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Logistical Resource Capability During a Mass Casualty Event in Washington State

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MAHS, American Military University, 2010

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Dissertation Submitted in Partial Fulfillment

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Abstract

The need for increasing efficiencies for medical resource delivery during a mass casualty incident/event is a paramount logistical planning factor that could mean life or death to the citizens affected by a disaster. As such, Washington State has prioritized emergency management and preparedness. Using the just-in-time system by way of Baghbanian' s complex adaptive decision-making theory as the foundation, gave purpose to this qualitative study. This was accomplished by analysis of emergency management professional responses, and to what degree, improvements can be made to the medical resource delivery system during a mass casualty incident/event. Data were collected through semi structured interviews with a random sample of 12 experienced emergency professionals from the State of Washington. This study was guided by primary research questions that focused on emergency managers and their understanding and adaptability toward preparedness. Interview data were deductively coded and analyzed through a thematic analysis procedure. The key theme of this study is that participants perceived slight differences in logistical and operational approaches that vector into transportation and operational understanding as the main factors influencing medical resource delivery. The positive social change association of this study is that it provides emergency managers, first responders, and medical staff with recommendations for analysis and planning development for medical resource delivery, thereby mitigating the life and death implications for citizens in future disasters.

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Dedication

I would like to dedicate this research to the brave men and women who continuously plan and execute all levels of support for emergency and disaster management.

Acknowledgments

I would like to dedicate this research to all the men and women I have served with, both in the United States Marine Corps and United States Army. I have learned a great deal about being a leader, follower, adapting and accepting what it means to apply selfless service to make our Nation feel safe and secure. I would like to thank Walden University faculty, Dr. David Milen, Dr. Jessie Lee and Dr. Tanya Settles for their expert advice and guidance through my Doctoral journey. I would like to thank my parents Robert and Elaine Brauckmiller for preparing me for the wide range of trials and tribulations we face in our world today. I would like to thank my uncle's Robert Forrey, and Charles Palmer for setting the example of what good men are and supporting me even in the most difficult of times. All these people have had a great significance on my life more than they could ever know. Most importantly, I want to acknowledge my son Todd Brauckmiller Jr. You are why I live. I am so very honored and appreciative of you, and the intelligent, respectful, charismatic and overall outstanding young man that you have grown up to be. Thank you, son, you have made me a better man, I love you very much.

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Chapter 1: Introduction to the Study

Mass casualty incidents/events (MCI/MCE) are defined as a situation where the number of injured patients usually exceeds the resources of the health care organization; the goal of MCI/MCE driven medical care is to provide the greatest good for the greatest number of victims (VandenBerg & Davidson, 2015). The medical dictionary defines an *MCI/MCE* as a catastrophic event in which there are between 10 and 100 or more casualties (Miller-Keane, 2014). A wide variety of threats such as school shootings, terrorist attacks, and natural disasters can also constitute an MCI/MCE. However, experts argue that the definition of an actual MCI/MCE comes down to the effectiveness of the medical resources and care vis-à-vis the actual number of casualties.

In this case study, I explore the issues surrounding funding and the inability to keep current stock levels up to date, deterrence against pilferage of assets, and the need for updating to a just-in-time (JIT) delivery system of critical medical resources and continued collaboration of all state agencies to identify a working cycle of stockage levels to deal with the effects of an MCI/MCE. In response to an MCI/MCE, citizens may be on their own for several hours or longer, depending upon the security of the disaster. In order to assist with preparedness levels for the citizens of Washington and to critically examine what levels of medical resources are available, this study makes an attempt to divulge and expand the capabilities for medical resources by proposing the JIT model to effectively engage with an MCI/MCE.

Although this case study focuses on the logistics surrounding the delivery and storage of critical resources, I begin this chapter by delineating the background, then state the problem and explain my purpose in this study. In addition, I discusses the theoretical framework and the nature of the study, and I identify critical definitions, state the assumptions, address the study's scope and delimitations, and describe the limitations and overall significance of the study.

Background of the Study

The probability of an MCI/MCE occurring seems to be low; however, events such as 9/11 and the 2001 anthrax incident have shown that the severity of any such MCI/MCE can have a catastrophic effect on both infrastructure and human life (Kanyoma, Khomba, Sankhulani, & Hanif, 2013; Watkins et al., 2011; Weyand, Junck, Kang, & Heiner, 2017). Experts agree that even with low probability or low risk, the need for preparedness is paramount, as it relates to the severity level of an MCI/MCE. The organization and delivery of health care are highly regulated at both federal and state levels (Blumenthal et al., 2015; Kearns, Cairns, & Cairns, 2014; Roof & Oleru, 2008). In an MCI/MCE, it is likely that some provisions for temporary modification of regulatory requirements at all levels of government will be necessary. At present, uncertainty about legal issues (specifically the liability issues) may be engendering a reluctance to plan for MCI/MCEs that would require flexible and creative delivery of medical resources to specific areas.

Emergency preparedness planning, as a concept, is a comprehensive one; these issues range from infrastructure to communication and training, education, logistics, and direct response (Blumenthal et al., 2014., Kanyoma et al., 2013; Lee, 2017; Li, 2015; Manuell & Cukor, 2011). Logistics in reference to emergency preparedness can be defined as "the capability to identify, dispatch, mobilize, and demobilize, and to accurately track and record available critical resources throughout all incident management phases" (Kapucu, 2012, p. 3; GAO, 2007, p.47). The accountability regarding these medical resources is the key for all medical personnel who oversee the logistical aspects (Haverkort et al., 2017; Mizumoto, Imazu, Sun, Shibata, & Yasumoto, 2012; Ruan, Wang, & Shi, 2014; Ruan et al., 2014; Welzel, Koenig, Bey, & Visser, 2010). This in turn points to the need for transportation, delivery, and storage of these critical medical resources by implementing a JIT system.

Problem Statement

The problem of protecting the citizens of Washington from a wide variety of natural and humanmade threats is one of the most significant challenges within the state, according to the Department of Health (DOH, 2016). Despite the efforts in Emergency Management logistics, gaps still exist in the medical resources on standby for any MCI/MCE. This research identified the distribution method gaps (IOM, 2016) between current medical resource readiness (both public and private organizations) and improved delivery of these medical resources (Blumenthal et al., 2014., Bush & Perez, 2012; Kearns et al., 2014; DOH, 2016). Although Washington's response delivery template

includes National, 12- to 72-hour limited medical supply push packages from the Centers for Disease Control and Prevention (CDC) (CDC, 2018), a need exists for further research that can shed light on the relationship of timely and specific supplies, or a JIT logistical operation as required at the point of impact of an MCI/MCE. Furthermore, a direct connection exists between the response to an MCI/MCE and the very concept of actual preparedness (Binder et al., 2010; Blumenthal et al., 2014., Donahu, Eckel, & Wilson, 2013). This issue is still unresolved due to low prepositioned stock levels throughout Washington (DOH, 2016). Although current efforts have expanded the overall response capability, the operational plan for timeliness and delivery of these medical resources in relation to an MCI/MCE is still unclear. Baghbanian (2011) provided the theoretical construct of a complex adaptive decision-making theory (CADMT) to help define the relationship between economics and policy making in a health-related setting. This research explored the MCI/MCE phenomenon and identified the relationships between various logistical techniques to medically assist (by way of a JIT medical supply delivery) the greatest number of people during an MCI/MCE.

Purpose of the Study

My purpose in this case study were to explore the issues that have become more significant in recent years (2010–2018) and have negatively affected the ability to keep Strategic National Stockpile (SNS) medical supply levels up to date. Ongoing issues with SNS include pilferage of resources, the need for updating the receipt, stage, and store (RSS) teams (DOH, 2016), and the lack of a JIT system (Boysen, Briskorn, & Emde,

2016; Kanyoma et al., 2013; Kee-Hung & Cheng 2012; Li, 2015; Michelsen, O'Connor, & Wisemann 2014; Saripalle, Maker, Bush, & Lundman, 2016). This process will not only ensure timely delivery of critical medical resources exactly when and where they are needed but will also address the limited issue of maintaining adequate medical supply levels, *just in time*, for the end user or patient. It is necessary to know more about the fragile state of emergency preparedness, with a view specifically to exploring the most efficient way to combat an MCI/MCE. The central focus of the research was derived from emergency management experts from various Washington State emergency and preparedness organizations to determine a shift in process, from the currently prevailing on-hand medical storage capabilities to a JIT system. This research examines the feasibility of such a shift and discusses whether state officials can be convinced of changing policy to put in place a JIT system to respond to any MCI/MCE in Washington State.

Research Questions

The following are the research questions guiding this study:

RQ1. Does the JIT theory fall in line with the CADMT for improving the efficiency of delivery of medical resources to the end user during an MCI/MCE?

RQ2. What is the current perception of readiness among stakeholders, such as emergency preparedness managers, military officials, physicians, and nurses for an MCI/MCE in terms of response and medical resource capability?

Theoretical Foundation

Baghbanian (2011) provided the theoretical construct of a complex adaptive decision-making theory (CADMT) that helped define the relationship between economics and policy making in a health-related setting. This research explores the MCI/MCE phenomenon and identifies the relationships between various logistical techniques to medically assist (by way of medical supply delivery) the greatest amount of people during an MCI/MCE (Kearns et al., 2014; Nilsson, 2010; Palm & Ramssell, 2007; Ruesch et al., 2012; Sylves, 2008; Underwood, 2010; Watkins et al., 2011; and Weyand et al., 2017).

Conceptual Framework

The prime reason for using this theoretical framework is to justify the need for a CADMT that attempts to define the relationship between economics and policy decision making in a health-related setting for organizational change by way of evidence-based strategies (Baghbanian, 2011). According to the author, complex thinking provides additional insight into the already natural setting and traditional knowledge. This approach has the potential of creating multiple perspectives, removing transdisciplinary uncertainty, and offering a wider range of social involvement (Baghbanian, 2011). This research used the author's CADMT paradigm to examine the possibility of shifting from a traditional decision-making process and open new pathways to a change in policy that is economically, technically, and tactically sound.

Resources that I used were analyzed through time and activity (e.g., a program, event, institution, or social group) and by collection of detailed information using a multitude of data collection procedures in the course of a constant period. Individuals were randomly selected for participation, and all data were gathered either through face-to-face interviews or telephonically (Patton, 2015). The case study provides explanations and data that compound the need for greater emphasis on positioning JIT delivery methods for critical medical resources and procedures within the State of Washington. The names of any products or agencies were redacted and participants have been identified only through pseudonyms.

Nature of the Study

I used a standard qualitative method, because it aligns directly with my purpose in this study, which is to analyze the perception and way ahead for providing critical medical resources and supplies during an MCI/MCE. The views and perception of experts and key stakeholders were used based on their respective training, knowledge, and experience regarding emergency preparedness for an MCI/MCE. I used a qualitative method in the form of interviews, documentation, and data review and observation (Maxwell, 2012; Merriam, 2014; Yin, 2014). Targeted organizations were various Washington State emergency management organizations. Archival data and reports were drawn from both agencies for this study, to include random samples of both executive and operational level personnel. By using purposive sampling, I derived a more robust and rich description of their experiences from interviews with selected participants that I

investigated (Maxwell, 2012). For the purposes of this study, I gathered data from participants through interviews until data saturation was reached. Content analysis was achieved and subjected to data analysis for metric dispersion within this research. The direction of this research was to establish a thought process within the emergency management community on the need to adopt and expand a JIT system for transportation, delivery, and storage of medical resources. This project is solidified by the need to plan for the very best outcome (saving lives) during an MCI/MCE. This qualitative study and the unit of analysis focused on the need for delivery of medical resources from point A (the manufacturer or storage facility) to point B (the end user, the affected person).

Definitions

***Mass Casualty Incident/Event* (*MCI/MCE*).** Any event planned or unplanned, that results in the need to provide medical care to patients, outside of traditional hospital operations. Moreover, incidents are divided into planned events (special events like a sporting event or a political protest) and unplanned incidents (such as terrorism, natural disasters, or weather-related triggers) (DOH, 2017).

Preparedness. The ability to develop and rehearse strategic plans and operations for response, in accordance with county, state, and federal guidelines to directly address natural or human-made disasters and emergencies (DOH, 2016).

***Incident management team* (*IMT*).** Activated emergency response personnel in the event of a public health crisis. They coordinate with county, state, and federal

emergency managers and other first responders, operating within, and leading the required incident management system during an MCI/MCE (DOH, 2016).

***Just in Time* (*JIT*).** A logistics management approach that enhances quality, productivity, and efficiency through improved communications to decrease overall costs and waste. This management system is used to provide greater value to the customer with an emphasis on cost savings through a lean approach from manufacturer to end user (Kee-hung, 2016).

Assumptions

I made several assumptions for this case study. First, I assumed that all the Washington State emergency management organizational experts who were interviewed would be candid, honest, and sound in their respective answers to interview questions. The questions were designed to drill down into the specifics of the MCI/MCE phenomenon, and more specifically the JIT management system, in the hope of establishing genuine and professional trust between interviewer and interviewee.

Standard guidelines for safeguarding sensitive and personal information were utilized to keep the interviewees from providing vague answers and to ensure a comfortable setting during the interview process. In addition, each question was asked in the same format and style so as to ensure clarity and proper understanding for each interviewee. My last assumption was that selection of all experts and stakeholders who participated were based on the criteria of job description, expertise, and education. The participants were proactive and responded in a manner that exemplified advanced

knowledge of MCI/MCE operations. In addition, those participants who had any experience as to the relationship of logistics (specifically the JIT system) with the end user (patient-level care necessitated by an MCI/MCE) also responded in kind.

Scope and Delimitations

The research questions focused on the types of relationships that exist, through local first responder organizations to more substantial state and federal governmental involvement, specifically, the storage of medical supplies strategically placed within Washington State. These relationships were looked at from an employee to supervisor perspective and as to cross-agency cooperation, with the discovery of methods, procedures, and the conflicts that these various organizations face. In this study, I focused on the role of logistics and in particular the JIT management system during and after an MCI/MCE. In addition, I analyzed the general level of preparedness at a county and state level for reacting to an MCI/MCE. Furthermore, the scope of this study specifically focused on the central areas of Washington State, and the responses of stakeholders from Washington State emergency management organizations helped evaluate preparedness levels. There were no other outside organizations included, for the purposes of this study.

Limitations

I focused on the relationship of the JIT system with its use during and after an MCI/MCE. Although this research unveiled specific perceptions and understandings from chosen interviewees, this is only a single case study, which limits its generalizability for arriving at a wider range of perceptions and theories.

Significance of the Study

A comprehensive literature review of journals, government reports, and other related documents were conducted by using databases and personal interviews through the Washington State Emergency Management organizations. The search parameters were set to identify documents from both organizational sources between the years 2008 to 2018, using the key phrases (Mass Casualty, Disaster and Terrorism, Casualty, Preparedness, Logistics, Prepositioned Stocks, Medical Supplies, Medical Supply Transportation, Hospitals, Clinics, Triage, Medical Field Work, Rescue, Biological, Chemical, Nuclear, Natural Disaster, Planning, and Capacity). Furthermore, this review included journals, policies, procedures, and after-action reports (AAR) through 39 Washington State counties and 28 Tribal areas. This study is a critical part of the overall understanding and justification for a JIT system to combat an MCI/MCE (Boysen et al., 2016; Horta, Coelho, & Relvas, 2016; Kee-Hung & Chen, 2012; Kearns et al., 2014; Li, 2015; Michelsen et al., 2014). I also found a gap in medical resource capability and preparedness within the state (WSEMD, 2016; DOH, 2016).

The significance of this research is that it provides documentation to enable additional logistic variables, such as transportation and delivery of critical medical resources (Dessouky, Ordonez, Jia, & Shen, 2013; Jahre, Pazirandeh, & Van Wessenhove, 2016; Kanyoma et al., 2013; Kearns et al., 2014; Lee, 2017; Rachiotis et al., 2014; Ruan, Wang, & Shi, 2016; Ruesch et al., 2012; Saripalle et al., 2016), which

will be used to benefit and influence current policy to further increase the preparedness level in Washington State, specifically to combat an MCI/MCE.

Summary and Transition

In this research, I address the relationships from stakeholders to officials to the public and focuses on the additional relationship of logistics (specifically the JIT management system) (Boysen et al., 2016; Chelsen et al., 2014; Kee-Hung & Cheng 2012; Kearns et al., 2014; Li, 2015; Serially et al., 2016), to moderate current preparedness levels to adequately respond to an MCI/MCE (Nilsson, 2010; Palm & Ramssell, 2007; Ruesch, et al., 2012; Sylves, 2008; Underwood, 2010; Watkins et al., 2011; Weyand et al., 2017). Moreover, my purpose in this qualitative study were to critically analyze how prepared Washington is for an MCI/MCE. Specifically, a need exists to compound the JIT management system and for an investigation to expand on this technique by the EM stakeholders. This investigation extrapolates data from further research and the interviews mentioned above to define these relationships.

Chapter 2: Literature Review

Literature Review

Literature Search Strategy

Multiple sources such as Mendeley, Zotero, ViVIO10 Google, research papers, journals, and other publications were used to define and gather pertinent data of mass casualty incidents/events (MCI/MCE) emergency medical response and preparedness, logistics, the JIT theory, and the complex adaptive decision-making theory (CADMT).

During the past 100 years, improvements to threat response strategies have facilitated innovations to technological systems that support efficient medical resource delivery. However, these gradual improvements have yet to influence how governments at all levels collaborate to implement these stronger logistical models in practice. Preparedness strategies developed from the training models endorsed by the federal government, for example, may not always facilitate efficient coordination processes for delivering medical resources to local communities affected by an MCI/MCE. In such contexts, the theoretical construct of a *Complex Adaptive Decision-Making Theory* (CADMT) and a JIT methodology have contingent implications for determining whether local governments should continue relying on state and federal governments to provide medical resources or develop training strategies rooted in the notion of providing mutual aid between communities affected by MCI/MCEs. Considering the paradigms of general preparedness reviewed earlier, the JIT methodology has contingent implications for determining how local governments can foster conditions to receive medical resources

from state and federal government agencies more efficiently when MCI/MCEs occur. In addition, the CADMT support systems implemented in the critical infrastructure of local governments may produce the most sustainable end-user outcomes (in this case patient treatment). The CADMT may promote resilience among communities affected by MCI/MCEs, based on the observation that state and federal governments currently circumference a homeland security framework designed to mitigate terrorist attacks. While any kind of MCI/MCE may pose a threat to critical infrastructure and human life, the CADMT advances stronger preparedness and response strategy models in light of such tragedies (Baghbanian, 2011).

The Threat of a Mass Casualty Event

Historical research on the threat of an MCI/MCE has highlighted how triage in an emergency department received widespread attention during the First World War. Kearns et al. (2014) noted specifically how the capacity of medical providers to treat wounded soldiers depended consistently on their threat detection skills. Soldiers often cross-trained as medical professionals when an influenza pandemic claimed millions of children residing in temperate climates, as many health care facilities lacked enough resources to treat the surge of patients admitted into patient care (Kearns et al., 2014). The influenza pandemic of the First World War appeared suddenly and caused many medical professionals to experience symptoms themselves. Because of its suddenness, the influenza pandemic triggered a chain reaction of disastrous institutional and economic problems. Hospitals located in temperate climates throughout the country could neither

coordinate nor deliver critical medical resources effectively enough to determine which causes of the influenza pandemic to mitigate. Moreover, emergency management agencies sponsored by the federal government did not exist during the First World War. In fact, it was not until the 1950s that this happened, when the nation's civil defense systems were developed to address the threat of a nuclear attack by the Soviet Union. The government officials who staffed the civil defense programs at all levels of government were the nation's first emergency managers by default (Federal Emergency Management Agency [FEMA], 2015). In the 1980s, the US Government approved formation of the Federal Emergency Management Agency (FEMA), which reflected the priorities of the Reagan Administration, focusing exclusively on a nuclear attack and continuity of government planning. During the 1990s, FEMA were unable to provide adequate support for other types of MCI/MCEs such as hurricanes or other natural disasters, which forced a larger scale "all-hazard" approach to counter any possible type of MCI/MCE. This also included the need for public involvement, which resulted in the launch of a national mitigation initiative called "Project Impact," involving all members of the community in developing a community hazard mitigation strategy (FEMA, 2015).

Gradual Improvements in Detecting Threats of Mass Casualty Events

Most American hospitals in operation from the late 19th to the mid-20th centuries experienced only gradual improvements to health care practice (Kearns et al., 2014, p. 29). The influenza pandemic of the First World War is a case in point, indicating how detection systems were largely difficult to maintain, considering that soldiers and medical

professionals lacked sufficient training for responding effectively to an MCI/MCE. Presumably, none of the soldiers or medical professionals who treated influenza cases during the First World War had basic knowledge of which remedies would promote conditions for improvement. However, researchers who addressed the influenza pandemic of the First World War have highlighted profoundly how the limited opportunities to implement both technological innovation and logistics across an entire health care system contributed to deaths among soldiers and medical professionals responsible for administering medical care.

Another historical case in point was the Korean War, which in retrospect were also considered an MCI/MCE from which medical professionals adopted combat innovations such as ambulance evacuation, triage centers, and field hospitals to evacuate and treat wounded soldiers. As explained in the study by Kearns et al. (2014), although threat detection systems during the Korean War were extremely rudimentary, medical professionals adopted the same "lessons learned" to treat victims in subsequent wars. At that time, the Military was still a victim of one-dimensional lesson-learned thinking, only putting into play what had "worked before" instead of strategizing on what could be improved upon from previous events. Consequently, the Cold War led to a more gradual advancement of threat detection systems, as nuclear war seemed imminent and civil defense programs launched initiatives addressing how medical facilities might need to handle a surge of patients admitted into triage for symptoms such as radiation sickness (Kearns et al., 2014). Although radiation sickness does not have the same pandemic

qualities of influenza, its potential to cause severe illness in medical professionals suggests that threat detection systems must contain information pertaining to the risks associated with treating victims of chemical, biological, and other airborne toxins.

The Vietnam War represented another historical instance of the large gaps between air/ground ambulance evacuation and trauma care, as indicated by the discussions among American policymakers (Kearns et al., 2014, p. 29). The unfortunate drawback was that no policy discussions reportedly mentioned threat detection despite how the United States instituted an Emergency Medical Service (EMS) system to improve trauma care. Extended to the civilian realm, however, the lack of attention to detecting threats of MCI/MCE indicates how discussions on improvements to trauma systems focus extensively on fostering improvements in emergency care between North America, Australia, and Europe. When the Vietnam and Cold Wars ended, the public sector reduced its involvement in responding to and preventing future armed conflicts, even as medical professionals emphasized the development of response strategies for occasional natural disasters or other MCI/MCEs with limited political, social, economic, and public health implications.

Technological Innovation in Threat Detection Since the September 11 Attacks

Technological systems designed to detect the threat of an MCI/MCE were not implemented in medical infrastructure until after the terrorist attacks of September 11, 2001 and Hurricane Katrina, which fostered a social, political, and economic climate in which Homeland Security were formed within the White House. Subsequently in

November 2002, U.S. Congress passed the Homeland Security Act, whereby it became a standalone, formal cabinet-level department, charged with protecting national homeland interests. Extending into the present, the legal and policy mechanisms for detecting threats of MCI/MCEs now provide for behavioral profiling that could point to any probability that a terrorist attack of similar scale will occur again in the future (Kearns et al., 2014; Sylves, 2008). As such, the September 11 attacks and Hurricane Katrina represent two more recent historical cases related to the consequences of not implementing effective technology systems capable of detecting security threats to critical homeland infrastructure. Both MCI/MCEs prompted a surge in emergency department visits, and medical facilities lacked sufficient resources to treat patients in a high-volume triage. Moreover, a lack of institutional planning for addressing terrorist attacks and natural disasters indicated that medical personnel became de facto representatives of emergency management agencies.

Clinicians often took commanding roles in ensuring that primary care providers who included physicians, surgeons, and nurses could respond effectively when triage cases surged. However, many clinicians lacked sufficient training in managing life support systems when flooding and power outages during Hurricane Katrina limited threat detection capacities.

Returning to pandemics, researchers who addressed the emergence of the H5N1 influenza virus in 2007 have outlined how medical professionals required innovative vaccination technologies to allay public fears about contracting a potentially deadly

illness. The lack of vaccination technologies at that time reinforced the notion that insufficient training leaves medical professionals, emergency management personnel members, and government leaders ill prepared for determining which courses will mitigate the detected threats (Kearns et al., 2014). Although one or two anecdotal cases of H5N1 cases should have sufficed to facilitate the development of effective response strategies, the pandemic was allowed to spread to such an extent that only a series of planning efforts (both state and federal) prioritizing emergency mass casualty critical care eventually resulted in patients having greater access to treatment options. In addition, upon the emergence of the H1N1 influenza virus in 2009, the response strategies used in detecting threats of MCI/MCEs reflected the improvements made to standards of care (p. 30). However, the standards for detecting threats of an MCI/MCE remain subject to ethical consideration, just as the H1N1 pandemic had significant global connotations. As were the case during the influenza pandemic outbreak of the First World War, medical facilities could not have coordinated effectively enough to ensure successful delivery of medical resources.

In effect, researchers who studied the H1N1 pandemic have pointed to how large gaps between resource availability and CADMT remain, along with the scope for considering the development of structured ethical guidelines (Kearns et al., 2014, p. 30). A more significant implication of the recent historical case in point concerns how emergency response professionals may detect threats of MCI/MCE by adapting models for creating objective, situation-based assessments at the patient and community levels.

Such assessments may facilitate the development of effective response strategies. However, research findings suggest that objective assessments must include criteria reflecting a convergence of individual and environmental factors potentially contributing to triage surges. Objective assessment including such criteria may produce more evidence-based findings of empirical value to develop response strategies in conjunction with threat detection strategies for an overall improvement in response.

Complex Adaptive Decision-Support Management Theory and Professional Experience

Researchers in earlier studies have suggested that the threat of an MCI/MCE represents a point between two extremes. One extreme indicates how CADMT is successful only to the extent that governments may develop effective responses to problems by leaving an acceptable level of critical infrastructure intact. The other extreme implies that rescuing victims from an MCI/MCE represents an unstructured problem when information determining the best course of action is only situation-specific (Thompson, Altay, Green, & Lapetina, 2006, OSHA, 2005). More specific to the other extreme is how the information applied towards rescuing victims reflects only the prior professional experience of emergency management personnel. From both extremes, decision-support systems may detect the threat of an MCI/MCE when emergency management personnel have sufficient experience to know fully which resources will optimize response times. As Baghbanian (2011) noted further, decision-support systems may only assist with detecting the threat of an MCI/MCE when information about victim

location and other solutions is precise. Most problems with decision-support systems fall between the two extremes, with consideration of which strategies will produce the most sustainable outcomes. Depending on the strategies used by experienced emergency management personnel, the use of decision-support systems aids in producing the most updated findings, with lessons learned to ensure the best possible outcome. Unfortunately, the ability to detect threats of MCI/MCE is often beyond the capacity of some local emergency management personnel, hence they must rely on state and federal involvement.

According to researchers who covered the Meta-Leadership Summit for Preparedness, a 5-year initiative took place from 2006 to 2011, showed that the strategies used by government leaders to prepare for MCI/MCEs must involve more than using innovative social media technologies to distribute information publicly (Sobelson et al., 2013). Participants at the Meta-Leadership Summit included representatives of the *Centers for Disease Control and Prevention* (CDC), the CDC Foundation, the Harvard School of Public Health, and the *Robert Wood Johnson Foundation* (RWJF). These four main representatives highlighted precisely how governments alone are quite incapable of mitigating threats of MCI/MCE, and therefore they must construct a cross-sectoral national network to produce the most effective tactical and strategic responses possible.

One may presume that planning manuals and policy documents distributed publicly to the community residents may lack audience reach, thanks to a combination of extenuating circumstances and sociodemographic factors. Though some local community

residents may possess a minimal awareness of the likelihood of an MCI/MCE occurring, many others simply lack the time, concern, or literacy skills to interpret the long-term implications of using planning manuals and policy documents to detect threats. Likewise, the stockpile of medical resources, food supplies, and other essential items is often insufficient for mitigating threats from an MCI/MCE. As pointed out by Sobelson et al. (2013), such a strategy does not provide the space for both government leaders and community residents to adopt effective resilience strategies, if the stockpiled resources are inadequate. Budget shortfalls at all levels of government oblige leaders to labor under constraints in determining which resources will promote community-level resilience.

Concurring with Sobelson et al. (2013), some researchers addressing resource limitations in government have noted how most leaders rely on conventional wisdom in detecting threats of an MCI/MCE. By implication, government leaders who presume that some mass casualty events have a low probability of occurring in any municipality may decide to not expend funds towards informing local community residents of other potential hazards. Blumenthal et al. (2014) suggested that the reluctance of some local government leaders to think creatively towards promoting resilience fosters conditions of misinformation rooted in conventional wisdom. The ability of governments and community residents to detect threats of MCI/MCE accurately may depend on which industries are most prominent in a municipality or geographical region. Similarly, accurate threat detection by medical personnel may indicate the level of experience with handling emergency situations in communities impacted significantly by an MCI/MCE.

Professional Training and Threat Detection

Medical professionals and government leaders without emergency management experience have insufficient means to distribute planning manuals and policy documents (Blumenthal et al., 2014). A lack of training in detecting threats of MCI/MCE leads to government leaders expending already-constrained resources towards fostering a climate in which community residents have accurate information at their immediate disposal. Health care organizations may, however, have enough stakeholders willing to invest in maintaining the resilience of critical infrastructure, through implementing rigorous training programs. Emergency physicians, nurses, and public health officials have professional training that influences decision-making processes linked with the ability to detect threats of MCI/MCE (Blumenthal et al., 2014). Extended to community resilience, the training that these health professionals have should involve distributing accurate information drawn from the findings of evidence-based studies. The training received by health professionals should also include the application of current emergency management concepts to emerging threats. The importance of current emergency concepts has significant implications for responding more effectively to an MCI/MCE, as long as government leaders communicate with public health officials down to medical professionals.

Training strategies proposed to improve how emergency management personnel, public health officials, government leaders, and community residents detect threats of an MCI/MCE have included a four-tiered role-specific curricular system. As detailed by

Blumenthal et al. (2014), the proposed training strategy and curricula pertain initially to subject matter experts with experience of directing triage in an emergency department (ED). While these medical professionals are not directly responsible for detecting the threat of an MCI/MCE, the ability to predict future health outcomes of patients admitted into triage should indicate the severity of an immediate situation. Subject matter experts, however, represent only the smallest group of individuals who require more effective training to detect threats of MCI/MCEs. Despite having limited representation, subject matter experts may develop a more extensive background to address emerging challenges associated with acquiring knowledge of which community residents will suffer the most damaging public health outcomes. Accordingly, the research literature suggests that most training strategies for detecting threats of mass casualty events do not consider the overall health implications of at-risk populations who often lack the economic, material, and educational resources necessary to mitigate risk and damage.

Proposed training strategies developed to improve threat detection include the second tier of primary care providers or first responders such as emergency medical technicians (EMTs) and paramedics. Regardless of differences in training, these health professionals are typically the first contacts for victims of MCI/MCEs who require immediate treatment (Blumenthal et al., 2014). In acquiring knowledge of which threats are the most pernicious to at-risk populations and all other community residents, members of the second training tier are responsible for establishing medical and surgical priorities that may specifically involve wearing protective equipment. As Blumenthal et

al. (2014) highlighted further, members of the second training tier must know how to maintain personal safety from known hazards causing severe damage to critical infrastructure. Here, the ability to detect threats of an MCI/MCE implies that emergency management and medical professionals should receive sufficient training for handling chaotic localized environments affected by terrorist attacks, natural disasters, pandemics, or any other types of MCI/MCEs. It is imperative that any medical professional should have accurate and firsthand knowledge pertinent to the severity of an MCI/MCE, as detection capabilities in most cases rely on previous experience and case knowledge.

In the third training tier, public safety personnel manage community-level health concerns by controlling crowd behavior and communicating transparently with victims about what information contained in planning manuals and policy documents may entail. Concerning the ability of public safety personnel to manage mass casualty events, the third training tier involves a rigorous process of acquiring knowledge about all possible hazards directly reflecting the context in which a catastrophic incident occurs (Blumenthal et al., 2014). Public safety personnel must also explain to community residents affected by mass casualty events the potential consequences of not following recommendations to remain safe. Accordingly, public safety personnel must rely on training and guidance contained in the Incident Command Systems (ICS) to establish strict parameters for community residents affected by a mass casualty event to follow. Of further significance here is how resource coordination among public safety personnel will bolster the process of implementing a response strategy effective enough to maintain

transparent communication and reduce the risk of imminent harm. As the research literature suggests here, response strategies developed by public safety personnel, emergency management agencies, private sector businesses, and local/regional hospitals must all include an implicit yet larger goal of threat detection (Blumenthal et al., 2014). Put differently, the experience of surviving an MCI/MCE will likely encourage all stakeholders such as emergency management representatives, government leaders, medical professionals, and community residents to collaborate in prioritizing which potential causes response strategies should address in priority.

In the fourth training tier, health care and other medical professionals responsible for maintaining institutional support systems may influence capacities to detect threats of mass casualty events. As Blumenthal et al. (2014) noted further in their research, the fourth training tier is an essential component if subject matter experts (Tier 1) and other health care workers (Tier 2) are to provide adequate medical treatment and manage crisis situations that resulted in a large body count. Not only do health care and medical professionals in the fourth training tier possess basic knowledge about which core emergency management concepts most directly address a context-specific MCI/MCE, these individuals also have the most up-to-date knowledge about policy shifts determining how public-sector agencies may coordinate resources in priority of government focus to promote resilience in critical infrastructure and among communities. If an MCI/MCE contaminates affected communities severely, health care and medical professionals should adopt response strategies for ensuring that emergency management

agencies and government representatives communicate effectively in coordinating resources to deliver food service, sanitation, laundry, security staffing, and hospital staffing (Blumenthal et al., 2014). In ensuring that individuals in the fourth training tier adopt strategies for detecting possible threats of an MCI/MCE, more extensive knowledge of strategic logistics is necessary to promote long-term resilience in communities with large resource deficits.

Synopsis of the Threat Detection Literature

Since the First World War, research on MCI/MCEs has had its foundation in studying gradual improvements to threat detection strategies as linked with medical resource distribution. Some of these improvements included innovations made to technological systems after the September 11 attacks. While detecting threats of MCI/MCE may not produce the most effective treatment outcomes possible in cases involving pandemics such as the H5N1 and H1N1 pandemics, decision-support systems and professional experience may expedite medical resource delivery when governments at all levels lack effective preparedness and response strategies. Governments may distribute planning manuals and policy documents to community residents potentially affected by the imminent threat of an MCI/MCE. However, professional training and threat detection have inextricable links regarding expedient transport, delivery, and receipt of critical medical resources. The four training tiers highlighted in this section of the literature review each have implications pertaining directly to how governments

implement preparedness strategies as tools for adapting to the complexity in critical infrastructure.

Review of General Preparedness for a Mass Casualty Event

Preparedness for an MCI/MCE precedes the response phase, based on the number and types of resources available during the planning phase of an emergency management methodology. Here, decision-support systems may advance emergency management goals through evaluation of the impact produced by resource acquisition and allocation in responding effectively to an MCI/MCE. Preparedness, more generally, advances the notion that effective response to MCI/MCEs depends on a wide range of factors linked with how emergency management and medical professionals allocate resources towards implementing solutions to persistent complex issues.

Paradigms of General Preparedness

Palm and Ramsell (2007) noted the significance of preparedness strategies based on the quality of information distributed by government leaders at all levels and by emergency management agencies. Here, preparedness strategies entail cooperation between communities located in geographically dispersed areas. Preparedness strategies, in other words, do not always produce optimal outcomes between populations in close proximity to another. Rather, conditions of mutual aid and understanding achieve optimal levels of medical resource delivery when local governments place trust in State and Federal emergency management agencies. From this literature, the suggestion is that effective resource delivery in MCI/MCEs involves sharing and facilitated coordination

between municipalities. Regardless of size, population, and density, no municipality can have all the resources to maintain support for critical infrastructure when medical professionals must respond to an MCI/MCE.

In contrast with the mutual aid paradigm of preparedness suggested by Palm and Ramsell (2007), researchers have noted how preparedness for a mass casualty event generally follows a hierarchical paradigm regarding components and processes of emergency management leadership among government representatives at all levels. In particular, Caro (2016) outlined how the preparedness phase of emergency management pertains to components and processes such as business continuity, contingency and disaster planning, emergency training, recovery and response plans, simulation exercises, surge capacity plans, and threat analyses (p. 115). Preparedness in emergency management entails emergency management, medical professionals, and government leaders questioning the effectiveness of strategies currently being implemented in practice. Specific to business organizations affected by MCI/MCEs, the preparedness phase may help organizational leaders determine which emergency management strategies may enhance threat detection capabilities and mitigate severe financial losses (p. 118). In this context, the research literature suggests that preparedness strategies may require the representatives of public sector agencies to consider whether partnerships with private sector business will foster long-term resilience after an MCI/MCE occurs.

While private sector businesses may adopt preparedness strategies independent of government influence to mitigate financial losses caused by a mass casualty event,

governments may benefit from adapting unique training models in practice. Yet, the training models implemented to improve preparedness strategies may involve a process of introducing novel concepts (Blumenthal et al., 2014). If such training models were to introduce novel concepts, both private sector businesses and government leaders should consider collaborating to determine how community residents will receive new information contained in planning manuals and policy documents. Notwithstanding the legal jargon and technical language contained in these emergency management publications, public reception of planning manuals and policy documents remains an important factor for emergency management agencies to consider in determining which critical resources distributed at the local level will promote resilience.

In more specific legal terms, preparedness strategies have constitutional underpinnings. Federalist principles guide emergency management policy under ordinary circumstances in which federal and state governments consent mutually to maintain a considerable degree of superiority over resource distribution when responding to an MCI/MCE (Gillette, 2013). Pursuant to the Tenth Amendment, states have the authority to enact emergency management policy frameworks capable of influencing how much power local governments have in distributing critical resources to community residents affected by terrorist attacks, natural disasters, or pandemics. However, the Tenth Amendment requires the federal government to respond based on consent provided by states or on implied constitutional powers.

Criticisms of General Preparedness Paradigms

Critics of the current emergency management policy framework have, as Gillette (2013) noted further, addressed how commitment to federalism in emergency management produces conditions of fragmentation, wherein local governments lack the incentive to petition federal and state governments for resources. Neither the federal nor state governments are responsible for answering each other in terms of developing effective preparedness strategies with implications for promoting resilience in communities affected directly by mass casualty events. However, both forms of sovereign government may distribute planning manuals and policy documents not limited to the National Response Framework (NRF) and the National Incident Management System (NIMS). As the research findings suggest here, the efficacy of NRF and NIMS in developing effective preparedness strategies is indicative of how resource coordination correlates directly with the training provided to local government representatives.

Mayors of smaller municipalities may have the governing authority to issue evacuation orders for a city affected by a mass casualty event. Unfortunately, local-level preparedness strategies appear to have limited effectiveness in smaller municipalities lacking a sufficient emergency management infrastructure. Gillette (2013) noted further how, because of federalism, tribal governments lack representation regarding participation in discussions and plenary sessions about resource coordination. The suggestion here is that the sovereignty of tribal governments should entail Tenth Amendment constitutional protections. Fourteenth Amendment protections apply just as

well in the consideration of how emergency management policy frameworks must treat all victims of mass casualty events equally. Even so, researchers point to future directions of studies that involve addressing how preparedness strategies for MCI/MCEs have a disproportionate effect on indigenous tribes and rural communities. Since both populations typically lack immediate access to health care institutions or government agencies responsible for distributing critical resources, the implications of current preparedness strategies for indigenous tribes and rural communities reinforce institutional problems such as fragmentation and decentralization of agency-level processes.

Equitable resource distribution at the local/regional level is, as researchers who assessed the Meta-Leadership Summit for Preparedness Initiative noted, part and parcel of developing preparedness strategies as tools for detecting potential threats of mass casualty events. Sobelson et al. (2013) noted how local-level resource distribution facilitates varying degrees of crisis leadership. Depending on the level of experience had with managing mass casual events, representatives of local or tribal governments may consider developing training strategies to foster improvement in response time when a mass casualty event severely damages critical infrastructure. As the researchers suggested further, didactic training strategies may operate in conjunction with a community-oriented action-based learning project to increase collaboration between local, state, and federal governments. However, the willingness of state and federal governments to create participatory space for local and tribal governments in developing preparedness strategies suggests that didactic training sessions must also have sufficient financial sponsorship to

achieved desired outcomes associated with managing mass casualty events. Didactic training sessions often include descriptions of real and hypothetical scenarios to facilitate critical thinking skills that reflect medical training. Here, the facilitation of critical thinking skills in didactic training programs reinforces a need for local and tribal government leaders to address gaps associated with distributing resources towards implementing effective preparedness strategies. Addressing resource distribution gaps at the local level may eventually drive the construction of program initiatives designed to detect threats of mass casualty events with greater accuracy. Similarly, addressing local-level resource distribution gaps may simplify emergency management operations in complex systems requiring efficient resource delivery.

In sum, the paradigms of general preparedness strategies range from mutual aid and collaboration to training models implemented in practice by governments. While mutual aid and collaboration may establish more transparent communication channels between local governments in geographically dispersed areas, government-endorsed training models may produce similar outcomes regarding medical resource delivery in managing any MCI/MCE. Criticism of general preparedness strategies reinforces the notion that local and tribal governments lack effective preparedness strategies, considering how leaders must wait for state and federal authorities to ensure medical resource delivery. Regardless of the training models implemented locally to facilitate more efficient resource coordination and delivery, preparedness strategies implemented throughout the United States maintain decentralized operations. Consequently,

emergency management systems must have leaders capable of addressing which paradigms foster ideal conditions of resilience at the local level.

Complex Adaptive Decision-Making Theory and Mass Casualty Incidents/Events

The main tenets of complex adaptive decision-making theory are informed heavily by "complexity science," an umbrella term used by researchers to distinguish between core concepts used for assessing resource capacities of critical infrastructure designed to serve community residents affected by mass casualty events (Brainard & Hunter, 2016, p. 128). Features of complex adaptive decision-making theory include a large number of known and unknown elements, nested or looped overlapping networks, unintended consequences, self-organization, cascading events, and leverage points. At first blush, researchers may assume parallels between the features of complex adaptive decision-making theory and systems thinking concepts. However, complex adaptive decision-making theory allows researchers to interpret features by accepting their contextual significance in critical situations such as mass casualty events.

In public health situations, for example, the features of complex adaptive decision-making theory may counteract the tendency among medical professionals to apply reductionist thinking in delivering medical resources to victims of mass casualty events (Brainard & Hunter, 2016). The reductionism cited by researchers pertains to an uncritical reliance on evidence-based findings to guide professional practice. Partly due to the seeming unpredictability of mass casualty events, reductionist thinking and an

over-reliance on evidence-based research findings aggravate key issues found in application of CADMT.

At a conceptual level, the CADMT pertains directly to the maintenance of large-scale military operations. Thompson et al. (2006) suggested that training sessions developed from application of complex adaptive decision-making theory should include "what-if" questions to facilitate critical thinking skills development. Such questions must involve addressing concepts of "evidential reasoning," "capabilities-based planning," and "exploratory analysis" to explore all possible implications of managing mass casualty events without sufficient involvement from state and federal governments (pp. 257–8). Evidential reasoning entails local, tribal, and state government representatives managing mass casualty events, accounting for the broader implications of applying flawed decision-making processes.

CADMT also allows for various health resources to be managed much more effectively. As Baghbanian and Torkfar state, CADMT makes more efficient health resources by examining problems from the perspective of contextual criteria, including that of ethical, institutional, economic, and clinical criteria (2012). Each of these allows practitioners to be able to make their own processes more efficient, and from the perspective of health systems, especially just in time, it makes the system almost exponentially more efficient because it reduces the time spent on guesswork.

Capabilities-based planning, secondly, refers to the budget-constrained investments made towards acquiring equipment and emergency management personnel.

As explained by Thompson et al. (2006), capabilities-based planning shapes the scope of systematic assessments based on resources distributed in the management of mass casualty events. Furthermore, capabilities-based planning ideally provides all levels of government with the assurance that assets listed in budget portfolios will support various recovery missions (p. 258). Effective coordination of plans and personnel is necessary to ensure that capabilities-based planning fulfills an overarching objective of maximizing response and preparedness strategies. However, capabilities-based planning is problematic to the extent that response and preparedness strategies for managing mass casualty events lack the decision-support technologies often applied in military contexts (p. 258). While military operations frequently invest in assets initially defined as non-essential, commanders also consider the use of equipment for transporting critical resources to communities affected directly by mass casualty events. Especially in military operations, decision-support technologies include event simulations to facilitate critical thinking skills from a command and control perspective (Ingrassia et al., 2014). Regarding capabilities-based planning and its use in military operations reinforces the necessity of constraints-based resource coordination between public sector agencies at the local, state, and federal levels. Tribal governments may also integrate capabilities-based planning into response and preparedness strategies by emphasizing collaboration as being beneficial towards achieving optimal outcomes.

Capabilities-based planning has specific relevance to treating burn victims of mass casualty events when medical professionals make initial patient assessments,

individualize triage, and make referrals to specialized care centers. As Taylor et al. (2014) highlighted, capabilities-based planning refers to the activities involving medical professionals responding to mass casualty events by providing appropriate care and utilizing high-quality medical resources to treat injuries. The activities associated with capabilities-based planning must allow medical professionals to increase the number of available beds by at least 20 percent (p. 443). Here, medical professionals must have sufficient resources available to treat seriously injured patients in triage. Yet, capabilities-based planning also entails that treatment of burns or other injuries resulting from MCI/MCEs must include a focus on accommodating needs in holding areas and outpatient facilities. In some MCI/MCEs, the delivery of medical resources through capabilities-based planning may involve constructing makeshift structures (p. 443). Still, the main factors for consideration in capabilities-based planning as understood by drawing from CADMT include asset types, non-inventory materials, transportation, and credentialing data.

Thirdly, the inclusion of exploratory analysis as a concept in CADMT implies that governments at all levels should refrain from using response and preparedness strategies as predictive tools with respect to the successful management of MCI/MCE. The exploratory analysis follows from capabilities-based planning, insomuch as government leaders and emergency management personnel recognize that no perfect model exists for solving problems common to MCI/MCE (Thompson et al., 2006, pp. 257–8). Drawing from the application of decision-support systems, the exploratory

analysis indicates that the costs associated with choosing one course of action and then making necessary changes may leverage risk based on the immediate situation at hand. Considering how military operations adopt exploratory analysis to bolster decision-support systems, governments and emergency management agencies may benefit from constructing a working best practices model to leverage risk while acknowledging the unpredictability of MCI/MCE.

CADMT also heavily emphasizes flexible management solutions, and the implications of this in terms of resources in a health-related setting are obvious. This theory, then, states that resource allocation decisions must be weighed against conditions of both complexity and uncertainty, necessitating more broad and flexible solutions, even for simple problems relating to medical resources (Baghbanian & Torkfar, 2012). This might sound like overcomplication of the issue, but the idea here is that by formulating these complex management behaviors, it becomes possible to pave the way for future development and change.

CADMT also has mechanisms built into it that allow for unexpected occurrences to be responded to and benefitted from in diverse ways. Indeed, the theory states that information would be fed back into the decision-making model if there is an unexpected development, and this allows for constant growth of the various solutions and philosophies associated with problems (Baghbanian, 2011; Baghbanian & Torkfar, 2012). This is healthy, because of how it empowers medical decision-makers to respond more dynamically to issues.

More recent studies have considered how CADMT is a constructive response to external events, including a wide range of emergency situations requiring the immediate delivery of medical resources. Emergency management systems (EMS), nevertheless, distinguish between "emergencies," "mass emergencies," "disasters," and "catastrophes" in providing the space for governments, in particular, to determine which strategic measures will align with the overarching objectives of producing optimal outcomes (Caro, 2016, p. 114). While emergencies are an umbrella term that encapsulates mass emergencies, disasters, and catastrophes, mass emergencies are typically small-scale and have a relatively high predictability rating. Resources available locally and regionally account for how governments respond to mass emergencies even when these events do not produce a high number of casualties.

Catastrophes are another type of disaster referred to in complex adaptive decision-making theory, based on the general fact that such MCI/MCEs devastate critical infrastructure in affected neighborhoods and communities. Catastrophes require external assistance from agencies of state and federal governments. International governments may have some involvement in actively repairing critical infrastructure by delivering humanitarian aid such as medical resources and volunteer personnel (Caro, 2016).

Looking at the general level of preparedness for an MCI/MCE, it seems to leave much to be desired. As another source states, there is a profound focus in various philosophies and literature on disaster management, though at the same time they adopt a broader approach (Born et al., 2007). This profoundly inhibits their ability to respond to

mass casualties, because it leads to tunnel vision, for lack of a better term, and this adversely affects performance.

In alluding to the relationships between all levels of government, researchers have cited difficulties in establishing causal relationships when leveraging CADMT, confirming the evidence that sufficient response and preparedness strategies improve the management of an MCI/MCE. Brainard and Hunter (2016) noted that the use of CADMT in health care scenarios remains unclear. Accordingly, the solutions for treating victims of MCI/MCE may not be suitable to a sufficient degree when concepts of CADMT conform to practice. Some MCI/MCEs are simply too complex for medical professionals to manage when governments and the public sector lack transparent communication channels for distributing critical resources. Inter-agency communication barriers affect the outcomes of mass casualty events when medical professionals must rely on inconsistent inputs, with real-life public health consequences (p. 127). Along these lines, researchers have defined human resources (HR) limitations, material constraints, and inefficient coordination as inconsistent inputs posing challenges for medical professionals who must rely on governments and emergency management agencies to ensure efficient resource delivery in treating victims of MCI/MCE.

Critiques of Complex Adaptive Decision-Making Theory

While critiquing the features of the CADMT in practice, an initial point worth addressing is the difficulties associated with understanding relationships between overlapping nested or looping networks. Specifically, Brainard and Hunter (2016) noted

that some initiatives to develop networks for encouraging systemic change exist only as a means of verifying available contacts. Such a presence does not, unfortunately, guarantee that medical professionals will work collaboratively with governments and emergency management personnel to ensure that victims of MCI/MCE receive medical resources at an expedient pace. Accordingly, the formal acknowledgment of contact with government and emergency management personnel does not suffice to improve the competencies of medical professionals. Institutional pressures may, in effect, leave some medical professionals to their own devices even when collaborative opportunities with governments and emergency management agencies are plentiful (p. 134). On that note, more research is necessary to determine which strategies will close gaps in nested or looping networks. While closing network gaps may facilitate transparent communication between medical professionals, governments, and emergency management agencies, nested networks reinforce hierarchical relationships between system components and operational action.

Especially since local governments may receive medical resources based solely on established definitions of state and federal-level interests, recommendations for closing gaps must have a functional approach that evaluates systemic components to identify barriers incompatible with the main propositions of complexity science. Baghbanian and Torkfar (2012) suggested that a functional approach to CADMT is appropriate for achieving optimal outcomes when medical professionals must deal with resource constraints while treating victims of MCI/MCE. Evidence-based strategies that

include economic evaluations establish a context for testing the efficacy of medical resource delivery within a general preparedness paradigm. Functional approaches are beneficial for facilitating improvement in the outcomes of response to an MCI/MCE, taking into consideration factors such as risk and uncertainty, local-level civic engagement, and cross-disciplinarily communication (p. 395). Here, the application of CADMT illustrates how evidence-based reviews provide some indication as to whether local governments already have emergency management operations in place that may not necessarily rely on state and federal approval to achieve optimal outcomes. Evidence-based reviews of emergency management systems pertinent to mass casualty events may, nevertheless, produce unintended consequences when uncertainties plague medical resource delivery.

Baghbanian and Torkfar (2012) also critically examine CADMT in regard to how it affects complex health systems, especially that of the JIT system. In particular, they suggest that adaptive decision making in this context is heavily dependent on external factors affecting JIT systems, including that of the context in time, place, and purpose (Baghbanian & Torkfar, 2012). This means that CADMT correlates with this JIT system through understanding and application of these extraneous factors.

CADMT has numerous implications for the health setting. Indeed, as the same authors point out, each of the major medical decisions made here were not taken in isolation, but rather were the result of collectives and networks making decisions based on the wants and needs of the many (Baghbanian & Torkfar, 2012). From the perspective

of CADMT, it opens possibilities, demonstrating that it is possible for it to easily align with a JIT system if managed properly.

In similar vein, other researchers have cited the unintended consequences frequently produced by the application of complex adaptive decision-making theory to managing mass casualty events. Unintended consequences result from the fact that the causes of MCI/MCE are difficult to determine. Here, Brainard and Hunter (2016) highlighted how the unintended consequences of applying CADMT follow inconsistent input changes included in medical evaluation reports. Evaluations of input changes have methodological implications, as indicated by comments and suggestions made by researchers who have studied CADMT extensively (p. 130). Accordingly, the methods used in developing strategic interventions must include a clear description of processes for identifying unintended consequences. By implication, the research literature suggests that medical professionals, governments, and emergency management agencies which include a clear description of strategic facilitators in evaluation of input changes report the most significant improvement in managing MCI/MCE. However, the research also suggests that changes to the metrics of design features in CADMT may continue to lead to unintended consequences.

Assessing the Features of Complex Adaptive Decision-Making Theory

The self-organization feature of CADMT indicates that processes occurring as systemic elements are not necessarily deliberate. Self-organization in CADMT may entail the use of mutual aid paradigms to facilitate the effective coordination and delivery of medical resources used for treating victims of MCI/MCE (Paul & Ramsell, 2007). Yet, the internal processes of self-organization are self-reinforcing, given the unpredictability of MCI/MCEs. Based largely on the unpredictable nature of such events, self-organization in CADMT has a strong association with unintended consequences regarding how governments and emergency management agencies work collaboratively towards having medical resources delivered efficiently (Brainard & Hunter, 2016). Yet, the unpredictability of MCI/MCEs requires backup strategies when state and federal governments reproduce unintended consequences by relying heavily on nested networks. Self-organization is generally insufficient as a concept tailored towards efficient delivery of medical resources by state and federal governments.

Another of the prominent features of CADMT is its contextual and social nature. As Baghbanian and Torkfar point out, CADMT maintains a level of contextual complexity that allows for it to be reflected in many different ways, and in many different models, that can be pragmatically applied to a wide array of different JIT health systems (2012).

Another key dimension here regarding CADMT is its ability to utilize research within the purview of policy-making. This is another angle examined by the researchers,

which states that the literature which has emerged surrounding the use of models and theories as they relate to resource allocation decision making eludes new results and conclusions, including on aspects like economic evaluation (Baghbanian & Torkfar, 2012). This alludes to the ways that the JIT system complements some of the most salient elements within CADMT.

Complex health systems commonly necessitate management of resources through utilizing advanced theories. The JIT system is one that is functional on its own merits but brings value and weight that amplifies the use of CADMT. Baghbanian and Torkfar (2012) in their article state that CADMT, as well as other architectures, bring about a more flexible, integrated, and trans-disciplinary approach in order to be effective. This makes CADMT important because of its ability to more precisely allude to, and even modify in some cases, the underlying structure of the JIT system.

More introspective and integrated utilization of the findings and concepts within management theories also will allow for a maximization of results here, and CADMT facilitates this easily. Baghbanian and Torkfar (2012) state that adaptive decision-making is one of the core theories within management theory, particularly as it alludes to the usage of resources. Naturally, one of the key concepts at play here is that of efficiency, and the CADMT system allows for decisions to be made in a manner that is much quicker, while also making better use of available resources.

Yet another feature of CADMT surfaces when cascading events indicate how governments and emergency management organizations need to develop a system for

identifying any unforeseen chain of incidents. If cascading events have a negative impact on treating medical conditions in an MCI/MCE, causal analyses are relevant in determining which preparedness and response strategies will mitigate damage to critical infrastructure caused by similar incidents in the future. However, positive cascading events reproduce unintended consequences, as indicated by researchers (Brainard & Hunter, 2016, p. 128). Negative cascading events may lead governments and emergency managers to develop strategies capable of facilitating a more efficient dissemination of critical medical resources. Yet, negative cascading events must also provide medical professionals with sufficient evidence for improving process evaluation when MCI/MCEs require immediate resource delivery (p. 133).

Leverage points ensure that, although system outcomes will remain influenced, yet they are never controlled by the unpredictability of MCI/MCEs. Leverage points also entail governments and emergency management agencies delivering medical resources efficiently to facilitate a positive change. The influence of leverage points in identifying causal pathways suggests that interventions informed by complexity science will improve process evaluations (Brainard & Hunter, 2016, p. 127). However, researchers in complexity science continue to address gaps in developing explanatory tools for supporting the design of interventions concomitant with efficient medical resource delivery. The institutional capacity of governments and emergency management agencies should lead researchers of MCI/MCEs to consider how leverage points reduce the likelihood that unintentional consequences will exacerbate communication gaps with

medical professionals. Nonetheless, leveraging action may remain the most challenging aspect of CADMT, when there is lack of empirical evidence for developing such effective preparedness and response strategies.

Synopsis of the Complex Adaptive Decision-Making Literature

Complexity science continues to influence how governments and emergency management agencies deliver medical resources when MCI/MCEs affect communities of varying size, largely because MCI/MCEs are unpredictable, and CADMT facilitates critical thinking skills and strategic development, much like training for a large-scale military operation does. Questions regarding the evidential reasoning, capabilities-based planning, and exploratory analysis used in application of CADMT indicate how distinctions between mass casualty events influence the direction of resource coordination and delivery. In critiquing CADMT, the research literature has indicated that local and tribal governments remain at the mercy of state governments who must in turn answer to the federal government.

Just-in-Time Methodology

Researchers who have studied the JIT methodology extensively highlight how the effective delivery of medical resources to treat victims of mass casualty events may require trained human resources to utilize atypical spaces. Because medical professionals often lack sufficient training to treat victims of mass casualty events, researchers have suggested that a JIT methodology is applicable towards coordinating institutional human resources more effectively. As Kearns et al. (2014) suggested, the JIT methodology

substitutes standard operating procedures with crisis thinking to facilitate a convergence of institutions and agencies, each having limited supplies. Yet, the same researchers briefly addressed an unforgivably overlooked problem of substituting medications and hydrating fluids when medical professionals without sufficient training in emergency management concepts need to rely on state and federal agencies for assistance. Referring once again to the unpredictability of MCI/MCEs, the JIT methodology has contingent benefits when state and federal governments fulfill the obligations of ensuring that communities affected by MCI/MCEs recognize that quick response times are a variable that will determine whether preparedness strategies produce their intended outcomes.

This JIT philosophy correlates easily with CADMT. Primarily, CADMT specializes in making quick and effective decisions through application of its own complex and varied integration model (Baghbanian & Torkfar, 2012). Through this, the minutiae of JIT can be more pragmatically understood and applied. Furthermore, JIT emphasizes the use of sound decision making, and therefore is a multiplier of CADMT.

Quick response times to MCI/MCEs by state and federal governments are indicative of how concepts like "cross-training" may enhance preparedness strategies (Kearns et al., 2014, p. 31). Cross-training may facilitate more efficient response times when trained medical professionals work collaboratively by pooling resources that comply with standards for treating victims of an MCI/MCE. However, cross-training may pale in comparison to military strategies when MCI/MCEs, severely damage critical infrastructure and leave many critical resources far from reach (Kearns et al., 2014;

Thompson et al., 2006). Military strategies provide sufficient leverage for implementing a JIT methodology, insofar as trained medical professionals may attend to a large number of patients in triage.

CADMT integrates effectively with other health systems as well, unilaterally improving the performance of the JIT system, and all others as a result. Indeed, decision makers using CADMT are able to evaluate their own decisions and performance much more easily, allowing it to integrate with health models such as the social health model (Baghbanian & Torkfar, 2012). This is because some of these other health models emphasize cooperation with others, and this is the specialty of CADMT.

Abu-Zidan (2017) cited the usefulness of ultrasound technologies to detect internal injuries affecting victims of mass casualties that occurred in isolated or austere conditions. In such conditions, trained medical professionals may not have access to institutions or other facilities with enough space to manage surge capacity (Bayram et al., 2013). However, the research suggests that ultrasound technologies may facilitate improvements to application of the JIT methodology by relying less on X-ray technologies that require medical professionals to wear protective equipment. Ultrasound technologies may also improve the JIT by detecting bone fractures and internal injuries more accurately. Particularly when mass casualty events occur in geographically isolated areas, the use of ultrasound technologies will most likely reduce costs based on the portability of such equipment (Abu-Zidan, 2017). Yet, one particularly troubling feature not included in this research strand suggests how the efficacy of ultrasound technologies

must necessarily fall, albeit grudgingly, under the auspices of federal government authorities and emergency management agencies.

Just in Time in Local Preparedness and Emergency Management Planning

In their case study of the Rana Plaza Tragedy in late April 2013, Murshed and Sultana (2015b) highlighted specifically how human resources may include anesthesiologists and surgeons. Human resources in the management of mass casualty events may also include occupational therapists, intensive care physicians, and the assistants to both (p. 2). Yet, many local governments in smaller communities lack the human capital to facilitate efficient medical resource delivery. Tribal governments frequently confront similar issues, despite their status as sovereign nations under federal law.

Human resources are also important for ensuring that complex emergency management systems can adapt to sweeping policy changes reflective of the constraints placed on decision making in local and tribal governments. The research conducted by Murshed and Sultana (2015a) indicated that human resources facilitate transparent communication to ensure the timely delivery of medical resources to local and regional facilities. Accordingly, human resources on the scene of a mass casualty event must not rely on standard protocols to achieve optimal outcomes when multiple victims await triage. Due to the complexity of most MCI/MCEs, however, the research literature suggests that performance assessment of human resources based on the three criteria of staff, stuff, and structure should guide preparedness strategies applied towards medical

resource distribution. The research literature indicates, further, how governments and emergency management agencies emphasize essential care when victims of an MCI/MCE have potentially life-threatening injuries yet receive treatment either immediately or after a short-term delay (Carli et al., 2017; Murshed & Sultana, 2015a). Governments and emergency management agencies may enact policies mandating health care facilities to deliver critical medical resources only when there is a surge of patients from an MCI/MCE.

The case study of terrorist attacks in Paris, France, illustrates how local perceptions of a JIT methodology guide medical resource delivery in mass casualty events. According to Carli et al. (2017), resource availability guided preparedness strategies in Paris as local governments called upon provincial and federal agencies for immediate assistance. Delayed transfers also played a role as medical professionals determined which victims of the MCI/MCEs would be admitted on priority into triage shortly after the terrorist attacks occurred. Local and regional hospitals surrounding the cities evolved operationally and technically when medical professionals received adequate training to prepare for these MCI/MCEs. More specific to the JIT methodology, however, adequate preparation training strategies must emphasize a need for timely updates to emergency management procedures and policies. As the literature suggests, medical professionals experienced in MCI/MCE may benefit from adopting the JIT methodology in order to reduce response times and ultimately save lives.

The JIT methodology proved successful when trained medical professionals treated victims of the Paris terrorist attacks. Both cases involved an emphasis on identifying surgical resources needed within a specific time frame rather than relating these to the number of available beds (Carli et al., 2017). More importantly, the actual trained medical professionals distinguished between absolute and relative emergencies to distribute resources most efficiently among victims. Where we consider an absolute emergency as an urgent need for medical resources to treat patients in triage, relative emergencies may involve delayed transfers based on the actual severity of the injuries.

The JIT methodology also emphasizes identification and response to problems in a more group-focused way, and the implications of this, as it relates to CADMT being able to respond to it, are obvious. Indeed, CADMT allows for the development of individual social networks, allowing for many of these problems arising within the purview of JIT to be tackled in a modular way (Baghbanian & Torkfar, 2012). This is especially effective when it becomes necessary to critically examine patterns and possibilities within a health care setting.

The Paris terrorist attacks, therefore, represent a recent case in which medical resource delivery were equally both efficient and inefficient. Trained medical professionals had sufficient medical resources to treat victims. Medical professionals operated according to divergent institutional paradigms based on training received for treating victims of MCI/MCEs that included shootings and suicide bombings. Likewise, medical professionals responsible for treating victims of the Paris terrorist attacks applied

conflicting definitions to identify which bodies were mostly intact or "highly disrupted" (p. 2736). At the local level, families of victims expressed legitimate concerns about which processes trained medical professionals used to identify bodies and deliver resources on an ad hoc basis. Victim identification processes were especially relevant with regard to application of the JIT methodology, insomuch as medical professionals could deliver resources more efficiently depending on whether a body was intact or highly dismembered. Medical professionals trained in genetic data collection were able to apply Disaster Victim Identification (DVI) standards developed by Interpol (Carli et al., 2017, p. 2737).

A key dimension here is how these injuries can be reduced through proper disaster management operations. Another study finds that responding dynamically to problems through formulating social models is an effective way to respond to these sorts of threats (Underwood, 2010). This makes preparedness for MCI/MCE a much more qualitative and subjective matter.

Threats of nuclear attack also present a case wherein application of a JIT methodology serves to promote resilience when hospitals and clinics experience surge capacity yet lack sufficient training for determining who should receive triage and who will receive a delayed transfer (Bayram et al, 2013; Caro, 2016). Nuclear attacks necessitate that medical professionals who may, for example, include X-ray technicians and oncologists, should warn about the side effects of radiation sickness (Blumenthal et al., 2014; Carli et al., 2017).

Frameworks such as the National Strategy to Combat Weapons of Mass Destruction include a layout of responsibilities for responding to an MCI/MCE such as a nuclear attack. Authorized by President George W. Bush on December 11, 2003, the National Strategy includes recommendations for preparing and responding to threats of nuclear attack. Based on the National Security Presidential Directive 17, signed in September 2002, the National Strategy is the official policy founded on three key pillars of counterproliferation, nonproliferation, and consequence management (Sylves, 2008). Each of the three key pillars indicates that international governments should play a critical role in delivering medical resources efficiently to communities affected by threats or attacks involving nuclear weapons (Larsen, 2013, p. 5). However, inter-agency responses between governments deepen the problems associated with decentralization. Such problems reflect how preparedness and response strategies for mitigating threats of nuclear attack are mostly ineffective when medical professionals lack training resources for acquiring knowledge about the long-term health consequences of radiation sickness.

Accordingly, some researchers studying the JIT methodology may benefit from considering how inter-agency relationships in critical infrastructure depend on the quality of knowledge transmitted between medical professionals, governments, and emergency management personnel. If medical professionals were to receive training derived from military procedures, a JIT methodology would suffice in ensuring that hospitals and clinics that experience surge capacity will have sufficient resources available in preparation for nuclear attacks when threats become real (Bayram et al., 2013). The

literature suggests also that training to detect the inevitability of nuclear attack may draw from military procedures only when governments cite national or homeland security objectives when delivering resources for the management of MCI/MCEs (Sylves, 2008). Put differently, local government leaders will draw some benefits from adopting preparedness and readiness strategies under a homeland security framework to receive medical resources for treating victims of MCI/MCEs on an ad hoc basis. Local governments may, however, rely on NGOs and non-profit organizations to produce more sustainable outcomes when federal guidelines impose constraints on resource delivery when preparedness and readiness strategies fall outside the purview of decision making designed for the timely management of MCI/MCEs.

Perceptions of Just-in-Time Preparedness and Readiness Among Local Officials

Earlier research trends have indicated that local perceptions of the JIT methodology applied towards developing preparedness and readiness strategies in managing mass casualty events reflect a strong need to increase data availability and enhance solutions capabilities in critical infrastructure. Initially, the implementation of a National Incident Management System (NIMS)—a program developed by the Department of Homeland Security (DHS)—extended to local and state governments based on how initial details about MCI/MCEs stem from the public, news media coverage, and reports published by public safety organizations (Sylves, 2008; Thompson et al., 2006). Application of the NIMS framework by local governments based on information from these three sources should foster ideal conditions for medical

professionals to manage MCI/MCEs. However, responses from public information sources to calls to emergency centers and media outlets rarely reflect the precision (or lack of it) with which governments and emergency management agencies may deliver medical resources on an ad hoc basis.

Researchers have suggested that, in such instances, emergency centers and media outlets receiving calls about the imminent threat of an MCI/MCE may wait until the last possible moment to contact government leaders and emergency management agencies (Thompson et al., 2006). Similarly, emergency centers and media outlets may receive only a few calls about an MCI/MCE. Local media outlets may then issue a brief warning about the dangers lurking in a community and recommend that residents maintain a vigil. In such cases, the JIT methodology may apply only to delivering medical resources already available in most health care facilities. Biased reports published by public safety organizations are, however, representative of cultural distortions regarding how governments and emergency management agencies prepare for as well as respond to an actual MCI/MCE. This by all accounts gives a false sense of security to the population. Recognizing the fact that emergency centers are obliged to treat all calls of MCI/MCE with a degree of urgency, inaccurate or biased news media coverage of information pertaining to public safety matters may have an indirect influence on how efficiently governments and emergency management agencies deliver medical resources to treat victims. As Thompson et al. (2006) noted further in their earlier study, managers of emergency centers and local media outlets are partly responsible for broadcasting

information pertaining to the type and amount of resources required to treat victims of MCI/MCE. Yet, emergency centers and local media outlets continue to rely on incomplete information in communicating with government leaders and emergency management agencies about an immediate reported threat. Applying the JIT methodology may only compound the problems associated with relying on incomplete information. As such, the research suggests that complex adaptive decision support can produce the most sustainable outcomes when local organizations establish strong communication links with public sector institutions.

Concerning the effect that the threat of nuclear attack may have on potentially affected communities, researchers have suggested implicitly that the NIMS framework influences the decision-making process of local government leaders who must apply national security concepts in determining which preparedness and response strategies will mitigate unintended consequences caused by insufficient medical resource delivery. Sylves (2008) initially noted how the adoption of NIMS to manage mass casualty events provided federal emergency management agencies with financial assistance through grants and contracts. Local and state governments were not required to adopt the NIMS framework but were simply encouraged to work within a newly established homeland security paradigm. By adopting the NIMS framework, however, local and state governments were more likely to receive federal emergency management funding. Still, multiple stipulations rooted in federalist principles applied with regard to how local and state governments could implement strategies for responding to and preparing for

MCI/MCEs. Blumenthal et al. (2014) cited federal planning mandates implemented since the September 11 terrorist attacks as influencing how local governments manage mass casualty events. While federal planning allows local governments to oversee the training of medical professionals responsible for treating victims of mass casualty events, alignment with the JIT methodology is effective only to the extent that preparedness and response strategies do not incur long-term financial risks.

Synopsis of the Just-in-Time Literature

In summary, the JIT methodology applies to medical resource delivery in MCI/MCEs insofar as a substitution of standard operating procedures facilitates more efficient use of time and communication. Human resources who include trained medical professionals may adopt the JIT methodology in practice by drawing from experience to develop a broad range of preparedness and response strategies. However, it may not be advisable for governments at all levels to adopt the JIT methodology in practice regardless of whether time, communications, or the conditions for introducing technological innovation will allow improvement in efficiency. Improvements to the JIT methodology may require federal and state governments to consider how efficacious portable medical technologies are in treating victims of an MCI/MCE. The review of case studies that focused on local preparedness and emergency management planning and the perceptions of a JIT methodology reflect a strong need to improve decision-making processes in complex adaptive systems (Baghbanian, 2011). Considering the paradigms of general preparedness reviewed earlier, the JIT methodology has contingent

implications for determining how local governments can foster conditions to receive medical resources from state and federal government agencies more efficiently when unpredictable MCI/MCEs occur. Accordingly, adaptive decision-support systems implemented in the critical infrastructure of local governments may produce the most sustainable treatment outcomes, and in turn save the most lives.

Conclusion

Detecting threats of MCI/MCE may not produce the most effective treatment outcomes possible in cases involving pandemics such as the H5N1 and H1N1 outbreaks. However, the literature review indicated that adaptive decision-support systems and professional experience may expedite medical resource delivery when governments at all levels lack effective preparedness and response strategies. The paradigms of general preparedness indicated further how federalist principles in the United States influence medical resource delivery. Regardless of the training models implemented locally to facilitate more efficient resource coordination and delivery, preparedness strategies implemented throughout the United States maintain decentralized operations, insomuch as local and tribal governments must still depend on state and federal governments. Largely because MCI/MCEs are unpredictable, complex adaptive decision-making theory facilitates critical thinking skills development, much like training for large-scale military operations does. Yet, the features of complex adaptive decision-making theory reflect how transparency between communication networks remains critical if local governments are to develop and implement effective preparedness and response strategies in critical

infrastructure. The JIT methodology applies to medical resource delivery in MCI/MCE events insofar as a substitution of standard operating procedures (SOP) facilitates more efficient time and communication management. As indicated by the review of case studies involving the JIT methodology, local governments can foster conditions to receive medical resources from state and federal government agencies more efficiently when unpredictable MCI/MCEs occur. In effect, adaptive decision-support systems implemented in local government infrastructure can most likely produce the most sustainable outcomes concerning effective medical resource delivery in treating victims of an MCI/MCE.

Chapter 3 explains the methodology and focuses on the qualitative concepts, design, and analysis of MCI/MCE preparedness and its logistical relationship with JIT.

Chapter 3: Research Method

My purpose in this qualitative case study were to explore the issues that have become more significant in recent years (2008-2018) and have negatively affected the ability to keep current SNS medical supply levels up to date. Current issues with SNS include: Pilferage of resources, the need for updating RSS Teams (DOH, 2016), and the lack of a JIT system (Boysen et al., 2016; Kanyoma et al., 2013; Kee-Hung & Cheng 2012; Li, 2015; Michelsen et al., 2014; Saripalle et al., 2016). Addressing these issues will not only ensure timely delivery of critical medical resources exactly when and where they are needed but will also address the finite issue of maintaining adequate medical supply levels, *JIT*, for the end user or patient. It is necessary to know more about the fragile state of emergency preparedness in regard to specifically exploring the most efficient way to combat an MCE. The central focus of the research was derived from emergency management experts from the Washington State emergency management organizations to determine a shift in process from current on-hand medical storage capability to a JIT system. This research ascertained the feasibility of this shift and derived conclusions as to whether state officials can be convinced of policy change to a JIT system, in response to any MCE in central Washington State.

The setting of this qualitative study focused on the densely populated areas of Washington. As matters stand, there have not been very many MCI/MCEs visited upon Washington over the past many years. However, the potential for any MCI/MCE resulting in catastrophic loss exists, and only prudent planning efforts at the highest level

can be accepted. Among the few such events that have happened, an example is the one caused by the eco-terrorist group labeled the “Earth Liberation Front”, who were responsible for a fire bomb explosion at the University of Washington’s northern campus in 2001, causing millions of dollars of damage (Seattle Times, 2008). In addition, the AMTRAK derailment in 2017, which left 3 dead with hundreds of casualties, were declared an MCI/MCE by first responders and then echoed as such by the state’s Governor. Both events were met by an overwhelming effort of emergency management operations from local and state levels, besides some federal involvement.

According to the Washington State Department of Health (DOH), all hazards strategic planning model, set protocols are in place to ensure that only certified emergency management system personnel are allowed to treat above their level of certification (DOH, 2015). In addition, the Emergency Division of the DOH has shown due diligence in strategic planning factors that incorporate the nation’s priorities on MCI/MCEs (DOH, 2015). Specific collaboration with DOH and the Centers for Disease Control and Prevention (CDC) has enabled sharing of best business practices and lessons learned, ensuring public disclosure and alertness. Along with King Counties alert system, the public would be notified through various mediums such as radio and television broadcasts and updated public health website information sent through various social media outlets such as Facebook and Twitter. The current strategic response plan also incorporates mobile command centers and surge capacity with initial push packages of resources that can ship within 12–24 and 48 hours upon notification (CDC, 2017).

Considering that all these planning efforts are usually on paper and described in briefings during training and exercises, seeing how prepared Pierce county really is in the event of an MCI/MCE is the engaging factor that must be critically examined.

Research Design and Rationale

This research identifies a working cycle of production, transportation, delivery, and receipt of medical resources to reduce lead time and costs to positively affect the patients in an MCI/MCE (Caunhye, Nie, & Pokharel, 2012). Based on a compilation of theories including emergency response tradecraft (exploring the reactive action in response to an MCI/MCE), supply cycles (production, transportation, and delivery of medical supplies), and strategic logistics (the encompassing plan that brings together the aspects earlier mentioned in the most efficient manner possible), these are all critical elements for the successful implementation of a medical resource capability. The ability to reach the greatest number of people is the key factor and one of the most significant issues in transporting and receiving these medical resources. Gathering perceptions of different stakeholders became the source of this targeted data, specifically their expertise and experiences of emergency planning, response, and lessons learned before, during, and after an MCI/MCE. To address this phenomenon, this research can help focus on the types of relationships that exist through climate change (Binder et al, 2010) and first responder and Incident Management Teams (IMT) to more extensive federal involvement (DOH, 2008). This case study focused on an in-depth analysis of more than one event, social group, and other entities in their natural or modified settings (Yin, 2014). A study

of this nature can identify the positive and negative impacts of a JIT theory, and specifically the delivery system of medical resources in Washington (DOH, 2016).

Role of the Researcher

This research identifies a working cycle of production, transportation, delivery, and receipt of medical resources to reduce lead time and costs to positively affect the patients in an MCE (Caunhye et al., 2012). Based on a compilation of theories including emergency response tradecraft (exploring the reactive action in response to an MCI/MCE), supply cycles (production, transportation, and delivery of medical supplies), and strategic logistics (the encompassing plan that brings together the before mentioned aspects in the most efficient manner possible), these are all critical elements for the successful implementation of a medical resource capability. The ability to reach the largest number of people is the key factor and one of the most significant issues in transporting and receiving these medical resources. Perceptions gathered from different stakeholders were the source of this targeted data, specifically their expertise and experiences of emergency planning, response, and lessons learned before, during, and after an MCI/MCE. To address this phenomenon, this research can help focus on the types of relationships that exist through climate change (Binder et al, 2010), and first responder and Incident Management Teams (IMT) to more extensive Federal involvement (DOH, 2008). This case study focused on an in-depth analysis of more than one event, social group and other entities in their natural or modified settings (Yin, 2014).

A study of this nature can identify the positive and negative impacts of a JIT theory, and specifically the delivery system of medical resources in Washington (DOH, 2016).

Participant Selection Logic

A qualitative method was utilized, as it aligns directly with this specific type of study, which is to analyze the perceptions and way ahead for providing critical medical resources and supplies during an MCI/MCE. The targeted views and perceptions of experts and key stakeholders were used based on their respective training, knowledge, and experience regarding emergency preparedness for an MCI/MCE. I used a qualitative method in the form of interviews, documentation, and data review and observation (Maxwell, 2012; Merriam, 2014; Yin, 2014). Targeted organizations are the Washington State emergency management organizations. Archival data (After Action Reports (AAR) and other operational historical lessons learned data) and other reports were drawn from both agencies for this study. The participants were contacted through email after permission were accorded for further research. The email contained directions and a consent form detailing the participants' rights and the risks of participation. The inclusion criteria for this study were: (a) an EM professional either in a management position and/or other situational stakeholder who has a direct part in the planning and operational process; (b) must have worked at the position for at least one year, to ensure a wider range of experience; (c) must be 18 years of age or older. The exclusion criteria consisted of: (a) any stakeholder who speaks broken or does not speak English; (b) those who do not have any direct planning or operational ties to the EM process; (c) those who are not

directly part of the operational groups formed by either DOH or WSMD. By using purposive sampling, this research derived data from participant interviews that provided a more robust and rich description of the experiences that this researcher wanted to investigate (Maxwell, 2012). The purpose of this qualitative case study was to explore and examine the issues surrounding the delivery of medical resources during an MCI/MCE. In doing so, this study drilled-down into the imperative need for a JIT resource delivery system to combat any such MCI/MCE. A sample of 10–15 stakeholders (i.e., emergency planners, first responders, and administration staff) were interviewed to help identify and address the JIT delivery methods during an MCI/MCE within central Washington State. Research questions focused on the types of relationships that exist through local first responder organizations to larger state and federal governmental involvement. The interview data collected was run through the qualitative data analysis tool called NVivo 10.

For the purposes of this study, I gathered random participants for interviews until data saturation was reached (Creswell, 2013). Thematic analysis was achieved, following which the data was subjected to analysis for metric dispersion. The direction of this research is to establish a thought process within the emergency management community on the need to expand and adopt a JIT theory for transportation, delivery, and storage of medical resources. The depth of this project is underlined by the need to plan for the very best outcome (lives saved) during an MCI/MCE. This qualitative study and the unit of

analysis focused on the need for delivery of medical resources from point A (the manufacturer or storage facility) to the point B (the end user, the affected person).

Instrumentation

For thoroughness, I audiotaped the interview, but only if the participant gave permission to do so. All participants received a copy of the interview questions to ensure preparedness for the discussion. No participant was audio-taped without their specific consent. Once all the initial formalities were completed the session started with a quick, five-minute ice-breaker discussion on general topics (greetings, current social topics, sports) to encourage the participants to be more comfortable within the room and with each other. After the general discussion I started the formal interview with questions that were directly related to the case study and gathered their respective perspectives on the current level of preparedness for an MCI/MCE and what role a JIT management system could possibly play in the planning efforts before, during, and after an MCI/MCE. Depending on the level of logistical and JIT understanding of each participant, the researcher may need to expand additional participants until enough data saturation can be reached. During the interview, I used the Walden University interview guide (Walden, 2018) and each interview lasted no more than 60 minutes. Upon conclusion of the interview, I then reviewed all pertinent interview documentation and reports provided by the participants for relevancy and added depth.

Procedures for Recruitment, Participation, and Data Collection

A Walden University approved IRB letter must be obtained before commencement of any research. After receipt of the IRB approval, I sent all the necessary documents and permission letters to start conducting the interviews, and retrieved additional documents as advised by the participants that would encompass any and all preparedness levels and understanding as to the relationship between an MCI/MCE and employing a JIT method for medical resource delivery. Once the IRB had granted permission, I announced the case study through email and phone calls to EM professionals in the hope of garnering their support for interviews and various participation levels. The email (already prepared for the IRB) contained a brief description of who I am, the study, its purpose, and a risks and benefits disclosure to all interested participants. This includes publication of the full dissertation by Walden University. Only those who showed an inclination to participate were contacted (keeping in mind the inclusion criteria) for an interview for a more in-depth gathering of data. For thoroughness I audiotaped the interviews, but only if the participant gave permission to do so. All participants received a copy of the research questions in advance to ensure preparedness for the discussion. Once all the initial formalities were completed the session started with a quick five-minute ice-breaker discussion on general topics to encourage the participants to be comfortable with each other. Interviews were conducted outside each participant's place of work in a private room with the doors closed. I already had verbal approval to conduct such interviews as time and availability permitted. I

prepared a general script to follow that aligned with the interview questions each participant would have a copy of. After the general discussion, I started the semi-formal interview with questions that were directly related to the case study and gathered their perspectives on the current level of preparedness for an MCI/MCE and what role JIT management system would play in the planning efforts before, during, and after an MCI/MCE. During the interview, I utilized the Walden University interview guide (Walden, 2018). The first two interviews triggered a data analysis (descriptive coding) prior to the subsequent interviews. This ensured that the data produced was complete and accurate. Upon conclusion of the interviews, I reviewed all pertinent interview documentation and reports advised by the participants for relevancy and added depth. This also included examination of any other organizational documentation, such as After-Action Reports (AAR) and historical planning EM operations data that were consistent with this research. Yin (2011) has stated that document analysis is a key factor in qualitative work, as it allows researchers to analyze multiple sources of evidence, thereby breeding credibility in one's research. This is known as triangulation, in which researchers make use of multiple sources to provide corroborative evidence of their findings, triggering conclusions (Creswell, 2007).

Only documents that fell within the inclusion criteria and the topic of research were used. All others were set aside and not used for the study but will be safeguarded for the 5-year period stipulated in the ethical procedures.

Data Analysis Plan

Descriptive coding was applied to all the data used within this study both during and after collection in order to codify the data. A researcher codifies data by applying codes during collection and reapplying them during analysis. The act of codifying allowed me to segregate, group, and regroup the data, which is applied to a systems approach to understanding meaning and explanation (Saldana, 2012). Using this approach complements the research question used by allowing the focus of the researcher's phenomenon to be an integral part of the deductive thematic process while allowing themes to emerge directly through using a descriptive coding approach.

The first phase, data familiarization, was when I read and achieved a basic understanding and transcribed the data. The second phase of initial coding was achieved when I labeled and prioritized important features about each data point that is directly linked to the research questions(s). Once the entire data set was coded, I prioritized and collated the codes in order to extrapolate the relevant data extracts, identifying categories, themes, and patterns. In the third step, I gathered all the codes and collated data to reveal any possible additional patterns or meanings. In the fourth phase, I reviewed the themes created and aligned them against the research questions to actively find a relationship between question and answer. This also included data extracts or a coding summary for content review. In the fifth phase, I defined and named the refined themes to separate and help with theory flow by mind mapping or naming each code. The last step was achieved

when I cross-checked the findings with already existing literature to ensure validity and assist with originality.

Issues of Trustworthiness

Credibility

The book *Practical Research and Design* by Leedy and Ormrod (2013) concludes that content validity connotes the extent to which a measurement instrument is a representative sample of the content area being measured (Leedy & Ormrod, 2013). Therefore, this research utilized the triangulation method (length of employment and position, etc.) in order to incorporate content validity into this research, and to confirm multiple data sources within common themes and analysis of findings. The use of the triangulation method in this case study consisted of data collected from interviews and other relevant documents as well as strategizing on feedback from others, respondent validation, and thick description (Leedy & Ormrod, 2013). The use of the authors' 6-phase research cycle (Leedy & Ormrod, 2013, fig 1.1) begins with: 1. The problem, or an unanswered question in the mind of the researcher, 2. Researcher defines the goal in terms of a clear statement of the proposed problem, 3. Researcher subdivides the problem into sub-problems as appropriate, 4. Researcher posits tentative solutions to the problems through reasonable hypothesis, which directs the researcher to the appropriate data, 5. Researcher looks for data directed by the hypothesis and guided by the problem and then the data is collected and organized, 6. Researcher interprets the meaning of the data, which leads to the resolution of the problem and other support for the hypothesis. The

cycle is continuous until no further problems arise. This cycle was used as a guideline to ensure the cyclical research process and theory building. I provided feedback to individual interviewees to ensure I had a grasp of the content and thorough understanding of their responses. In conclusion of the analysis, the interpretations I made were provided back to the interviewees for verifying accuracy and understanding.

Transferability

This research utilized the triangulation method in order to confirm multiple data sources within common themes and for analysis of the findings. The use of the triangulation method in this case study consisted of data collected from interviews and other relevant documents, as well as strategizing on the feedback from others, respondent validation, and thick description (Leedy & Ormrod, 2013). I used the following five steps to ensure transferability: 1. Data was collected systematically, 2. Data was processed and interpreted, 3. A discovery was made, and a conclusion reached, 4. A tentative hypothesis was either supported or not supported, depending upon whether the question was answered or not answered, 5. End of cycle (Leedy & Ormrod, 2013).

Dependability

Leedy and Ormrod (2013) conclude that content validity signifies the extent to which a measurement instrument is a representative sample of the content area being measured. Baghbanian (2011) provided the theoretical construct of complex adaptive decision-making theory (CADMT) to help define the relationship between economics and policy decision making in a health-related setting. This research explored the MCI/MCE

phenomenon and identified the relationships between various logistical techniques to medically assist (by way of a JIT medical supply delivery) the greatest number of people during an MCI/MCE. The triangulation method helped to confirm multiple data sources within common themes and in analysis of findings. The use of the triangulation method in this case study consisted of data collected from interviews and other relevant documents as well as strategizing on the feedback from others, respondent validation, and thick description (Leedy & Ormrod, 2013).

Confirmability

I evaluated the impact on the collection and analysis of data from beliefs, attitudes, values, and reactions to the object of the case study. Upon completion of the study the researcher conducted a data audit to ensure that the data collection and analysis procedures were untainted and unbiased, thus adding additional weight to the credibility of the study. Silverman (2004, p. 283) has stated that “Validity and reliability are two important concepts to keep in mind when doing research, because in them, the objectivity and credibility of research are at stake”. During this phase of the study, I ensured that all variables were reliable and valid. "If a measure is unreliable, it cannot be valid because at least some of the differences in the scores assigned to cases result from measurement errors rather than from true differences between cases" (Brian’s, 2011, p. 107). Validity is the measurement standard of the variables to the concepts that are being theorized. If the variable is in fact valid, it will "be both appropriate and complete" (Brian’s, 2011, p.105). This validity can come from both internal and external sources. "Internal validity involves

accurate measurement of our theoretical concepts" (Brian's, 2011, p. 105). I took every precaution to maintain anonymity and confidentiality of each participant. I assigned a pseudonym to each participant. Participants were labeled by the order of the interviews, as P1, P2, P3, etc. Using a pseudonym as a marker ensured that this was the only way each participant was identifiable. All data collected, including audio tapes, documents, and any other relevant data have been securely locked in two separate safes for a minimum of 5 years and will not be used for anything other than the intended use for research in this case study exclusively.

Ethical Procedures

To protect the privacy of all participants and the organizations they represent, the safe keeping of this data is treated as paramount. At no time will any identifiable information be disclosed to anyone or any other organization in any capacity. Preserving the anonymity of each participant and organization involved is strictly my responsibility. In order to keep within those guidelines, I asked for no identifying data, so that each participant is only identified by a pseudonym. As stated before, two separate safes in the researcher's dwelling suffice as the security measure needed to keep this data from being exposed at any time. Under the guidelines of this research, all data will be kept in these safes for no less than 5 years, and at the end of that minimum period I will shred and/or delete all files related to this study. All signed documentation from all organizations has indicated understanding, compliance, and agreement with these protocols and policies.

Summary

The purpose of this qualitative case study is to critically examine the relationship in the context of an MCI/MCE of logistical preparedness and incorporation of a JIT management system in order to counter an MCI/MCE within central Washington State. This qualitative case study explores and examines the issues surrounding the delivery of medical resources during an MCI/MCE. In doing so, this study drills down into the imperative need for a JIT resource delivery system to combat the effects of any such MCI/MCE. A sample of 10–15 stakeholders (i.e., emergency planners, first responders, and administration staff) were interviewed to help identify and address the JIT delivery methods during an MCI/MCE within Washington's densely populated areas. Research questions focused on the types of relationships that exist, through local first responder organizations to more extensive state and federal governmental involvement. The interview data collected was run through the qualitative data analysis tool NVivo 10.

The following chapter includes the qualitative results gathered from the participants belonging to some state-run emergency preparedness divisions in Washington state. I describe all data obtained in its setting, demographics, data collection, and the results of that data analysis. I have also collected and coded the data utilizing thematic analysis and hand coding to identify themes and sub-themes.

Chapter 4: Results

My purpose in this study was to explore the issues that have become more significant in recent years (2010–2018) and have negatively affected the ability to keep current SNS medical supply levels up to date. Ongoing issues with SNS include Pilferage of resources, the need for updating the Receipt, Stage and Store (RSS) Teams (DOH, 2016), and lack of a JIT system (Boysen et al., 2016; Kanyoma et al., 2013; Kee-Hung & Cheng 2012; Li, 2015; Michelsen et al., 2014; Saripalle et al., 2016).

The following research questions guided this study:

RQ1. Does the JIT theory fall in line with the CADMT for improving the efficiency of delivery of medical resources to the end user during an MCI/MCE?

RQ2. What is the current perception of readiness among stakeholders, such as emergency preparedness managers, military officials, physicians, and nurses for an MCI/MCE in terms of response and medical resource capability?

Chapter 4 is divided into the following sections: (1) research setting, exposing anything that can influence the findings; (2) demographics delineating the participants' backgrounds and organizational settings; (3) how the data was analyzed and composed; (4) providing evidence of trustworthiness, credibility, dependability, transferability, and confirmability; (5) presentation of the findings; and (6) an overall summary of how the research questions were addressed and the findings, including their relationship, as continued in Chapter 5.

Research Setting

Research data was collected from 12 participants through both face-to-face and telephonic interviews that were held in a comfortable setting, and away from their respective places of employment. Of the 12 participant interviews, seven were face to face and five were conducted telephonically. All the participants are current residents of Washington State. Although many of the participants were extremely busy with ongoing operations and training, all felt that their participation and engagement with the research was necessary, and they were willing to share personal and professional perspectives on the research topic. The participant pool ranged from executive emergency management personnel, operational level leaders, and first responders to medical professionals.

During the interviews, none of the participants described or disclosed any personal (emotional or behavioral) or organizational conditions that might in any way influence their ability to answer questions candidly and truthfully.

Demographics

All participants had direct and extensive experience in the emergency management field. The 12 participants represented in this research showed an objective platform of diversity and were separated by pseudonym (code name), age, gender, race, profession, years in profession, and interview method. Participants were from both male and female genders and ranged in age from 33 to 56, with a professional service tenure ranging from 10 to 26 years. Each participant's data was graphed in the order in which they were interviewed. Each participant gave passionate and clear-minded views that left

no room for any insinuation or bias in their respective responses. All nine interview questions were asked and answered by each participant. Although some of the participants were "unfamiliar" with either the JIT or the CADMT theories, that did no negate the fact that certain responses added value after both theories were briefly defined and discussed in accordance with the two research questions.

In the course of the interviews, various themes were created in the respective topics such as (P) policy, (T) Training, (B) budget, (O) operations, and (L) logistics. Many participants showed various levels of concern that specifically related to these themes as emerging from the research questions. Both logistics and operational capability issues seem to be the prime concerns, among all 12 participants.

Data Collection

The IRB approval number for this study was # 12-06-18-0364435, granted on December 6, 2018. My intent was to initially call and email several participants and have them recommend other participants to ensure that I met my goal for saturation before data review and observation (Maxwell, 2012; Merriam, 2014; Yin, 2014). Although my preference was to have face-to-face interviews with each participant, operational needs and timing were major factors resulting in some of the interviews being carried out telephonically. All participants were given the invitation, explaining their part in the dissertation process and the research topic of logistical resource capabilities, specifically during an MCI/MCE. I also provided the interview consent form outlining their security and risk management if they chose to share it in this study. Finally, I provided a copy of

the questions to each participant to ensure that they were comfortable and prepared to answer with honesty, candor, and professionalism. Further contact was both face to face and telephonic. Follow up was made by email to ensure that each participant received all the forms described above and to double check their consent for being part of this study. Additional emails were exchanged to ensure that the discussed data was accurate, through thoughtful, flexible, and reflective responses to the interview questions (Bowden & Galindo-Gonzales, 2015). Upon completion of each interview, the participant was given the opportunity to review all transcripts and notes for accuracy and approval.

This study consisted of 12 interviews, with seven held face to face and five being telephonic. Each interview took an average of 54 minutes for the face-to-face interview and 46 minutes for telephonic conversations. I assigned a pseudonym for each participant and erased any other identifying marks, for the protection of each participant (Table 1). I verified each response to each question, ensuring that each participant's response was extracted verbatim, to ensure accuracy. I was careful not to lead or maneuver any questions during the interview process, considering my own background in emergency management. I was extremely careful not to introduce any potential bias that might guide or manipulate any of the responses. I reviewed and made sure that there were no deviations from my research plan as agreed upon with the IRB.

Table 1.
Participant Demographics

							Themes				
Pseudonym	**Age (y)**	**Gender**	**Race**	**Profession**	**Years in Profession**	**Interview Method**	**P**	**T**	**B**	**O**	**L**
P1	42	Male	Causcasion	Emergency Management	24	Face to Face	1	0	2	5	6
P2	51	Male	Causcasion	Emergency Management	28	Face to Face	3	1	4	6	4
P3	40	Male	Causcasion	Emergency Management	25	Face to Face	5	2	2	3	8
P4	39	Male	Hispanic	Emergency Management	12	Face to Face	1	1	1	4	4
P5	39	Female	Causcasion	Nurse	15	Telephone	1	1	3	1	0
P6	49	Male	Causcasion	Medical Doctor	25	Telephone	2	2	0	0	1
P7	41	Male	Causcasion	Emergency Management	12	Face to Face	1	0	0	3	4
P8	36	Male	African American	Emergency Management	11	Face to Face	3	1	0	1	4
P9	45	Female	Causcasion	Emergency Management	12	Telephone	2	2	1	4	3
P10	38	Female	Causcasion	First Responder (Medical)	13	Telephone	1	2	2	0	2
P11	28	Male	Causcasion	First Responder (Medical)	10	Face to Face	0	0	3	2	2
P12	27	Male	Causcasion	Emergency Management	9	Face to Face	1	0	0	3	1
							21	12	18	32	39

Data Analysis

The data collected from the interview questions were specifically open-ended, to identify and expound on a JIT method for medical supply delivery, this being directly related with MCI/MCEs. I proceeded to extract data from 12 participants in accordance with the IRB data collection plan established and defined in Chapter 3. Seven interviews were face to face at an offsite location away from the participants and researcher's place of business. Five interviews took place telephonically outside business hours and away from both participants and the researcher's place of business. Coding began with the first phase of reading, understanding and the initial start of transcribing the data. The second phase consisted of finding that link between the data received and my research questions. Once that was achieved, I prioritized the data into main and sub themes by frequency of subject as illustrated by each participant. The third phase was to re-evaluate for any other possible patterns or meanings. In the fourth phase I reviewed the themes to find a possible relationship from the findings and the research questions. The fifth phase consisted of refining the main themes into an illustrated map. The final phase is where I cross examined the findings to ensure that there was notable validity and originality.

after the first few interviews were completed and continued until redundancy had been reached, by (P11) and (P12). The act of codifying allowed me to segregate, group, and regroup, which ensured meaning and explanation (Saldana, 2012). In addition, to avoid ambiguity and misrepresentation (Bowden & Galindo-Gonzales, 2015), one follow-up telephonic interview was conducted with each participant to ensure the

accuracy of the participants' perceptions and my transcripts. The data was coded on an Excel spreadsheet and was divided into five categories (themes) and 15 sub-categories (sub-themes) that were determined by the responses to the interview questions.

Themes

The five main themes using thematic extraction were (P) policy, (T) training, (B) budget, (O) operations, and (L) logistics. The most utilized and discussed words for each participant were *logistics* and operations. This had a direct link to my research questions and after following Sadhana's (2012), 5 phase model, Logistics was found to be the main theme. I found that my interview questions were direct and specially vectored to medical resource delivery by way of a JIT system, using the CADMT as a planning template. Although some participants tended to migrate towards the operational capability as their concern in relation to logistics and resource delivery, I did not want to interrupt or "lead" the discussion in any way, to ensure a true reading of the data. (Please see Table 2 depicting themes and sub-themes of this study).

Table 2
Themes and Sub Themes

Policy	**Training**	**Budget**	**Operations**	**Logistics**
Policy need to match concurrent operational readiness and capability	Risk analyses and liability issues regarding lack of proper training	Equipment delays due to other budget priorities	Joint and multi taskforce mixed/separate operational priorities	Limited stockpile variations
State driven policy changes to match Federal visa/versa.	More scenario driven training other than classroom/online training	Lack of financial capability/ Folding in smaller areas into larger rural areas	The need for single operational platforms that work with other agencies	Using personal equipment such as cars, cell phones and protective gear
Relying on Federal backstop if MCI/MCE exceeds capabilities	Back-up training to automated electronic ran equipment	Cost/Risk analysis of resources on-hand VS JIT	Coordination with outside private sectors to enhance capabilities	Defined Medical facility contracts in place for and MCI/MCE

Main Theme 1: Logistics

Table 2 depicts logistics as the focus of this study. This critical word was discussed more than any other theme as reported by the respondents. As illustrated in Table 2, logistical points of failure can lead to catastrophic results regarding the lives affected by any MCI/MCE. When there is failure in logistics, or lack of backup planning to ensure that operational capability is met, the likelihood of success becomes narrowed. Logistics in reference to emergency preparedness can be defined as "the capability to identify, dispatch, mobilize, and demobilize, and to accurately track and record available critical resources throughout all incident management phases" (Kapucu, Lawther, & Pattison, 2007). As discussed in my framework and the literature, all the discussed themes of policy, training, budget, operations, and logistics become seamless and dependent on one another for success. However, some participants such as P1 went as far as to say that "logistics as a whole, can control the entire collective flow of any response or operation to an MCI/MCE". By default, it becomes the "single point of possible failures that need to be calculated and analyzed before they become a real time factor", as described by (P2).

Sub-Themes: a, b, and c

The sub-themes included (a) *limited stockpile variations*, with these "push packages" being preponderantly comprised of biological and chemical threat pharmaceuticals, water, saline, and basic first aid supplies. In addition, there were (b) *multiple mechanisms or points of failure for delivery of patients and or resources by*

road, rail, and air. This sub-theme was concluded from the concerned responses regarding flexibility and transporting necessary medical resources and patients if a certain transport corridor is compromised in some way. The last sub theme created was having (c) *defined medical facility contracts that depict specific roles and obligations during an MCI/MCE.* According to various responses, having set policy and contracts would hold the producer, receiver, and user's feet to the fire for specific reasonability's by each entity during an MCI/MCE.

Main Theme 2: Operations

The next theme that was created by way of the participant experiences was *operations*. The term operations are the "catalyst", if you will, for all things put into action from a plan. Operations are what control and synchronize all plans, actions, movements, and the tempo of emergency response.

Sub-Themes: a, b, and c

The sub-themes derived from operations included (a) *Joint and multi-taskforce, mixed and separate operational priorities*. The confusion of separate policies from some county to city to state to federal, at times causes displacement and confusion in priorities for action. As many of the respondents are in leadership roles, over fifty percent of the participants added that this was an issue of concern. An additional sub-theme was that of (b) *various single points of failure relating to warehouse, trans routes, and automation.* The phrase, "single point of failure" (SPOF) is a critical part of a system, that if one part of that system fails, all others will follow suit, stopping the system. (P2) stated that, in

relation to warehousing medical resources, a SPOF could be that a significant portion of our brick and mortar supply warehouses are within a flood plain in the Kent River valley. If those buildings flood, what is the backup for those items? In addition, (P2) also stated how another SPOF could be the transportation routes within Washington State, and if one is compromised can we rely and have the flexibility to plan and resolve with other transportation measure such as rail, air, and in some cases by water? The final sub-theme was (c) *coordinating with the outside private sector to enhance current capabilities*. (P1), (P2), (P3), and (P4) expressed some concern with some private sector players who are "not as passionate" about EM planning as others due to lean process emplacement and how their organization's risk analysis does not put much of a focus on planning factors due to the (un) likelihood of such an event. This also includes budgetary constraints by way of actual cost or loss by putting efforts into planning and actions when it is a center with low likelihood of an MCI/MCE.

Main Theme 3: Policy

The third most utilized phrase of the participant pool was *policy*. Although circumference policies are rampant among EM organizations through Washington State, the very nature of some policies is more of a "check the block" requirement for general guidance and coordination leads. According to (P8) and (P12), "EM policies are ambiguous at best and leave a lot of general citizens wondering what to do". (P8) stated that "unless you are an actual EM professional, most of the information is lost in translation to the average citizen".

Sub-Themes: a, b, and c

The first sub-theme created was (a) *policies need to match concurrent operational readiness and capability*. (P3) stated that some of the current policies only get updated annually or over 2 to 4 years, depending on the type of policy. Lack of information sharing between some AEM organizations also creates a gap between current policy and what an organization's capability is. The next sub-theme was (b) *state driven policies that match federal and vice versa*. (P3) also stated there were variations in policy, specifically in capabilities and backstop plans that aren't necessarily shared below executive level until the last minute or even at all. Five of the 12 respondents stated that reading policy was never required on the job, and that they read them on their own initiative. Even more subjective was the use of policy during an operation, because "sometimes you have to do things in a case by case basis, that don't necessarily align with a procedure or policy". Therefore, it can be noted that in certain viewpoints, some current policies within the EM community lack depth. The final sub-theme is *relying on federal backstop if an MCI/MCE exceeds local resources' capability.* This was also in the response from (P2), (P3), and (P4), that information sharing about capability is still an issue.

Main Theme 4: Budget

The next highest discussed theme as reported by the respondents was budget. (P1), (P2), and (P3) all discussed budget as a factor of concern at various levels, as it relates to logistics and specifically medical resources delivery.

Sub-Themes: a, b, and c

The first sub-theme created was (a) *equipment delays due to other budget priorities.* Obviously, not everything can be an actual priority; there must be a "rack and stack" on competing requirements, and someone then decides what is more of a priority than another. According to (P3), "the main budget factor is explaining the need for medical resources either on standby or delivered just in time with decision makers can be strenuous". "It is hard to explain the equity and trade-off for expenditures on items and personal for something that may not happen". The next sub-theme created was (b) *lack of final capability/ folding in smaller areas into larger rural areas.* Among the 39 counties within Washington State, there are 281 incorporated municipalities that are divided into towns and cities. As many of these smaller towns are in remote areas, the point of interest is envelopment of these remote areas into the closest larger municipality for response coverage. According to (P3), many of these remote towns including some tribal areas do not have the budget nor the capability to help themselves in case of a disaster. The final sub-theme created was (c) *cost and risk analysis of resources on hand VS a JIT system.* As stated before, there is great disconnect between EM professionals trying to convince decision makers and stakeholders about the need for investment in medical resources for an unlikely event. However, improvements have been made as far as leveraging compromise and the understanding of resource delivery reliability from manufacturer to end user are concerned. (P2) stated that there are numerous coordination and situational awareness agreements among organizations such as pharmacy and other private sector medical resource manufacturers: "This is a case of lean verses resiliency";

"Having to convince decision makers that resiliency is the key factor in planning for MCI/MCE". (P2) states that "understand that having a JIT system sounds great on paper, however numerous planning factors to include lead times, transportation and delivery are all critical points of finite planning, for example what are our back up plans? what happens if this fails?"

Main Theme 5: Training

The final theme created by the participants was training. The specific question asked during the interview was framed especially for logistics, and more specifically medical resource delivery. Although eight of the 12 patients responded with the word "training", this was in response to the training needed for back up of automated systems that would have to be shut down, forcing them to do hand written reports and audits if an MCI/MCE were to happen. In addition to that response both (P3) and (P9) stated that most of their in-house training consisted of in-house professional development, outside of real-world EM involvement.

Sub-Themes: a, b, and c

The first sub-theme created was (a) *risk analyses and liability issues regarding lack of proper training.* (P3), (P6), (P9) and (P10) all referred to the inadequacies of training and the liability issue with decision makers who don't have the proper training. However, both (P3) and (P9) stated that in recent years there has been a "push" to get organization and individual training jackets up to date in accordance with both FEMA and State organization requirements. The next sub-theme created was(b) *more scenario*

driven training other than classroom and inline classes. Seven of the 12 participants mentioned that there has been a better effort in scenario development training that involves all stakeholders from executives to first responders. The last sub-theme created is (c) *backup to automated electronic equipment.* Of the 12 respondents, three referred to redundancy in back-up training in case automation systems were shut down by either disaster or other means. (P3) stated that EM managers and staff need to be able to tabulate with pen and paper as efficiently or as close to an automated system, specifically for medical resource delivery. "Let's face it—back up, redundancy and flexibility are the name of the game when making efforts to save lives".

Evidence of Trustworthiness

Credibility

An open-ended qualitative interview was conducted in addition to other data sources from my literature review. Various notes and illustrations were written through the data collection process to ensure my understanding. I used the triangulation method in order to minimize potential bias and confirm the multiple data sources within common themes and the analysis of those findings (Leedy & Ormrod, 2013). Upon completion of each interview, I circled back around (by phone or email) with each participant to ensure that my analysis accurately reflected their respective responses.

Transferability

I utilized the triangulation method in order to confirm multiple data sources within common themes and the analysis of findings (Leedy & Ormrod, 2013). I used the 5-step model to ensure that the continuous cycle was exhausted, leading to a sense of understanding and perception in each participant and myself.

Dependability

The purpose of this study was to determine the views of emergency management professionals and the relationship of medical supply delivery to combatting an MCI/MCE in Washington State. Consequently, certain EM organizations were specifically selected because of their experience and mission for the citizens of Washington State. In addition to the JIT system, I introduced Baghbanian' s (2011) Complex Adaptive Decision-Making Theory (CADMT) as a theoretical framework and process to plan and execute logistical readiness by way of the JIT system. Data was collected from 12 participants, literature resources, and analytical notes. I then utilized thematic analysis and triangulation to develop key themes and sub-themes. Analysis was accompanied by feedback and validation from the participants (Leedy & Ormrod, 2013).

Reliability was accomplished through a solid chain of custody for all data collected, including interview data and analytical notes (Creswell, 2013; Yin, 2010). All interviews, either face to face or telephonic, were recorded with the participants' permission to ensure validity.

Confirmability

I maintained my direction of data gathering and analysis by conducting an internal audit to ensure that any personal or biased views or thoughts were not reflected in this study that might affect its credibility. Silverman (2004, p. 283) states how "Validity and reliability are two important concepts to keep in mind when doing research, because in them, the objectivity and credibility of research are at stake". I took every precaution to ensure the anonymity and confidentiality of each participant. I assigned a pseudonym for each participant in order of interview, such as (P1), (P2), (P3), etc. All data was collected, including audio recordings, documents, and any other relevant data, are securely locked in two separate safes for a minimum of 5 years and will not be used for anything other than the intended use of research for this case study exclusively. Safe keeping of this data will be paramount, to protect the privacy of all participants and the organizations they represent. At no time will any identifiable information be disclosed to anyone or any other organization in any capacity.

Every participant showed an extreme amount of passion and professionalism in the emergency management field. The pinnacle of each participant's discussion was the concern and care they had for the citizens of Washington State, and at times exceeding this demographic beyond the state lines to both national and international joint levels of cooperation. For example, (P1) stated "I believe we have the inherent duty to plan, protect and preserve any human life and not just the citizens of Washington State. I have been a part of numerous exercises and real-world events that have accomplished exactly that".

Study Results

The first cycle of my analysis started with thematic coding. By using this coding, I initiated the raw data from each interview. The use of word clouds initially helped illustrate and show visual keywords that exploit each research question's main phrases. According to Saldana (2012), the act of codifying allows the data to be segregated, grouped, and regrouped, which was applied to a systems approach for understanding meaning and explanation. The results were then triangulated with both interview and secondary data that were categorized into the main themes of policy, training, budget, operations and logistics. The themes arising from data gathered through both data collection methods were checked for redundancy or singularity. According to the findings, there was a significant relationship between emergency management personnel, first responders, and medical professionals. Moreover, there is a direct connection of the themes of operations and logistics for those individuals, in preparation for logistical resource delivery.

Summary

The purpose of this chapter was to present the findings of this research. It contains a review and reflection upon the study, the data collection protocols, and a description of how the data were organized, coded, and illustrated. The findings projected a clear indication that each participant has identified factors that directly relate to both operations and logistical improvements. Moreover, some participants expressed ties with budget

allocation and logical needs. Many provided suggestions for improvement that will be discussed in chapter 5.

Chapter 5 is a summary of the findings in relation to the literature review and elaboration of the conceptual framework. In addition, a brief recommendation for positive social change will be presented.

Chapter 5: Discussion, Conclusions, and Recommendations

My purpose in this qualitative study was to discuss and explore the issues surrounding medical resource delivery by way of the logistical means of a JIT system. This study was based on both operational and strategical level logistics as reported by an EM participant pool. The research method that I used was a basic qualitative approach that extracted data from emergency management professionals under the premise that medical resources and the most efficient delivery of them to the end user or patient of an MCI/MCE are critical. The bridge between operational and strategic level logistics relating to policy, budget, training, and operations is synonymous with resource management. Specifically, this study involved interviews with emergency management professionals from state ran organizations within Washington State. Using these professionals' experiences afforded traction to grasp the need to collaborate on efficiencies in logistics during an MCI/MCE. These emergency managers discussed a wide range of logistical needs that coincide with an MCI/MCE level operation and discussed openly the shortcomings in additional logistical needs such as transportation, fuel, and power that must be operable to ensure any medical resource delivery system can be effective. Although some respondents were not as familiar as others with the JIT, all noted that there is room for greater efficiency at the operational and strategic level logistics, as a whole, for emergency management and applying those through organized policies and procedures.

Interpretation of Findings

Although a substantial literature exists on procedures for health care such as triage, first responder care, and response, a significant gap exists in the research on medical resource delivery, specifically relating to any MCI/MCE. Moreover, there is little academic analysis done on medical resource delivery and JIT specifically, other than its general relationship with logistics (Boysen et al., 2016; Chelsen et al., 2014; Kee-Hung & Cheng, 2012; Kearns et al., 2014; Li, 2015; Serially et al., 2016). A thorough literature search revealed that most studies do not expound specifically on JIT and medical resources during an MCI/MCE. In addition, little academic literature exists on the relationship between training, budget, and policy that ties them all together. My purpose in this study, therefore, was to provoke a collaboration of what efficiencies a JIT could bring regarding getting the right medical resource to the right person and at the right time. Therefore, this study can provide additional literature to find a bridge between procedures and policies that trigger logistical efficiencies and promote positive social change through an adequate understanding and implementation of the CADMT to expose a better way for medical resource delivery. This study encapsulates an understanding of more efficient ways to streamline these resources and ultimately save lives during a disaster. Although any form of MCI/MCE may pose threats to critical infrastructure and human life, the CADMT advances stronger preparedness and response strategy models concerning these tragedies (Baghbanian, 2011).

Overall, the data results showed that although the participants had extensive knowledge and EM experiences in logistics and operational ability, few gave much thought to examining the JIT as an efficiency multiplier regarding medical resource delivery during an MCI/MCE. All 12 participants were asked the same interview questions, but only three (P1), (P2), and (P3), among them gave any real insight into the JIT and its relation to this medical resource and disaster scenario. Participants (P4) and (P7) stated that although the bulk of training is operationally driven, any coordination of medical resources outside of pre-positioned stocks is done on a case-by-case basis. Furthermore, only one (P1) of the participants could identify with the CADMT (as having heard of it) but gave no indication that there were current or future plans to implement such a theory for EM planning and operations in their respective organization. Although most of the participants were intrigued by both the JIT and CADMT functions, the participants neither confirmed nor denied the need for a JIT system by way of implementing a CADMT planning tool for medical resource delivery during an MCI/MCE. However, there was confirmation from all eight EM professionals of capabilities-based planning through utilizing the Comprehensive Preparedness Guide (CPG) 101, (FEMA, 2010) in the development of their organization's respective EM operations and response plans, which are currently stratifying that requirement.

Upon completion of the interviews, all data was cross-referenced with the literature including any peer-reviewed journals and articles pertaining to JIT for medical resource delivery during an MCI/MCE, for thoroughness. I found no new articles that

related to any linkage between medical resource delivery, JIT, and the CADMT. However, the data gathered from each participant and analyzed revealed that the concentration of each EM professional veered towards the basics of what was current within the themes of policy, training, budget, operations, and logistics. The main theme of logistics arising from the participants' responses contained these subthemes: (a) limited stockpile variations, (b) multiple mechanisms or points of failure for delivery of resources by road, rail, and air to patients, and (c) defined medical facility contracts that depict specific roles and obligations during an MCI/MCE.

According to the CDC (2018), 12 and 24 "push packages" (PP) are strategically placed all over the US. Upon federal declaration, they can be released for transport to the disaster area. However, as explained in Chapter 4 and discussed by some of the participants, the transportation of this 50-ton medical resource package is the bigger issue. As explained by (P1) and (P2), there are concurrent issues of pilferage and expiration of vaccines and various bio threat pharmaceuticals that need continuous updating and repackaging. However, the major issue is still the transportation of these resources to the right place and at the right time. According to the Washington State Department of Transportation (WSDOT, 2018), Traffic Geoportal, Annual Average Daily Traffic (AADT) shows millions of vehicles traveling per day on Interstate 5 (I5) and other arterial road networks. Washington State demographics also include variations in elevation (mountains and floodplains) that all tie into the potential for serious impediment

during an MCI/MCE, that would force planning for alternate routes and transportation avenues like rail, air, and water.

The subtheme by (P2) stated that coordinating with outside private sector players to enhance current capabilities shows that EM planning is derived from lean process emplacement and how their organization's risk analysis does not put much of a focus on planning factors due to the (un) likelihood of such an event. As stated in the literature, Blumenthal et al. (2014) have suggested that the reluctance of some local government leaders to think creatively towards promoting resilience fosters conditions of misinformation rooted in conventional wisdom. The ability of governments and community residents to detect threats of an MCI/MCE accurately may depend on which industries are most prominent in a municipality or geographical region.

Preparedness falls directly under the umbrella of logistics, as explained in Chapters 2 and 4. Factors such as collaboration between all EM stakeholders, Executives, managers, first responders, medical professionals, and citizens play a part in finding the most effective (though not always efficient) way to combat an MCI/MCE. Chenoweth and Clark (2015) states that planning efforts should incorporate emergency managers and first responders, as they play a critical role in the successful response to a disaster, before, during, and after the MCE. However, Wood et al. (2012) suggest that citizens are not usually part of the planning process when it comes to disaster or MCI/MCE management and response. This sends an ambiguous message, leading to a general lack of EM knowledge and understanding among the public. Notably, this syndrome also affects

private sector organizations that could be, or which are already within the scope of logistics during an MCI/MCE. Disaster preparedness should be on an even keel while presenting the risk and likelihood of events, among both private sector organizations and the citizens of Washington State. As discussed in Chapter 4 regarding the response from (P1), there is need to convince decision-makers to invest in the planning and preparedness for an MCI/MCE even when the chance of "getting something back" is improbable, because it poses considerable disparity when trying to get everyone on board for a successful emergency response.

Limitations of the Study

Although additional participants could have been used for this study, redundancy of replies became significant after the ninth respondent. Participants used were only within the EM profession and worked in Washington State only. However, to address some of the limitations, participants were broken down by specific occupation within the EM field as; 2 senior EM executives, 3 EM managers, 3 EM planners, 2 ambulatory medics, 1 Doctor, and 1 Nurse. I initially planned to do face-to-face interviews only, so as to ensure not only a thorough understanding of each participant's view, but also to ensure a repour that could be called upon if additional information and continuance of the study should prevail. Due to operational and timing issues, however, five of the interviews were done telephonically. Although that became the secondary method of choice, the findings were consistent, and responses were audio-recorded with participants' permission to ensure validity. The greatest limitation, however, was the lack

of familiarity with the JIT and CADMT (theories) among most of the participants. I was initially excited about learning from the Washington State EM organizations, in the hopes of understanding the two research questions derived from my chosen framework of CADMT. However, I was surprised that 11 of the 12 participants had never heard of CADMT. Although Baghbanian and Torkfar (2012), state that adaptive decision making in this context is heavily dependent on external factors affecting JIT systems, including that of the context in time, place, and purpose, (P1), (P2), and (P3) all currently rely on the CPG 101 EM planning templates for any MCI/MCE. There is, however, a relationship to Baghbanian' s (2011), two ordered domains of the CADMT, ordered (simple and complicated) and the two unordered domains (complex and chaos). In relation to the ordered domain, the traditional decision-making process is currently applied (CPG 101 EM), whereas a contextual or "adaptive-decision making process" are appropriate for the un ordered complex domain (Baghbanian, 2001 pg. 260).

Recommendations

The recommendations from this research are based upon the literature review, data that was collected, and the findings coded and analyzed to draw a clear picture of the challenges within EM logistics, specifically medical resource delivery. The following recommendations are not intended to be exhaustive or inclusive but are subject to the limits and scope of this study.

The concurrence about the need for getting the right resource to the right person at the right time seems to be the ultimate factor in response to an MCI/MCE. Although

several participants agreed that this was the most crucial part of an EM operation, there is still a disparity between back-up plans for transportation and delivery of these resources, more specifically as to the JIT methodology. However, adequate preparation training strategies must emphasize a need for timely updates to emergency management procedures and policies. The first recommendation would be a comparative study that includes the CPG 101 planning outline, using the same format for data extraction to determine its effectiveness in planning. This would help broaden the planning factors used and give a better understanding of its relationship to the CADMT.

The second recommendation would be expanding this study to additional states in supporting roles for EM operations. From the responses provided by (P1) and (P3), multiple coordination and After-Action Reports (AAR) are shared within the EM community to focus on "what works and what doesn't". Each state has their own organizations and jurisdictions that cross over to joint efforts in some cases. According to DOH (2016), Washington can develop and rehearse strategic response plans and operations by county, state, and federal guidelines to directly address natural or human-made disasters and emergencies. The very cycle of EM preparedness is dependent upon information sharing within agencies being at its most effective level of response.

The third recommendation is to expand this research to the supply cycle of medical resources from manufacturer to end user. This would encompass the need, planning, procurement, transportation, delivery, and storage of a resource and its continuing cyclical process. This would draw out the relationship of all six supply cycle

terms and expand each role of the supplier, producer, retailer, distributor, customer, and all the serviced and support that comes with each action of providing goods and services. Drilling down into this supply cycle could also outline disparities in cost analysis and most importantly the timing factors that affect the treatment of the end user (patient).

The fourth recommendation could be a quantitative approach by assigning numeric values to show correlation between the factors identified in this study. For example, a researcher could do comparative studies on timing of production of a medical resource and transportation to the end user (patient).

The fifth recommendation could be an in-depth study done on the effects on patients during an MCI/MCE and their relationship to the availability of a resource needed for treatment. This could be done either by qualitative means my assigning numeric values of patients and the effect on their treatment for injury, by diagnosis and treatment during an MCI/MCE. Additionally, this recommended study could be done as a qualitative approach by focusing on first responders and medical professionals, and their perceptions and views of treatment depending on the availability of medical resources at the time of an MCI/MCE.

The final recommendation would be to expand on this study by incorporating medical facilities that use the JIT system currently. Just as some of the respondents brought attention to being resilient about medical resource delivery and logistics, Kearns et al. (2014) have also noted that the JIT methodology substitutes standard operating

procedures with crisis thinking to facilitate a convergence of institutions and agencies, each having limited supplies.

All these recommendations can be used to assist further understanding and implementation of better procedures and practices that can directly affect the EM community for response and the end user (patient) for treatment.

Implications for Social Change

The implication for social change is ensuring that all possible information is out in the open so that EM leaders have all the possible data to make an informed and timely decision. This starts with EM executives, managers, medical professionals, first responders, citizens, and those injured by an MCI/MCE. Each EM professional is individually significant, but it is collectively that powerful and impactful changes are made. The implications of ensuring utmost efficiency and timeliness in medical resource delivery is paramount in an MCI/MCE.

EM professionals play a significant role in the cycle of planning, mitigation, response, and recovery in any disaster. The overall goal of an EM professional is to *prevent* as much as *improvise* before, during and after a crisis. However, the results of this study brought up many concerns about the ability to plan and overcome certain logistical areas such as transportation planning and the private sector's (manufacturer) compliance with production. Recognizing these gaps ensures greater understanding, and therefore leads to more informed decisions being made by EM professionals. This includes improvements to written Standard Operating Procedures (SOP) (operational

level) and polices (strategic level). Each part of these plans has a logistical section in which both supply and transportation are vital elements. Unbeknownst to the public, EM professionals and organizations are privy to the standard logistical procedures and the actions needed to address them. According to (P1), public display of procedures is ambiguous in nature by design, to ensure that any menacing efforts do not to disrupt EM response efforts. This could be misunderstood by the public as keeping them in the dark; however, it is necessary to ensure the safety of logistical plans. This study can help inform the public that not all EM plans need to be shared in public view and that the security of logistical procedures is in some cases as important as the MCI/MCE response itself.

As described above, this study could serve as a catalyst for other types of studies that exploit best courses of action between all EM professionals. The sharing of information becomes a critical part of preparedness planning, and in turn raises awareness among decisions makers for funding, policy, or operational approvals. This also affects the public, and by default perpetuates the citizen's perception of the EM community keeping them safe during a disaster.

Conclusions

The findings of this research, if confirmed, could result in substantial implications for both logistics resource capability/delivery and decision-making theories. The current theoretical platform used is the emergency management theory (EMT). While EMT methods become increasingly sophisticated, the need for a more complex and an

adaptive decision-making theory becomes more relevant (Baghbanian 2011). Furthermore, a need for a JIT system could improve the timeliness of delivery of medical resources from manufacturer to user (patient) during an MCI/MCE. The essence of the JIT system is "pulling" rather than "pushing" a medical resource as it is needed. However, the concern for transportation of the assets still becomes the impediment, in regard to getting that resource from point A (manufacturer) to point B (patient). The JIT as a logistical model follows the lean system for being efficient and cost-effective. However, the EM society believes that being resilient or flexible is equally important. Ensuring contractual agreements for a JIT compact with the manufacturers would transfer some risk back to them for inventory tracking. However, being resilient in the planning for transportation and delivery is still owned by the EM professional.

Over all, this study suggests that the CADMT should replace the current EMT-framework. This is supported by the findings in the literature, continued research outside this study and the data gathered here from the limited participant pool. This study remains to be confirmed by future research as explained by the recommendations. All are predicated in the hopes of influencing policy to further increase the current preparedness level, for medical resource delivery in response to an MCI/MCE in Washington State.

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Appendix A: Participation Invite

Dear Friends and Colleagues.

I am currently a Doctoral Candidate at Walden University and am conducting research to fulfill my dissertation.
My goal is obtaining a Ph.D. in Public Policy with a focus on Homeland Security Policy/Emergency Management

As an expert in the field of Emergency Management and Logistics you are in the ideal position to provide valuable first-hand information from your own perspective.

I have generated various questions and will be seeking participants to hold one-on-one interviews in order to capture this critical data.

The interview will last no longer the 60 minutes and will be recorded to ensure thoroughness. Each participant will be given and identifier code to help ensure that personal identifiers are not revealed during the data analysis and write up of findings.

There is no compensation for participating in this study, however your participation will be a value-added addition to my research and could lead to greater understanding for Emergency Management personnel.

If you are willing to participate, please respond to the email with the research questions attached and a good time to coordinate an interview.

If you have any question, please don't hesitate to ask at any time.

Thanks!

Sincerely,
Todd D. Brauckmiller Sr.

Todd.brauckmiller@waldenu.edu
(253) 219-5011

Appendix B: Letter of Consent for Research

CONSENT FORM

You are invited to take part in a research study about "Logistical Resource Capability During and Mass Casualty Event in Washington State". I am asking for your consent to take part of this study as this is a requirement needed for further research. Please read this form carefully and ask any questions prior to agreeing to the terms if this form and taking part in this study.

This study is being conducted by a researcher named Todd D. Brauckmiller Sr., who is a Doctoral Candidate at Walden University.

Background Information:
The purpose of this study is to explore and examine the issues surrounding the delivery of medical resources during a Mass Casualty Incident/Event. In doing so, this study will drill down into the imperative need for a just in time (JIT) resource delivery system to combat any such MCI/MCE.

Procedures:
If you agree to be in this study, you will be asked to:

- The interview will be coordinated, and each selected interviewee will spend no more the 60 minutes discussing in depth, the research questions provided.
- Interview will be audiotaped for thoroughness.
- Your name and any other personal identifying information will be met with strict confidentiality and will not be released anywhere in this study at any time.

Here are some sample questions:

- How would you rate the state's ability to coordinate and maneuver medical resources from one municipality to another? Who is the State proponent leader in the development of transportation and delivery of medical resources for an MCI/MCE?
- Are you satisfied with the current efforts of response and resources that are currently on hand? For example, Washington's latest efforts in the train derailment in December and the resources that were transported to the impacted area. Did you think this was sufficient? Why or why not?
- What are the most critical areas of interest when planning and executing the delivery of medical resources to an impacted area?

Voluntary Nature of the Study:
This study is voluntary. You are free to accept or turn down the invitation. No one at you place of employment will treat you differently if you decide not to be in the study. If you decide to be in the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as fatigue, stress or becoming upset. Being in this study would not pose risk to your safety or wellbeing. There is minimal risk, to participating in this study and every effort will be made by the researcher to ensure that there is minimal risk.

The potential impact of this study could broaden the thought process and planning factors that may expand a positive impact on medical supply delivery during a Mass Casualty Incident/Event. Having the right resource, at the right time could save someone's life, this being the ultimate factor and reason for this study.

Payment:
As a participant you will have my most sincere gratitude and thanks for providing your time and expert opinions that will have a significant impact on the study.

Privacy:
Reports coming out of this study will not share the identities of individual participants. Details that might identify participants, such as the location of the study, also will not be shared. I will not use your personal information for any purpose outside of this research project. All data collected to include audio tapes, documents and any other relevant data will be securely locked in two separate safes for a minimum of 5 years and will not be used for anything other than its intended use of research for this case study exclusively, as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via telephone at (253) 219-5011 or email at todd.brauckmiller@waldenu.edu If you want to talk privately about your rights as a participant, you can call the Research Participant Advocate at my university at (612)-312-1210. Walden University's approval number for this study is 12-06-180364435 and it expires on December 5th, 2019.

The researcher will give you a copy of this form to keep.

Obtaining Your Consent

If you feel you understand the study well enough to decide about it, please indicate your consent by

Printed Name of Participant _____

Date of consent _____

Participant's Signature _____

Researcher's Signature _____

Appendix C: Interview Questions

Interview Questions

1. What are your parameters while assessing the quality of on-hand stock levels for medical resources? (Supplies in specific).

2. Are you satisfied with the current efforts of response and resources that are currently on hand? For example, Washington's latest efforts in the train derailment in December and the resources that were transported to the impacted area. Did you think this was sufficient? Why or why not?

3. Can you describe the financial impacts and differences between having medical resources on hand around areas of Washington and compare it with the Just in Time delivery (JIT) option, direct from the manufacturer?

4. What are your recommendations for improvement of stockage levels and what is your experience with knowing the available or currently on hand in each major city in Washington State?

5. How would you rate the state's ability to coordinate and maneuver medical resources from one municipality to another? To whom do you think the State proponent leader is in developing the transportation and delivery of medical resources for an MCI/MCE?

6. What are the critical areas of most concern and what are the strategic land points for either roadway, rail, train or air delivery?

7. Are you aware of any policy or strategic plan to incorporate a logistics plan (JIT specific) from manufacturer to end user during or after an MCI/MCE?

8. What are the most critical areas of interest when planning and execution of delivering medical resources to an impacted area?

9. What is your understanding of the Complex Adaptive Decision-making Theory (CADMT) and is this platform utilized for strategic planning for logistics in the state regarding an MCI/MCE?