness efforts. Findings from the focus groups informed a conceptual framework identifying five key components of respondents' decision-making process regarding sharing: resource factors, provider factors, recipient factors, situational factors, and exchange factors. Recommendations focused on the improvement of disaster communication capabilities, emphasis on renewable resources in disaster preparedness messaging, development of organized sharing structures, and enhancement of community social networks.

Synthesis

Taken together, the findings of the three studies reiterate the importance of social ties as a resource in a disaster scenario. But in order to realize the full benefits of those potential ties, people need to know one another in advance of a disaster. We argue that because community social infrastructure supports the formation of social ties between neighbors in advance of a disaster, its programming and maintenance should be viewed as an essential component of an asset-based approach to disaster preparedness. Integrating community organizations and social infrastructure providers (e.g., libraries, schools, parks) into localized approaches to disaster preparedness could help to make it more relevant to the everyday experience of community members.

Currently, people anticipate relying on the private sector (stores) in the event of a disaster. Our limited interactions with business owners in the three study communities suggest that there is a lack of preparedness and coordination in the private sector regarding potential disasters and that stores may not be a reliable resource during a time of emergency. There is potentially great opportunity in building disaster preparedness initiatives that include local businesses, particularly those that function as community gathering places.

In the interviews for the resource matching study, stakeholders in all communities discussed innovative ideas for working together with local businesses and social infrastructure providers to support community disaster preparedness, from the use of vacant industrial warehouses in South Park to store preparedness supplies to establishing MOUs with restaurants for emergency feeding in Westport to rethinking the role of the church in disaster response in primarily residential communities like Laurelhurst. Many of these ideas were borne out of the challenges experienced during the COVID-19

pandemic. As we begin to emerge from lockdown, there would be great value in bringing community stakeholders together to discuss ways in which lessons learned during the pandemic could help to inform future preparedness initiatives.

Reflection: Engaging in disaster research during the COVID-19 pandemic

In many regards, this study anticipates a specific kind of disaster – a cataclysmic seismic event. While it is our intention that the lessons learned be applicable in a range of disaster scenarios, as well as during smaller disruptions experienced during “normal” times, none of us could have foreseen the role that the COVID-19 pandemic would play in the ongoing dialogue about disaster preparedness, response, and consequences. The COVID-19 pandemic highlighted the broad-reaching effects of socioeconomic inequities and disparities as immigrant communities and communities of color were disproportionately impacted by the virus and its secondary effects (Gaynor and Wilson 2020; Sequist 2020; Clark et al. 2020; Tai et al. 2021). The experiences of the COVID-19 pandemic have underscored the outsize role that social conditions and structures play in cascading disasters (Deborah S.K. Thomas, Jang, and Scandlyn 2020).

To us, the uneven effects of the pandemic demonstrate the need for approaches to disaster preparedness that emphasize social connectivity and more equitable access to essential resources across communities. The concept of the 15-minute city, which is based on the idea that residents should have access to all essential needs within a 15-minute travel distance of their homes, became immensely popular with civic leaders after the COVID-19 pandemic highlighted the fact that many communities lacked local access to basic resources and services (Sisson 2020; Duany and Steuteville 2021).

We saw different responses to the pandemic in each of the study communities. City and agency staff were overwhelmed, and many of their planned earthquake preparedness activities had been sidelined as they responded to the challenges raised by the pandemic. In Laurelhurst, LEAP noted that getting their organization together to advance their initiatives had been difficult without the ability to meet in person. South Park residents organized an ambitious emergency feeding and food sharing program based on the principles of mutual aid. In Westport, community institutions stepped up to help connect vulnerable residents with needed resources.

In some ways, South Park’s lack of resources and Westport’s historic exposure to weather-related hazards make them better equipped to face disruption than a community like Laurelhurst that doesn’t have the same kind of muscle memory that results from pulling together to face adversity. Lack of wealth can motivate the development of mutual aid systems that help under-resourced populations to cope with disaster when it strikes, but those same communities also often suffer disproportionately (Tierney 2014; Kendra, Clay, and Gill 2018). Mutual aid efforts developed to assist those in need during the COVID-19 pandemic were meant to be temporary measures and have now become seriously overtaxed (de Freytas-Tamura 2021). We hope that the resourcefulness and efforts of communities like South Park can help to serve as a guide for the kind of local coordination that is needed to respond to a large-scale crisis. We also believe our findings support the allocation of sustained resources to grassroots efforts that help to improve everyday quality of life and to connect people with basic resources as a viable – and necessary – means of disaster preparedness.

The COVID-19 lockdown began just as we were mailing surveys to residents of South Park – our third and final study community. Because we knew that earthquake preparedness was not likely to be the

topic at the forefront of people's minds when we asked them about disaster readiness, we added a new section to the survey instrument to make space for feedback about people's response to the pandemic. We asked people whether, and if so, how, they might be thinking differently about being prepared for different kinds of disasters since the COVID-19 lockdown began. Many people responded that the experience of quarantine helped them to realize how unprepared they might be for other kinds of disasters and that they felt motivated to take additional preparedness actions. "To tell the truth, it's my first time living through something similar to what is happening now, but maybe this will serve as a caution to be more prepared for something similar in the future," commented one respondent. It will likely always be challenging to motivate people to prepare for uncertain disasters – or even certain ones, like climate change. Broadly instilling the importance of long-term thinking and responsibility needed to safeguard communities against all manner of potential disruptions will require a significant paradigm shift (Brand 2008). For all of the damage it has caused, the pandemic also presents an opportunity – one we must seize – for collective learning about how communities can become more broadly resilient.

Contributions

The expansion and integration of socio-ecological resilience theory across disciplinary boundaries has benefitted disaster research (Kendra, Clay, and Gill 2018). A resilience perspective necessitates thinking carefully about the long-term consequences of present-day actions and thus has also been adopted widely in urban design and planning research and practice, which often involves assessing and anticipating the long-range effects of urban form and policy. Beginning with a framework rooted in resilience theory can help to guide the integration of disaster preparedness planning and urban planning as the two fields continue to find common ground. As we continue to face the challenges posed by the increasing incidence and effects of disaster, such circumstances are likely to become less an exception to the norm and more a characteristic of routine daily life and practice.

Although this research demonstrates that communities have great potential within to help sustain themselves during times of need, they can also benefit greatly from the kinds of space-shaping and policy tools that planners can work to champion – decentralized infrastructure, renewable resource provision, and a vibrant public realm. By designing this research approach in response to the most extreme disaster scenario our region anticipates experiencing, we hope to stimulate thinking about interventions that have the broadest potential applicability and effectiveness.

The dissertation makes empirical contributions in two specific areas – resource sharing and willingness to share research – as well as methodological contributions in its further exploration of appreciative inquiry approaches to disaster research and the development of a novel survey instrument.

Resource sharing

Disaster response and recovery research on resource sharing tends to adopt a top-down, centralized approach to resource allocation. We approach resource sharing at the community level, by seeking to understand the opportunities and challenges associated with the sharing of dispersed resources belonging to individuals or families and located within their private households.

Our findings reveal that people do expect to turn to one another – to leverage their social ties – in order to access needed resources in a disaster scenario. Having the ability to share resources person-to-person in the critical days or weeks after a disaster could help people to connect with resources within their

own community while they wait for outside assistance. Our research suggests there is latent potential within local networks to help match people with needed resources. Approaches to community disaster preparedness that focus on building social connections between neighbors could add value to more traditional strategies that emphasize household stockpiling of resources. Strengthening community social networks has many co-benefits that could also help to improve community wellbeing more generally. This could involve extending the role of planners further into social programming.

The study results also suggest there is latent disaster response potential embedded in community institutions, including local businesses, community organizations, and social infrastructure. On an everyday basis, these kinds of institutions play a role in facilitating communication and interaction among community members, yet their role in community-scale disaster response is not clearly defined.

Our findings suggest the need for further study of the role of social infrastructure and stores in disaster response and recovery (see *Directions for future research*, below).

Willingness to share

Willingness to share resources in a disaster scenario is an under-researched topic. In our exploration of this subject, we demonstrate the importance of social tie strength in anticipated willingness to share as well as the association between willingness to share and higher levels of social trust. These findings suggest that community disaster preparedness could be enhanced through the provision of opportunities for building social connectivity among neighbors, potentially in the form of both spatial and programmatic interventions.

We also show that anticipated willingness to share varies by the nature of the resource in question, and that some of the barriers to sharing in a disaster scenario can also be addressed through increased social connectivity as well as through the establishment of organized information and resource sharing structures in advance of a disaster. Integrating creative approaches to sharing into everyday life at the local level has the potential to strengthen interpersonal relationships and build community (Beatley 2004). Thus, enhancing community social connectivity could contribute to a positive feedback loop that would help increase adaptability to a range of potential disruptions.

Methodological contributions

Appreciative inquiry approach

Disaster preparedness can be difficult for people to talk about because it involves a great deal of uncertainty and often leads people to think about personal vulnerability and loss. This discomfort has been a challenge in disaster preparedness strategies, and it was also noted in our stakeholder interviews. However, by approaching disaster preparedness from a perspective of appreciative inquiry, and by focusing on the generation of creative solutions leveraging local social ties and resources, we were able to create a more comfortable space for conversation about disaster preparedness. Building on previous proof-of-concept research, we provide additional evidence that asset-based approaches to disaster research can set the stage for creative and collaborative dialogue (R. C. Freitag et al. 2014). Several interviewees and focus group participants commented to the research team that they had fun brainstorming ways to prepare together with their neighbors, and some were truly excited about the ideas that came up in our conversations. Approaching the topic from this perspective can help to

normalize considerations of disaster readiness and facilitate a broader dialogue about how to address disaster preparedness in ways that are contextually appropriate to individual communities.

Community resilience sample survey

Over time, conceptions of “disaster” have evolved from being understood as an agent-based, damage-focused, uncontrollable event to a human-caused social disruption (Perry 2018). Social network theory and methods, which are rooted in the description and understanding of social structures, constitute an appropriate – but underutilized – means of approaching community-level disaster preparedness research. The survey instrument developed to carry out this research integrates the collection of sociospatial, sociodemographic, attitudinal, and social network data, enabling the construction of a richly detailed community profile for informing disaster preparedness research and practice. Designed to be adapted to specific local contexts, it constitutes a novel contribution to the study of community-scale disaster resilience.

Directions for future research

As several components of this research were exploratory in nature, it is not difficult to anticipate methodological extensions of the assessments that would make further contributions to the literature while providing useful information for practitioners and policy makers. Additionally, the research produced a rich data set that could support further analyses related to disaster preparedness, social connectivity, resource access, and willingness to share in the three study communities.

Resource matching

Analytical extensions

While the current analyses attempted to include a diverse range of community settings by including study sites along spectra of urban-ness and socioeconomic status, implementing the sample survey in additional study communities would help to make the findings more generalizable. In particular, engaging with additional rural communities, additional urban neighborhoods falling between the extremes of Laurelhurst and South Park, and suburban communities would add more depth to the research. The survey instrument could be easily adapted for use in additional locations.

The survey results revealed a striking anticipated reliance on “the store” for essential resources in the event of a large-scale disaster. Following up on these findings to develop a better understanding of which stores people anticipate relying on and why could help to highlight potential gaps in disaster preparedness outreach and messaging. A further phase of the research involving interviews with additional store owners to discuss the survey results and the nature and extent of their disaster response planning could provide a better understanding of the extent to which stores likely could be relied upon in the event of a large disaster and could thereby inform the development of appropriate public messaging in that regard.

For policy makers and officials, resilience is an aspirational target toward which to steer capacity building and initiatives (Kendra, Clay, and Gill 2018). Bringing together urban planners, disaster preparedness officials, and community organizations to further translate the research findings into actions for policy and practice could work toward addressing both chronic and acute hazards.

Methodological extensions

Methodological extensions include more comprehensive network analysis and modeling building from the conceptual framework and ground-truthing exercise presented in *Chapter 4*. Developing an understanding of network-level dynamics would more thoroughly illustrate the potential benefits of local social connectivity for post-disaster sharing of resources.

The network analysis literature points out that one actor's gains can result in another's loss, and that in many situations, people who are especially well-connected tend to be at an advantage in terms of having access to network resources (Prell 2012). Developing a more sophisticated understanding of the potential drawbacks of greater social network connectivity, particularly to those individuals who have extra resources to share, would add important nuance to the research.

Finally, geospatial analyses could relate local resource distribution to individuals' access to needed items and services in both "blue skies" and disaster scenarios. While this kind of analysis was beyond the scope of the present research effort, the existing data set could be enriched with additional spatial information to support such an investigation. Such a contribution could help to inform future land use policy as well as support the maintenance and programming of social infrastructure.

Willingness to share

Analytical extensions

Our findings regarding willingness to share suggest that institutionalizing forms of localized organized sharing could help to aid community-level disaster preparedness and response. Such institutionalized sharing is likely to take different forms in different communities based on the existence and capacity of local community organizations. Understanding how to build the capacity of existing sharing efforts like those in South Park to take on disaster preparedness work as well as how to expand the community-building potential of purpose-specific disaster preparedness networks in communities like Laurelhurst that have relatively little community organizational infrastructure remains an open area for future research. Engaging further with community organizations in these, and other, study communities in follow-on qualitative studies could inform the development of best practices for supporting community-based sharing initiatives.

One limitation of the willingness to share study is the anticipatory nature of the data gathered. Although an earthquake on par with an anticipated CSZ event has not occurred in the United States in recent history, magnitude 9.0 events (or near-9.0 events) have occurred relatively recently in Japan (2011), Chile (2010), and Sumatra (2004). A comparative study of the kinds of post-earthquake sharing that occurred within communities in these places could provide relevant historic context to inform future research in this area.

While the data gained from the focus groups enabled us to develop a preliminary conceptual framework of factors influencing anticipated willingness to share, our participants were nearly all native English speakers, and the focus groups were conducted in English. Conducting additional focus groups with non-English-speaking communities, particularly in South Park and Westport, would likely add valuable perspectives that are currently missing from the research. The conceptual framework of factors affecting willingness to share could then be amended, if necessary, further refined using factor analysis, and developed into a scale for incorporation into future surveys.

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Appendices



SECTION 1: DISASTER PREPAREDNESS

In this section, we ask some questions about disaster preparedness, including how you would get supplies or other items you might need in the case of an emergency (such as an earthquake).

- 1. If you were to lose water, electricity and gas service for a week or more due to a disaster (such as an earthquake), how concerned would you be about being able to do the following things?**

	<i>Not at all concerned</i>	<i>Slightly concerned</i>	<i>Somewhat concerned</i>	<i>Moderately concerned</i>	<i>Extremely concerned</i>
Cooking	☐	☐	☐	☐	☐
Bathing/washing	☐	☐	☐	☐	☐
Staying healthy	☐	☐	☐	☐	☐
Staying warm and dry (in winter)	☐	☐	☐	☐	☐
Staying cool (in summer)	☐	☐	☐	☐	☐
Staying safe and secure	☐	☐	☐	☐	☐
Communicating with family and friends	☐	☐	☐	☐	☐
Getting around (transportation)	☐	☐	☐	☐	☐
Other (please describe)					

- 2. If your house was damaged in an earthquake and became unsafe to stay in, do you have neighbors in South Park that you would feel comfortable staying with for several days or more?**

- ☐ Yes
☐ No
☐ I don't know

- 3. In the past month, how many neighbors have you talked to about disaster preparedness?**

_____ neighbors

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4. For each item listed below, please tell us for how long your household is prepared to be on its own in case of a disaster (such as an earthquake).

	0 days	1-3 days	4-6 days	7+ days	Don't know
Drinking water	☐	☐	☐	☐	☐
Non-perishable food	☐	☐	☐	☐	☐
Medications	☐	☐	☐	☐	☐
Transportation	☐	☐	☐	☐	☐
Communication (phone, Wi-Fi, AM/FM radio, etc.)	☐	☐	☐	☐	☐
First aid supplies	☐	☐	☐	☐	☐
Warmth (clothes, blankets, shoes, etc.)	☐	☐	☐	☐	☐
Sanitation (toilet facilities)	☐	☐	☐	☐	☐
Power (extra batteries, generator, etc.)	☐	☐	☐	☐	☐
Shelter (tent or alternative shelter if needed)	☐	☐	☐	☐	☐
Other (please explain) _____					

5. If you did not have the items listed below, where do you think you would go to get them in the case of a disaster (such as an earthquake)?

Drinking water _____

Non-perishable food _____

Medications _____

Shelter _____

Communication (phone, Wi-Fi, AM/FM radio, etc.) _____

First aid supplies _____

Warmth (clothes, blankets, etc.) _____

Sanitation (toilet facilities) _____

Power (extra batteries, generator, etc.) _____

Transportation _____

Other (please describe) _____

6. Please tell us about your familiarity with the City of Seattle's emergency preparedness resources.

Check all that apply.

- ☐ I have visited the Office of Emergency Management disaster preparedness website.
- ☐ I have participated in a disaster training event provided by the City of Seattle.
- ☐ I have participated in other (non-City of Seattle) disaster training events.
- ☐ I am signed up for AlertSeattle emergency alerts and notifications.
- ☐ I have watched videos online about how to be prepared for emergencies.

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7. There are many reasons why you might not want to share some of your own resources with neighbors. For example, you may need them for yourself or your family, or perhaps you think your neighbors should have been more prepared themselves, or that others who have more than you should be the ones to share. So, honestly speaking, in the case of a large-scale disaster (such as an earthquake), and assuming you had a one-week supply of the items listed below, with whom would you be willing to share the following kinds of resources?

	<i>Nobody</i>	<i>Family and close friends only</i>	<i>Family, close friends and acquaintances</i>	<i>Anyone in need (including strangers)</i>
Drinking water	☐	☐	☐	☐
Non-perishable food	☐	☐	☐	☐
Medications	☐	☐	☐	☐
Transportation	☐	☐	☐	☐
Communication (phone, Wi-Fi, AM/FM radio, etc.)	☐	☐	☐	☐
First aid supplies	☐	☐	☐	☐
Warmth (clothes, blankets, shoes, etc.)	☐	☐	☐	☐
Sanitation (toilet facilities)	☐	☐	☐	☐
Power (extra batteries, generator, etc.)	☐	☐	☐	☐
Shelter (tent or alternative shelter if needed)	☐	☐	☐	☐
Other (please explain) _____				

8. For each of the disaster-related skills below, please tell us whether you, personally, have that skill or expertise. Please also tell us if you know any South Park neighbors who have that skill or expertise. Check all that apply.

	<i>I personally have this skill/expertise</i>	<i>I know a South Park neighbor who has this skill/expertise</i>
First aid/CPR	☐	☐
Childcare specialist	☐	☐
Search and rescue	☐	☐
Crisis counseling/psychologist	☐	☐
Damage assessment	☐	☐
Disaster feeding	☐	☐
HAM radio operations	☐	☐
Plumber/carpenter/electrician	☐	☐
Firefighting	☐	☐
Other (please describe) _____		

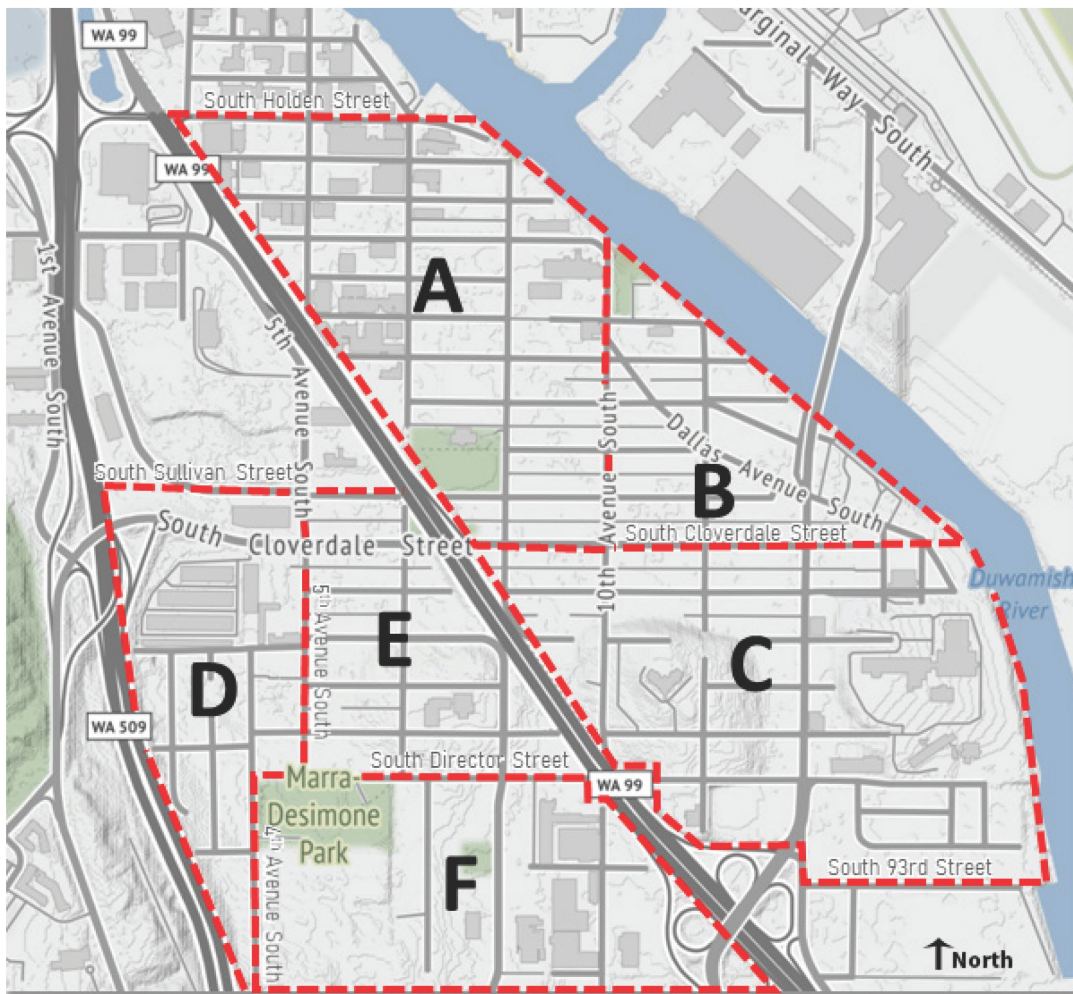
SECTION 2: YOUR COMMUNITY

In this section, we ask some questions about how well you know people in the South Park neighborhood. We also ask some questions regarding your feelings about your neighborhood and your involvement in neighborhood activities.

Please use the map below to answer questions 9 & 10.

9. In which area of the map do you live? Please select the letter marking the area in which you live.

- ☐ A ☐ C ☐ E ☐ I don't live in any of the areas marked on the map
☐ B ☐ D ☐ F



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10. For the different areas marked on the map (A–G), please tell us how many close, trusted friends/family members and how many acquaintances (people you know on a first-name basis) you have who live in each area. Count each person in one category only – either family/friend OR acquaintance.

	Number of close, trusted friends or family members	Number of acquaintances		Number of close, trusted friends or family members	Number of acquaintances
Area A			Area D		
Area B			Area E		
Area C			Area F		

11. In the past month, how many hours did you spend participating in community, civic, recreational or social activities with other people who live in South Park?

_____ hours

12. Please indicate how much you agree or disagree with the statements below:

	Strongly agree	Agree	No opinion	Disagree	Strongly disagree
In general, you can trust people.	☐	☐	☐	☐	☐
Nowadays, you can't rely on anybody.	☐	☐	☐	☐	☐
It's better to be cautious before trusting strangers.	☐	☐	☐	☐	☐
I feel South Park is a part of me.	☐	☐	☐	☐	☐
I do not feel integrated into the South Park neighborhood.	☐	☐	☐	☐	☐
South Park is the ideal neighborhood for me.	☐	☐	☐	☐	☐
It would be very easy for me to move away from South Park.	☐	☐	☐	☐	☐

SECTION 3: ACCESS TO HEALTH CARE

In this section, we ask some questions about how you normally access health care services using different means of transportation and communication. We also ask about where you would go for emergency medical care if needed.

13. What means of communication do you use to contact and/or communicate with your health care provider/s? Please check all that apply.

- ☐ phone
☐ email
☐ online/website
☐ social media (Facebook, WhatsApp, etc.)
☐ other (please describe) _____

14. How many miles (from your home) do you travel to get to your... Please round to the nearest mile.

primary health care provider/s? _____ miles

pharmacy? _____ miles

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15. What means of transportation do you use to get to your health care provider/s for medical appointments or other health care services?

Please check all that apply.

- ☐ personal automobile
- ☐ bus and/or light rail
- ☐ dial-a-ride
- ☐ ride-hailing service (Uber, Lyft, etc.)
- ☐ car-sharing service (ZipCar, ReachNow, etc.)
- ☐ carpool/vanpool or ride from a friend
- ☐ bicycle
- ☐ walk
- ☐ other (please describe) _____

16. Where would you go if you or a member of your household needed emergency medical care on a "normal" day? *Please provide the name of the hospital, clinic or other medical provider you think you would go to if needed.*

17. Where would you go if you or a member of your household needed emergency medical care during or immediately after a disaster (such as an earthquake)? *Please provide the name of the hospital, clinic or other medical provider you think you would go to if needed.*

SECTION 4: BACKGROUND INFORMATION

This section asks some questions about you and your household. The answers you provide will help us to project the information from this small study sample to a larger population.

18. How many people in your household travel/commute at least ten miles to work or school on most weekdays?

_____ people

19. How many people in your household drive (including you)?

_____ people

20. How many motorized vehicles does your household have?

_____ automobiles _____ motorcycles/ATVs

21. How many bicycles does your household have?

_____ bicycles

22. How many people in your household have physical or mental conditions which prevent or limit them from...

Driving? _____

Taking public transit? _____

Walking? _____

Riding a bicycle? _____

23. Do you rent or own your home?

- ☐ rent
- ☐ own
- ☐ provided by somebody else (e.g., relative/employer)

24. What is the primary language spoken in your household? _____

What other languages are spoken in your household? _____

25. How many people live in your household (including yourself)? *By "household" we mean "people who live together and share at least some financial resources." Roommates are usually not considered members of the same household.*

Number of children 0 – 5 years old _____

Number of children 6 – 17 years old _____

Number of adults 18 – 64 years old _____

Number of adults 65+ years old _____

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**26. Which best describes the type of home in which you currently live?**

- ☐ stand-alone house
☐ condo
☐ apartment
☐ mobile home
☐ attached home/townhouse
☐ other (please describe) _____

27. For how many years have you lived in... Please round to the nearest whole number.

Your current home? _____

South Park? _____

Seattle? _____

The Pacific Northwest? _____

28. In what year were you born? _____**29. Which ethnicity (or ethnicities) best describe/s your background? Please check all that apply.**

- ☐ White
☐ Black or African American
☐ Asian or Pacific Islander
☐ Hispanic or Latinx
☐ Native American or American Indian
☐ Decline to state
☐ Other (please specify) _____

30. Knowing more about where you live will help us to put your disaster preparedness choices and options in context. Please provide the closest intersection to your home location:

Street 1: _____

Street 2: _____

31. Please select the category that contains your annual household income before taxes.

- ☐ Less than \$25,000
☐ \$25,000 to \$49,999
☐ \$50,000 to \$74,999
☐ \$75,000 to \$99,999
☐ \$100,000 to \$149,999
☐ \$150,000 or more

32. What is your gender identity?

- ☐ Female
☐ Male
☐ Other
☐ Prefer not to answer

33. Which of the following social media tools do you use MOST often – daily or several times a week – to obtain news about events affecting your community? Please check all that apply.

- ☐ Facebook
☐ Instagram
☐ Twitter
☐ NextDoor
☐ Other (please explain) _____
☐ I do not use social media very often or at all.

34. What is your educational background? Check only the highest level attained.

- ☐ Some grade/high school
☐ Completed high school or GED
☐ Some college/technical school
☐ Completed bachelor's degree/s
☐ Some graduate school
☐ Completed graduate degree/s

You may contact me for the following purposes:
Check all that apply. We will only use your contact information for the purposes you specify.

- ☐ To send me a \$5 Resistencia Coffee e-gift card (please provide your email - printed neatly - below)
☐ If you have any questions about this study
☐ For a follow-up interview
☐ To send me a report of the study results

How would you prefer to be contacted? Please print clearly and provide all that apply:

Phone _____

Email address _____

Mailing address _____

Please leave any comments on the next page.

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We would value any additional comments you may have about the content of this questionnaire. Please write them in the space below, and/or attach another page.

Although this survey was originally designed to ask about earthquake preparedness, we realize everyone in the Seattle area has been affected in one way or another by the recent spread of the Coronavirus Disease 2019 (COVID-19). Since the COVID-19 outbreak, have you thought differently than before about being prepared for different kinds of disasters? If so, how?

Thank you for your participation!

Would you like to learn more about disaster preparedness in Seattle? Visit the City of Seattle's Office of Emergency Management website for information about how to prepare your household and community: <https://www.seattle.gov/emergency-management--/prepare>

For information specific to COVID-19, please see King County Public Health:
<https://www.kingcounty.gov/depts/health/communicable-diseases/disease-control/novel-coronavirus.aspx>

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Interview guide

Introduction (5 min)

Hi [name] Thanks so much for taking the time to talk with me today. How are you doing?

Ok, let's get started. First, let me provide a little background. As you know, in the fall of 2019 and the winter of 2020, our University of Washington research team carried out a community resilience survey to households in three Washington State communities, including [community name]. In the survey, we asked respondents about disaster preparedness, their social connections within the community, and demographic information.

One of the survey questions asked respondents where they thought they would go to seek different kinds of resources in a disaster scenario, such as an earthquake. This was an open-ended question, so people were not prompted to select from any specific answers. All of the answers were reviewed and organized into the categories you see here [refer to survey results].

We also know from the survey generally how prepared households in these communities in terms of the number of days respondent households are prepared to be on their own for items like food, water, power, and so on [refer to survey results]. We asked about ten different kinds of resources.

Today, I'd like to discuss these survey responses with you to understand how they might inform community-based disaster preparedness planning. First, we'll talk about some more general trends and then we'll look more closely at specific resources.

Interview questions

General trends across resources: reliance on the store and social ties; not knowing where to go – 10 min

1. On page 2 [show graphic], we can see some general trends about where respondents expect to seek resources in a disaster scenario. In particular, we found that people expect to turn to social ties (like neighbors and friends), to go to the store, or they don't know where to go for that particular resource.
 - a. What is your overall reaction to these general trends of resource-seeking? Is this a pattern you would expect to see in [community name]? Why or why not?
 - b. Very few respondents feel they will rely on first responders or outside emergency aid for these kinds of resources. Why do you think that is, and what do you think this means for disaster preparedness in [community name]?

Resource seeking for specific resources with which respondents are least prepared: water, communication, sanitation and power – 20 min

2. On page 1, there is some more specific information about the items with which respondents in Westport are least prepared and where they expect to get them in a disaster. I'd like to talk a bit about where they expect to get these resources and potential interventions to address potential gaps.

For each resource: Water, Communication, Sanitation, Power

- i. How realistic are peoples' expectations regarding where they might get these resources in a disaster scenario? **(How realistic are these assumptions?)**
- ii. Are there other places people in Westport could go to obtain these resources? **(Where else could people go?)**
- iii. In addition to encouraging people to be better prepared in advance of a disaster, what are some actions that could be taken to help make sure people could access these resources in a disaster scenario? **(Given these expectations, what could we do to help people be better prepared?)**

Cooperation between the city and community – 5 min

3. Are there ways in which this type of information (knowledge about where people think they will go) could help to inform collaboration on disaster preparedness, either between the city and communities, or within communities themselves? How about informing future policy?
4. What could planners or planning do to help? Could changes to the physical environment of the community help?

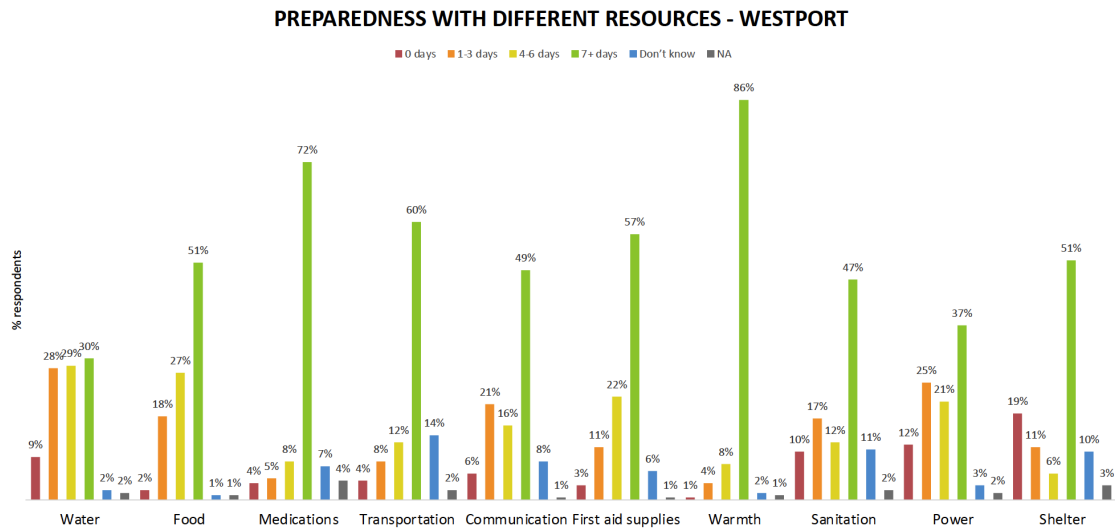
COVID-19 pandemic/overlapping disasters – 5 min

5. In the survey, we asked people to focus on a disaster that would cause disruption to the physical environment (e.g., a severe storm). I'd like to shift gears a little and talk about the current pandemic.
 - a. What kinds of essential resources have people in [community name] had trouble accessing during the pandemic?
 - b. Has the pandemic changed your perspective on community-based approaches to disaster preparedness? If so, how?
 - c. What actions could communities take to be better prepared for potential overlapping disasters (like a pandemic and an earthquake, for example)?

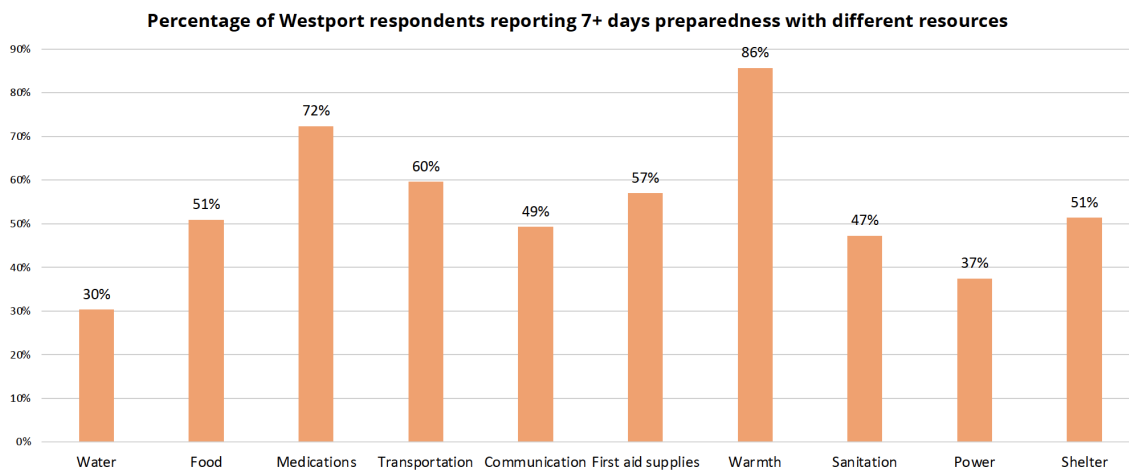
Closing thoughts – 5 min

6. Do you have any other thoughts about the survey results or community disaster preparedness in [community name] that you would like to share?

Slides used for reference in interviews (Westport version)



1



2

Westport: Resources with which respondents are least prepared



Water	Communication	Sanitation	Power
30% of Westport respondents report being prepared for 7+ days	49% of Westport respondents report being prepared for 7+ days	47% of Westport respondents report being prepared for 7+ days	37% of Westport respondents report being prepared for 7+ days
If Westport respondents did not have this resource in an emergency scenario, they would anticipate getting it from:			
- The store (40%) - Outside of the community (15%) - Social ties (10%)	- Social ties (23%) - Don't know (22%) - The store (13%) - Outside of community (12%) - First responders (12%)	- Social infrastructure (21%) - Don't know (18%) - The store (17%) - Natural environment (13%) - Social ties (10%)	- The store (35%) - Don't know (18%) - Social ties (16%) - Outside of community (12%)

3

Westport: Where residents expect to get resources they don't have in a disaster scenario (% responses)

	Communication	First aid supplies	Food	Medications	Power	Sanitation	Shelter	Transportation	Warmth	Water
Don't know	22%	9%	5%	16%	18%	18%	15%	21%	9%	5%
First responders (fire, police)	12%	19%	4%	4%	8%	2%	3%	3%	6%	9%
Social ties (neighbors, friends, family)	23%	16%	15%	7%	16%	10%	28%	27%	29%	10%
Hospital/clinic	0%	1%	0%	4%	0%	0%	0%	1%	0%	0%
Local social services (food bank, clothing bank)	2%	2%	5%	0%	2%	1%	3%	1%	5%	2%
Natural environment (waterways, rainwater)	0%	0%	1%	0%	0%	13%	1%	0%	0%	7%
Outside emergency responders (FEMA, Red Cross)	4%	4%	1%	2%	2%	2%	3%	2%	5%	2%
Pharmacy	1%	13%	1%	27%	2%	2%	1%	1%	2%	1%
Social infrastructure (school, church, library)	6%	4%	7%	3%	6%	21%	14%	3%	9%	5%
Store	13%	20%	46%	16%	35%	17%	5%	6%	16%	40%
Transportation	1%	0%	0%	0%	0%	2%	6%	28%	1%	1%
Outside of community	12%	12%	16%	20%	12%	7%	13%	7%	15%	15%
Other	4%	1%	0%	2%	1%	8%	10%	2%	1%	4%

> 25%

20-25%

15-20%

10-15%

4

Focus group protocol

I. WELCOME (*Allow 15 min for sign-in, welcome, consent, ground rules, and logistics*)

Welcome, and thank you for participating in our focus group today. My name is Katherine Idziorek. I'm the one you've been emailing with. I am a PhD student researcher in the Department of Urban Design and Planning at the University of Washington, where I study community disaster resilience, and I will be leading our discussion today about sharing resources in a disaster scenario. My assistant today is Cristina Cano-Calhoun, who will be helping me out as a scribe to record your comments, as well as Zoom logistics. Cristina, could you please introduce yourself? [CRISTINA INTRODUCES SELF]

II. CONSENT

Before we get started, I need to confirm that you freely consent to participate in this study. So let me share some background about the study and your participation.

This research study is being conducted by the Department of Urban Design and Planning at the University of Washington. You were selected as a potential participant in this study because you live in [COMMUNITY NAME] and because you previously participated in a survey about community resilience in your community. I want to let you know that your participation in this research study is voluntary.

There are two main goals of this study. First, we want to better understand how people in [COMMUNITY NAME] might be able to share resources in the event of a large-scale disaster, like a major earthquake. Second, we want to learn more about how individual households, community-based organizations and [RELEVANT EMERGENCY MANAGEMENT OFFICE/AGENCY] can help communities to be better prepared for an earthquake scenario. Your participation today is very important for helping us to understand this topic better.

In today's focus group discussion, we will ask you some questions about reasons you and others in your community might be more or less willing to share different kinds of resources that would be needed in a disaster. The focus group will last no more than 90 minutes total. You will receive a \$100 Amazon.com gift card for your participation. We will provide you with instructions for ensuring you receive your gift card at the end of the focus group today.

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. Also, you do not have to answer any questions that make you uncomfortable.

Although we will do all we can to ensure confidentiality, we can't guarantee complete confidentiality because it's a group discussion. So, we do ask that all of you keep today's discussion to yourselves so that everyone can feel comfortable sharing their thoughts. Also, please feel free to use your first name only to introduce yourself if you prefer.

If you have any questions or concerns about the research study, please feel free to contact me or any of the other researchers mentioned previously. The project contact information was provided in your invitation email and is also shown on the screen.

Do I have your consent to participate in this study? Please type your confirmation of consent in the chat.

III. GROUND RULES

All right. Next order of business. We have some ground rules we would like you to follow during today's discussion.

1. First of all, we expect everyone to participate in the discussion. Think of this focus group as a brainstorming session. We would like to include as many perspectives as possible, so we want to hear what each one of you think.
2. Everybody's perspective is important, and there are NO right or wrong answers. I can't emphasize this enough. We want to hear all of your ideas.
3. We expect that you may have different views and opinions, and that's great. We don't expect everyone to agree, so please feel free to share what you really think.
4. We are recording the focus group, so please speak clearly and one at a time as much as possible. I know that can be tough to gauge in a Zoom environment, but please just try to keep this in mind.
5. Please also keep today's conversation to yourselves. As I mentioned earlier, we would like to ask that everyone in the group respect the confidentiality of other participants.

Can everyone agree to those ground rules? Please type your agreement in the chat. If you have any questions about the ground rules or rules you would like to add, please let us know at this time.

IV. ZOOM AND MIRO LOGISTICS

The last thing I'd like to cover before we get started are a couple of logistical items related to Zoom:

We'd like to ask that you please keep yourself unmuted and on camera as much as possible, and this is just to help our discussion feel as much like an in-person group as we can, given the circumstances. Of course, we understand if you have some background noise or activity and need to mute yourself or go off-camera temporarily.

If you have an idea that comes up while someone else is talking, please feel free to type it into the chat, and we will make sure it gets recorded.

If for some reason you drop out of the meeting, please go ahead and log back in.

Does anyone have any questions at this point?

V. INTRODUCTIONS/ICE BREAKER

(Allow 5 minutes for introductions)

To get started, I'd like each of you to introduce yourself. Please tell us your first name and your favorite thing about living in [COMMUNITY NAME]. Who would like to start? [FACILITATOR MAKES SURE EVERYONE INTRODUCES THEMSELVES]

V. QUESTIONS

Great - thank you for introducing yourselves. Now let's get started with some brainstorming! For this activity, Cristina is going to be keeping track of your ideas on an online post-it board, which I will share on my screen. As you provide ideas and comments, we'll keep track of them on virtual sticky notes. [CRISTINA DEMONSTRATES]

(Allow 5 min for Question 1)

1. So just to warm up and to get us thinking about the topic of sharing, I'd like to do a quick brainstorm with all of you. My question is this: what are some things that people in [COMMUNITY NAME] share with one another during "normal" times (and by "normal," I mean not during any kind of earthquake, pandemic, or other disaster scenario)? This might be something like a cup of sugar, or books in a little free library, or anything else you can think of. So, in your experience, what kinds of things do neighbors share with one another in [COMMUNITY NAME]? We'll just take a quick five minutes here, so please go ahead and just shout out your ideas and Cristina will record them on the post-it board. [FACILITATOR MAKES SURE EVERYONE PARTICIPATES]

Great - thank you all. Now I'd like to move on to thinking about sharing in a disaster scenario. The scenario I'd like you to keep in mind for the following questions is a large earthquake that would cause damage to some buildings and roadways. Travel out of the area would be very difficult, and [COMMUNITY NAME] residents would likely be without utilities like water, electricity, gas, or telecommunications for several weeks or longer. In this kind of scenario, the Washington State Office of Emergency Management has suggested that households could potentially be on their own without outside assistance for two weeks or more.

I know that might sound a little scary, and it is. It is a hypothetical, but also a possible, scenario that could occur in our region, and we are here to learn about what is likely or realistic in terms of community members being willing and/or able to share resources with one another locally. We believe that what we learn today can help your community to be more prepared in the event something like that does happen, so your honest thoughts are very important. So that's the scenario I'd like you to keep in mind for the next couple of questions.

(Allow 20 min each for Questions 2 and 3)

[SHOW RESOURCE GROUP 1: 5 ITEMS RESPONDENTS WERE MOST WILLING TO SHARE]

2. In the survey that you completed a while back, people in [COMMUNITY NAME] indicated they would be more or less willing to share different kinds of resources. The five resources you see here are the resources that [COMMUNITY NAME] residents felt they would be *most* willing to share with others in an earthquake scenario. My question for you is, what factors do you think would shape your decisions about sharing these resources in a disaster scenario? We would like to hear both about reasons to share and reasons not to share. Feel free to talk about either a specific resource, a group of resources, or all of them together. We'll spend about 20 minutes talking about these five items.

[SHOW RESOURCE GROUP 2: 5 ITEMS RESPONDENTS WERE LEAST WILLING TO SHARE]

3. Ok - this is the same question, now with a different group of resources. These are the five resources that [COMMUNITY NAME] residents felt they would be less willing to share with others in an earthquake scenario. What factors do you think would shape your decisions about sharing these resources in a disaster scenario? Again, please talk about both reasons you might be more or less willing to share, and feel free to talk about either a specific resource, a group of resources, or all of them together. Again, we have about 20 minutes for this discussion.

(Allow 10 min each for Questions 4 and 5)

Ok, let's move on to the next question. To provide some background for this question, I'm sharing some of the data we gathered from the [COMMUNITY NAME] survey in which you participated. This chart shows how willing people are to share different kinds of resources, and with whom. [DESCRIBE DATA]

4. How might knowing what kinds of resources *other people in your community* are more or less willing to share in a disaster scenario factor into your own decisions about disaster preparedness? Why or why not?

Moving on to our final question of the focus group:

5. So far, we have been talking about sharing resources in an earthquake scenario. How do you think willingness to share resources would be affected in a pandemic scenario?

VI. WRAP-UP

(Allow 5 min)

All right, it's time to wrap up, but I want to give you a chance to share any final thoughts. Is there anything else you would like to share about resource sharing or anything you didn't get to say during the discussion? Do you have any questions?

Thank you all very much for your time and for sharing your opinions. This has been a very helpful discussion. Please be on the lookout for a brief follow-up survey via email, which will include instructions about how to receive your gift cards. I have also placed the link to the survey in the chat. Your gift cards will be sent out by mail.

Thank you again and take care.