Project Report

Attitudes and Trust in Leveraging Integrated Sociotechnical Systems for Enhancing Community Adaptive Capacity: Phase IV

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

Prepared for **Teaching Old Models New Tricks (TOMNET) Transportation Center**

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16. Abstract This project is situated in a dialogue that draws from literature in three areas: 1) the role of social ties and social capital in disaster preparedness and response; 2) the potential role of social infrastructure in disaster scenarios; and 3) the integration of urban planning and hazard mitigation planning. The primary research question explores the potential for resource matching at the local level – how can social ties and social infrastructure help 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. 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 leave communities dependent upon local resources. We approach community disaster preparedness planning from a resource-matching perspective, by understanding what resources people might need and how they expect to access them in the case of a disaster. Using data gathered from a sample survey conducted in three Washington State communities, we explore respondents' expectations regarding where they might turn to meet essential needs in a disaster. We find that while preparedness with specific resources varies between communities, common trends in resource seeking can be identified, with a strong anticipated reliance on social ties and stores. Potential interventions are presented in the conclusion, with a focus on the role of urban planners.			
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EXECUTIVE SUMMARY

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 standard, top-down approaches to preparedness. Social capital, mobilized via social ties, and social infrastructure can serve as a kind of "backup" for physical infrastructure when it fails. As managers, shapers and regulators of public space, planners have an important role to play in strengthening the state of community social infrastructure.

This study is situated in a dialogue that draws from literature in three areas: 1) the role of social ties and social capital in disaster preparedness and response; 2) the potential role of social infrastructure in disaster scenarios; and 3) the integration of urban planning and hazard mitigation planning. The primary research question explores the potential for resource matching at the local level – how can social ties and social infrastructure help 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.

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 leave communities dependent upon local resources. We approach community disaster preparedness planning from a resource-matching perspective, by understanding what resources people might need and how they expect to access them in the case of a disaster. Using data gathered from a sample survey conducted in three Washington State communities, we explore respondents' expectations regarding where they might turn to meet essential needs in a disaster. We find that while preparedness with specific resources varies between communities, common trends in resource seeking can be identified, with a strong anticipated reliance on social ties and stores.

Following the initial quantitative analysis of the survey data, we interviewed disaster preparedness planners, community volunteer organizers, and business owners in the study communities to identify potential gaps and opportunities for improved future disaster preparedness. Despite the communities' different approaches to organizing for disaster preparedness, stakeholders in all communities felt the role of community organizations and social infrastructure could be expanded to 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. 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 and social infrastructure in advance of a disaster.

INTRODUCTION

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 (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, I explore the potential for community-level disaster preparedness, consider how it might intersect with households-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 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.

1.1 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?

1.2 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 below). 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. My own role in these activities was as a teaching assistant/research assistant who helped to develop the studio activities, train students in facilitation, and advise students regarding their studio work.

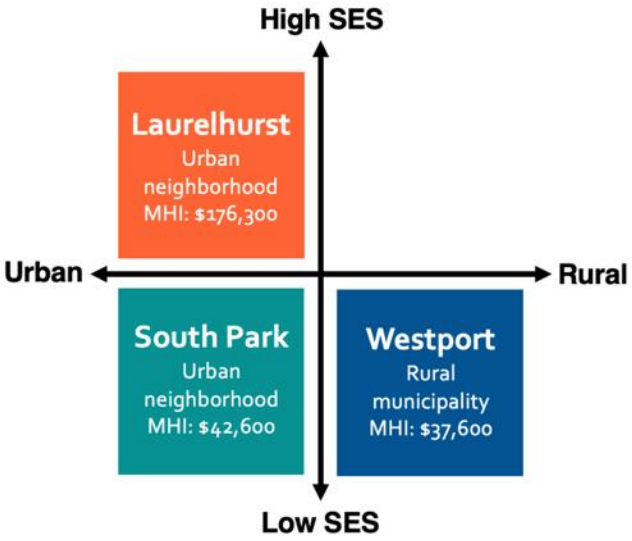

Figure 1: Socioeconomic and urban/rural characteristics of the three study communities (MHI = median annual household income)

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. 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 2: Study community locations within the Pacific Northwest

LITERATURE REVIEW

1.3 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. 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 (Putnam 2001).

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 (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; 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). It should also be noted that, 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.

1.4 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.[1] 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 Kobal Grum 2020) and a broader scope of social and public services related to health, education, and community development (Atkociuniene, Vaznoniene, and Pakeltiene 2015; Davern et al. 2017). Here we focus on a definition of social infrastructure that is in alignment with Klinenberg's: the 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 can interact to 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,

[1] 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.

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 (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 (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.

1.4.1 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 moved 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 (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 rarely happens in practice (Koch et al. 2017).

DATA

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.

1.5 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.

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.

1.5.1 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 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.

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.

1.5.2 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.

1.5.2.1 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.[2] 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,[3] and respondents' use of social media for finding information about disaster preparedness in their community.

1.5.2.2 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.

1.5.2.3 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

[2] 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.

[3] Although this question was included in the pilot survey, it was removed in the full survey.

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 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).

1.5.2.4 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.

1.6 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, I 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.[4]

[4] Although I 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, I was ultimately unable to successfully schedule an interview with them. One of

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 go for 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.[5]

Table 1: Interviewees

Community	***Interviewer role***
Laurelhurst/South Park	Community Relations Manager, Seattle Office of Emergency Management
Laurelhurst/South Park	Lead coordinator, Seattle Emergency Hubs
Laurelhurst	Volunteers, Laurelhurst Emergency Action Plan (LEAP)
Laurelhurst	Owner, City People's Mercantile
South Park	Owner, Resistencia Coffee
South Park	Board member, Cultivate South Park
Westport	Deputy Director of Emergency Management, Grays Harbor County
Westport	Director of Public Works, City of Westport
Westport	Volunteer, Westport Tsunami Safety Committee
Westport	Volunteer, Westport Tsunami Safety Committee

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 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

the Westport interviewees does own a local real estate business, but I did not interview a store owner in that community as I was able to in Laurelhurst and South Park.

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

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.

ANALYSIS

1.7 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:[6] 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). Figure 1 shows the percentage of households prepared with seven or more days of the ten essential resources by community.

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

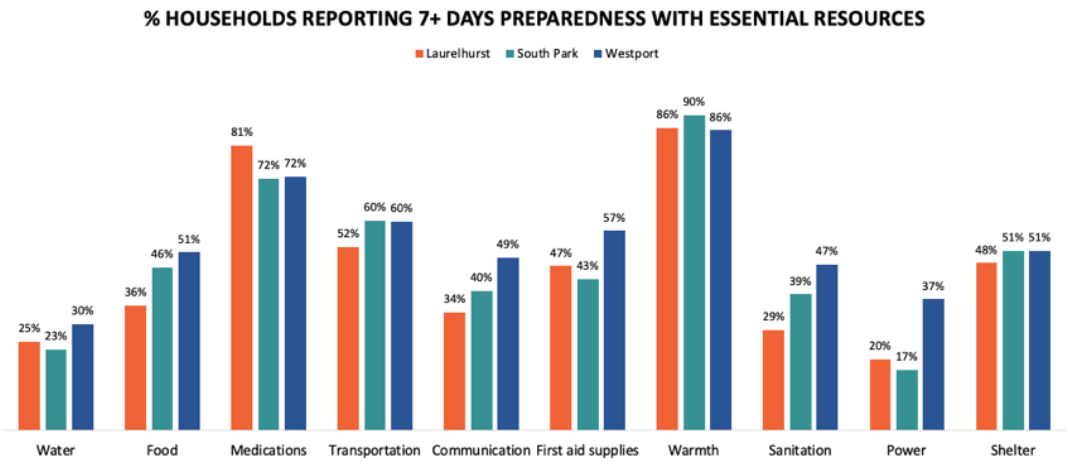

Figure 3: Percentage of households reporting 7+ days preparedness with ten essential resources, by community

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 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 2-4 below 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. I 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 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.

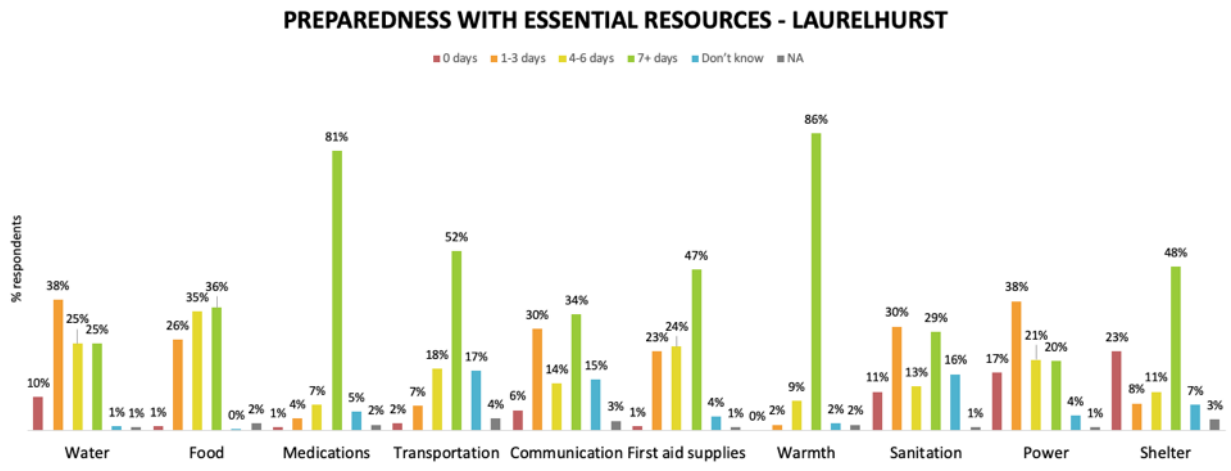

Figure 4: Laurelhurst household preparedness with essential resources (number of days)

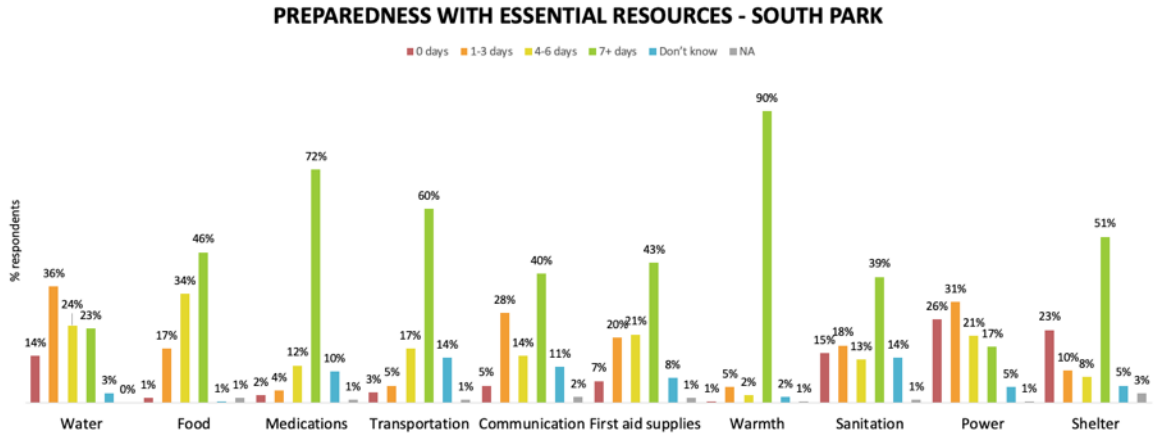

Figure 5: South Park household preparedness with essential resources (number of days)

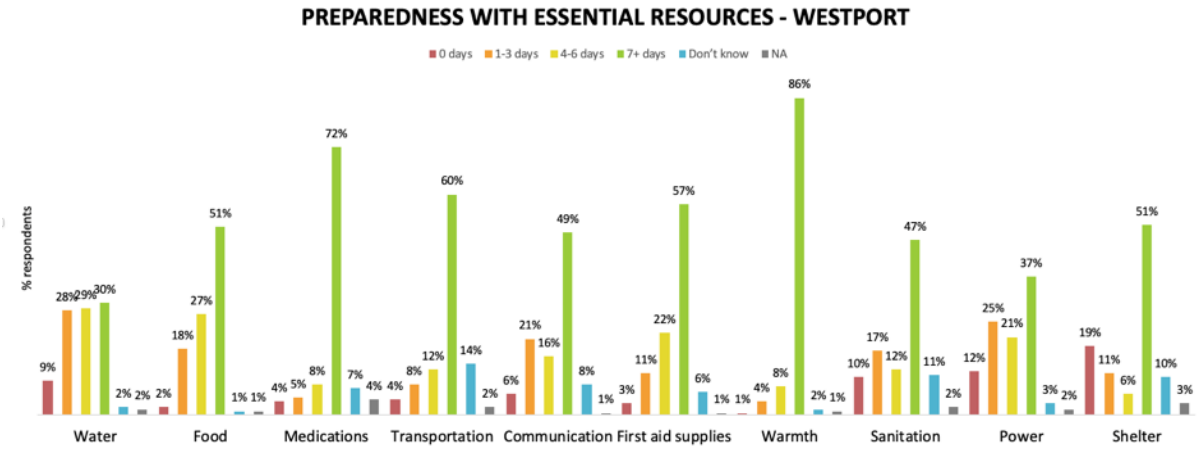

Figure 6: Westport household preparedness with essential resources (number of days)

1.8 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.[7] 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 2: Number of resource seeking response items, by resource and community

Resource	**Total number of answers**		
	Laurelhurst	***South Park***	***Westport***
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 question[8] 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. 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 resultant thirteen categories were:

- Social ties (neighbors, family, friends)

[7] 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 that what we might have included in the initial, multiple-choice question design. 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.

[8] 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.

- 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)

Data about where people in each community expect to seek resources in the event of a disaster was gathered through a random sample survey. Using an open-ended question, we asked respondents to describe where they expected they would turn to obtain the same ten resources outlined above in a disaster scenario if they did not have them on hand.

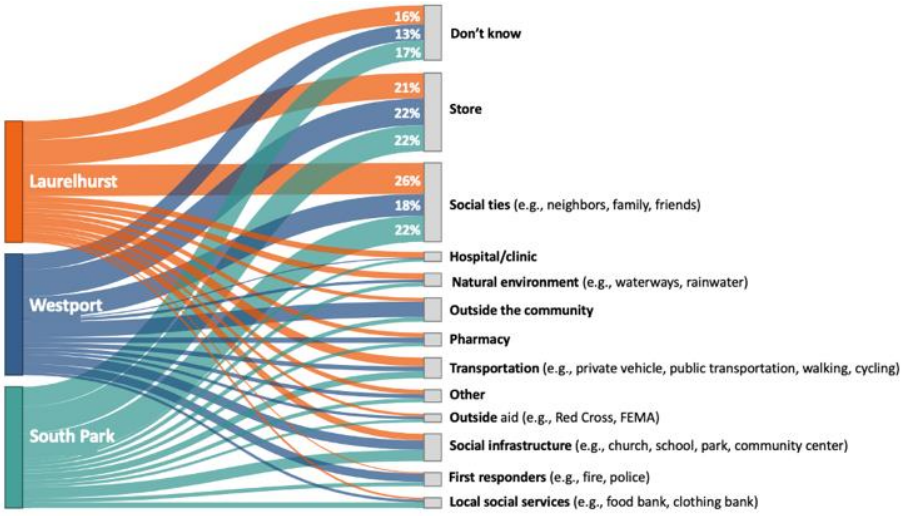

Figure 7: Where respondents expect to turn for needed resources in a disaster scenario

Using *Atlas.TI* (version 9.0.7) qualitative analysis software and an inductive approach to coding, I grouped the open-ended responses into representative categories, starting first with very specific codes. We then grouped codes together until they represented broader but conceptually distinct categories of resources,[9] resulting in thirteen total code groups. Initial codes with very small numbers of responses that did not fit conceptually within any of the larger groups or together with

[9] For example, responses including "school," "church," and "community" center, which each received few individual responses were grouped into a broader category of "social infrastructure" representing institutional community resources. Likewise, "firefighters," "police," and "EMTs" were grouped into a "first responders" category and "food bank," "clothing bank," and "shelter" were grouped into a "local social services" category.

any of the other smaller groups were combined into an "other" category. 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. 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.

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 5 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 3-5 provide resource-specific detail about anticipated resource seeking behaviors for all items.

Table 3: 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	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%

Table 4: 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	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 modes & services	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 5: 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%	46%	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.[10] 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.[11]

Table 6: 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 not 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%
			First responders	12%
Sanitation	Laurelhurst	71%	Don't know	23%
			Social ties	22%
			Natural environment	15%

[10] 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.

[11] 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.

			Social infrastructure	11%
			The store	11%
	South Park	61%	Social ties	20%
			Don't know	19%
			The store	19%
			Social infrastructure	17%
			Natural environment	10%
	Westport	53%	Social infrastructure	21%
			Don't know	18%
			The store	17%
			The natural environment	13%
			Social ties	10%
Power	Laurelhurst	80%	The store	28%
			Don't know	24%
			Social ties	23%
	South Park	83%	The store	29%
			Don't know	27%
			Social ties	22%
	Westport	63%	The store	35%
			Don't know	18%
			Social ties	16%
			Outside of community	12%

Table 6 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).

RESULTS

1.9 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.

*1.9.1 **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 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."

1.9.2 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.

1.9.2.1 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.[12] Some Seattle volunteers also suggested the City 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.

1.9.2.2 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.

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

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

1.9.2.3 Challenges to preparedness

Interviewees from all three locations acknowledge that their communities are underprepared for a major earthquake. As one 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."

1.9.2.4 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.

1.9.2.5 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 used to give guidance for people to 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 of 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.

1.9.3 Potential interventions

1.9.3.1 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. 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.

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.

1.9.3.2 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 ap 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.

1.9.3.3 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.

1.9.4 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 take place more directly between community members. LEAP 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.

1.9.5 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.

1.9.5.1 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."

1.9.5.2 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.

1.9.5.3 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 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."

CONCLUSIONS AND POLICY IMPLICATIONS

1.10 The role of social ties in disaster preparedness

Social ties can connect people with needed resources in the event of a disaster, whether those resource 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. 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 I 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.

1.11 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. Westport is served by a single grocery store and food bank. 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, but whether those kinds of activities 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). The less affluent communities of 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.

1.12 Reliance on infrastructure

While the survey results confirmed a strong reliance of all communities on physical infrastructure 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 where 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 (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.

1.13 "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 organization 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 maintenance[13] of water supplies alone would present a logistical challenge. The thought of being cut off from the outside world 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 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 don't 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.

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

1.14 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.

1.14.1 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 government 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.

1.14.2 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.

1.14.3 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.

REFERENCES

Aldrich, Daniel P. 2012. "Social, Not Physical, Infrastructure: The Critical Role of Civil Society after the 1923 Tokyo Earthquake." *Disasters* 36 (3): 398–419. https://doi.org/10.1111/j.1467-7717.2011.01263.x.

Allen, K. M. 2006. "Community-Based Disaster Preparedness and Climate Adaptation: Local Capacity-Building in the Philippines." *Disasters* 30 (1): 81–101.

Atkociuniene, V., G. Vaznoniene, and R. Pakeltiene. 2015. "Aim of the Development of Rural Social Infrastructure: A Sustainable Community." *Transformations in Business & Economics* 14 (2A): 509–28.

Audirac, Ivonne. 2005. "Information Technology and Urban Form: Challenges to Smart Growth." *International Regional Science Review* 28 (2): 119–45. https://doi.org/10.1177/0160017604273624.

Berke, Philip, Galen Newman, Jaekyung Lee, Tabitha Combs, Carl Kolosna, and David Salvesen. 2015. "Evaluation of Networks of Plans and Vulnerability to Hazards and Climate Change: A Resilience Scorecard." *Journal of the American Planning Association* 81 (4): 287–302. https://doi.org/10.1080/01944363.2015.1093954.

Borgatti, Stephen P., Ajay Mehra, Daniel J. Brass, and Giuseppe Labianca. 2009. "Network Analysis in the Social Sciences." *Science* 323 (5916): 892–95.

Brown, Julie, and Austin Barber. 2012. "Social Infrastructure and Sustainable Urban Communities." *Proceedings of the Institution of Civil Engineers - Engineering Sustainability* 165 (1): 99–110. https://doi.org/10.1680/ensu.2012.165.1.99.

Burby, R. J., R. E. Deyle, D. R. Godschalk, and R. B. Olshansky. 2000. "Creating Hazard Resilient Communities through Land-Use Planning." *Natural Hazards Review* 1 (2): 99–106.

Carpenter, Ann. 2015. "Resilience in the Social and Physical Realms: Lessons from the Gulf Coast." *International Journal of Disaster Risk Reduction* 14 (December): 290–301. https://doi.org/10.1016/j.ijdrr.2014.09.003.

Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94 (Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure): S95–120.

Davern, Melanie, Lucy Gunn, Carolyn Whitzman, Carl Higgs, Billie Giles-Corti, Koen Simons, Karen Villanueva, Suzanne Mavoa, Rebecca Roberts, and Hannah Badland. 2017. "Using Spatial Measures to Test a Conceptual Model of Social Infrastructure That Supports Health and Wellbeing." *Cities & Health* 1 (2): 194–209. https://doi.org/10.1080/23748834.2018.1443620.

Dynes, R. R. 2006. "Social Capital: Dealing with Community Emergencies." *Homeland Security Affairs* 2 (2).

Elliott, James R., Timothy J. Haney, and Petrice Sams-Abiodun. 2010. "Limits to Social Capital: Comparing Network Assistance in Two New Orleans Neighborhoods Devastated by Hurricane Katrina." *The Sociological Quarterly* 51 (4): 624–48. https://doi.org/10.1111/j.1533-8525.2010.01186.x.

Emery, M., and C.B. Flora. 2006. "Spiraling-Up: Mapping Community Transformation with Community Capitals Framework." *Community Development: Journal of the Community Development Society* 37: 19–35.

Federal Emergency Management Agency. 2011. "A Whole Community Approach to Emergency

Management: Principles, Themes, and Pathways for Action." FDOC 104-008-1. https://www.fema.gov/sites/default/files/2020-07/whole_community_dec2011__2.pdf.
Freitag, Robert C., Daniel B. Abramson, Manish Chalana, and Maximilian Dixon. 2014. "Whole Community Resilience: An Asset-Based Approach to Enhancing Adaptive Capacity before a Disruption." *Journal of the American Planning Association* 80 (4): 324–35.
Geis, Donald E. 2000. "By Design: The Disaster Resistant and Quality-of-Life Community." *Natural Hazards Review* 1 (3): 151–60. https://doi.org/10.1061/(ASCE)1527-6988(2000)1:3(151).
Green, Gary P., and Anna Haines. 2016. *Asset Building & Community Development*. Fourth edition. Los Angeles: SAGE.
Grum, Bojan, and Darja Kobal Grum. 2020. "Concepts of Social Sustainability Based on Social Infrastructure and Quality of Life." *Facilities* 38 (11/12): 783–800. https://doi.org/10.1108/F-04-2020-0042.
Hampton, Keith N., Chul-joo Lee, and Eun Ja Her. 2011. "How New Media Affords Network Diversity: Direct and Mediated Access to Social Capital through Participation in Local Social Settings." *New Media & Society* 13 (7): 1031–49. https://doi.org/10.1177/1461444810390342.
Jong, F. de. 2017. "Parks and Bicycles Were Lifelines after Mexico City's Earthquake." *CityLab*, 2017. https://www.citylab.com/environment/2017/09/parks-and-bicycles-were-lifelines-after-mexico-citys-earthquake/541320/.
Klinenberg, Eric. 2015. *Heat Wave: A Social Autopsy of Disaster in Chicago*. Chicago: University of Chicago Press.
———. 2018. *Palaces for the People: How Social Infrastructure Can Help Fight Inequality, Polarization, and the Decline of Civic Life*. First Edition. New York: Crown.
Koch, Heather, Zeno E. Franco, Tracey O'Sullivan, Mia C. DeFino, and Syed Ahmed. 2017. "Community Views of the Federal Emergency Management Agency's 'Whole Community' Strategy in a Complex US City: Re-Envisioning Societal Resilience." *Technological Forecasting and Social Change* 121 (August): 31–38. https://doi.org/10.1016/j.techfore.2016.12.009.
Latham, Alan, and Jack Layton. 2019. "Social Infrastructure and the Public Life of Cities: Studying Urban Sociality and Public Spaces." *Geography Compass* 13 (7): e12444. https://doi.org/10.1111/gec3.12444.
Leyden, K. M., and A. Goldberg. 2015. "The Built Environment of Communities and Social Capital." In *Social Capital at the Community Level: An Applied Interdisciplinary Perspective*, edited by J. M. Halstead and S. C. Deller, 7:31–43. Routledge.
Meyer, M. 2018. "Social Capital in Disaster Research." In *Handbook of Disaster Research*, edited by H. Rodriguez, W. Donner, and J. E. Trainor, 2nd ed., 263–86. New York: Springer-Verlag.
Mileti, Dennis. 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States.* Place of publication not identified: National Academies Press.
Mimaki, Junko, Yukiko Takeuchi, and Rajib Shaw. 2009. "The Role of Community-Based Organization in the Promotion of Disaster Preparedness at the Community Level: A Case Study of a Coastal Town in the Kochi Prefecture of the Shikoku Region, Japan." *Journal of Coastal Conservation* 13 (4): 207–15. https://doi.org/10.1007/s11852-009-0065-8.
Pearce, Laurie. 2003. "Disaster Management and Community Planning, and Public Participation: How to Achieve Sustainable Hazard Mitigation." *Natural Hazards* 28: 211–28.

Pfefferbaum, Betty, Richard L. Van Horn, and Rose L. Pfefferbaum. 2017. “A Conceptual Framework to Enhance Community Resilience Using Social Capital.” *Clinical Social Work Journal* 45 (2): 102–10. https://doi.org/10.1007/s10615-015-0556-z.

Putnam, Robert D. 2001. *Bowling Alone: The Collapse and Revival of American Community*. 1. touchstone ed. New York, NY: Simon & Schuster.

Rainie, Lee, and Barry Wellman. 2014. *Networked: The New Social Operating System*. Cambridge, Mass: MIT Press Ltd.

Ritchie, L. 2017. “Social Capital and Transportation: Critical Assets in Community Resilience.” *TR News*, 2017.

Rogers, S. H., and P. M. Jarema. 2015. “A Brief History of Social Capital Research.” In *Social Capital at the Community Level: An Applied Interdisciplinary Perspective*, edited by J. M. Halstead and S. C. Deller, 7:14–30. Routledge.

Sadri, Arif Mohaimin, Satish V. Ukkusuri, Seungyoon Lee, Rosalee Clawson, Daniel Aldrich, Megan Sapp Nelson, Justin Seipel, and Daniel Kelly. 2018. “The Role of Social Capital, Personal Networks, and Emergency Responders in Post-Disaster Recovery and Resilience: A Study of Rural Communities in Indiana.” *Natural Hazards* 90 (3): 1377–1406. https://doi.org/10.1007/s11069-017-3103-0.

Sampson, Robert. 2013. “Survival of the Sociable.” *New Scientist* 218 (2916): 28–29.

Schwab, J. C. 2010. “Hazard Mitigation: Integrating Best Practices into Planning.” Planning Advisory Service Report 560. American Planning Association, Federal Emergency Managment Agency.

Solnit, Rebecca. 2010. *A Paradise Built in Hell: The Extraordinary Communities That Arise in Disaster*. New York: Penguin Books.

Swanson, L. E. 1996. “Social Infrastructure and Economic Development.” In *Rural Development Research: A Foundation for Policy*, edited by T. D. Rowley, D. W. Sears, G. L. Nelson, M. J. Yetley, and J. N. Reid. Vol. 170. Westport, CT: Greenwood Publishing Group.

Urry, John. 2012. “Social Networks, Mobile Lives and Social Inequalities.” *Journal of Transport Geography* 21 (March): 24–30. https://doi.org/10.1016/j.jtrangeo.2011.10.003.

Vaznonienė, G. 2015. “The Role of Rural Community-Enhancing Rural Social Infrastructure Changes.” *Research for Rural Development* 2: 176–82.

Wasserman, Stanley, and Katherine Faust. 1994. *Social Network Analysis: Methods and Applications*. Structural Analysis in the Social Sciences 8. Cambridge ; New York: Cambridge University Press.

Webber, M. M. 1963. “Order in Diversity: Community without Propinquity.” In *Cities and Space: The Future Use of Urban Land*, 23–54. Baltimore: The Johns Hopkins Press.

Wellman, B. 1999. “The Network Community: An Introduction.” In *Networks in the Global Village: Life in Contemporary Communities*, edited by B. Wellman. Boulder: Westview Press.

Whitham, Monica M. 2018. “Paying It Forward and Getting It Back: The Benefits of Shared Social Identity in Generalized Exchange.” *Sociological Perspectives* 61 (1): 81–98. https://doi.org/10.1177/0731121417712492.

Yelvington, Allison. 2020. “Public Libraries as Social Infrastructure in Disaster Resilience and Recovery: Houston Libraries and Hurricane Harvey.” Houston, TX: Rice University.