Research needs to inform coastal healthcare disaster risk management in the Pacific Northwest

A report of two partner workshops

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Abstract

Coastal communities may be at increased risk of healthcare access disruptions in a major disaster due to their geographical isolation, limited availability of specialized resources locally, and proximity to hazards. Post-disaster healthcare access is of particular concern in the Pacific Northwest (PNW) region, home to a large number of rural and tribal communities that receive healthcare services outside of their geopolitical boundaries. The region is prone to myriad seismic, and increasingly climate-sensitive hazards, and is expected to experience a major (9.0 magnitude) earthquake along its Cascadia Subduction Zone (CSZ). To identify opportunities for researchers to support coastal healthcare and public health disaster risk management (DRM), we hosted two forums with regional partners to:

1. Connect practitioners and multi-disciplinary scientists interested in collaboration to improve healthcare access following major disasters;
2. Identify information needed to better understand healthcare access impacts on PNW coastal communities following disasters; and
3. Develop a research agenda to inform and improve healthcare access following major disasters.

Data, including notes from notetakers and those written by participants and responses from virtual workshop registration surveys, were read to identify key themes and to develop an organizational framework (i.e., staff, stuff, services, systems, and society (i.e., the social environment outside of the healthcare system), for reporting results. Following the development of this framework, data were manually organized into each domain and synthesized. Participants described several challenges and information needs pertaining to healthcare access following disasters. We discuss participant-identified challenges and information needs within each of the domains of our framework, present responsive, guiding research questions, and outline principles of engagement for researchers interested in collaborating with practitioners on such investigations. Findings can inform future research and planning efforts in support of coastal healthcare DRM.

Introduction

Coastal communities may be at increased risk of healthcare access disruptions in a major disaster due to their geographical isolation, limited availability of specialized resources locally, and proximity to hazards. This is especially concerning in the Pacific Northwest (PNW), where several rural and tribal communities with low population densities exist along the coast, many of which receive healthcare outside of their local communities. High acuity care for PNW decentralized populations is highly centralized, including for time-sensitive care to trauma, stroke, and cardiac emergencies (Bulger et al., 2017; Washington State Department of Health, 2020). While these healthcare system structures were designed to meet everyday patient care needs in largely rural states, their ability to meet ongoing and hazard-related healthcare needs during a major disaster, particularly one with widespread infrastructure disruption, is unknown.

Situated along the Pacific Ring of Fire, the PNW region will again experience a major (9.0 magnitude) earthquake along its Cascadia Subduction Zone (CSZ), which stretches from Northern California, USA to Vancouver Island, Canada.(Walton et al., 2021) A CSZ earthquake is expected to trigger tsunamis, landslides, and widespread critical infrastructure failures (Cascadia Subduction Zone Earthquakes: A Magnitude 9.0 Earthquake Scenario, 2013; Dominey-Howes et al., 2010). The region is also prone to more localized earthquakes and climate-sensitive hazards (Frankel et al., 2015; May et al., 2018). The multi-level, system-wide information required by healthcare systems in the context of a major disaster, like a CSZ earthquake, falls outside the expertise of public health and healthcare system experts alone and requires an interdisciplinary approach. However, in the PNW, there has been limited engagement between coastal healthcare organizations and scientific experts about how they can support coastal healthcare disaster risk management (DRM).

In response, we hosted two workshops with regional partners to:

1. Identify information needed to better understand healthcare access impacts and prevent disruptions within Cascadia coastal communities following disasters resulting from natural hazards; and
2. Develop a collaborative research agenda, based on coastal community priorities, to inform and improve healthcare access following major disasters resulting from natural hazards.

Methods

The first workshop was held via the Zoom online meeting platform on March 2, 2022. Invitees included practitioners and researchers with responsibilities for, expertise related to, or interests in ensuring healthcare continuity to PNW coastal communities following disasters, including emergency managers, public health officials, healthcare coalitions, hospital emergency managers, healthcare service providers/administrators, transportation planners, local elected officials, public safety (police/fire/EMS), and community planners and partners. Invitees were identified through public websites, state public health agencies, regional healthcare coalitions, and professional networks within each of the three U.S. states along the CSZ (California, Oregon, and Washington). Prospective participants were invited via email and asked to complete a short registration survey.

The second workshop was held in person at the Tribal Public Health Emergency Preparedness (TPHEP) Conference on May 12, 2022, an annual conference organized by the North Portland Area Indian Health Board and attended by tribal (inland and coastal), federal, state and local public health and emergency preparedness practitioners. Participation in the workshop was open to all conference attendees and encouraged via flyers distributed during the lunch hour and a $25 gift card for participation.

In both workshops, participants responded to the two questions (Table 1) in breakout groups with a facilitator and notetaker before debriefing the larger group after their discussions. After a brief introduction regarding the hosts, purpose, and structure of the meeting, virtual participants were divided into breakout rooms with 5-10 participants each with a trained facilitator and notetaker; in-person attendees discussed each question (Table 1) in small groups and shared individual responses on sticky notes.

Data included notes from notetakers, participant notes, and responses from the registration survey for the first workshop. We read and re-read these data to identify key themes and to develop an organizational framework (i.e., staff, supplies, services, systems, and society) for reporting results. Following framework development, data were manually organized into each domain and synthesized. Tribal-specific considerations were highlighted, where relevant. As participants primarily discussed data, research, or information needs in the context of existing problems or challenges, the project team, which includes both researchers and practitioners,

developed responsive guiding research questions to address them (Table 2). The University of Washington Human Subjects Division determined that this study (STUDY00014923) was human subjects research that qualifies for exempt status.

Discussion

Seventy-eight unique participants engaged in discussions at the virtual workshop for at least 30 minutes and 23 participated in the tribal workshop; 114 submitted responses to the short registration survey prior to the first workshop (Table 2). Participants described several challenges and information needs pertaining to healthcare access following disasters. We discuss participant-identified challenges and information needs within the domains of healthcare staff, supplies, space, services, systems, as well as society (i.e., the social environment outside of the healthcare system), present responsive, guiding research questions (Table 3) and outline principles of engagement for researchers interested in collaborating with practitioners on such investigations (Figure 1).

Staff: Participants discussed concerns that could lead to inadequate staffing during a disaster. For example, they described high levels of burnout among staff due to the ongoing pandemic, which may impact baseline staffing capacity, healthcare worker readiness, or willingness to respond to hazard events. They also noted that the pandemic has contributed to increased housing prices, which has forced some healthcare workers to live farther from their places of work. This, alongside an existing lack of concentrated housing stock near coastal hospitals, was perceived to contribute to a growing healthcare workforce living outside the service area of coastal healthcare organizations, which may hinder some workers from getting to work during a disaster. Anticipated transportation system failures, including bridges and roadways, could "island" people and communities, cutting them off from one another, and keeping coastal healthcare workers from their workplaces.

As a strategy to mitigate the impacts of islanding on healthcare delivery, some participants identified an opportunity to share staff across healthcare facilities and jurisdictions in a disaster; for example, if healthcare staff were unable to travel to their facility, they could work in a similar context locally. Relatedly, a provider who normally works in an ancillary care facility could support acute care in the context of an emergency. Participants suggested the development of a regional provider contact list to promote staff redistribution to meet local and regional needs during a disaster.

Supplies: The impacts of transportation system failures and resultant islanding on the healthcare supply chain were among the chief concerns expressed by participants. Only a few participants reported that their jurisdiction produced maps or other materials related to islanding impacts on supplies. Some participants expressed a desire for estimates of the amounts and kinds of medical supplies that would be needed under different disaster scenarios, as well as for accurate, real-time operational information (including beds, personal protective equipment, specialized equipment, etc.) on a shared regional platform.

Within tribal communities, participants expressed the need to identify potential supply chain and access/transportation disruptions, even for inland tribal communities. Resource and contact lists could be developed and exchanged among tribal communities to inform resource sharing opportunities during disasters.

Space: Participants expressed interest in understanding and providing/discussing engineering strategies to improve the resilience of the critical infrastructure that healthcare facilities rely on to remain operational in the event of a disaster, and for functional recovery. They also discussed the capacity constraints of coastal healthcare facilities, and the added strain that diversion policies for emergency medical service (EMS) put on their limited facility space. Acknowledging the difficulties of transporting patients into and out of "islanded areas," participants pondered ways to reverse the paradigm to bring healthcare to people instead of people to healthcare. This was discussed as a way of concurrently alleviating workload of EMS organizations, who have competing roles and responsibilities during a disaster event.

Services: Participants reported opportunities for improvement and information needs from their experience dealing with the impacts of the ongoing pandemic. Specifically, participants reported that the pandemic springboarded innovations in healthcare delivery, particularly in rural areas, with dual-use applications in other disaster contexts. For example, the increased use of telehealth provides opportunities for care delivery during disaster response and recovery. However, despite regional discussions about crisis standards of care during the pandemic, some participants described existent knowledge gaps about approaches to crisis and contingency care. Participants also reported concern about disasters deepening existing inequities in access to quality care, especially inequities that have been exacerbated by the pandemic.

Systems: Many participants discussed the need to understand the interdependencies between different components of healthcare delivery systems (e.g., provider and supplier types), their interaction and reliance on other critical infrastructure systems (e.g., water, wastewater transportation, and communication), as well as the expected performance of such systems in the event of a disaster. Participants also identified the need for asset mapping and network analysis to inform a holistic understanding of these interdependencies for planning and preparedness. Some also discussed a need to understand the flexibility of the regulatory environment post-disaster to see if rigid requirements imposed on healthcare facilities can be loosened or adapted during emergencies.

Participants sought strategies to build interconnectedness between jurisdictions and facilities. Forming and maintaining relationships, identifying silos, and clarifying roles in a disaster to avoid duplicative or contradictory efforts were all identified as major priorities. For example, participants described a potential to engage home health providers to avoid overwhelming hospitals, as well as to better connect clients and care providers during a disaster.

Within tribal communities, participants explained that there are few healthcare resources located on reservation lands, and many tribal members travel to nearby communities to access healthcare. They expressed the need to assess the impacts of tribal member access to healthcare in the event of a disaster and to understand if and how non-tribal healthcare facilities are accounting for tribal member needs during and after emergencies. There was a reported need to share and collaborate on planning efforts and resilience/preparedness projects across (and between) tribal communities and their non-tribal neighbors.

Participants described the necessity of accounting for regional impacts of facility-level evacuation decision-making, including by creating classifications of patients to understand their care needs, developing thresholds or other criteria for evacuation, identifying those who need to be involved in decision-making processes, and balancing comfort care with rapid evacuation. In this and other surge planning research, participants also highlighted the importance of considering the healthcare needs of tourist populations, which can swell in number during summer months along the coast.

Lastly, several participants discussed the need for equitable system-level recovery planning to strengthen healthcare systems after disaster (i.e., “build back better''). Notably, the role of the Indian Health Service (IHS), the primary healthcare provider on tribal lands, as it relates to tribal healthcare-related DRM was not discussed at either workshop, possibly due to lack of federal/IHS employee participation, and is worthy of further consideration.

Society: Several participants shared how community preparedness could reduce the volume of patients requiring healthcare attention during an event. Building preparedness was seen as intimately tied to the community members' connections with local healthcare organizations; participants wanted to identify ways to create such bridges, including through community emergency response team (CERT) establishment. They also stressed the importance of hyper-local response, both in tailoring messaging and in understanding the material needs and community preparedness levels. Key concerns were primarily related to messaging, including how best to message to those unfamiliar with the community or its hazard risk, about triage decisions for limited medical services, as well as through multimedia, in multiple languages and to multiple audiences. Participants noted that there are additional equity concerns that need to be understood as part of the tribal disaster experience; emphasizing the need for linguistically inclusive, trauma-informed, and diverse communications through trusted channels.

Conclusion

PNW coastal communities have information needs related to healthcare DRM that can be addressed, at least in part, through collaborations with researchers. Guiding research questions responsive to community needs, and principles of engagement for researchers interested in collaborating with practitioners on such investigations presented herein can inform future research and planning efforts in support of coastal healthcare DRM.

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Table 1: Open-ended registration survey and workshop discussion questions

	Virtual workshop registration survey questions	Discussion questions asked at the virtual and in-person workshop
1	In the context of your everyday role (i.e., before a disaster), in what types of decisions are you involved, with regard to providing access to or ensuring healthcare following a disaster?	What data, research, and/or information is missing in your region/community that would improve healthcare access and better understand healthcare access impacts following disasters resulting from natural hazards, such as an earthquake or tsunami in the context of: planning and preparedness, response, and recovery?
2	Is there any particular information that would enable you to improve preparedness for supporting post-disaster healthcare access? (e.g., data, research results, situational awareness, any essential element of information (EEI))?	How best can researchers engage and work together with communities to develop a research agenda that meets your community's needs for improving healthcare access and better understanding healthcare access impacts following disasters resulting from natural hazards?

Table 2: Virtual workshop registration survey demographics

Registrant affiliation	**n**	**%**
State[1]		
Oregon	18	15.8
Washington	96	84.2

Table 2 ct

Sector		
Academic[2]	28	24.6
Healthcare, non-hospital	16	14.0
Healthcare, hospital or hospital system	16	14.0
State public health	5	4.4
Local public health	19	16.7
Tribal public health*	4	3.5
Healthcare coalition staff	5	4.4
Public safety (emergency management, fire, and EMS)	12	10.5
Non-profit organization (including non-profit consulting)	6	5.3
For-profit consulting	1	0.9
Utility company	1	0.9
Unknown	1	0.9

[1] While the Cascadia coast includes the two northernmost counties of California, our workshops did not include any participants from California. This is likely due to the stronger professional networks of the project team in Washington and Oregon.
[2] Registrant list includes 28 participants who concurrently served as facilitators or notetakers, including 27 from academic organizations and 1 from a tribal organization

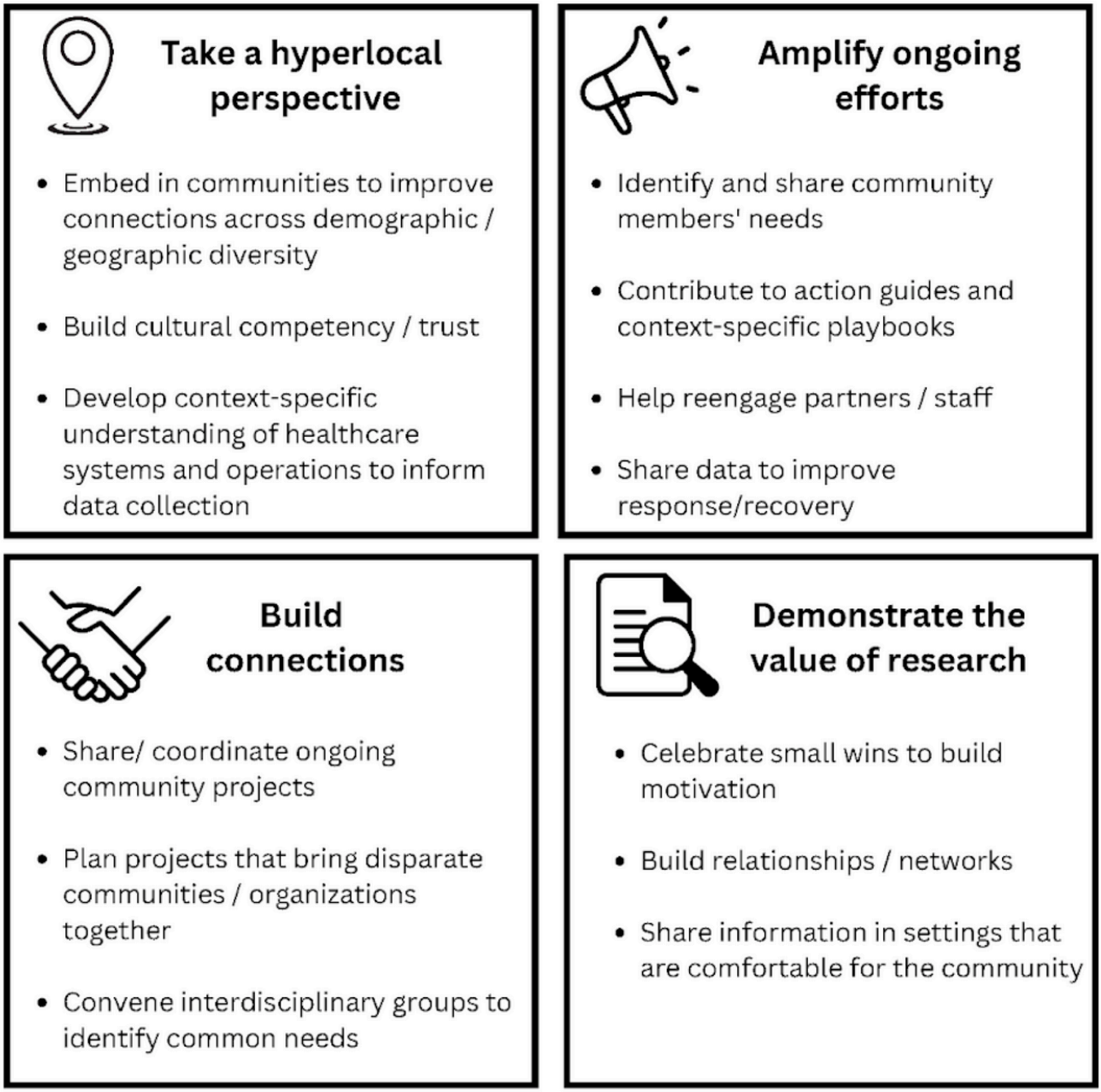
Table 3: Research questions developed in response to challenges and information needs described by participants

Domain	Responsive Research Questions
Staff	1. What are the post-pandemic determinants of, and strategies to improve, healthcare worker willingness to respond? 2. How have rural and coastal changes to affordable housing impacted the capacity of healthcare workers to respond in the event of an emergency? 3. What areas in Cascadia coastal communities are most susceptible to islanding? How will islanding impact staff access to healthcare facilities? 4. How can staff be shared across healthcare facilities and jurisdictions to meet local and regional healthcare delivery needs in the event of a disaster? What policies and processes are necessary to support implementation?
Supplies	1. How will islanding impact the delivery of healthcare supplies to points of care? 2. What health impacts are expected during and after various disaster scenarios? What medical supplies (including medical equipment, medications, and bed spots) are required to address these impacts under different scenarios?
Space	1. What pre-facility (e.g. pre-hospital) engineering strategies are most effective in reducing patient load during a surge? 2. How do approaches that integrate care provision out in the community (versus in healthcare facilities) impact access to care during a disaster, including system capacity and time to treatment? 3. What policy and operational barriers exist to providing care outside of healthcare facilities, and how can these be overcome?

Table 3 ct.

Services	1. What inequities in access to care are likely to be exacerbated by disasters? 2. How does telehealth augment access to care during a disaster, including system capacity and time to treatment? 3. What are operational and policy barriers to using telehealth to provide care during and after an emergency, and how can these be overcome? 4. How can inequities in crisis or contingency care delivery be minimized?
Systems	1. What are the interdependencies of different healthcare provider and supplier types and other critical infrastructures? How do failures in one provider type, supply type or critical infrastructure impact other provider or supplier types? 2. What are effective approaches to, and key considerations in, regional decision making about facility-level evacuation? 3. What "blue sky" policy and regulatory requirements hinder the healthcare system's ability to respond to disaster, and what changes to existing or emergency laws are required to overcome them? 4. How can recovery plans facilitate healthcare system strengthening?
Society	1. What messaging strategies are most effective at communicating both preparedness information and the healthcare sector's capacity and constraints to the general public? 2. How can healthcare facilities build deeper bonds with and connections to the communities that they serve?
Tribal	1. How will islanding impact tribal healthcare access? 2. How can healthcare facilities that serve tribal members account for their needs during and after a disaster? 3. Which tribal communities are most susceptible to islanding? How will islanding impact tribal supply chains? 4. How can risk communication be tailored to meet the needs of tribal members?

Figure 1: Principles of engagement for researchers interested in collaborating with practitioners on coastal healthcare disaster-related research, as suggested by participants



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