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The Disaster Health System: Built for Collaboration and Coordination in a Complex Environment

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Walden University

College of Health Sciences and Public Policy

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Leslie Elaine Taylor

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University

2023

Abstract

The Disaster Health System: Built for Collaboration and Coordination in a Complex

Environment

by

Leslie Elaine Taylor

MA, Brandman University, 2015

BA, Evergreen State College, 2013

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Services – Disaster Health

Walden University

August 2023

Abstract

This qualitative case study examined patient distribution and coordination during complex, rapidly changing, uncertain emergencies or disasters. The study explored how Washington State's Northwest Healthcare Response Network (NHRN) uses the state's patient tracking system, WaTrac, as a collaboration tool for Emergency Support Function 8 (ESF 8) and public health emergency operations. This study used complexity theory to address a gap in the literature, acknowledging the importance of relationships among members of the NHRN and how the patient tracking system could enhance positive patient outcomes. This study included nine healthcare response participants; all were members of the NHRN healthcare coalition serving in multiple positions and disciplines with direct experience with patient tracking during the COVID-19 response. Manuscript One studied the patient tracking system as a communication and coordination tool between responding parties for patient load-balancing and distribution. Manuscript Two intentionally researched the healthcare coalitions' roles and responsibilities in coordination and collaboration and how it is interconnected to state government and its duties in patient distribution. Manuscript Three considered the local, state, and federal government's roles in response and how miscommunication and lack of leadership can destabilize the response system from top to bottom. As the system utilizes its feedback loop processes, incorporating lessons learned could close the gaps revealed in these three manuscripts and establish an efficient and effective disaster health system to enhance national health security.

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Dedication

This dissertation is dedicated to my family. May you never be too afraid to reach for your dream, surround yourself with people who will help you defeat obstacles, and always remember that I love you.

Acknowledgments

I wish to express my most profound appreciation to Dr. Kim Sanders (dissertation chair), Dr. Kristin L. Wiginton (dissertation committee members, and Dr. Magdeline Aagard (URR) for their guidance, technical assistance, and most of all, patience as I navigated this process through being activated for the COVID-19 response and all the ups and downs that came during this time.

I want to send a special thank you to my husband, John; you have been my biggest supporter and cheerleader. You have motivated me during this journey and have been there for every milestone—my two sons, Eric, and Ryan; their spouses; and my beautiful grandchildren; your love fills my heart and carries me through every day.

Lastly, I would like to mention my public health response colleagues. I joined my employer halfway through this dissertation and during the COVID response. We were tired and stressed, but you found the time to rally around me and encourage me to continue, even when it seemed never to end.

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Part 1: Overview

Introduction

Disaster health response in a complex environment involves multidimensional efforts to reduce health impacts on those affected. Disasters or public health emergencies are dynamic events that evolve as they progress. Multiple agencies and government levels manage response activities. In theory, lessons learned from previous events have shifted response paradigms towards collaborative and coordinated systems. However, a lack of trust in the new paradigms leaves responders continually reverting to trusted methods, notwithstanding their previous failures.

Effective coordination can mean the difference between order and chaos when a health crisis evolves, whether due to a pandemic, disasters triggered by natural hazards, or human-made incidents. During an emergency, proper communication from lead agencies, including alerts and notifications regarding medical surges, patient offloading, and resource distribution, must be disseminated promptly to prevent life loss. The COVID-19 pandemic highlighted the importance of disaster health system coordination in complex environments. Hospitals nationwide were overwhelmed and experienced shortages of life-enhancing medical devices, intensive care beds, staffing, and personal protective equipment.

In 2021, the United States (U.S.) experienced 20 weather or climate disasters, each resulting in at least \$1 billion in damages (Climate.gov, n.d.). These events were directly or indirectly related to 688 deaths (Climate.gov, n.d.). One in three Americans

was estimated to be affected by weather-related events in 2021 (Isaacs-Thomas, 2022). The impact of weather-related disasters from intense wildfires, droughts, hurricanes, and tornadoes on people's health causes a substantial burden on an already overwhelmed health delivery system (Flynn, 2018). There are also Americans wounded due to mass shootings or human-made incidents in 2021; the Federal Bureau of Investigation (FBI, 2022) designated 61 shootings as active shooter/mass shooting events, an increase of 52.5% since 2019. The FBI (n.d.) defined a mass shooting as having four or more fatalities, not including the shooter.

One of the critical concerns involving such medical surge events is continually tracking and distributing victims in disaster scenes through rehabilitation and release (Tavakoli et al., 2016). Equally important is allocating disaster victims to appropriate care facilities, with the most critical being diverted to Level 1 trauma centers. Less critical victims are transported to lower-level medical centers (Khajehaminian et al., 2017; Turner et al., 2016). Patient distribution is determined by the regional healthcare coalition (HCC), a network of healthcare organizations, public health agencies, emergency medical services (EMS), and emergency management departments. HCC primarily aims to support life safety in emergencies or disasters via coordinated preparedness and response efforts (NACCHO, 2017). In Washington State, there are three HCCs; this qualitative case study explored how the Northwest Healthcare Response Network (NHRN) collaborates with healthcare response partners and how the coalition

managed patient distribution during the COVID-19 pandemic using the WaTrac patient distribution system.

Managing bed availability and forecasting future needs should be done in real-time. In Washington State, the tool to track the hospital's available bed count is WaTrac. WaTrac is limited by the requirements for healthcare facilities to report their census. Bed availability reporting is required every eight hours. With periodic bed counts, it isn't easy to ascertain the current immediate bed availability during nonreporting times. Collecting and presenting data three times daily is insufficient (Mark et al., 2019). Additionally, when a system or skill is not used regularly, the end-user's retention of program procedures severely diminishes (Kluge & Frank, 2014; Kluge et al., 2019; Healy et al., 2005). Not using the WaTrac system regularly makes it difficult in a disaster or public health emergency, which is even more reason to use a patient tracking system daily.

Emergencies are “any occasion or instance-- -that warrants action to save lives and to protect property, public health, and safety” (Federal Emergency Management Agency [FEMA], 2009, p.4). Disasters are “an occurrence of a natural catastrophe, technological accident, or human-caused event that has resulted in severe property damage, deaths, and/or multiple injuries” (FEMA, 2009, p. 2). In comparison, a large-scale disaster or catastrophe is categorized as “one that exceeds the response capability of the local jurisdiction and requires State, and potentially Federal, involvement” (FEMA, 2009, p. 2). Disasters overwhelm local assets and deplete available resources; response efforts rely on regional and federal assistance to meet immediate demands.

Regional hospitals operate near or beyond capacity during a disaster or public health emergency. The surge in cases of COVID-19 highlighted the Washington State WaTrac patient distribution to be ineffective, leaving the state unprepared. The problem exists that Washington State does not have a collaborative framework to provide real-time situation awareness and patient bed availability.

This study explored how western Washington's healthcare response partners organize to form the NHRN to coordinate during an Emergency Support Function 8 (ESF 8) or public health emergency and identify lead agencies. Additionally, this study explored the use of the WaTrac patient tracking system, administered by the NHRN, and how it is used to improve communications involving resource needs, provide situational awareness, and coordinate immediate bed availability (IBA) and patient distribution. Patient tracking systems are tools for collaboration between standard operating competitors during time-sensitive events when the number of critically injured patients surpasses available resources. The complexity theory was used as the theoretical framework to understand how inter-organizational collaboration of disaster health responders would integrate and perform to increase efficiency.

Additionally, this study investigated Washington State's disaster health responders' individual experiences using the WaTrac patient distribution system to maintain situational awareness and measure response progress during mass casualty incidents (MCI). A cohesive ESF 8 or public health response process and an efficient and

effective patient distribution system address gaps in the more significant social problem of rising human-caused and natural disaster threats to national health security.

Preparedness levels vary nationwide and even within Washington State. Linear, discipline-specific approaches to medical surge planning for Public Health and Medical Services Emergency Support Function 8 (ESF8) response are helpful. Still, they cannot address the multiple layers of the overall patient surge and the interdisciplinary partners' influence on the response effort. During a pandemic or large-scale mass casualty incident (MCI), community hospitals and regional trauma centers will not have enough resources to accommodate the surge of critically injured (Eriksson, Stoner, Eden, Newgard, Guise, 2017). The patient distribution system records resource availability directing EMS to available facilities, not overwhelming a single healthcare response entity (Sharter, Morre, Wood, 2017).

In 2022, Standard and Poor's Global (S&P) healthcare systems had an operating margin of 2.7 percent and an excess margin of 4.3 percent for 2019. At the same time, Statista identified and reported that in 2019 (pre-COVID), the average-maintained hospital bed occupancy in the United States was 65.4 percent, and the U.S Department of Health and Human Services reported in 2022 (during COVID), a national average of 76 percent of inpatient beds in use (HHS, 2022). Healthcare executives (pre-COVID) collectively considered 85 percent the ideal occupancy rate for peak profitability (Allen, 2017). James Allen (2017) explained that hospital occupancy rates are based on the number of beds utilized at midnight when the census is lowest in 24 hours. Typically, the

morning hours have a far greater census as patients wait to be discharged and new surgery patients are admitted (Allen, 2017; Toerper, Kelen, Sauer, Bayram, Catlett, Levin, 2018). Healthcare facilities generally schedule elective surgeries Monday through Friday, keeping patient census higher during the week; consequently, the census is lower on the weekend with a concurrent reduction in nurses and weekend staff (Allen, 2017).

Background

In August 2017, Hurricane Harvey in Texas led to trillion gallons of rain in just four days (Flynn, 2018). One day before Harvey landed, the Houston Emergency Operations Center activated the Southeast Texas Regional Advisory Council (SETRAC), one of 22 regional Texas healthcare coalitions encompassing 25 counties, each with its own command post (Flynn, 2018). During this, the SETRAC's Catastrophic Medical Operations Center (CMOC) completed 773 missions, evacuating, and tracking over 1500 patients from 44 healthcare facilities (Flynn, 2018). Highlighted in the Hurricane Harvey after-action review (AAR), effective, efficient communication throughout the health system response was noted to be the third of seven significant lessons learned, posing challenges in information flow, and evolving situational awareness (Ross & Grace, 2018).

On October 1, 2017, a gunman opened fire on a group of country music fans at the Route 91 Harvest Music Festival, leaving 59 dead and 527 injured (Radebach, 2018). Emergency Medical Services (EMS) reported transporting 20% of the victims, while others were self-transported (Radebach, 2018). Radebach (2018) identified

healthcare networks need to develop a patient distribution plan addressing patient surge, movement, and immediate bed availability (IBA) to mitigate incident mortality. Hospital admission data pointed to the absence of an organized and coordinated operation to ensure the safe transport of victims, patient accountability, and secure casualty cross-leveling patient distribution to prevent overcrowding (Radebach, 2018).

Radebach (2018) said if a cohesive patient tracking system had been available at the time of the shooting, it would have positively impacted patient outcomes, simplified the family reunification processes, and tracked real-time bed resource availability. However, the NHRN has not addressed how WaTrac is activated in Washington State and how bed counts remain current during impending medical surges.

Theoretical Framework

Response systems, by necessity, adapt to address the type of incident, number of causalities, available resources, and the medical and public health infrastructure. The WaTrac patient tracking system and NHRN are complex adaptive subsystems to the dynamic disaster health response system (Bergström et al., 2016). Because of NHRN's integrated systems-based approach, the complexity theory was the best theoretical framework for this study. By design, healthcare coalitions (HCC) are a group of healthcare organizations and response partners supporting ESF 8 and public health emergency response efforts (ASPR, 2016). This multiagency coordination group of public and private partners guides medical response coordination and continuity of care in a medical surge (ASPR, 2016).

The complexity theory was applied to analyze and understand WaTrac, the NHRN, and national public health emergency or ESF 8 responses. Disaster health response is complex because of the multiple interconnected responding partners in a dynamic environment. Understanding the response system could lead to a synergetic effect while strengthening the overall disaster health response system's function in response to a medical surge (Bergström et al., 2016). The disaster health response system calls for a systematic approach to improve community resilience effectively. Systemic risk must be evaluated as healthcare response becomes increasingly interconnected and cross disciplines and jurisdictional boundaries (Hochrainer-Stigler et al., 2020). Controlling systemic risk requires information-sharing and collaboration between response partners (Hochrainer-Stigler et al., 2020). The complexity theory was also used for this study's literature review while supporting the study design and problem evaluation.

The complexity theory originated from the general systems theory created by Ludwig von Bertalanffy in the 1940s and expanded by Ross Ashby in 1964. The theory suggests that a complex system is defined more by its relationships than its basic parts; individual entities have their functions and purpose but must operate within the system to achieve one common goal; they are interdependent yet remain autonomous (Manson, 2001; Wheatley, 1992). The complexity theory addresses how systems develop and adapt to environments (Mitchell, 2009). The NHRN comes together in an ESF 8 or public

health event; its members are independent response partners from different modalities and must adapt to a dynamic, changing situation

The complexity theory has three significant categories: algorithmic, deterministic, and aggregate (Manson, 2001). Algorithmic complexity involves difficulty in describing system characteristics (Manson, 2001). Deterministic complexity means two or three variables can disrupt the system (Manson, 2001). I focused on aggregate complexity to address how individual components work together to create a system with complex behavior. Using aggregate complexity as an analytical tool allowed an understanding of the NHRN's members' interrelatedness with each other during health response coordination and the organization's relations with local ESF 8 efforts.

For several reasons, studying coalition response to fulfill responsibilities for performing ESF8 under the National Response Framework (NRF) is critical. ESF 8 aims to minimize health and public health adverse effects in an emergency or disaster. HCC is tasked with ESF 8 Responsibilities (ESF 8 Annex, 2016). I used the complexity theory as a framework when evaluating the literature addressing the importance of relationships between members of the NHRN and how the response system adapted to its environment.

Overview of the Manuscripts

The manuscripts provide an overview of the experiences and beliefs of response partners in western Washington State who used the WaTrac patient tracking system during the COVID-19 pandemic. This study includes three manuscripts designed to

contribute to the current body of knowledge; each manuscript highlights particular challenges health responders encounter during the COVID-19 pandemic. Additionally, study findings filled literature gaps on WaTrac user experience, collaboration in a health emergency, and lead agency. Three separate manuscripts expanded the exploration of unified health crisis operational responses. Integrating findings can lead to standardized best practice models, reducing chaos and confusion during health response.

Manuscript 1

Specific Problem

This study explored the WaTrac patient tracking system's role in providing situational awareness, ad-hoc reporting, and IBA during the COVID-19 response. Linear and discipline-specific approaches to medical surge planning still have not addressed overall efforts that are needed during a patient surge. Understanding Washington's healthcare response partner's experiences using the WaTrac patient tracking system during the COVID-19 pandemic was essential for NHRN to establish best practices to share current bed availability, coordinate and communicate, share real-time data, and streamline patient distribution processes to increase efficiency.

Research Question

What are the experiences and attitudes of Washington state's health response professionals using the WaTrac patient tracking system during the COVID-19 pandemic?

Nature of Study and Design

A case study design was chosen as the research method to collect data from those who had used the WaTrac patient tracking system during the COVID-19 health response. I interviewed nine disaster health responders using Zoom.

The primary source of data was nine semi-structured participant interviews. Field notes were maintained for research recall. Supporting documents such as white papers and policy documents, after-action reports (AAR), situational reports, and archival records were reviewed for triangulation.

Manuscript 2

Specific Problem

This study examined the Northwest Health Response Network (NHRN) as a complex system with subsystems operating independently. These subsystems must be adaptable in order to lessen the burden of illness, injury, and loss of life during medical surges. A problem existed involving intermittent levels of preparedness among response partners and a lack of existing command and control.

Research Question

How did self-organizing disaster health professionals with training involving medical surges experience collaboration regarding patient distribution during the COVID-19 response in Washington State?

Nature of Study and Design

I used a qualitative case study design. I used self-reporting by participants who experienced response efforts and worked with a patient tracking system. Clark and Vealé

(2018) explained qualitative research involve recording non-numeric data, such as opinions, feelings, and experiences. Qualitative research is used to obtain information about an event or topic through a systemic and objective process (Korstjens & Moser, 2017). The qualitative methodology also allows researchers to explore perceptions and experiences of different people within the context of a specific phenomenon (Korstjens & Moser, 2017).

Sources of Data

The primary source of data was interviews with participants. Supporting sources included white papers and policy documents, AARs, situational reports, and archival records focusing on patient distribution. Additionally, field notes were maintained, including notes on body language and other relevant information during participants' interviews.

Manuscript 3

Specific Problem

Manuscript three includes a discussion about ESF 8 and public health disaster response conceptualization and lead agency identification. Command and management remain challenging and inconsistent at the federal, state, and local levels. This study was intended to address specific processes, laws, and directives that generate cohesive activation of public health emergency operations, augmenting multilevel and multi-jurisdictional coordination in order to address longstanding authority and responsibility issues.

Research Question

What did Northwest Health Response Network (NHRN) members perceive regarding where and why connectivity gaps existed involving disaster health responses when initiating public health emergency operations?

Nature of Study and Design

A qualitative case study design was selected to understand NHRN disaster health responders' personal experiences involving anxiety in emotionally charged environments. Information gathered directly from a predefined group of subject matter experts was the primary research method via interviews involving in-depth information about lived experiences. This study was built on interviewees' experiences and perceptions. Data collection involved a pilot study, comprehensive research, and validation.

Sources of Data

The primary data source was participant interviews. Additional data sources included pertinent federal, state, and local laws, the Washington State Comprehensive Emergency Management Plan (2019) with supporting Annexes, white papers, and Presidential Directives. Field notes were maintained during interviews for recall.

Methodology

Purposive and snowball sampling were employed for this qualitative case study in order to collect data from a predefined group of subject matter experts with experience using WaTrac patient tracking system during the COVID-19 response in 2020-2023. Initially, recruitment efforts included posting invitations on social media focusing on the

Washington state area. However, individual emails were used due to the COVID-19 pandemic and lack of response to social media posts. Seventy-eight emails were sent to Western Washington regional disaster responders, and nine exploratory interviews were conducted. Email addresses were found on corporate and government websites in order to identify potential participants.

All participants were members of the NHRN healthcare coalition who had direct experience with patient tracking and movement during the COVID-19 response. This included emergency managers and public health officials who had used the WaTrac system to monitor the Washington healthcare system's status. This study did not include U.S. Department of Veterans Affairs (VA) facilities and Department of Defense (DoD) health systems employees, as their facilities do not report to the WaTrac statewide patient tracking system. Data was collected until saturation was met. Guest et al. (2006) said saturation in qualitative research is achieved when the same patterns are observed. Mason (2010) defined saturation as when research reaches the point of diminishing returns.

Participant interviews were compared to research to provide theme support and strengthen data collected from interviews. Once participants agreed to participate, consent forms (see Appendix B) were emailed. No interview took place without obtaining a signed consent form.

Data Collection and Instrumentation

Each prescheduled discussion started with an introduction, requesting permission to tape-record the conversation, and verifying the consent form. Participants were

guaranteed their responses would be deidentified to enrich responses. Following consent verification, the participant was provided with an explanation of the study's purpose. Participants were asked if they had used the Washington State WaTrac statewide patient distribution system during the COVID-19 response. Participants were asked questions about their role in healthcare response and how many years they had been in their position; this was used for informational purposes only. Confidentiality was guaranteed for each participant, and participants could end the process at any time.

The remaining interview questions focused on their experiences using the WaTrac patient tracking system. I developed an interview guide consisting of six categories, each with three or more questions (see Appendix A), focusing on participant meanings and interpretations to gain insights regarding intricacies inherent in Washington State's WaTrac patient tracking system. These six categories and subsequent questions were created to gain insights regarding participants' experiences during the COVID-19 pandemic response and ascertain whether their experiences aligned with knowledge gleaned from previous studies. Interview questions were constructed to align with the study's research questions.

Validity and reliability are the fundamental criteria for qualitative research trustworthiness (Tolley et al., 2016). The interview guide was pilot tested by two subject matter experts; feedback was requested about question content, wording, and category arrangement. Minimal revisions were needed to validate the study instrument. Validity is the process of developing and validating an instrument by verifying results or findings

accurately from the researcher's perspective and study participants (Kimberlin & Winterstein, 2008). The interview guide used in this study was tested to evaluate if it measured what it was supposed to.

All interviews were scheduled for 1.5-hour appointments, with an option for further discussion if participants needed additional time. Interviews were organized based on participants' availability and conducted via Zoom. Other questions were posed for clarification if participants' answers were unclear. An audit trail was maintained as a record of the data collection, analysis, and interpretation process. The audit trail for each participant will be kept in a separate folder and consists of uncoded transcripts, data analysis, recordings, field notes, and study protocols.

Given that my role in this study was to define the issues, interpret the data, and guide the process, I continually tried to remain non-biased. In addition, at the conclusion of each interview, participants were asked if they would like a verbal presentation of collected data once the study was complete and the dissertation was approved. I assumed participants were forthright in their responses. Participants were told they could withdraw from the study at any time.

Analytic Framework

Interviews were transcribed within 24 hours of conducting them using NVivo Transcription. Participant identifiers were removed, and each participant was assigned a participant number. To ensure validity, all data collection, storage, and dissemination followed appropriate policies and procedures, adhering to guidelines set forth by the

dissertation committee and IRB. All raw deidentified participant and coded information was backed up and stored on a password-protected thumb drive and kept in a locked box at my home. Data will be held for five years post-completion of the study and then destroyed.

Each interview was coded to document essential themes related to using Washington's WaTrac state patient tracking system and how it was used for statewide collaboration regarding patient distribution during the COVID pandemic health crisis for Manuscripts 1 and 2. Manuscript 3 themes pertained to public health emergency operations, coordination, and authorities. Qualitative inductive thematic analysis was conducted (Vaismoradi, Turunen, & Bondas, 2013).

Interviews were organized and coded by hand to become familiar with the data, then via NVivo. Open coding searching for descriptive words or short phrases led to labels representing key concepts I observed. Coding is an organizational tool that categorizes data into classifications centered on universal qualities (Salazar et al., 2015; Williams & Moser, 2019). Two coding cycles were completed, the second round of coding was achieved using the autocode feature in the NVivo software. I studied the coded data to determine if any meaning or patterns emerged, then scrutinized it for themes. I then used the NVivo software to code the themes automatically.

It was important to note the frequency of identifying patterns and code combinations; the frequency of codes and code combination data revealed evidence that

had not been previously considered. Identifying gaps or concepts that were not discussed or commented on was also critical. Analysis and synthesis processes were ongoing.

Significance

A preliminary literature review revealed a lack of peer-reviewed publications involving how Washington's WaTrac patient distribution system performed during the pandemic or an MCI. Extensive research has been completed involving healthcare coalitions' disaster response, patient tracking systems, and the role of ESF 8, but information about response professionals' experiences using WaTrac, NHRN's role in a significant complex response, and the difference between ESF 8 and public health emergencies is missing from the literature.

Results could improve preparation and cohesive responses for NHRN partnerships, making them more efficient and effective. Insight from multiple perspectives and experiences about the phenomenon, increased understanding of the factors associated with patient load-balancing, the NHRN's roles, how WaTrac was used in the pandemic, and the unification of multiple layers of government in healthcare response. Incorporating the results of this qualitative case study of NHRN's Washington state WaTrac patient tracking system, used as a collaborative tool during health crises, will fill gaps in Washington State's healthcare response and possibly provide better health outcomes for Washingtonians.

Relevant Scholarship

To enrich reliability and mitigate researcher bias for this study, two types of triangulations were used: data and methodological triangulation. In addition to interviews, further evidence was obtained from open-source databases for triangulation. Sources include supporting documents such as white papers, policy documents, AAR, situational reports, and archival records focusing on patient distribution.

For the study's document analysis portion, articles relating to the NHRN, patient tracking, immediate bed availability, medical surges, and ESF-8 coordination were selected. Keywords were *patient tracking, patient identification in disaster, trauma-related mass casualty incidents, casualty distribution, casualty evacuation, pre-hospital care, inter-hospital patient transfer, major incident response, health readiness, command and control, public health laws and regulation, federal and state government disaster response, COVID-19 response, and pandemic*. Seven databases were used: ProQuest Science Journals, Health Services and Sciences Research Resources (HSRR), Homeland Security Digital Library, PubMed, SAGE Journals, and Thoreau multi-database search.

Previously published research has addressed the need for a statewide patient tracking system, public health response in a geographical location, and the roles and responsibilities of the NHRN. However, the landscape for patient tracking, healthcare prehospital response, coalitions' responsibilities, public health, and government healthcare response changed due to the COVID-19 pandemic.

Summary

This qualitative case study examined NHRN roles and responsibilities during health crises. This assessment involved using the Washington WaTrac state patient tracking system as a collaboration tool to respond to a complex ESF 8 event or public health emergency. The U.S. continues to face pandemics, disasters triggered by natural hazards, and terrorist threats. When used to its fullest capability, a patient tracking system or immediate bed inventory will be the appropriate tool to provide situational awareness deliver the proper care at the right time.

Emergency response involves multiple interrelated subsystems that converge in demanding and rapidly changing environments. The primary objective is always to perform better the next time. This study addressed improvement opportunities and resources to prepare whole communities for better health crisis responses, providing improved health outcomes.

Part 2: Manuscripts

**Disaster Responders Explain Challenges in Using a Patient Tracking System in a
Medical Surge: An Exploratory Qualitative Study Using the Complexity Theory**

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Short Running Title: Challenges of Medical Surge Patient Tracking

Outlet for Manuscript

Disaster Medicine and Public Health Preparedness from Cambridge University Press was selected for Manuscript 1. This peer-reviewed journal publishes articles about search and rescue, disaster medicine, disaster risk reduction, mass gathering medicine, population, and public and crisis health. Manuscript 1 shares the journal's scope by addressing patient distribution strategies to impact patient outcomes positively. In addition, Manuscript 1 is highly cited, with multiple works previously published in the *Disaster Medicine and Public Health Preparedness Journal*. All journal articles will be submitted using the *American Medical Association Manual of Style* (11th edition).

Instructions for authors, along with a manuscript checklist, can be found at <https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/information/instructions-contributors>.

ABBREVIATION LIST

ASPR – Depart of Health and Human Services Assistant Secretary of Preparedness and Response

ED – Emergency department

EMS – Emergency medical services

ESF8 - Emergency Support Function 8- Public Health and Medical Services

IBA – Immediate bed availability

MCI – Mass casualty incident

NWHRN – Northwest Healthcare Response Network

WaTrac - Washington System for Tracking Resources, Alerts, and Communication

Abstract

Objectives: Patient tracking and distribution are integral to favorable health outcomes for disaster victims. Managing bed availability and forecasting future needs should be done in real-time. This study explored Washington State healthcare response professionals' perceptions of the WaTrac patient tracking and alert system's ability to provide immediate bed availability (IBA), situational awareness, and ad-hoc reporting during the COVID-19 pandemic response.

Methods: This qualitative case study involved using semi-structured interviews with the Washington State Patient Tracking (WaTrac) System user professionals. Study participants included Western Washington State healthcare, public health, emergency management, and EMS representatives with experience in patient distribution during the COVID-19 pandemic. Participant interviews were conducted via Zoom, and all interviews were voluntary.

Results: This study revealed that when patient load-balancing reached critical capacity, WaTrac failed and could not perform at the level needed in a medical surge.

Conclusion: This qualitative research was used to identify vital opportunities to improve patient distribution and load-balancing during medical surges. Findings suggest the need to standardize a real-time patient distribution system for collaborative response efforts with positive patient health outcomes. **Keywords:** *Patient tracking, casualty distribution, patient tracking, immediate bed availability, prehospital emergency care, health readiness*

Introduction

Every day, those on the front lines of disasters face complex challenges; ineffective patient load balancing or distribution can quickly overwhelm health facilities. The National Hospital Ambulatory Medical Care Survey (2019)¹ reported 51% of participant hospitals diverted patients during that year. An estimated 501,000 ambulances are redirected to another facility yearly, or one ambulance every minute.² In the Washington State, King County Central Region EMS & Trauma Care System Plan July 1, 2021- June 30, 2023 (p. 11), the Regional Council staff will monitor hospital diversion via WaTrac to provide bimonthly reports to hospitals that support no-diversion policy. This same plan contains a strategy for a sizeable multi-casualty incident (MCI) that may require transportation to healthcare facilities outside the King County area.³ WaTrac is a web-based healthcare patient tracking and alert system; established to monitor medical facility operational status and bed availability daily while offering incident management situational awareness during disaster response.⁴ The system was designed to manage bed availability and forecast future needs, which should be done in real-time, notwithstanding the inherent uncertainty of healthcare crises. Unfortunately, Washington has not implemented the system in its entirety, and patients are not tracked in real-time.

This study explored Washington State healthcare response professionals' perceptions of the WaTrac patient tracking and alert system's ability to provide immediate bed availability (IBA), situational awareness, and ad-hoc reporting during the COVID-19 pandemic response. Additionally, this study involved identifying how

WaTrac, in its current form, performed when Washington's healthcare systems were overwhelmed during a high patient volume incident.

Hospitals, public health, and emergency management entities must work collaboratively to develop and implement regional operational baseline procedures to address chronic and acute medical surges. Patient tracking and distribution are integral to favorable health outcomes for disaster victims. Healthcare administrators need focused, timely information that provides evidence to decide on interventions for patient load balancing. The Central Region Patient Care Procedures July 1, 2019-June 30, 2021³, stated, "the decision on where to transport a patient will remain at the discretion of the prehospital provider unless directed to a specific facility by medical control" (p. 23). Also, the plan states, "Ambulance diversion is defined as an active statement by a hospital, whether verbal or via WaTrac ED Status, that patients arriving by ambulance will not be accepted"³ (p. 23).

Patient movement, tracking, and distribution in healthcare are multidimensional problems that require complex thinking and a broad systems perspective to frame the issue. A patient distribution best practice model, with proficiency training, must be designed to provide the best health outcomes to a more significant number of patients.⁵⁻⁸ No proven best-practice model in Washington offers real-time situational awareness among healthcare response partners.

Surge planning is vital to disaster health preparedness; patient distribution is concerned with capacity and facility capability.⁹ The challenge lies in identifying the

number of beds available (capacity), patient acuity, and healthcare facility capability.⁹ A scalable plan to track patients through the health system used during daily patient care delivery and surge cases is critical for decision-makers to analyze real-time data to streamline patient distribution processes and increase efficiencies.¹⁰⁻¹⁵ The use of a regional patient distribution system during daily operations is inconsistent across the Nation. Nonuse of the system during day-to-day operations could lead to the inappropriate distribution of casualties between health facilities in a health emergency, adding to an already chaotic response environment.¹⁶

Frequently area hospitals operate at or near-total capacity, with many hospitals experiencing large volumes of patients daily.^{17,18,8} Daily marked increases in patient volume already exhaust resources, compromising the ability to surge during a large-scale health emergency.^{17,18,8} Also, it has been estimated depending on the type of event, up to 40% of staff may not report to work due to transportation disruptions, lack of childcare/child supervision, illness, or safety concerns.^{19,8}

There is a growing body of evidence in the disaster health field that increased patient volume leads to an increase in delayed care and, in some cases, an increased mortality rate.^{5,20} Eriksson et al.⁵ revealed a considerable rise in mortality in 18 of the 30 studies, with numerous studies finding upwards of a 50-150% increase in mortality. Forster et al.²¹ revealed that each time a hospital's occupancy increased by 10%, it extended admitted emergency department patients' wait time by 18 minutes. Moreover,

Valesky et al.²² claimed hospitals were underreporting surge capacity by 71% to 100% in some units.

Using the "Golden Hour" concept, the 60 minutes directly after an injury or illness, critically injured patients have the highest chance of survival.^{12,23} It becomes imperative that hospital systems manage surge capacity, distribute casualties promptly to the correct type of care facility, and use resources efficiently to reduce patient suffering and mortality. When hospitals frequently run at or near full capacity, allocating additional patients promptly to the suitable facility to receive the appropriate level and type of care becomes difficult.

Immediate Bed Availability as Inventory and Patient Tracking

Disaster patient tracking systems are designed to identify and track patient movement from the disaster site to the care facility, facilitate a continuum of care, and aid in family reunification.²⁴⁻²⁷ The patient tracking system also provides situational awareness, monitoring healthcare systems and population impacts while providing an IBA count.^{28,24,26} Patient movement is a logistical issue,²⁹ and available beds are inventory. There are two types of inventory management systems, periodic and perpetual systems. A periodic inventory control system is not tracked in real-time but is updated on an interval basis.³⁰ While a perpetual inventory control system is in real-time and immediately updated as inventory, hospital beds, in this case, become available or are filled.³⁰ When resources such as beds in an MCI become scarce, adequate supply and demand management becomes critical.

Periodic Patient Tracking System

WaTrac is an example of a periodic patient-tracking system. The standard established by the healthcare coalition is to use the system as a periodic inventory system, with bed availability reporting at the beginning of every eight-hour shift.

Notwithstanding, it isn't easy to ascertain the current immediate bed availability during nonreporting times. Simply collecting data and presenting it three times a day is not enough.³¹ Additionally, when a system or skill is not used regularly, the end-users' retention of program procedures severely diminishes,³²⁻³⁴ even more reasons to use a patient tracking system daily.

Washington is divided into three regional healthcare coalitions: the western region or the Northwest Healthcare Response Network's multi-county patient tracking plan attaches a unique identifier to each patient as they receive care, either in the field or if self-transported at the hospital. WaTrac is not used during daily operations but can be activated by the state Department of Health, the coalition, local health jurisdictions, and at the request of EMS, local health facilities, local emergency management, or Tribal governments.³⁵ The participating agencies and health facilities are asked to update their bed count and operational status once per 8-hour shift during daily operations.

When the WaTrac system is activated during a health crisis, a blanketed message is sent through the WaTrac system requesting hospital bed availability information from area hospitals.³⁵ A substantial time could exist from the incident onset, coalition activation, message sent, and all local facility information updated to provide a situation

report. By the time the situation report is issued, the data is outdated. Unfortunately, this system, shelved until needed, has reduced value and is unfamiliar to the end user, making them difficult to use in an already chaotic environment.

Perpetual Patient Tracking System

An example of a perpetual patient tracking system is the St. Louis Area Regional Response System (STARRS), which gives near real-time access to hospital status and bed availability needed by incident commanders to make informed patient distribution decisions.³⁶ Perpetual tracking systems are more integrated into daily operations; the end-user is familiar with the system and provides semantic interoperability with other health systems.³⁷ Every patient transported by EMS is entered into the tracking system. St. Louis's Emergency Patient Tracking System (EPTS) provides dispatch personnel with the data needed for patient assignment,³⁶ ensuring the right patient is transported to the suitable facility for proper care, reducing mortality.³⁸ Real-time data transmission allows hospitals to monitor the incident scene and gain knowledge of patient acuity and injury type to have the appropriate staff and equipment standing by.³⁹ Simultaneously, Incident Command collects on-scene information, relaying it to the Emergency Operations Center (EOC) to provide data to decision-makers regarding resource allocations.³⁸ Perpetual IBA inventory/patient tracking systems are used in several key regions such as Boston, San Diego, Florida, and Texas.³⁶

Methods

This qualitative case study employed purposive and snowball sampling of nine subject matter experts in the regional disaster health response field with experience using the patient tracking system in a chronic patient surge. For this study, multiple triangulation methods were employed; data and methodological triangulation.^{40,41} An initial document analysis was obtained from open-source databases to provide shared themes supporting and strengthening the interviews' data. Sources included peer-reviewed literature, recent grey literature not formally published, including but not limited to; white papers and policy documents, after-action reports, situational reports, and archival records focusing on patient distribution. Keywords used in the search were *patient tracking, patient identification in disaster, trauma-related mass casualty incidents, casualty distribution, casualty evacuation, pre-hospital care, inter-hospital patient transfer, major incident response, and health readiness*. Six databases were used: ProQuest Science Journals, Health Services and Sciences Research Resources (HSRR), PubMed, SAGE Journals, and a Thoreau multi-database search.

Furthering the methodological triangulation, nine in-depth interviews were conducted to gain the responder's personal experiences using WaTrac in a medical surge.^{40,41} Data triangulation was achieved when saturation was met^{40,41}. The targeted population for the in-depth interviews was regional healthcare response professionals directly or indirectly involved in the COVID-19 pandemic response. Participation was voluntary, and participants could withdraw at any time. The data provided by an

occupationally heterogeneous group of response professionals offered thick information about how the patient tracking system components interact in a health crisis response system.

Table 1

Participants' Demographic Data

Participant #	Modality	Years of Experience	Urban/Rural Geographic
2303	EMS/Fire Chief	>15 years of experience	Rural
2305	County Public Health	>5, but <15 years of experience	Urban
2306	DMCC Staff Member	>5, but <15 years of experience	Urban
2307	EMS/Fire Chief	>5, but <15 years of experience	Rural
2308	EMS/Fire Chief	>5, but <15 years of experience	Rural
2309	County Medical Director	>15 years of experience	Rural
2310	County Emergency Manager	>15 years of experience	Rural
2311	E911	>15 years of experience	Rural
2312	E911	>15 years of experience	Rural

Data was collected via Zoom with participants who directly or indirectly experienced patient tracking. Interviews comprised six categories: participant background, including roles, organizational roles in health response and patient tracking, participant experiences with collaboration and coordination in an emergency or disaster, participant's awareness of NHRN's roles in a disaster and how the coalition facilitates patient movement and load-balancing, federal, state, and local response operations, lessons from their tracking system experience, and a conclusion. Each category contained three or more questions. Questions focused on the participant's meanings and

interpretations, gaining insight into the complexity inherent in the complex adaptive patient tracking system. The interview allowed the participant to present additional information at the end. Participant questions were constructed to align with the study's research question. At the same time, instrument validity was established through a pilot study using two participants, which was not included in the final results.

RESULTS

All jurisdictions represented in the study encountered significant issues accessing WaTrac during the recent pandemic, and no jurisdiction had access to real-time patient distribution data. WaTrac patient tracking system was not consistently used across the various counties within Washington State. The bed availability registered in the system was considered historical data by the system's users. Currently, facilities are only required to update the bed usage and availability once per eight-hour shift, which is not an accurate picture for those using it in the field. Pre-pandemic, those requirements may have reflected the overall health of Washington's healthcare capacity. However, in a chronic response, such as COVID-19, where all healthcare facilities were operating at or near capacity, the lack of timely data caused the system to break down, rendering it inefficient.

The medical director found the historical information on the system's dashboard helpful. One county public health jurisdiction was ready to pull out of the system due to their perception the system was mismanaged. Three rural county EMS/Fire Chiefs downloaded WaTrac Mobile App to their smartphone devices, thinking they were getting

real-time information. They reverted to calling health facilities en route to find an available bed, leaving decisions of patient load balancing to EMS providers when they saw the system flawed. The results of this study revealed when patient load-balancing reached critical capacity, WaTrac, in its current form, failed and could not perform at the level needed in a medical surge.

In the initial phases of the pandemic, the healthcare system was overwhelmed by the sheer number of affected patients. Bed capacity increased as the pandemic continued, but staffing issues reduced bed inventory. EMS was experiencing long delays in off-boarding patients as they were parked in the parking long or standing in the hallways with patients that could not be transferred to the facility due to a shortage of beds. In rural areas with limited EMS units, when one is out of service due to off-loading issues, the jurisdiction is left with the reduced capacity to respond to another call.

All participants had previous experience in a medical surge, but none had worked in a chronic or sustained one. The number of patients and lack of staffed beds during COVID-19 highlighted gaps in the patient distribution system. These gaps may have gone undetected until an MCI, where patient distribution is critical. Washington State activated the Washington Medical Coordination Center (WMCC), designed as a statewide load-balancing service.⁴² Unfortunately, this new tool, developed during the pandemic, fell short of expectations of relief to the overburdened rural prehospital distribution systems.

Three key themes were identified from nine interviews using NVivo Transcription and NVivo coding data analysis software.

Table 2

Theme 1: Unclear Usage of the Patient Tracking System

Themes	Codes	Participants' Quotes
Unclear Usage of the Patient Tracking System	System Performance	Participant 2203: “During COVID we installed WaTrac on our phones to check bed availability in neighboring counties. Bed capacity & availability are not known in real-time, so it was not useful.” Participant 2207: “Patient tracking system does not address patient movement. EMS make decisions on patient load balancing based on personal phone calls to area hospitals while en route. [Our]County EMS hasn't embraced the technology. Um, the search for the bed typically comes from our base station.” Participant 2209: “There is no real-time information within system. No, I mean, like I said, it's pretty bad, it's turned out to be pretty, pretty useless because, you know, right now and either in, you know, looking for big capacity for units, it's not up to date, it's not timely. You know that. You know because you can pull up WaTrac right now. I'm going to be on shift today at noon. And you know, there's a chance that I'm going to have, you know, someone is going to be transferred” Participant 2210: “On the western side of Washington State, WATRAC does not seem to be updated as though it is a running inventory. However, if the system is not updated it becomes a historical accountability tool, which defeats the purpose for having the capability of WATRAC. If used correctly can be an early warning system based on patient flow.”
	Tracking System	
	WaTrac	
	Credible Data	
	Reliable Data	
	Historical Data	
	Realtime information	
	Health System	
	Alert System	
	Functional System	
Using Tracking System		
Tracking System Experience		

Participant 2208: “Bed capacity & availability are not known in real-time. WaTrac really relies on the hospitals to upload and put in information. And that's not always the case. Most hospitals will do so at least once every 24 hours.”

Participant 2209: “You still have to talk to the hospitals to receive that, and pretty much our course of getting really, really good at because it's actually an easy conversation to have. Call up, you know, multi care Franciscan Province system. Do you have any beds today? Can you accept a GI patient? No, nothing. So you can in about 30 minutes of calling hospitals, you cover about 12 to 14 different hospitals and health care systems from Bellingham to Portland and pretty much know all the way across the western part of the state. And that can be independent from whatever is actually listed on WaTrac.” “And then I know on the list is the WMCC, then that's the final call. It's like, OK, I've called we've called 12 places and 12 health care systems and nobody has any beds and they have this person and has a specialist need. And can you find me a bed? And that's usually a longer conversation. They're pretty overwhelmed. It takes a little while for them to get back to you. Using the WMCC is like buying concert tickets, you might get luck and find an available bed.”

Participant 2211: “hospital that they weren't good at updating that. And that's why we kind of we've looked at it over the years and just haven't done it because it didn't, you know, if it's not consistent, it doesn't mean anything to us. If it's not updated, we still end up making a phone call. And so when the medics have to call the hospital anyway.”

Participant 2205: “The system does not have real-time information, does not show accurate bed capacity, information is shared in sit reps from the coalition and is not done in a timely manner, so information is outdated. It seemed to work well for family reunification during the train derailment, but most of the injured went to the same facility. It is not a good tool for resource management, that is done through other software like WebEOC, and WaHealth.”

Participant 2206: “Bed capacity & availability are not known in real-time; information sharing is in the form of operational period sit reps and are disseminated each operational period. We used the patient tracking system for family reunification during the train derailment, all patients went to the hospital. WaHealth developed in 2020 is a better tool for resource management. Not using it for immediate bed availability, you're using it more for a patient tracking from initial arrival at a facility through rehabilitation.”

Participant 2208: “conditions at an emergency room can change in a matter of five to 10 minutes. So we might be going off of, let's say, it's eight o'clock at night. We might be going off of information that is, you know, 10, 12 hours old. That can be difficult. And we've got some alternative strategies where, you know, if we don't have the latest and information that's in WaTrac we might just go to, you know, making a phone call and checking real time as to what conditions and availability is happening at these different locations. Sometimes it doesn't matter what WaTrac says by protocol, we have to go to that facility and generally what happens is those are your very severe patients, those your your life, truly life patients.”

Table 3*Theme 2: Lack of Collaboration and Coordination*

Themes	Codes	Participants' Quotes
Lack of Collaboration and Coordination	Coordination	<p>Participant 2205: “EMS is causing the pushback on WATrac real-time. Collaboration and coordination is EMS is causing the pushback on WATrac real-time. Collaboration and coordination is not done within WaTrac. We contact the DMCC during a MCI, but they were not available during the COVID medical surge. Collaboration within the system in nonexistent.”</p> <p>Participant 2206: “We are a partner with the coalition to move patients within the region and if need be, can assist in state or interstate patient movement.</p> <p>Participant 2207: “We don't collaborate or coordinate within the tracking system. Once we realized it wasn't real-time information, we stopped using it.”</p> <p>Participant 2208: “And so WaTrac is just an electronic communication tool that that facilitates that, information on a mass scale. prior to WaTrac, we would always make a phone call into the hospital when I was talking about the [our] general [hospital] example for, you know, routing patients, what would happen is you would give the physician down at [our hospital] General a number of patients</p> <p>Participant 2209: “It's as bad as much collaboration it is because right now everybody is just trying to survive.”</p> <p>Participant 2210: “Because of the lack of updating the system, has limited application and ability for to allow response partners to</p>
	Bed	
	Lack	
	Staff	
	Time	
	Situational Awareness	
	Open Bed	
	Activation Protocols	
	Share	
	Patient Movement	
Tracking System Partners		

sharing information and work together.”
“Collaboration & coordination, a common theme does not happen between health system, & there is no collaboration between counties”

Participant 2212: “We don't collaborate or coordinate within the tracking system. Once we realized it wasn't real-time information, we stopped using it. takes a liability off of us, too, because of a patient that needs medical care.

Participant 2003: “do not know how the system is activated.”

Participant 2005: “Hospital Directors & C-Suite do not know about WaTrac, have not had trainHospital Directors & C-Suite do not know about WaTrac, have not had training, and do not understand what it is used for, therefore there is no leadership by-in. WaTrac is activated by the county, EMS, coalition, or state DOH. We have an enormous need for improved communications and coordination structures.”

Participant 2006: “So ours is just to communicate that the MCI has occurred, and I don't know if there's a threshold for the coalition that would kind of kick that into play. I think it really depends on the situation if it's I believe it's probably gonna be like a collaboration.”

Participant 2007: “I don't think there is a protocol, we downloaded WaTrac thinking they were getting real-time information, were surprised to find out the system is only updated once per shift. If we had an MCI, we would notify our base station declaring MCI. That would open up the protocols to the scope of practice. They, in turn, would notify the disaster medical coordinating center.”

Participant 2008: “Should have a protocol to activate system, should always be activated &

updated in real-time. For EMS when we get into a patient that we feel that multiple locations could appropriately serve the patient, we utilize the tool to try to give us information and activate the tool to give us information. What is the best receiving facility.”

Participant 2009: “It's a daily chore that happens. So there isn't really. This is again from the original incident from just the start of COVID 19. We've been activated and and we utilize that every day. And so it's a chore that the house supervisor does at the start of his or her shift. And it certainly is when we start to get to truly pushing our limits of capacity. And certainly, you know, I've been fortunate enough to be in kind of conventional operations and going to start to push, you know, over into contingency and maybe even the fringes of contingency that then it is. Then there's also another trigger that makes now that we have to go into and and update into what track what, what our capacities really are and where patient volume is. We're on internal triage things of those staying nature.”

Participant 2003: “30% of patients in rural communities are airlifted due to a lack of available beds and tracking systems not being updated regularly. Limited staff means we do not have time to 'shop' for an open bed.”

Participant 2005: “No funding for a new pre-hospital patient tracking system, so is not a good tool overall. The tracing system in theory is a good idea and would be of great benefit in a sudden and chronic surge, but is mismanagement and not helpful in its current capacity.”

Participant 2007: “Rural communities are airlifted patients at alarming rates due to the lack of available beds & tracking systems not

used. Health systems outside of our local facility are too far away to find out that they don't have any available beds and we have to wait in the rig for a bed to become available and we can off-load our patients. This is usually an hour or longer.”

Participant 2009: “Rural hospitals dedicate staff & resources to calling & pleading for access to care at medical centers. WMCC system, a joke; if you are not the first caller you don't get a bed for your critical patients. People are receiving inadequate care when they go to a facility that doesn't have the capabilities to care for them. Health systems are transferring patients between facilities, we are a stand-alone facility and cannot find beds for our patients.”

Participant 2010: “Collaboration & coordination, a common theme does not happen between health system, & there is no collaboration between counties.”

Table 4

Theme 3: Patient Distribution

Themes	Codes	Participants' Quotes
Patient Distribution	Load-balancing	Participant 2203: “EMS make decisions on patient load balancing.” “We shop for a hospital to find an open bed, and wait time has dramatically increased. Have to stay with the patient if we can't offload. Most critical patients are airlifted out of the area.”
	Health	
	Bed	Participant 2206: “Local administrator in the DMCC, employed by a local healthcare facility within the region. We use the tracking system for load balancing and level loading, and patient placement to match facilities capabilities. Widespread staffing shortages constraining health care surge capacity.”
	Open bed	
	Patient	
	Patient Load	

**Rural
Communities****Patient
Movement**

Participant 2207: “Familiar with the with the software. Initially when WaTrac was established as boots on the ground during MCI. Just applying identification tags and bracelets. I had not used the tracking system until COVID. We downloaded on our phones to use for patient load balancing and bed availability.

Participant 2203: “Didn’t use WaTrac before COVID. Downloaded the WaTrac system onto smartphone; refer to it when needing an available bed.”

Participant 2205: “We use bed capacity and availability which are not known in real time, facilities update 1 time per shift and is not consistent.”

Participant 2206: “Each county uses WaTrac differently using different terminology. Collaboration and coordination is not done within WaTrac. EMS contacts the DMCC during a MCI, but we were not readily available during the COVID medical surge due to staffing shortage. I think our biggest piece is just the communication that there's an event going on so that they can consider whether it would be useful to help stand that module up.”

Participant 2207: “We downloaded WaTrac looking for beds thinking they were getting real-time information, were surprised to find out the system is only updated once per shift.”

Participant 2208: “Search for a hospital to find an open bed. I would just assume just based on, you know, obviously input at the hospital, putting it into a centralized tool that then distributes the the information to the end user, i.e. us in the field as EMS responders.”

Participant 2211: “We're telling them to go someplace with an open bed and they're going the they're going to be a general, but it's

actually in the opposite direction of another hospital that maybe they should be going to kind of put the liability on us. So I don't like it.”

DISCUSSION

This study involved assessing experiences of response professionals with expertise in patient surge and load balancing. The interviews revealed that all nine study participants experienced significant patient tracking and distribution challenges during COVID-19. All nine study participants pursued using the WaTrac patient tracking system, only to find out the information in the dashboards was not accurate or current due to the limited requirements of updating the system once per shift. During the initial phases of the pandemic response, study participants were under the impression WaTrac was a relevant tool that provided helpful information for patient distribution decision-making.

To ensure IBA, the regional patient tracking system must continually monitor patients currently in the healthcare facility's bed count while maintaining the ability to control a surge of disaster victims. Given the complexity of response to a significant medical event and time constraints of injury to intervention, a patient distribution system must perform optimally under the stress of an emergency or disaster and provide real-time information, displaying hospital capacity and resource availability. Real-time information supports patient distribution where definitive care can be administered at the

facility with the proper capability level. Additionally, a patient tracking system in daily operations can detect a sudden increase in patient volume.

The small number of interview participants does not necessarily represent the functional environment, and the findings cannot be generalized to the whole community; however, saturation was quickly met as all participating jurisdictions encountered significant issues with finding open beds. I also faced challenges in the limited number of previous studies on user perceptions of a patient tracking system in an emergency or disaster. Furthermore, the literature does not adequately discuss incorporating complexity theory and the patient tracking system, a new concept. Consequently, the lack of previous studies hindered reliability.⁴³

CONCLUSION

In an acute or chronic medical surge, the need for patient beds will increase exponentially, and many healthcare facilities, which already run at total capacity, will be overwhelmed. It is critical to have an accurate picture of facility capacity, capabilities, and current bed availability in such an event and before the event. Only a real-time system will consider operational factors and provide immediate information to decision-makers for efficient load-balancing. Given the number of surge patients, patient acuity, EMS resources, and healthcare facility capacity, a real-time bed-tracking system would provide better health outcomes for many patients. Contemporary preparedness plans focusing on adequate IBA, and resources fail to consider the tracking system's process and the advantages of real-time information for patient load-balancing.

It is beyond the scope of this manuscript. Still, it warrants further research in the Emergency Medical Treatment & Labor Act (EMTALA), which states that a hospital is “required to provide stabilizing treatment for patients with emergency medical conditions. If a hospital is unable to stabilize a patient within its capability, or if the patient requests, an appropriate transfer should be implemented.”⁴⁴ What are the ramifications when a patient requests to be transferred to an alternate facility due to off-boarding and bed availability wait times? In addition, what is law enforcement's need when seeking an available bed for individuals suffering from a mental health crisis? In Washington State, a severe shortage of psychiatric beds exists; having real-time bed availability status may be of benefit when law enforcement is seeking assistance.

Conflict of interest statement

The authors reported no potential conflict of interest.

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Author's contributions

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**Regional Disaster Health Response Systems' Role in Patient Movement and Load-
Balancing During a Health Crisis**

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Short Running Title: RDHRS's Role in Patient Movement

Outlet for Manuscript

I chose *Disaster Medicine and Public Health Preparedness* from the Cambridge University Press as the journal for Manuscript 2. This peer-reviewed journal publishes articles about disaster medicine, disaster risk reduction, mass gathering medicine, population, public and crisis health, and search & rescue. Manuscript 2 also shares the journal's scope by contributing strategies to augment the coordination for a surge by clarifying the Regional Disaster Healthcare Response Systems' or healthcare coalition's role in disaster response. Manuscript 2 is highly cited, with multiple works published in the Disaster Medicine and Public Health Preparedness Journal.

Instructions for authors, along with a manuscript checklist, can be found at <https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/information/instructions-contributors>.

ABBREVIATION LIST

ASPR – Depart of Health and Human Services Assistant Secretary of Preparedness and Response

EMS – Emergency medical services

ESF8 - Emergency Support Function 8- Public Health and Medical Services

FMOCC – Federal Medical Operations Coordination Cell

HCC - Health Care Coalition

HPP – Hospital Preparedness Program

HSPD-5 - Homeland Security Presidential Directive Five

IBA – Immediate Bed Availability

MCI – Mass casualty incident

MSCC - Medical Surge Capacity and Capability Handbook

MOCC - Medical Operations Coordination Cells

NWHRN – Northwest Healthcare Response Network

PAHPA - Pandemic and All-Hazards Preparedness Act

RDHRS - Regional Disaster Health Response System

RMOCC – Regional Medical Operations Coordination Cells

Stafford Act - Stafford Disaster Relief and Emergency Assistance Act

SMOCC – State Medical Operations Coordination Cells

HHS - U.S. Department of Health and Human Services

ABSTRACT

Objectives: Strategies in a medical surge require a system-based approach grounded in interdisciplinary coordination. This study using complexity theory addresses an evidence-based practice gap in literature. It acknowledges the importance of relationships between regional disaster health response systems (RDHRS) or healthcare coalition members and how the system adapts to its environment.

Methods: This qualitative case study centered on individuals and organizations who come together in an environment of collaboration and the impact of that phenomenon concerning their overall experiences.

Results: The lack of understanding of the healthcare coalition's roles and responsibilities in patient load balancing, resource allocation, information sharing, and response leadership created barriers in a high-volume patient movement incident.

Conclusion: This study identified many challenges in Washington State's health response efforts. There is a common purpose based on a synchronized response analysis with the expectation of multi-agency collaboration. While the sample size of this study was a modest representation of the total number of public health, EMS, emergency management, E911, and healthcare workers, the study provides an identified standard for further investigation.

Keywords: *Health care coalition, regional disaster health response system, command and control, Medical Operations Coordination Cells, patient movement, load-balancing*

INTRODUCTION

The September 11, 2001 (9/11) events revealed national, state, and local vulnerabilities in responding to an MCI where the number of wounded would overwhelm the health system.^{1,2} Absent from the Nation's healthcare and public health infrastructure was an incident command structure, an integrated communications system, and a method to disseminate information critical for situational awareness.²

Numerous laws and regulations have a direct impact on healthcare organizations. During a disaster, entities must merge into a cohesive effort providing lifesaving support that they have consistently proven incapable of doing. Following the Nation's 9/11 attacks, President Bush issued Homeland Security Presidential Directive Five (HSPD-5).³ HSPD-5 appointed the Secretary of Homeland Security as the lead for ensuring the creation of an NRF.⁴ HSPD-5 aimed to identify steps to coordinate independent response organizations into a consolidated single supporting response network.³

The NRF includes 15 Emergency Support Functions (ESF) detailing the government's role in organizing resources and services necessary for life safety, property protection, and incidence stabilization.⁵ The HHS is the primary agency responsible for ESF 8 or a public health emergency through the ASPR.⁵ ESF 8 encompasses services vital to public health and victims' medical needs in a public health emergency or disaster.⁵ ESF 8 resources can be activated through the Stafford or Public Health Service Act in a public health emergency.⁵

In 2006, President Bush signed the PAHPA,⁶ reauthorized in 2013,⁷ further to improve the Nation's public health and medical preparedness. The act was created under the HHS, the Office of the ASPR.⁷ Since its inception, ASPR has worked diligently to strengthen the Nation's health security, creating the *2017-2022 Health Care Preparedness and Response Capabilities* guidelines defining healthcare and public health response roles⁸ and the *National Health Security Strategy 2023-2026*.⁹

RDHRS Framework

While the United States Public Health System and healthcare infrastructure have advanced since 9/11, it struggles to fulfill the aforementioned federal government legislation's directives. In a 2017 study, Murthy et al. identified and reported that more than 20% of jurisdictions still said coordination between the health system and public health agencies had not been fully formed.¹⁰ Multiple disciplines involved in response to a mass causality event do not routinely work together, complicating interactions when responding under the stress of an emergency or disaster.¹¹ There are three significant events or circumstances that will impact a regional health delivery system where a collaborative effort is needed for patient care and movement: 1) a 'no-notice' event such as a mass shooting, 2) 'notice' or 'slow-building' event such as imminent severe weather, or 3) evacuation of patients from compromised hospitals to alternative care sites, or a mass ingress or egress of disaster victims.¹²

Strategies to augment the coordination for a surge of injured victims require a system-based approach grounded in interdisciplinary coordination.¹¹ Also, injuries

sustained during a sudden health crisis or public health emergency are time-sensitive. They require prompt medical intervention to limit the severity of injuries or the number of fatalities. During a large-scale MCI, an infectious disease event, or a disaster triggered by natural hazards, community hospitals and regional trauma centers will not have enough resources to accommodate the critically injured or sick surge.¹³ A patient distribution system will record resource availability directing EMS to available facilities not to overwhelm a single healthcare response entity.¹⁴

An RDHRS or HCC is a network of healthcare organizations, public health agencies, EMS, and emergency management departments; their primary mission is to support life safety during an emergency or disaster through a coordinated preparedness and response effort.¹⁵ On any given day, these subsystems operate independently. Still, in an emergency or disaster, they must act as a well-integrated system to lessen the burden of illness, injury, and loss of life.^{15, 16, 17} System-level planning considers the entire RDHRS's capacities, capabilities, and deliverability.^{16, 17}

ASPR's HPP purpose is to enhance the ability of RDHRS to prepare for and respond to health emergencies.¹⁵ HPP supports priorities established by the National Preparedness Goal – Second Edition set by the Department of Homeland Security (DHS) in 2015; two of the program's priorities are interoperable communications and medical surge-patient bed tracking.¹⁸ Healthcare facilities need rapid treatment, effective triage, and coordinated communications to respond effectively.

HPP Capability 4: Medical surge of the 2019-2023 Hospital preparedness program: Performance measures implementation guidance,¹⁹ states the HCC, in collaboration with the ESF-8 lead agency, will deliver timely, proficient care to their patients even when the demand for services exceeds available staff and supplies. It is well recognized that the distribution of traumatic injury victims of a no-notice incident is within the first hours following the disaster. To reduce mortality and morbidity, local response capability must be strengthened to ensure the best outcomes; therefore, if a patient tracking system operates effectively, it should function before the disaster strikes.

HPP Capability 6: Information sharing. “Information sharing is the ability to conduct multi-jurisdictional, multidisciplinary exchange of public health and medical-related information and situational awareness between the healthcare system and Federal, state, local, tribal, and territorial levels of government and the private sector.”²⁰ Situational awareness reinforces the activation and maintenance of IBA and patient tracking system.

Coalitions’ Two-Part Structure: Leadership and Membership

An RDHRS or HCC, by definition, is a group of individual healthcare and response organizations in a specified geographic area that agree to work together to enhance their response to emergencies or disasters.²¹ Data provided by ASPR affirms 476 HCCs nationwide, with 38,000 members from emergency management, healthcare providers, emergency medical services, and public health departments.²¹ Membership contains 85% of all healthcare providers (health systems, hospitals, behavioral health,

long-term care, dialysis, etc.), 82% of all public health officials, 56% of all emergency management organizations belong to a coalition, and 27% of all emergency medical service professionals belong to a healthcare coalition in their geographical location.²¹

The RDHRS is a complex array of interconnected, self-organizing private and public partnerships. The RDHRS may use the Disaster Patient Tracking System as a multidisciplinary communication tool in a health emergency.²² In a survey by Rambhia et al.,²³ respondents indicated two types of RDHRS or HCC structures: ‘Preparedness Only’ and ‘Preparedness and Response.’ Those who responded to the survey affirmed that the coalition administration participated in a joint response effort when the local emergency management agency and EMS were involved.²³

Staff and leadership are equally important in the HCC definition, which supports the coalition's long-range goals, strategic plans, and objectives. For operational readiness, the RDHRS or HCC must maintain the ability to collect evolving health information, use a decision-making process to determine the impact on regional healthcare partners, and immediately disseminate additional action needed.²⁴ Individually, each group within the RDHRS or HCC has a defined duty in a health crisis.²⁵

RDHRS or HCC members arranged geographically, will provide medical care, other medical services, and emergency management services during a response.²⁴ In the meantime, RDHRS or HCC staff’s objectives may be simple or complex depending on the incident's structure and magnitude. The main goals are to facilitate information sharing, maintain situational awareness, expedite mutual aid agreements, and support

healthcare system resiliency and medical surge.²⁴ Each geographical region was given the latitude to establish the coalition's level of services, response objectives, how it will facilitate resource sharing between healthcare organizations, and by what method it will assess the incident's impact on healthcare delivery.²⁴ The RDHRS or HCC does not replace or become the incident command; however, there may be a representative from the organization within the incident command structure as an ESF 8 coordinator.

The revised MSCC laid out a six-tier healthcare response model.²⁶ Tier 1 consists of an individual healthcare organization response through Tier 6, which involves a federal-level reaction.²⁶ Tier 2 is reserved for an HCC response or more than one healthcare organization responding to a health incident. The coalition's duties are response coordination, information sharing, and resource support but give no authority to the coalition or command and control or Area Command organization.²⁶

With no command-and-control authority in a multi-agency coordination event, RDHRS or HCCs must assume an ancillary role. Suppose the coalition's duties are defined as response coordination, information sharing, and resource support and have no official responsibilities with the command structure. In that case, their skills could augment the response effort by providing situational awareness, current bed availability data, and inpatient resources between regional healthcare facilities to support patient distribution policies.²⁷ If updated as the situation unfolds, critical decision-making data would be disseminated through the state patient distribution or patient tracking system. During a response to an MCI, emergency management agencies and other governmental

agencies use WebEOC or other competing software; these platforms cannot track patients and delay information dissemination.²⁸ A patient tracking system used during daily operations and updated as a perpetual resource distribution system would immediately reveal a patient surge.

RDHRS' Role in Patient Movement and Load-Balancing

The federal government has developed a new patient movement and load-balancing standard in response to the recent healthcare crisis. The Medical Operations Coordination Cells (MOCC) is an initiative to ensure hospitals and healthcare systems avoid exceeding capacity where they may be forced to revert to crisis measures.²⁹

An alternative is to transfer patients within healthcare systems or nearby hospitals to continue a high-quality standard of care.²⁹ MOCCs are facilitated at the federal (FMOCC), state (SMOCC), or healthcare coalition (RMOCC) levels as a function of the ESF 8 response.²⁹

Given that the RDHRS or HCC 's roles and responsibilities during a response to a health crisis are to coordinate, provide situational awareness, share information, provide resource support, and maintain bed availability data through the statewide patient tracking system, it would be reasonable that they would serve as a single point of contact for healthcare facilities to seek support with patient movement.²⁹ Situational awareness is obtained by continually monitoring bed availability and hospital capacity, giving a consistent overall healthcare system view. Using set predictive indicators, the RDHRS sends alerts when bed availability and hospital capacity become problematic.³⁰

It is important to note that the RMOCC does not replace 911; they are responsible for inter and intra-health system patient transportation and transportation to alternative care sites.²⁹ However, in the Assistant Secretary for Preparedness and Response Technical Resources, Assistance Center, and Information Exchange [ASPR TRACIE] report (2019), *Mass Casualty Trauma Triage - Paradigms and Pitfalls*,³¹ 911 operators will rely on the situational awareness provided in the information shared by the RDHRS or HCC in the patient tracking system. In addition, in the *Mass Casualty Trauma Triage – Paradigms and Pitfalls*,³¹ local healthcare systems should consider the arrival of patients by self-referrals or EMS transporters.

Unrealistic is the expectation that EMS transporters can decide to redirect patient transports due to the existing limitations. During an incident where patient volume increases, there is no interoperability between healthcare and the 911 system if a hospital redirects. The RMOCC, as the conduit between healthcare and 911, creates a natural command and control element currently missing in today's operations. The complexity of patient distribution is amplified by the lack of existing Command and Control, which impacts the ability to effectively communicate and establish a common operational picture, preventing a unified functional response.

Assigning of Authority and Responsibility

The RMOCC is administered by the staff and leadership of the RDHRS or HCC.²⁹ Additional staff to operate the RMOCC should be sought within the RDHRS or HCC membership consisting of subject matter experts with intense knowledge of health

systems operations.²⁹ The RMOCC, in coordination with the local ESF 8 response, may collaborate with other government departments and coordinate with neighboring RDHRS or HCCs to further enhance the load-balancing of patients.

The RDHRS or HCC 's authority depends on the coalition's service level within their response objectives and mission. However, it has been reported that some jurisdictions may delegate full authority to the coalition to act on its behalf.²⁴ Regardless of the healthcare coalitions' authority and overall mission, their capabilities are limited to available resources and funding.

METHODS

The nature of this study lent itself to a qualitative case study due to its complex and ambiguous character.³² To strengthen the study's reliability, multiple triangulation strategies were applied.^{33,34} Methodological triangulation was used in the form of thematic analysis and participant interviews to gain credibility and mitigate researcher bias.^{33,34} Numerous sources were analyzed, including peer-reviewed literature, not formally published recent grey literature, including white papers and policy documents, after-action reports, situational reports, and archival records focusing on the roles and responsibilities of RDHRS or HCCs. Keywords used in the search were *healthcare coalitions, hospital preparedness program, disasters, health response and preparedness, and disaster management, medical surge*. Six databases were used: ProQuest Science Journals, Health Services and Sciences Research Resources (HSRR), PubMed, SAGE Journals, and a Thoreau multi-database search.

In addition to methodological triangulation, this study also employed data source triangulation techniques.^{33,34} The heterogeneous participant population for this research was disaster health professionals of an RDHRS or HCC with training in medical surges. The research strategy was to identify RDHRS and HCC who have experienced an emergency, disaster, or public health event within the last five years. The study centered on individuals and organizations who come together in an environment of collaboration and the impact of that phenomenon concerning their overall experiences.³²

Table 1

Participants' Demographic Data

Participant #	Modality	Years of Experience	Urban/Rural Geographic
2303	EMS/Fire Chief	>15 years of experience	Rural
2305	County Public Health	>5, but <15 years of experience	Urban
2306	DMCC Staff Member	>5, but <15 years of experience	Urban
2307	EMS/Fire Chief	>5, but <15 years of experience	Rural
2308	EMS/Fire Chief	>5, but <15 years of experience	Rural
2309	County Medical Director	>15 years of experience	Rural
2310	County Emergency Manager	>15 years of experience	Rural
2311	E911	>15 years of experience	Rural
2312	E911	>15 years of experience	Rural

For this case study, I was the primary instrument for data collection. An Interview Guide was broken into six sections; participant and organization background, participant experiences with collaboration and coordination in an MCI, participant's awareness of the healthcare coalitions or RDHRS roles in a disaster and how the coalition facilitates

patient movement and load-balancing, federal, state, and local response operations, lessons learned, and a conclusion. Each section contained three or more questions that were pilot tested for validity. The research design and study process supported answers to the proposed research question, assuming participants were forthright with their shared experiences. The interview questions focused on study participants' lived experiences, drawing on knowledge gained through their involvement in an RDHRS or HCC. The pilot test consisted of two interviews with the developed guide and incorporated their feedback to refine and validate; these interviews were not used in the final study outcome.

RESULTS

Seventy-eight invitational emails were sent to potential candidates; many potential participants declined due to the Omicron COVID-19 medical surge. Additionally, staff attrition was a factor, with 10% of the invitational emails being undeliverable. Also, not all subject matter experts were predetermined; half materialized as other interviews were concluded. Of those interviewed for this study, one was from a large county public health organization, one rural county emergency manager, three rural Captains with Fire/EMS, one rural county medical director, and one staff member from a regional Disaster Medical Coordination Center (DMCC).

Of interest, the three Chiefs from Fire/EMS had little knowledge of the roles and responsibilities of the Northwest Healthcare Response Network in western Washington. Additionally, no interviews were conducted with the Regional Emergency and Disaster

(REDi) Health Care Coalition members in eastern Washington or the Healthcare Alliance Coalition in southern Washington. All the Chiefs considered the Region EMS and Trauma Council their coalition, collaborating with emergency department physicians and directors. In addition, 100% of study participants experienced patient placement and load-balancing difficulties during the COVID-19 pandemic. Ninety percent of study participants reported that the Northwest Healthcare Response Network uses urban models that do not work in rural areas in Washington State.

Furthermore, EMS made field decisions in those rural areas on where to transport patients due to a lack of alternative care sites in their communities. Again, in rural communities, EMS reverted to airlifting patients to larger jurisdictions at a rate of 30% or higher during the pandemic response. The DMCC staff member reported in a 1:1 interview that the DMCC would be unable to support an MCI, and one public health jurisdiction was ready to pull out of the Northwest Healthcare Response Network coalition due to their perception of mismanagement. This same jurisdiction suggested that funding silos and a lack of systems linking resulted in the absence of coordination and collaboration between responding partners. Additionally, the county emergency manager stated that the Northwest Healthcare Response Network coalition did not encourage collaboration between modalities tangibly, nor were they involved in training and exercises related to patient distribution and tracking. This same study participant was initially trained in the WaTrac system during its inception, but no follow-up was provided.

From the nine interviews, three major themes were identified (see Table 2).

Table 2

Theme 1: Lack of Knowledge of Leadership from the Healthcare Coalition

Themes	Codes	Participants' Quotes
Leadership from the healthcare coalition	Local Health Care System	Participant 2303: “EMS/Medical directors do not recognize the health care coalition as their coalition.”
	Coordination Structure	Participant 2305: “Jurisdictions are both partners and clients of the healthcare coalition. Their role is operational response planning and exercising. They administer WaTrac and assist in patient movement. In addition, they are responsible for hospital preparedness, and training.”
	Healthcare Surge Capacity	Participant 2306: “Patient distribution and load-balancing (level loading). Health system situational awareness in an incident, resource coordination within the ESF 8 structure. help to support health care needs and requests throughout kind of our area or region. And that's through many different avenues, they both by just coordination of meetings or collecting of data. And then also potentially developing protocols or and or, you know, guidelines for things.”
	Healthcare Coalition	Participant 2307: “We do not have a fire EMS coalition coordinator in an event. Lack of collaboration leads to a lack of coordination between counties, health systems, and modalities. There are no rural load-balancing plans or help from the coalition and no real-time information sharing. If I needed to put into a box that I was the liaison with the coalition, I have contacts that I can reach out, but I would really be operating parallel to the hospital. If I reached out, it would have to be something I was assigned to. But as far as their role, I've actually never read their mission statement is
	Staff health care coalition	
	Healthcare Coalition Move	

a coordination piece between. Hospitals within various regions in western Washington. I guess open up, find beds. I actually don't know.”

Participant 2308: “So their role is primarily from what I understand, a hospital based and so when it comes to, let's say, a disaster that happens in the community, that's going to have a whole completely separate network and arrangement, whether it be Washington State Emergency Management that then trickles down to [our] County emergency management and then underneath a [our] County emergency management is then going to go fire police, public works, all these different entities that are doing their thing to try to mitigate work their way through a disaster. The coalition that can fall and should fall underneath either county or state disaster work efforts. And what from what I understand, most of the coalition is really what's happening with hospitals and hospital facilities, patients that are either being transported to and or away from a hospital facility. Only met someone from the coalition once. There are no rural load-balancing plans or help from the coalition and no real-time information sharing. And then, of course, you know where they fall under the umbrella of, let's say, [our]County, WASHINGTON, the state emergency management is all these different pieces and parts need to be organized. Fire needs to work with police, needs to work with public works, needs to work with waste, needs to work with, needs to work with the coalition and our local hospitals. And so the Coalition, you know, is representative for the hospitals and of course, EMS partners as well. So we kind of have our little side bubble underneath [our] County or state emergency management, but that's the

hierarchy that we fall within when we're when we're out there operating in a disaster mode.”

Participant 2309: “Northwest Healthcare Response Network (NHRN) uses WaTrac and WaHealth for bed availability.

NHRN monitors phone in low-level activity times, triages call and notifies the WMCC if coordination is needed. Have not been involved in patient transfers or helping to find an open bed.”

Participant 2310: “To coordinate and provide information on current incident healthcare conditions. Patient distribution and load-balancing. Regardless of the fact it is a key function in their incident response requirements, they seem to do little if any patient movement and distribution.”

Participant 2311: “They've never really been connected to us. So from a dispatch perspective and trying to keep it at that, there's very little connection, there's no connection.”

Participant 2312: “we are reasonably connected to county emergency management. And so we'll we'll. Get briefings and things like that, but that's about as far as it goes truthfully.”

Information Sharing

Participant 2303: “Coalition cannot provide real-time bed availability. Healthcare situational awareness is not current.”

Participant 2305: “healthcare situational awareness is not current, there is an inconsistent alert system. The coalition cannot provide real-time bed availability so current information is not provided. There are funding silos that exist so there is a lack of systems linking together, EMS versus emergency management, versus public health, versus healthcare facilities, versus the healthcare coalition. The healthcare coalition does send

emails and updates their dashboard after data is collected and analyzed.”

Participant 2307: “One of the side effects in [our] County is multiple smaller governments that operate fire EMS. So if there was a mass notification, it would come from our 9-1-1 center and that would come through the radio. We use an app called Easy Chat. And there is. Another software, Spillman or they could notify us. Which is the same software that would give us a day to day call, you know, just a regular a typical call that same software could let us know that there was a request for resources. And there's if it wasn't an immediate dispatch, immediate response that would come over the radio if it was a mobilization or a regional response that would actually go to Pierce County's fire dispatch there, the coordinating agency for Fire EMS. So the request would go to [neighboring large] County. [neighboring large] County would call [our] County 9-1-1. Um. Now, and that would get you an immediate response if it wasn't an all hazards state mobilization. There would be an inherent delay because it would go through. Thinks they would cross over to the state fire marshal's office down to the Fire Region board, and then that would be local phone calls to get teams together.

Participant 2308: “Rural communities feel they are on their own and make personal phone calls to facilities to find which ones have the shortest ‘wall-time.’ When it works, it would be through our emergency operating center. And so if we go into what would be known as disaster mode, [our] County would set up their emergency operating center down in [city name] and then really all coordinating efforts. Information needs request. Everything goes through that facility to get organized and then put out to the responsible parties. What if I'm going too much on a deep dive here? Let

me know. But you know, any time an emergency center is set up, depending on the size of scale, there's what's known as iOS apps, and those are called emergency support functions. Those are predetermined. They're given a number. And so, like fire and EMS is an emergency support function. Hospitals and hospital coordination is an emergency support function. So we all of a sudden stand up whatever emergency support functions, you know, a lot of times not all of them are needed, but we set up the ones that are most appropriate. And I say we that would be [our] County, the emergency management and then the coalition and the hospitals in [our] County. [Our hospital] would stand up as an emergency support function and then serve as an actor and a player within what's happening in the overall emergency.”

“Most of the information we get is kind of through our dispatch center, so we try to make our our base calm, our emergency communications center, our 9-1-1 center. Really, the pass through for most of our information that can switch, that's in, I would say, normal day to day operating mode. If we moved to a disaster event, it's going to switch a little bit where most of that communication is coming through the County Emergency Operations Center.”

Participant 2309: “Inconsistent alert system. Coalition cannot provide real-time bed availability. Healthcare situational awareness is not current. Dashboards and situation reports contain historical information, helpful for some things but not real-time bed transferring. You get pretty frequent emails from them, just kind of low intensity, you know, stuff. And again, that's a lot in the way of good, you know, kind of resource information, you know, standards of care

practices, best practices and things like that. Then get you get kind of more immersion texts from them.”

“I think it should be coming more from the emergency management, you know, directly, but we may get it from a coalition directly rather than emergency management. And then in this instance, when you know, this is a public health emergency, I think public health should be the lead. And I think it should have been.”

Participant 2310: “Coalition does not provide real-time bed availability. Healthcare situational awareness is not current in their system”.

Participant 2311: “Health Care Coalition or the Trauma Council have never reached out to include us in meetings, but we do get their emails.”

Participant 2312: “no contact with the coalition”

Table 3

Theme 2: Understanding of Patient Movement and Distribution Plan

Themes	Codes	Participants' Quotes
Understanding of Patient Movement and Distribution Plan	Healthcare Coalition Move	Participant 2303: “Lack of collaboration leads to a lack of coordination between counties, health systems, and modalities. Earnestly lacking direction and a functional system to track and move patients. Coalition urban models do not work int rural communities. There are no rural load-balancing plans or help from the coalition and no real-time information sharing. Rural
	Capacity	
	Mass Casualty Incident	

Coordinating Mass Casualty	communities feel they are on their own and make personal phone calls to facilities to find which ones have the shortest ‘wall-time.’
Patient Movement	Wall-time is us standing in the hallway, trying to find a bed, trying to get a nurse, trying to give a report? Or staying in our rig in the parking lot providing care for the patient. We are at the mercy of the ER staff. Hospitals are going on divert and we don't know until we arrive with a patient.”
Patient Distribution	
Patient Bed Placement	Participant 2305: “Health care coalition seemed to have little to do with patient movement and load-balancing during COVID. The lack of collaboration led to a lack of coordination between counties, health systems, and modalities. King County models do not work anywhere else, even in our jurisdiction. Collaboration was nonexistent if the care facility was not aligned with a larger health system. And there was no mental health patient tracking, and very little pediatric bed availability updates.”
Proper Patient Load-Balancing	Participant 2306: “Unwillingness between health systems to coordinate patient movement. Healthcare Coalition don't want anything to do with the actual patient movement, they just have to do with the supporting the module itself.”
Patient Unification	Participant 2307: E911 is not included in EMS/Trauma or health care coalitions. EMS/Medical directors do not recognize the health care coalitions as their coalition. Coalition cannot provide real-time bed availability. Healthcare situational awareness is not current. Lack of collaboration leads to a lack of coordination between counties, health systems, and modalities. There are no rural load-balancing plans or help from the coalition and no real-time information sharing.”
	Participant 2308: “A health facility may show they have an available bed in the

system, but it is being help for a patient at another hospital within their health system. Rural fire and EMS do not have a health care coalition coordinator to reach out to the coalition in an event. I don't know, to be honest with you, I'm going to I'm going to take a guess in the fact that they are working and connecting different hospitals and speeding up and expediting the sharing of information. You know, like we talked about, let's say a disaster happened right now and I'm going off of track information that's 12 hours old. You know, the coalition could. I believe their role is to jump in and just say, Hey, how do we streamline this communication between different facilities that are within our district to make sure that the different parties are talking to one another and really, really moving towards a real time information data sharing?"

Participant 2309: "Rural fire and EMS do not have a health care coalition coordinator to reach out to the coalition in an event. EMS are making field decisions on where to transport patients and reverting to airlift more frequently. Now the coalition kind of largely deferred to the the Washington, the WMCC, which now is another saturated resource. Prior to that, you know, they were going to be able to kind of stand up and and help them. But since the early in the pandemic, you'll see again was another great idea. And initially, it was incredibly useful to find beds for COVID patients, as was their original intent to get from, you know, the smaller hospitals to the bigger tertiary centers and for services and those really sick patients. And then we all started using them also for as the. Acuity of the COVID patients got less and less that. Have we been in this now marathon of old health care shortage of people who haven't had access to care of, you know, other

specialist services that are needed dialysis? You know, interventional radiology and gastroenterology staff and uncertain, especially surgeries and then any combination of any of those specialties. And they are saturated. And then and then you through another layer on like A. a pediatric bed. I've got a sick kid. I can't find a place to admit them. And so now what's happening is they take your case and stuff like that. And then they've already think establishing certain acuity matrices of, you know, your individual patients. And then they tell you of, okay, your patients not sick enough to even get on a waitlist and the waitlist is going to be five to seven days. But in the health emergency management stuff and pre-hospital know the crisis is over and then. Thank you very much. We'll get the next wave of viral illnesses that will further saturate our health care system. It was already saturated in the first place.”

Participant 2310: “Health care coalition does not encourage collaboration between modalities”

Table 4

Theme 3: Lack of Knowledge of DMCC/WMCC Infrastructure

Themes	Codes	Participants' Quotes
Lack of Knowledge of DMCC/WMCC Infrastructure	Collaboration	Participant 2303: “DMCC in our region is not active. “Hospital shopping” falls on EMS to call facilities on their own and self-direct depending on wall-time. DMCC is local health facility that does not have the staff, tried to connect with the regional trauma council to help direct patient movement but was unsuccessful. EMS personnel make the decision to go to neighboring DMCC region, beds could be as far away as 100 miles or more.”
	Planning	
	Funding and Staff	
	Urban Models	
	County	
	Rural Load-Balancing Plans	

Surge

“Drop off at hospital and let them call WMCC”

Medical Directors

Participant 2305: “The DMCC is unfunded and unsupported. It is not constantly staffed, especially during COVID due to a lack of staff.”

Movement

“The WMCC is a good theory, but there is a lack of execution. It does not facilitate collaboration and is first come, first serve. Beds could be available 100 miles or more away causing delay in patient care.”

Participant 2306: “DMCC unfunded and unsupported, not manned regularly due to lack of trained staff. DMCC is activated if surge is predicted, otherwise individual EMS units can call and be directed.”

“WMCC may have a bed 100 miles away and patients are airlifted. Used to help facilitate pediatric patient bed availability.”

Participant 2307: “We do not have direct contact, our base station coordinates with them and then we transport.”

Participant 2309: “So the [larger hospital in neighboring count] is supposed to be our DMC. I think in the state of affairs that are right now, if we ask them just to stand up, you know, some horrible natural disasters occurred and ask them to stand up. I think it'd be basically a coin flip, whether they would say yes, as are right now. It is an optional thing as far as that go. [Our county] has always aligned a little bit more [neighbor small county].”

“Reverted to WMCC for assistance to coordinate transfers for all patient conditions when existing approaches to interhospital transfers are unsuccessful. WMCC - “Like buying concert tickets” first come, first serve.

Over 150 calls in 7 days, well above the original estimation of 15 transfer patients per month. WMCC may have a bed 100 miles away and patients are airlifted.”

DISCUSSION

It is evident from the data collected through the nine interviews that the pandemic medical surge has revealed critical challenges with coordination and collaboration between the health system, EMS, Emergency Management, E911, and public health agencies in Washington State. The lack of understanding of the healthcare coalition's roles and responsibilities in patient load balancing, resource allocation, information sharing, and response leadership creates further barriers. In addition, it would seem that these shortcomings have not gone unnoticed by those within the organizations involved but remain unaddressed by the agencies responsible.

Healthcare systems within Washington State implemented the MOCC initiative; what wasn't considered was the need for additional EMS resources, the independent small rural hospitals that were not connected to a health system, and their need for further assistance from the healthcare coalition with patient movement. In the field, EMS personnel would use the WaTrac software to view the Dashboard, which was thought of as real-time information. When EMS called or arrived with a patient, they were told those beds were on hold for patients transferring within the system or had already been filled by patients in the emergency department.

Within Washington, the regional DMCC operates like the new government standard established in the MOCC initiative by the federal government during the COVID-19 response. Unfortunately, the DMCC uses WaTrac, and the lack of real-time information hinders their ability to assist in high-volume patient movement. Additionally, EMS providers were unaware when a health facility went on redirect or did not accept patients due to capacity issues. All study participants proposed a single funded entity overseeing a multi-modality health response to provide a uniform standard and overcome challenges relating to load-balancing, communication, collaboration, and, most importantly, coordination. Additionally, 90% of study participants suggested the need for an enhanced patient tracking system with real-time capabilities.

There are several possible limitations of this study. Participants were sought during the COVID-19 Omicron surges; there were few study participants due to the response effort. Additionally, several participants desired to participate but needed to postpone until the pandemic no longer affected patient load balancing and distribution. Furthermore, many email invitations were returned as undeliverable due to workforce attrition. Another limitation that could have influenced this qualitative study was the possibility of subjectivity and participant bias. These biases could have been intensified by the months, even years, of intense system strain and personnel burnout.

CONCLUSION

This study identified many challenges in Washington State's health response efforts. There is a common purpose based on a synchronized response analysis with the expectation of multi-agency collaboration. However, with differing agendas and objectives, there is little question that roles and responsibilities demand clarification to achieve incident command and control. While the sample size of this study was a modest representation of the total number of public health, EMS, emergency management, and healthcare workers, the study provides an identified standard for further investigation. In a time of increased natural disasters, infectious diseases, and decreased funding, it is critical for Washington State to establish a framework for coordination in an emergency.

Conflict of interest statement

The authors reported no potential conflict of interest.

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Author's contributions

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**Federal, State, and Local Roles in a National Health Crisis: Who is Leading the
Charge**

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Short Running Title: Government Roles in a National Health Crisis

Outlet for Manuscript

I chose the journal *Disaster Medicine and Public Health Preparedness* from Cambridge University Press for Manuscript 3. This peer-reviewed journal publishes articles about disaster medicine, disaster risk reduction, mass gathering medicine, population, public and crisis health, and search & rescue. Manuscript 3 shares the journal's scope by contributing knowledge to public and crisis health response and disaster risk reduction. This paper intends to uncover the specific process, laws, and directives that generate a cohesive activation of public health emergency operations, augmenting multi-level, multi-jurisdictional coordination in a medical surge event.

Instructions for authors, along with a manuscript checklist, can be found at <https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/information/instructions-contributors>.

ABBREVIATION LIST

ASPR – Department of Health and Human Services Assistant Secretary of Preparedness and Response

CDC – Center for Disease Control and Prevention

CEMP - Comprehensive Emergency Management Plan

ESF8 - Emergency Support Function 8- Public Health and Medical Services

FEMA – U. S. Department of Homeland Security Federal Emergency Management Agency

HHS – U. S. Department of Health and Human Services

ICS – Incident Command System

NIMS – National Incident Management System

NRF – National Response Framework

SEOC – State Emergency Operations Center

ABSTRACT

Objectives: Command and management remain challenging and inconsistent at the federal, state, and local levels. This paper uncovers the specific process, laws, and directives that generate a cohesive activation of public health emergency operations, augmenting multi-level, multi-jurisdictional coordination in a medical surge event.

Methods: The research in this qualitative case study did not focus on the healthcare responders' roles in the public health emergency operations /ESF 8 response. Still, it sought to understand what challenges have occurred in general when collaborating at the federal, state, and local levels.

Results: The results of this study revealed when patient load-balancing reached critical capacity, WaTrac, in its current form, failed and could not perform at the level needed in a medical surge.

Conclusion: This study explores the disaster health emergency response system, who is in command, and whether the silos of government disaster response still exist today. One lesson learned from the Covid-19 pandemic is that a poor communication infrastructure hinders the ability to communicate efficiently and effectively in a public health emergency or disaster.

Keywords: *National Public Health Emergency declaration, pandemic, ESF 8, public health law, public health legal authority, emergency management law, emergency management legal authority, command, and management*

INTRODUCTION

In the United States (U.S.), COVID-19 created the most severe public health crisis since the Flu of 1918;¹ as of this writing, the death toll had reached over one million.² Yet, the health delivery system was still reactive at the two-year mark from when the deadly virus was first detected, chaos and confusion had become the norm. Healthcare providers were overwhelmed, and rural hospitals diverted patients to larger urban areas. Some larger hospitals did not accept patients unless they were life-threatening, and communication between government agencies at the state and federal levels was fragmented.

The United States suffered a national health emergency; the U.S. Department of Health and Human Services (HHS) Secretary declared a public health emergency on January 31, 2020, in tandem with two Presidential orders. The first is Proclamation 9994, a National Emergency Declaration under the National Emergencies Act (NEA), which activates emergency powers in other legislation.³ The second was a Presidential Disaster Declaration under the Stafford Act.¹ For the first time in our nation's history, a National Public Health Emergency Declaration, a National Emergency Declaration, and a Nationwide Presidential Disaster Declaration were issued concurrently.⁴ Within each proclamation is a diverse assortment of authorities competing to reach like objectives.¹

Who is leading the nation's health security response? Under a public health emergency, the Public Health Services Act of 1944⁵ states HHS is the lead agency, and all others support it. The Stafford Act of 1988 states in a Presidentially declared disaster,

the Department of Homeland Security, Agency of the Federal Emergency Management Agency (FEMA), is the lead with HHS responding under Emergency Support Function 8: Public Health and Medical Services.⁶ The competing declarations made it unclear who the lead agency was in command and which agencies supported the response effort.

Washington State Public Health Response

Adding to the confusion in Washington State, a 'Home Rule' allows charter counties to adopt their constitution and govern themselves in a public health emergency.⁷ The 'Home Rule' law fragments and decentralizes the public health system statewide, leaving no cohesive pandemic response plan.

On February 29, 2020, Governor Jay Inslee issued a COVID-19 emergency proclamation and was approved for a significant federal disaster on March 22, 2020.⁸ Proclamation 20-05 activated a state-level Public Health Incident Management Team from the Department of Health to manage the state-level public health aspects of the COVID-19 response. The Washington State Military Department, State Emergency Operations Center, was also activated to coordinate resources supporting local jurisdictions and the state Department of Health. Washington State Law RCW 38.08,⁹ 38.52,¹⁰ and 43.06¹¹ gives the Governor the authority to declare a state of emergency and activate the state's Comprehensive Emergency Management Plan (CEMP).¹² However, an in-depth review of Washington State's CEMP states, "Consistent with the intent of the Emergency Management Act, the Military Departments coordinates its efforts with the

whole community," while the remaining state agencies fall within an Emergency Support Function system.¹²

Further, on page 7, "The Governor is granted general supervision and control of the emergency management functions of the Military Department."¹² Additionally, on page 12, the CEMP states, "the State Emergency Operations Center (SEOC) serves as a single point of contact for authorizing state resources or actions in response to and recovery from natural, technology, or human-caused emergencies or disaster."¹²

Emergency Support Functions (ESF) are included in supplemental annexes. In the CEMP Basic Plan, ESFs are referred to as the structure for coordinating interagency support for state response and are activated as needed (pg. 15-16).¹² When the ESFs are activated, a coordinating agency manages oversight for their ESF. A primary agency with "authorities, roles, resources, or capabilities," this agency supports the ESF coordinating agency, followed by the support agencies (pg. 16-17).¹² When Washington State declared the State of Emergency, conflicting information was disseminated from the Department of Health, the SEOC, the healthcare coalition tasked with medical surges, and local health departments. Additionally, information was shared from HHS, CDC, FEMA, and Indian Health Services for Tribal Nations, to mention a few.

Public Health and Emergency Management Competing Responsibilities

Critical public health and healthcare systems coordinate with local emergency medical services (EMS) and emergency management to address complex challenges. However, emergencies or disasters vary by region; nearly all lead to public health

consequences and have a healthcare response component.^{13,14} Disasters may intensify chronic diseases.¹⁴ Therefore, emergency management, public health, healthcare, emergency medical services, long-term healthcare facilities, and public and private partners must be committed to breaking down existing silos and working together in an "all-hazard" "whole community" response.¹⁵

Whether a pandemic, disaster triggered by natural hazards, or terrorist attack, it is critical to identify and clarify each incident's jurisdictional lead agency role based on incident type and magnitude.¹³ At the state and local level, a determination must be made in which jurisdiction or organizational group will be responsible for what capability standard, whose agency will lead, and how they will respond cohesively in a crisis.¹³ The chart below provides a timeline and comparison of public health and emergency management legislation.

Table 1

Public Health Versus Emergency Management Response Law Comparison Timeline

DATE	INCIDENT	DEPARTMENT OF HEALTH AND HUMAN SERVICES	FEMA ACTIONS
1700	Sick Foreign Sailors ¹⁶	Public Health Begins	FEMA NOT FORMED
1803-1950			128 Separate Laws lacking comprehensive emergency management planning⁴⁰
1935		Social Security Act of 1935¹⁶ Section 1135 waiver-specific Medicare,	FEMA NOT FORMED

		Medicaid, SCHIP, & HIPPA requirements	
1938		Food & Drug Administration (FDA) *Section 564 invokes Emergency Use Authorization (EUA) (See PHSA below)³⁴	FEMA NOT FORMED
1944- 1945	Several PH Incidents	Public Health Service Act combining PH Legislation¹⁷ <ul style="list-style-type: none"> • 1944 WWII Communicable Disease Center Created¹⁸ • Section 319 Authorizes DHHS authority to respond to PH emergencies • Authorized to declare PH emergency • *Section 319 PHSA declared PHE does not empower FDA to issue EUAs 	FEMA NOT FORMED
1950s	Multiple Hurricanes & Typhoons⁴²	Federal Disaster Relief ACT <ul style="list-style-type: none"> • President's authority to declare disasters 	FEMA NOT FORMED FEMA NOT FORMED Federal Disaster Relief Act⁴¹ U.S. Emergency Management Fragmented⁴¹

		<ul style="list-style-type: none"> • Created Federal Civil Defense
1960s		<p>FEMA NOT FORMED</p> <p>Federal Government remained reactive, not proactive⁴¹</p>
1970	CDC's Name changed to the Center for Disease Control	<p>FEMA NOT FORMED</p> <p>Federal Response Agencies over 100</p>
1974		<p>FEMA NOT FORMED</p> <p>Disaster Relief ACT⁴¹</p> <p>Response Remains Fragmented⁴²</p>
1979		<p>Federal Creation of Federal Emergency Management Agency (FEMA) Mission, not Federally Defined⁴³</p> <ul style="list-style-type: none"> • Combined responses from DOD, HUD, GSA • The country divided into 10 Regions
1988	Robert T. Stafford Disaster Relief & Emergency Assistance ACT	<p>President Assigns FEMA Primary Response Incident Dependent^{45,47}</p>

1992	Hurricane Andrew	Prevention added to CDC Created Federal Response Plan (FRP), FEMA's responsibility	FEMA Response <ul style="list-style-type: none"> • Mission Designated Responder • Creation of the Federal Response Plan (FRP)⁴⁸
1995-1996	Oklahoma City Bombing	Presidential Decision Directive/NSC-39^{17,20,21} <ul style="list-style-type: none"> • U.S. Policy on Counterterrorism • Lack of Responder Coordination 	Incident Responder Defense Against Weapons of Mass Destruction ACT⁴³ FEMA Director elevated to Cabinet-Level⁴⁵
2001-2006	9/11 Terrorist Attack -Anthrax Letters	Public Health Security & Bioterrorism Preparedness & Response Act (PHSBPRA)^{17,22,23,24} <ul style="list-style-type: none"> • (NDMS) National Disaster Medical System²⁵ • DMAT Disaster Medical Assistance Team²⁵ • Public Health Law 107-188 NBHPP^{23,24} • The Joint Commission's Emergency Preparedness Standards.^{23, 24} • Created ASPHER over NDMS consisting of HHS, FEMA, DOD, FDA, & DVA 	HSPD-5 Manage National Domestic Incidents HSPD-8 National Preparedness HSPD-9 Defense of U.S. Agriculture & Food HSPD-11^{48,49} Comprehensive Terrorist-Relate Screening Procedures^{48,49} FEMA Director moved under the Secretary of Homeland Security⁴⁸⁻⁴⁹ Homeland Security ACT 2002

		<ul style="list-style-type: none"> Establishes Assistant Secretary Public Health Emergency Preparedness (PHSBPRA)²³ 	<p>established National Response Goals^{50,51}</p> <p>-2005 National Response Framework (15 ESFs)</p>
		<p>Homeland Security ACT of 2002</p> <ul style="list-style-type: none"> National Incident Management System (NIMS) >Incident Command System (ICS) 	
2005	Hurricane Katrina & Hurricane Rita	<p>Pandemic & All-Hazards Preparedness Act^{26,27}</p> <ul style="list-style-type: none"> ASPHER Medical Countermeasures (MCM)²⁷ Created National Response Framework (NRF) 	<p>Joint Mission PHSBPRA / ASPHER response</p> <ul style="list-style-type: none"> MCM deployment assistance by FEMA National Response Goals Revised
2006-2012		<p>PAHPA improvements for ASPR adding MCM^{28,29}</p>	<p>NO NOTABLE ACTION</p>
2007		<p>Hospital Preparedness Program (HPP) assigned to ASPR³⁰</p> <ul style="list-style-type: none"> Funding through 2012 Creation Healthcare Coalitions Medical Surge Capacity Handbook 	<p>NO NOTABLE ACTION</p>

2009		The Healthcare Coalition in Emergency Response & Recovery³⁰	NO NOTABLE ACTION
2011		CDC established 15 Capabilities, creating ESF#8^{31,32} <ul style="list-style-type: none"> • National Response Framework • CDC 15 preparedness capabilities implemented 	FEMA adopts ESF support structure
2012-2019		PAHPA improvements for ASPR adding MCM REAUTHORIZED¹⁷	NO NOTABLE ACTION
2013		HPP under ASPR funding reauthorized³⁰	UPDATED
		Public Health Services ACT amended by Section 319⁶	Robert T. Stafford Disaster Relief & Emergency Assistance ACT³³
2013		AMENDED Public Health Emergency Fund / Public Health Services ACT	
		AMENDED Social Security ACT of 1935 Secretary HHS waives specific Medicare, Medicaid, SCHIP & HIPPS.	
	Hurricane Wilma		Nation Response found Deficient.
2017	16 Separate Weather-Related Disasters	Est. Cost \$300 billion, affecting 25 million Americans.³⁵	PDD, PA, IA
2017	Hurricane Harvey	Hospital Preparedness Program (HPP)	PDD, PA, IA

Capability 4,6 Published in the 2017-2022 Health Care Preparedness and Response Capabilities³⁵			
2017-2022	27 Mass Shootings, including the Mass Shooting at Route 99 Harvest Music Festival (59 dead, 527 Injured)	RENEWED CDC established 15 Capabilities, creating ESF#8 <ul style="list-style-type: none"> • National Response Framework CDC 15 preparedness capabilities implemented	Federal Assistance to include Federal Law Enforcement
2019		HPP under ASPR funding was reauthorized. <ul style="list-style-type: none"> • Create Pandemic & All-Hazard Preparedness & Advancing • Innovation ACT (PAHPAIA) • Enhanced HHS, ASPR, Dir. CDC roles & responsibilities • Funded MCM, Rapid Response FDA • Fortifies HPP, Healthcare Coalitions, & NDMS • Support to local Health Departments • Medical Operations Coordination Cells 	NO NOTABLE ACTION

**PAHPA
improvements for
ASPR adding MCM**

**REAUTHORIZED
Expanding:
Pandemic & All-
Hazard Preparedness
& Advanced
innovation Act
(PAHPAIA)**

2020	<p>COVID-19 PANDEMIC</p> <p>**The COVID-19 Pandemic is historically the first transitional incident of national significance connecting national disaster response with a public health emergency.</p>	<p>National Emergency Act National Emergency Declaration PDD Stafford Act HHS Proclamation 9994 (National Emergency Declaration)³⁶</p>	<p>The First Time a National Disaster & Public Health Emergency linked DHSC & FEMA activated</p>
2022- 2023	<p>COVID-19 PANDEMIC</p>	<p>Public Law, 117-159 Secretary of HHS, Leads all Federal public health, medical responses, & medical emergencies under NRF³⁷</p> <p>Public Health Services ACT (Title III-General Powers & Duties of Public Health Services)³⁸</p>	<p>NO NOTABLE ACTION</p>

Public Health Responsibilities and Legal Authorities

Responsibility

In 2011 and updated in 2018, the CDC established and revised a set of 15 Capabilities (see Table 1); these standards facilitated a national framework advancing public health for an ESF #8 response. ESF #8, as laid out in the National Response Framework (NRF) at all levels of government, provides the structure for coordinated public health and medical disaster in collaboration with emergency management agencies.³¹ The CDC's 15 preparedness capability standards provide public health and medical operational support to the FEMA's National Preparedness Goal.³²

Legal Authority

Section 319 of the Public Health Services Act provides the U. S. Department of Health and Human Services with the legal authority to respond to public health emergencies.⁶ Further, section 319 authorizes the Secretary of HHS to determine if a public health hazard exists, to declare a national public health emergency, and the authority to act using funds from the Public Health Emergency Fund.⁶ Public Health Services Act, Section 319, will later be amended by the Pandemic and All-Hazards Preparedness Reauthorization Act of 2013, Pub. L. No. 113-5, giving the secretary authority to temporarily reassign personnel at the request of governors or tribal Chief Executives.⁶

Social Security Act of 1935. Section 1135 authorizes the Secretary of HHS to waive specific Medicare, Medicaid, SCHIP, and Health Insurance Portability and

Accountability Act (HIPAA) requirements.³³ The 1135 waivers can be authorized under Section 319 of the Public Health Service Act by the Secretary of HHS or when the President declares a disaster or emergency under the Stafford Act or National Emergencies Act.³³ The waivers put aside program participation for individual healthcare providers, pre-approval requirements, state licensure for out-of-state medical providers, and direction or relocation of an individual to receive medical care, to name a few.³³

Federal Food, Drug, and Cosmetic Act of 1938. Section 564 authorizes the U.S. Food and Drug Administration (FDA) to invoke the Emergency Use Authorization (EUA).³⁴ EUAs allow for unapproved medical products or alternative uses of approved medical products for other reasons not stipulated in the original use, approval when no adequate, supported, and available alternatives exist.³⁴ Under Section 319 of the Public Health Services Act, a declared public health emergency does not empower the FDA to issue EUAs.³⁴ A declaration of emergency must be filed under section 564 of the FFDCFA justifying a EUA.³⁴

Emergency Management Responsibilities and Legal Authorities

Responsibility

FEMA's National Preparedness Goal is an "all community" approach for a coordinated and unified effort to protect the nation's security by establishing an operational structure and processes that embrace all critical stakeholders.⁵⁰ The Healthcare and Emergency Services' core capabilities provide the functional coordination structure for lifesaving treatment, emergency management, public health, and behavioral

health are supporting entities.⁵⁰ The objectives of the National Preparedness Goal are to: deliver medical countermeasures, triage victims, stabilize casualties, resume medical surge resources to pre-event levels, and classify and prioritize recovery processes.⁵⁰

In comparison, the Health and Social Services core capability's operational structure aims to restore health and social services to an affected area. These objectives include identifying stakeholders, completing a community assessment of health and social service needs, and prioritizing. The whole community should develop a comprehensive recovery plan and establish a timeline for restoring health care, behavioral health, public health, and social services functions. As the repair regenerates services, attention to improving the resilience and sustainability of the health care system and social service capabilities are supported and prioritized within the specified recovery timeline.⁵¹

Legal Authority

Presidential Directives or Executive Actions. Presidential directives or executive actions are constitutional power given to the President, explaining how Executive branch agencies will execute the national strategy to secure the homeland.⁵² HSPD-5 required the Secretary of the Department of Homeland Security to craft the National Response Framework (NRF) and the National Incident Management System (NIMS).⁵² HSPD-8 was revised in 2007 and again in March 2011, when the four categories of hazards were added: terrorism, catastrophic disasters triggered by natural threats, cyber-attacks, and pandemics.⁵²

Robert T. Stafford Disaster Relief and Emergency Assistance Act. The Robert T. Stafford Act (Stafford Act) brought a systematic process to federal government disaster assistance programs and established the statutory authority for national disaster response endeavors.³³ Under the Stafford Act, the President is authorized to declare an emergency or major disaster permitting federal supplemental assistance depending on the event's type and magnitude and should be identified in the disaster declaration.³³ There is limited federal participation in a declared emergency, while a significant disaster usually requires greater federal government involvement and assistance. Federal disaster assistance is available to states after the President declares a major disaster. Within the Stafford Act, unless otherwise stipulated, the cost-sharing provisions are laid out are a 75% federal to 25% state or tribal nation split.³³ The Stafford Act authorizes three categories of assistance: public assistance providing funding and expertise, individual assistance directly to individuals and businesses, and disaster mitigation funding.³³

National Response Framework. The National Response Framework is a comprehensive strategy for all-hazards disaster response; it establishes a layered, integrated response between federal and nonfederal entities.⁵⁴ The NRF can be a benchmark for federal, state, tribal, local, territorial governments, and the private sector to prepare, respond, and recover from incidents.⁵⁴ Using key concepts from NIMS, the NRF is designed to be flexible and scalable, meaning the response can be adjusted according to the incident's magnitude and size.⁵⁴ The NRF consists of the base document, which is the guiding principles with clarifications of roles and responsibilities, general

authority lines for responding federal agencies, and coordination procedures to fulfill the core capabilities broken down into ESFs.⁵⁵ The core capabilities are further detailed in the attached ESF Annexes, Support Annexes, and Incident Annexes.⁵⁵

The ESFs stipulate the operations' concepts. ESF #8: Public Health and Medical Services provides coordination procedures and clarity of health and medical response responsibilities during a disaster.⁵⁶ HHS is the primary agency at the federal level. Simultaneously, the ASPR directs and coordinates the overall response effort and liaises with other key federal agencies.⁴⁹ Using Incident Command System (ICS) principles, ASPR coordinates the federal response through the HHS Emergency Management Group at the operations center.⁵⁷ In a layered approach, a field-level team, acting under the direction of the HHS Emergency Management Group, is deployed to the scene, primarily responsible for supporting local jurisdictions with an incident's public health and medical management.⁵⁷ Field-level teams do not provide direct medical or public health services; they provide direction and coordination of other federally deployed personnel and agencies.⁵⁷ Supporting agencies for ESF #8 are the Department of Homeland Security, FEMA, the Department of Defense (DOD), and the Department of Veterans Affairs (DVA).²³

ESF #8 response structure is used at the state, tribal, and local levels to coordinate an incident's medical and public health response. In Washington State, the primary agency is the Department of Health, sending an ESF #8 representative to the state military department emergency operations center.¹² Supporting agencies include the

Department of Agriculture, Department of Ecology, Department of Enterprise Services, Department of Fish and Wildlife, Department of Labor and Industries, Department of Licensing, Department of Social and Health Services, Department of Transportation, Washington Military Department, Washington State Health Care Authority, Washington State Patrol, and the Washington State Pharmacy Association.¹² Not all agencies are activated for every health crisis; the incident's scope and magnitude determine activations.

National Incident Management System (NIMS). Launched in 2004 by the Department of Homeland Security, NIMS is a comprehensive, national approach to incident resource management applicable at all government levels.⁵⁸ NIMS structure provides a common standard for incident management and is appropriate for all hazards regardless of size and magnitude.⁵⁸ The NRF is the 'what' or structure of the response, while NIMS is the 'how' or the groundwork of procedures and protocols, providing standardization for incident management.⁵⁸ The NIMS foundation is that all emergencies or disasters begin and end at the local level, where local governments first ask the state for assistance. It is not until the state's resources are overwhelmed does the state ask for support from the federal government.⁵⁸ NIMS integrates agency interoperability, resource management, command and management, and the incident command system into one flexible procedural document, revised periodically to incorporate modified best practices and lessons learned.⁵⁸ Since 2004, NIMS and the incident command structure have been largely entrenched in federal, state, tribal, local governments, and private organizations'

Comprehensive Emergency Management Plans (CEMP). For example, FEMA adopted a similar incident management team structure as ASPR in 2010.⁵⁹

Fragmentation in Disaster Response

Much progress has been made in integrated health delivery systems in a disaster; work remains. Command and management remain challenging and inconsistent at the federal, state, and local levels. As noted above, emergency management, public health, and healthcare response have historically been reactionary to an adverse event; most plans and legislation have been modality-specific until the 2008 National Response Framework was introduced. Emergency management, public health, and healthcare delivery operate separately with no interaction on any given day. Yet, they are expected to come together along with other private partnerships for an integrated complex response for life safety.

FEMA's mission is to protect lives by relieving people's burdens during adverse events and improving communities by rebuilding their lives.³⁶ Life safety and protect property. ASPR's mission is to save lives and protect Americans from health security threats.⁵⁹ ASPR's Hospital Preparedness Program (HPP) purpose is to "save lives during disaster events that exceed the day-to-day capacity and capability of existing health and emergency response systems."⁶⁰ Emergency medical services, another equally crucial system within the complex disaster health system, should not be left out when planning and preparing. Each mission's underlying foundational element is to save lives, yet these

entities do not exist in isolation. Each modality has a specific function in life safety, but it is unclear who is in command under ICS, as laid out in NIMS.

METHODS

A qualitative case study, using document analysis and participant interviews, was selected to understand better disaster health responders' personal experiences who encountered anxiety in an emotionally charged environment. The research did not focus on the healthcare responders' roles in the public health emergency operations /ESF 8 response. Still, it sought to understand what challenges have occurred in general when health, public health, emergency medical services, and emergency management collaborate at the federal, state, and local levels.

To offset researcher bias and increase the study's validity, document analysis was conducted using multiple sources of supporting documentation^{61,62}. Document sources included peer-reviewed literature and recent grey literature, including but not limited to; white papers and policy documents, after-action reports, situational reports, and archival records focusing on ESF-8, Command and Control, public health response policies and laws, and disaster management. The keywords searched were *mass casualty incidents, emergency response, health readiness, ESF-8, public health emergency, public health law, National Incident Management, and disaster management*. Seven databases were used: ProQuest Science Journals, Google Scholar, Health Services and Sciences Research Resources (HSRR), Homeland Security Digital Library, PubMed, SAGE Journals, and a Thoreau multi-database search. Documents used in this study were easily obtained

through database research and contained sources from National, Regional, State, and Local Levels.

To increase objectivity, reliability, and validity, I conducted nine in-depth interviews with healthcare response professionals with experience during the recent COVID-19 pandemic. As mentioned previously, the pandemic was the first time in our Nation's history that a Public Health Emergency and a Presidential Declaration were enacted simultaneously.

Participants

Nine interviews were conducted with individuals in public health, healthcare delivery, emergency management, emergency medical services, and E911 leadership who held disaster response roles.

Table 2

Participants' Demographic Data

Participant #	Modality	Years of Experience	Urban/Rural Geographic
2303	EMS/Fire Chief	>15 years of experience	Rural
2305	County Public Health	>5, but <15 years of experience	Urban
2306	DMCC Staff Member	>5, but <15 years of experience	Urban
2307	EMS/Fire Chief	>5, but <15 years of experience	Rural
2308	EMS/Fire Chief	>5, but <15 years of experience	Rural
2309	County Medical Director	>15 years of experience	Rural
2310	County Emergency Manager	>15 years of experience	Rural
2311	E911	>15 years of experience	Rural
2312	E911	>15 years of experience	Rural
		>15 years of experience	
		>15 years of experience	

Instrumentation

Data was collected using a guide constructed for this study. The guide consists of six categories: participants' backgrounds, participants' experience with collaboration and coordination in a disaster, participants' awareness of healthcare coalitions in a disaster, federal, state, and local response operations, lessons learned from the pandemic response, and conclusion. Each category had three or more semi-structured, open-ended primary questions. The developed guide sought participant perceptions of connectivity and procedural gaps and was constructed to align with the study's research question. Instrument validity was established through a pilot study using two study participants to assess the instrument's value.

RESULTS

Nine interviews were conducted. Study participants' work experience ranged from seven to thirty-seven years. The participants were from various modalities that respond to an ESF 8 or public health emergency. All participants held vital roles when the COVID-19 Presidential disaster was declared and continued to hold important positions through the spring of 2023. Of those interviewed, one hundred percent of the study participants agreed they received too many emails to read on any given day. They all agreed that the absence of direction in the early stages of the COVID-19 response at the federal and state levels made it difficult to make informed decisions locally. Additionally, 100% of participants expressed concern about not knowing which agency provided the most relevant information and which emails to read. One small jurisdiction assigned FEMA

email reading and meeting attendance to one staff member, while another was given HHS and CDC emails and meetings, and two other staff members divided state Department of Health (DOH) and State Emergency Management Division (EMD) emails and meetings, with a debriefing toward the end of the day to coordinate information sharing.

Local-level frustration grew into anger as the pandemic moved on, at DOH and EMDs' inability to coordinate and communicate with each other, leaving ESF 8 representation absent from the state Emergency Operations Center (EOC). The lack of coordination grew between neighboring counties as the 'Home Rule' law fragmentation and decentralization of the public health system displayed significant gaps in standardization.

Using NVivo, Transcription, and NVivo coding software, themes, patterns, and concepts were identified.

Table 3

Theme 1: Unclear Guidelines

Themes	Codes	Participants' Quotes
Unclear Guidelines	Public health, Emergency Operations	Participant 2303: "The current system is not working." Participant 2305: "we were working in pure chaos. There was no fatality management, and we needed a system in place to discharge to long-term facilities. Health systems don't link together, and everything was crazy, we need improved communication and coordination structures."
	Guidelines are Contradictory	
	Lack of leadership	Participant 2305: "There are many gaps in the overall response system and leadership is lacking. Healthcare coalition meetings are a waste of time, nothing changes at our level."
	Responder Lack of Knowledge	

**County
Authority**

Participant 2307: “We're not set up. We under we under under responded. We, you know, and then you're really playing catch up really, really quickly. But that's a double edged sword. I mean, do you throw the community into a complete pandemonium every time that there's somebody coming down the pike knowing what the percentages are? That's a fine line to walk. So it it. But but you need to, you know, you need to be prepared. We weren't prepared at all for this. Just weren't, you know, we had some plans in place. You know, you bring those out, you find out they're quickly outdated. They're they're insufficient. They don't they don't cover anything to this level of severity. So the playbook quickly goes out the window. And but, you know, every pandemic in any pandemic would be different. So how do you put together a concrete plan for the unknown? It's difficult, but but don't under under assume the severity of what's coming down the pike, which this my takeaway.

Participant 2309: “It was very chaotic, there was a lot of information and the guidelines changed daily and sometimes it seemed hourly, it was difficult to know where to get the most current and relevant information.”

Participant 2310: “We were overwhelmed by information and underwhelmed by the lack of situational awareness. For example, multiple agencies shared the same information with local levels. Yes too many communicators of the same information, where the local government became the clearing house for ensuring the operational picture was clear and accurate.”

Participant 2311: “we looked on the internet for CDC guidelines, certain things, but ultimately we typically relied on public health for. I guess confirmation, if nothing else, that

we were reading everything right and making the right decision.”

Participant 2305: “The county emergency manager coordinates all ESF resources, the county public health department guides and directs the public health component of the response.”

Participant 2306: “Usually Public Health leads, response is coordinated at the EOC in [our city].”

Participant 2307: “Multiple disciplines on X incident. It would be healthy for the county to go into area command, thereby the county elected. Would be the lead. And now breaking out the ICS chart.”

Participant 2308: “Emergency management is the true leader located in our public works building? So in our emergency operating center, which is down right off of what went on there, that becomes the nerve center for all emergency operations in [our] County

Participant 2310: “The one that has the most experience in health care? So if it's ESF 8, which would be our public health administrator, he would lead. We have both the emergency operation center and the Incident Command post with an area command post. So the incident commander, as in if it's public health, they have a small center located in their building as well as they have a space within the area command post. And we have a mobile command post which will deploy if they need it directly on the ground.”

Table 4

Theme 2: Effective Collaboration to Reduce Duplication

Themes	Codes	Participants' Quotes
Effective Collaboration to	Government, no inconsistency	Participant 2303: “There is a lack of proactive efforts to develop communication

<p>Reduce Duplication</p>	<p>Problems with Support from National Government</p>	<p>and collaboration structures and processes are critical especially in rural area.”</p> <p>Participant 2305: “funding silos cause different modalities to do things differently. We need some kind of state agency that regulates and coordinates health response, the regional healthcare coalition is mismanaged and needs new leadership”</p>
	<p>Lack of Communication Between Government Levels</p>	<p>Participant 2306: “Everything was confusing in the beginning. Information was coming at us from all directions and systems has not been put in place for the number of patients we were about to receive.”</p> <p>Participant 2307: “Response at the federal level was political and people in our county pushed-back. We lost a lot of staff when healthcare workers were forced to vaccinated.”</p> <p>Participant 2307: “Provide support and recommendations regarding the development of state, and regional operational and communication structures, enhance WaTrac and load-balancing models prior to the next pandemic or public health crisis.”</p> <p>Participant 2308: “Communication and influence from urban healthcare providers to state and federal agencies was unbalanced, impacting pre-hospital regulator decision-making and ultimately load-balancing outcomes.</p> <p>Participant 2309: “The lack of a coordinated, federal, state, and local response system lead to staff stress, burnout, attrition, negative outcomes, and an overwhelmed system. Smaller independent organizations with fewer resources struggled to put structures into place.”</p> <p>Participant 2310: “In accordance with the Robert T. Stafford Act, and Revised Code of Washington State 38.52, it depends on the severity of the incident and the lack of assets necessary to save lives. Local governments</p>

may request assistance from the federal government (government-to-government) is the State is not available or overwhelmed, and the assets are necessary to protect life. However, in most cases, specifically those State who are classified as Home-Rule States, the State functions as a broker for assets during response. To meet the federal requirements State assets must be committed or depleted before federal assets are authorized.”

Table 5*Theme 3: Lack of Effective Public Health Decisions During Complex Emergencies*

Themes	Codes	Participants' Quotes
Lack of Effective Public Health Decisions During Complex Emergencies	Control	Participant 2305: “No real-time information does not share the big picture and health of our health systems. We did the best we could with the little information we were receiving. Keeping up was a struggle with all the different sources of the same information.” Participant 2309: “highlighted the difficulty to coordinate amongst different systems and regions and counties and state and federal. How compartmentalized our health care system truly is and. How vulnerable it is.” Participant 2310: “A Public Health Emergency has an assigned Public Health Professional as the Incident Commander, and is coordinating all aspects to the public health incident. In this case the threat to life-safety is a public health incident.” Participant 2307: “Situational awareness reporting. Um, it was difficult in the early days. There was so much information in coming that it was frankly overwhelming. And that's what I shared with my commissioners, you know, early on is, you
	Dissemination of Information	
	Identify Lead Agency	
	Lack of Systematic Thinking	
	Problems Related to Resource Allocation	

know, we need three more people just to monitor the email and break this down for us. It was just I've never seen anything like it. I've never seen, you know, ten emails per second. And not all of it was redundant. That was probably some of the frustrating part is you're getting shot at with the same bullet from 10 different guns and. But my fear in the early, early days that I lost all kinds of information because I thought it was redundant, I was, you know, I'm dumping emails just trying to keep up. There was a lot of confusion and a need for improved communication and coordination structures.”

Participant 2309: “Preparedness needs to happen! EMS needs to think as a system, not a unit. Need to include E911.”

Participant 2310: “Trust the protocols in place and follow them. If after use, they do not work, change them, but do not change them before executing the protocol. Second, the incident command system (ICS) is the gold standard response structure throughout the nation. Don't assume a specific incident will not work using ICS before thinking through it. Not thinking through its application and the modifications necessary for ICS to work, puts lives at risk unnecessarily. Change should only be required when knowing ICS will not work. Two, to only know it does not work is by using it and finding through application it did work. So I guess what I'm trying to say is follow the law. If it doesn't work, then modify, but don't modify it based on assumption or perception.”

Participant 2311: “We'd get, you know, all the numbers. I mean, more data than we wanted, especially early on. I pushed out a lot of that to the troops here and then tried to find that fine middle ground of keeping them in

the loop without overload because I know I was”

Participant 2303: “We are using airlifts regularly; hospitals are a long distance, and we cannot wait to offboard patients. We have to stay with the patient until the facility takes over their care; if there are no beds, we wait. Waiting means taking a unit out of service for long periods.”

Participant 2305: “Additionally, collaboration across the continuum of care needs to be overhauled. COVID taught many lessons is patient movement, lack of leadership from the healthcare coalition and so many other lessons showing how ill prepared we are as a state. There are large gaps in patient tracking, in its present form WaTrac is a waste of time and money. DMCC is unfunded, and dysfunctional.”

Participant 2306: “The patient tracking system needs a complete overhaul, and DMCCs need to be funded during long responses like COVID. I think there's a huge gap in understanding of how to access the module from a local level to actually put patients into that system. So now it's just trying to get by and for from those groups to want to spend time to learn how to do it.”

Participant 2309: “Tracking and an information needs to be in that may exceed the capacity of the current system. We were reliant on the historical information provided on WaTrac and WaHealth dashboards. However, real-time information would have provided a far superior view of the current health system, and available bed occupancy.”

Participant 2310: “During the Pandemic, depending on the situation, we were overwhelmed by information, and underwhelmed the lack of situational awareness. For example multiple agencies shared the same information with local levels.”

However, because the tracking system is not used, our local EMS services, never know ahead of time whether a medical center was on accepting patients or not. It is not uncommon for an EMS unit to travel from hospital to hospital attempting to locate treatment for their patient. The situations provided above were worse during COVID-19.”

Study Limitations. This study does have some limitations. The original means for participant invitation was posting on social media to provide a greater pool of participants. However, this method resulted in zero participants and eventually initiated the need to pursue an alternative approach. An email invitation was sent to 78 random public health emergency managers, Fire/EMS Chiefs, medical directors, and E911 directors to reduce selection bias. The email invitations were sent to urban and rural jurisdictions and included potential participants on the western and eastern sides of the state. This method was intended to reach as many people from varying geographic locations as possible and may have missed potential participants.

The invitation response rate was also low due to the ongoing pandemic response efforts, the Omicron case surge, and workforce attrition. The invitation method did not yield participation from the eastern side of Washington State. Further research during non-pandemic times may attract increased interest in participation. Also, participants' experience during the COVID-19 response may have influenced their perceptions of understanding roles and responsibilities before the pandemic.

DISCUSSION

The U.S. disaster response system has the capabilities and capacity to respond to large health emergencies through plans and policies. However, the nation has still not met the goals of collaboration and coordination established in the National Response Framework. FEMA within the Department of Homeland Security and the Department of Health and Human Services, including the CDC, are well structured and methodical in their collective response efforts. These two vital agencies function in leadership roles for varying health emergencies; HHS for public health emergencies and FEMA for natural disasters with a health component. Regrettably, the pandemic showed their lack of understanding of which agency was lead when the President declared a disaster. The lack of knowledge led to ineffective coordination and indecisiveness, which trickled to the state and local levels.

Public Health Service Act-TITLE III (General Powers and Duties of Public Health Service) Public Law 117-159³⁸ was enacted on June 25, 2022. The law reiterates the Secretary of HHS leads all Federal public health and medical response to public health and medical emergencies and incidents covered by the National Response Framework. With this being firmly stated in current law, perhaps the federal government can establish a pandemic response plan with clearly defined roles and responsibilities that can translate to the state and local levels.

CONCLUSION

This study was designed to explore the disaster health emergency response system, who is in command, and whether the silos of government disaster response before the 2008 National Response Framework still exist today. One lesson learned from the Covid-19 pandemic is that a poor communication infrastructure hinders the ability to communicate efficiently and effectively in a public health emergency or disaster. Information sharing among multiple agencies and layers of government was disjointed and time-consuming during the initial days of the pandemic response. Informational emailing inundated mailboxes with redundant information. This study's findings suggest the need for standardized, better lead role definitions and evidence-based disaster communication guidelines. While still limited, the data is convincing and makes a strong case for enhanced initial communication, reducing chaos and confusion among response partners, thus providing better health outcomes.

As laid out in the National Response Plan and Framework, roles and responsibilities should be further defined with practical instruction for enacting these roles in a complex, multifaceted disaster situation. Multi-jurisdictional public health or disaster response is complex, and roles are usually unclear. The COVID-19 pandemic has also underscored flaws at the state response level, as roles and responsibilities among competing agencies are fragmented, causing siloes in the overall response efforts.

Conflict of interest statement

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Author's contributions

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Part 3: Summary

The findings of this study indicated no significant differences in all jurisdictions' perceptions of the WaTrac patient distribution system, roles and responsibilities of the healthcare coalition, and who is in charge during a public health emergency or disaster. Participants in this study expressed profound frustration with the lack of guidance and system failures involving patient distribution and load balancing, which significantly impacted Washington's health systems. Participants further articulated that lack of leadership from the federal government, state, and healthcare coalition caused chaos and enhanced frustration during chronic and peak patient high-load medical surges.

Manuscript 1 Themes

Results of thematic analysis from Manuscript 1 and corresponding interview questions (Appendix A, Section 2):

1. Unclear Usage of the Patient Tracking System
 - a. System Performance
 - b. Tracking System
 - c. WaTrac
 - d. Credible Data
 - e. Reliable Data
 - f. Historical Data
 - g. Real-time Information
 - h. Health System

- i. Alert System
- j. Functional System

2. Lack of Collaboration and Coordination

- a. Coordination
- b. Open Beds
- c. Lack
- d. Staff
- e. Time
- f. Situational Awareness
- g. Activation Protocols
- h. Share
- i. Patient Movement
- j. Tracking System Partners

3. Patient Distribution

- a. Load-balancing
- b. Health
- c. Bed
- d. Rural Communities
- e. Patient Movement

Questions from Interview Guide

- a) Describe your experience using a statewide patient tracking system.

- b) Please share your experience using a tracking system in a disaster or public health emergency.
- c) Can you share how the tracking system addresses patient movement?
 - i. Hospital bed capacity?
 - ii. Information sharing?
 - iii. Family reunification?
 - iv. Resource Management?
- d) To what extent do you collaborate and coordinate within the tracking system with response partners?
- e) How often does your facility update or input bed availability into the patient tracking system?
- f) Discuss the protocols for activating the patient tracking system.
- g) How is the patient tracking system interrelated to the overall healthcare response system?

Manuscript 2 Themes

Results of thematic analysis from Manuscript 2 and corresponding interview questions (Appendix A, Section 3):

1. Lack of Knowledge of Leadership from the healthcare coalition

- a. Local Healthcare System
 - b. Coordination Structure
 - c. Healthcare Surge Capacity
 - d. Healthcare Coalition
 - e. Staff Healthcare Coalition
 - f. Healthcare Coalition Move
 - g. Information Sharing
2. Understanding of Patient Movement and Distribution Plan
 - a. Healthcare Coalition Move
 - b. Capacity
 - c. Coordinating Mass Casualty Incident
 - d. Patient Movement
 - e. Patient Distribution
 - f. Patient Bed Placement
 - g. Load-balancing
 - h. Patient Unification
3. Lack of Knowledge of DMCC/WMCC Infrastructure
 - a. Collaboration
 - b. Planning
 - c. Funding and staff
 - d. Urban Models

- e. County
- f. Rural Load-balancing Plans
- g. Surge
- h. Medical Directors
- i. Movement

Questions from Interview Guide

- a) Explain the coalition's role. What is their role in a disaster?
- b) How do healthcare coalitions share information with their members during a health emergency?
- c) How does the coalition facilitate patient movement and distribution?
- d) What training and exercises have you or your organization been involved in through the healthcare coalition?
- e) What representation role do members from the coalition provide in the county emergency operations center?
 - i. In the state emergency operations center?
- f) Where do you or your facility share or receive your emergency information?
- g) What is your experience with the Disaster Medical Coordination Center (DMCC)?
- h) What is your experience using the Washington Medical Coordination Center (WMCC)?

Manuscript 3 Themes

Results of thematic analysis from Manuscript 3 and corresponding interview questions

(Appendix A, Section 3):

1. Unclear Guidelines
 - a. Public Health Emergency Operations
 - b. Guidelines are Contradictory
 - c. Lack of Leadership
 - d. Responder Lack of Knowledge
 - e. County Authority
2. Effective Collaboration to Reduce Duplication
 - a. Government Inconsistency
 - b. Problems with Support for National Government
 - c. Lack of Communication Between Government Levels
3. Lack of Effective Public Health Decisions During a Complex Emergencies
 - a. Control Dissemination of Information
 - b. Identify Lead Agency
 - c. Lack of Systems Thinking
 - d. Problems Related to Resource Allocation

Questions from Interview Guide

1. Response Operations

a) Federal Level

- i. What is your familiarity with the federal role in a public health emergency?
- ii. Please explain the difference between a public health emergency and an Emergency Support Function 8 (ESF 8) response.
- iii. Who is the lead federal agency in a public health emergency? Is that same agency the lead in an ESF 8 response?
- iv. What is the federal government's primary role when responding to a health emergency?

b) State Level

- i. Who is the lead agency in your state in a public health emergency? Is that same agency the lead in an ESF 8 response?
- ii. Explain who within the state structure has the authority to seek federal assistance.
- iii. What is the state's role in a health emergency?
- iv. Which state agency or organization disseminates information regarding available resources, operational status, and overview in a health emergency?

c) Local Jurisdiction

- i. What level of government is responsible for the primary response in a health emergency?
- ii. When multiple disciplines respond to a health emergency at the local level, which agency leads? Where is this multi-discipline structure housed?
- iii. How is information disseminated to response partners?
- iv. Explain the role of ESF-8 during a health/Public health activation.

Theoretical Framework and Study Results

An additional study outcome indicated a severe lack of trust among users of the WaTrac patient tracking systems and in NHRS's leadership. Study findings revealed a

need to develop collaborative relations further, build trust across all levels of government, and clearly define roles and responsibilities. Each health-responding entity is a complex adaptive sub-system to the overall disaster health response system. Public health emergencies and disasters are continuously evolving, dynamic events; they require the integration of multiple interrelated agencies and jurisdictions. When using complexity theory to address the public health response system, I witnessed a breakdown in the system as the COVID-19 response became more complex and dynamic. This study exposed gaps in Washington State's public health/healthcare response, leading to unfulfilling the responsibilities for performing ESF8 under the National Response Framework (NRF). These gaps became more apparent as responding entities experienced staff attrition, chronic fatigue, an overburdening patient load, a lack of supplies and available beds, and no clear direction from leadership. Furthermore, the WaTrac patient tracking system, in its current form, failed to provide immediate bed availability and real-time situational awareness, leaving decision-makers struggling to find beds for critically ill patients.

Public health/healthcare response incorporates interconnectivity with interdependent elements and dimensions between operational levels from the federal government to local jurisdictions and various responding agencies. These relationships are frequently non-linear, unpredictable, and self-organizing, becoming challenging. Constant information flow to allocate resources and achieve better patient outcomes is critical. Additionally, response planners must adapt to a changing environment, and quick

strategic, operational, and tactical decision-making requires well-defined roles, responsibilities, and flexible processes. As the response grew and became more complex, disruptions caused the system to become destabilized, collapsing system stability and throwing it into chaos. Autonomous sub-systems became less connected and interdependent, acting separately, causing further disruptions to the system.

Connecting Study Findings

The three manuscripts may appear separate from each other, and at times while writing them, I felt I was conducting three individual dissertations. However, each topic is a sub-system of public health/healthcare response. Each level of government and responding agency must work together to fulfill the National Response Framework and ESF8 responsibilities. Each sub-system is dependent on reliable communications and interdependent on others within the system.

Manuscript One studied the patient tracking system as a communication and coordination tool between responding parties for patient load-balancing and distribution. Manuscript Two intentionally researched the healthcare coalitions' roles and responsibilities in coordination and collaboration and how it is interconnected to state government and its duties in patient distribution. Manuscript Three considered the local, state, and federal government's roles in response and how miscommunication and lack of leadership can destabilize the response system from top to bottom. As the system utilizes its feedback loop processes, incorporating lessons learned could close the gaps revealed

in these three manuscripts and establish an efficient and effective disaster health system to enhance national health security.

Final Comments

Based on the findings of this study, policy and programmatic changes should be implemented to integrate all modalities better into an all-hazards response with a medical component. Understanding the response system and its sub-systems as a complex adaptive system operating in a dynamic event would support best-practice development. Additionally, a clear understanding of roles and responsibilities, using established tools to their fullest, and quality leadership would reduce chaotic stressors on the system. Furthermore, better coordination and collaboration among response partners could systematically leverage capabilities, strengths, and resources.

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Appendix A: Interview Questions

1. **Background**

- a) Explain your role within your organization and how the organization uses the state patient tracking system. What is your role in using the patient tracking system?
- b) What is your organization's role within a healthcare coalition or Regional Disaster Health Response System?
- c) How many years have you worked in a position where you collaborated with response partners during a health crisis or public health emergency?
- d) What modality (health, public health, EMS, emergency management, etc.) did you work in when you would have been involved in patient movement or distribution?

2. **Patient Tracking Systems**

- h) Describe your experience using a statewide patient tracking system.
- i) Please share your experience using a tracking system in a disaster or public health emergency.
- j) Can you share how the tracking system addresses patient movement?
 - v. Hospital bed capacity?
 - vi. Information sharing?
 - vii. Family reunification?
 - viii. Resource Management?
- k) To what extent do you collaborate and coordinate within the tracking system with response partners?
- l) How often does your facility update or input bed availability into the patient tracking system?
- m) Discuss the protocols for activating the patient tracking system.
- n) How is the patient tracking system interrelated to the overall healthcare response system?

3. **Healthcare Coalitions or Regional Disaster Health Response Systems**

- i) Explain the coalition's role. What is their role in a disaster?
- j) How do healthcare coalitions share information with their members during a health emergency?
- k) How does the coalition facilitate patient movement and distribution?
- l) What training and exercises have you or your organization been involved in through the healthcare coalition?
- m) What representation role do members from the coalition provide in the county emergency operations center?
 - ii. In the state emergency operations center?

- n) Where do you or your facility share or receive your emergency information?
- o) What is your experience with the Disaster Medical Coordination Center (DMCC)?
- p) What is your experience using the Washington Medical Coordination Center (WMCC)?

4. Response Operations

d) Federal Level

- v. What is your familiarity with the federal role in a public health emergency?
- vi. Please explain the difference between a public health emergency and an Emergency Support Function 8 (ESF 8) response.
- vii. Who is the lead federal agency in a public health emergency? Is that same agency the lead in an ESF 8 response?
- viii. What is the federal government's primary role when responding to a health emergency?

e) State Level

- v. Who is the lead agency in your state in a public health emergency? Is that same agency the lead in an ESF 8 response?
- vi. Explain who within the state structure has the authority to seek federal assistance.
- vii. What is the state's role in a health emergency?
- viii. Which state agency or organization disseminates information regarding available resources, operational status, and overview in a health emergency?

f) Local Jurisdiction

- v. What level of government is responsible for the primary response in a health emergency?
- vi. When multiple disciplines respond to a health emergency at the local level, which agency leads? Where is this multi-discipline structure housed?
- vii. How is information disseminated to response partners?
- viii. Explain the role of ESF-8 during a health/Public health activation.

5. Lessons Learned

- a) Since your prior experience using a patient tracking system, have you learned any new lessons to prepare you or your organization for future response efforts?
- b) How integrated was your organization in information sharing, situational awareness reporting, resource sharing, and bed availability intelligence in the recent COVID-19 pandemic response effort?
- c) Did you or your organization experience confusion in the beginning days of the pandemic response, and would you or your organization do it differently?

6. Conclusion

- a) If you could share two significant perspectives, what would they be in hindsight of the recent pandemic response effort?
- b) Is there anything else you want to share that I may want to know?
- c) Is there anyone else I should talk with?