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Interoperability Performance Among Campus Law Enforcement Agencies

Tammie Ann Massirer
Walden University

Walden University

College of Social and Behavioral Sciences

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Tammie Ann Massirer

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Review Committee
Dr. Richard DeParis, Committee Chairperson,
Public Policy and Administration Faculty

Dr. Mark Stallo, Committee Member,
Public Policy and Administration Faculty

Dr. Joseph Pascarella, University Reviewer,
Public Policy and Administration Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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Tammie Ann Massirer

MBA, University of Texas at Arlington, 1995

BBA, Texas Woman's University, 1990

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

The September 11, 2001 terrorist attacks exposed considerable breakdowns in communications interoperability and information sharing among first responders. Multijurisdictional responses to the active-shooter incidents at the University of Texas in 2010; Sandy Hook Elementary of Newtown, Connecticut in 2012, and the Reynolds High School shooting of Multnomah County, Oregon in 2014 were replete with interoperability failures as well. Recent multijurisdictional response events continue to illuminate difficulties with first-responder interoperability and minimal research exists to promote understanding of the interoperability challenges of university police departments. The purpose of this study was to explore the barriers that impede communications of campus based law enforcement agencies during multiagency or multijurisdictional response. General systems theory and the unified theory of acceptance and use of technology model provided the conceptual framework for this qualitative case study. Face-to-face interviews were conducted with 10 leaders of university public safety agencies in California. Data were collected, inductively coded, and thematically analyzed. Key findings indicate that participants perceived barriers of funding, policy, inclusiveness, and training that affect communications interoperability performance. The positive social change implications from this study include recommendations of policy change for improved interoperability during multiagency or multijurisdictional response which can contribute to increased first-responder safety, more efficient multijurisdictional response, and improved safety of students and society at large.

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Dedication

This work is dedicated to my family and to the brave public safety officers at universities who protect and serve. To my late father, who taught me the love of a parent is deep, strong, and true. Who told me I could accomplish anything I set out to achieve. Who believed in me and fostered belief in myself. To my mother, who showed me that education is the path to freedom and expansion of ideas and growth. To my sons, Brandon and Devin, who show me everyday how great it is to be their mother. To my husband Darren, who dedicated 30 years of his life to law enforcement protecting and serving citizens in California and encouraged me to finish this journey towards my doctorate.

This work is dedicated to the brave, selfless law enforcement officers at universities who protect the students, faculty, and visitors at their universities with commitment and self sacrifice. Most of all, this work is dedicated to the law enforcement officers of universities who gave their lives serving their communities and protecting citizens.

With great anticipation, may the findings of this study provide a light to those policy makers who seek to provide a more seamless interoperable communications experience for law enforcement in universities. May the knowledge imparted in this study provide a platform for active engagement between the university communities and their mutual aid partners.

Acknowledgments

Many people have contributed to my doctoral journey. I am grateful to my professors, coworkers, mentors, and my dissertation committee for their knowledge, direction, guidance, and assistance through the years as I completed this voyage. I wish to thank my chair, Dr. Richard DeParis for his unwavering guidance and critique of my dissertation work. I thank him for his counsel and patience. I thank Dr. Mark Stallo of the Dallas Police Department who provided insight and knowledge of the law enforcement community and enthusiasm for my research. I also thank Dr. Joseph Pascarella, my URR committee member for his assistance in completing my dissertation.

I thank the participants of this study who shared their perceptions and experiences with enthusiasm for my research and trusted me to carry the message forward into a constructive study that has the opportunity to shed light on an important issue. Although the participants are anonymous, and therefore cannot be recognized individually, their self-sacrificing devotion to their officers they command and the students and faculty they serve is their legacy. May their words in this study provide a beacon to improvement of policy decision making in interoperable communications.

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Chapter 1: Introduction to the Study

On September 11, 2001, the inability of the United States' first-responder community to communicate with one another in a multijurisdictional and multiagency crisis was revealed when terrorists besieged large East Coast cities with airline attacks. The management and response to these incidents was ineffective, noted Hamilton and Kean (2004), due in part to the inability of first responders to communicate with one another via their hand-held radios and the failure of existing critical infrastructure to support voice communications.

Hurricane Katrina struck the Gulf Coast and extensively damaged New Orleans and the surrounding areas, including 31 universities in 2005; this event also highlighted the communication failures among responding emergency personnel. Among the reasons cited for the failures was that many of the systems used by the responders were destroyed by the hurricane. Those who did respond could not communicate because their radio frequencies were different, channels were not set up to communicate, and no protocol was in place prior to the event to coordinate emergency communications (Daniels, 2007; Simon, 2006; Stuver, 2006).

The events of 9/11 and the subsequent communications collapse during Hurricane Katrina brought the seriousness of these interoperability issues to light on a national scale. The responses to 9/11 and Katrina were noted as failures of leadership and initiative because the leaders were not proactive in creating interoperability communication plans (Davis et al., 2006; Desourdis, 2012).

Government-led policy leaders created a renewed focused on interoperability, and on-scene first-responder communication improvement gained momentum following the 2001 terrorist attacks on the Pentagon and the World Trade Towers in New York and hurricane Katrina along the Gulf Coast in 2005. Pechta, Brandenburg, and Seeger (2010) highlighted that reliable communication among first responders is a necessity for any coordinated response, leading to more efficient on-scene management during a crisis. Effective communication after the event also enhances recovery operations (U. S. Department of Homeland Security [DHS], 2008c).

Communication interoperability concerns are not limited to terrorist attacks or natural disasters, but span across crisis situations to include large-scale fires, widespread medical emergencies, school campus emergencies, and localized law enforcement incidents. During the Boston Marathon bombing of 2013, most local first responders were able to communicate throughout the event; however, communications systems were saturated, and two federal agencies, including the Immigrations and Customs Enforcement Agency and the Secret Service, experienced limited ability to transmit communications to on-scene responding local law enforcement agencies (DHS, 2014).

During a routine crime sweep involving Homeland Security Immigration, Customs, and Enforcement (ICE) agents and the Roseville, California police department in 2013, agents came upon parolee Samuel Nathan Duran, who was a gang member and a wanted parolee. This sweep escalated into a multiple location shooting involving Duran and several law enforcement agencies. During this event, the parolee shot multiple

officers from both agencies and over 300 officers from federal, state, county, and city agencies converged upon the city of Roseville to assist with the apprehension of the suspect. Multiple lessons were learned from this incident including the aspects of communications interoperability preparedness, multi-agency training, and governance (Simpson, 2015).

Communications interoperability failures were also a contributor to inadequate coordination of response during the 1999 active-shooter event at Columbine High School, the 2007 mass shootings at Virginia Tech University, the active-shooter event at the University of Texas in 2010, the lone gunman at Sandy Hook Elementary in 2012, and the Reynolds High School shooting of Multnomah County, Oregon in 2014. The responding organizations operated either on different radio systems or on different frequencies and they could not communicate directly with each other. In addition, emergency responders reported that their radios did not work in some buildings (Virginia Tech, 2007) and channels were overloaded (Multnomah County, 2015). Erickson (2001) noted that the earliest problems the responding officers were facing at Columbine High School were due to lack of communication. Investigators from the Virginia Tech University event cited several post-incident recommendations included enhancing the county's radio system to handle emergencies of this magnitude (Desourdis, 2012; Systems Planning Corporation, 2009), and the creation of a multidisciplinary group to develop and implement radio system improvements.

One of the interoperability difficulties for the response at Sandy Hook Elementary in 2012 was similar to that at Virginia Tech in 2007: the inability of state police radios to operate inside school buildings (Sandy Hook Advisory Commission, 2015; Sedensky, 2013). The Kalamazoo, Michigan mass shooting incident by a 45-year old male Uber driver in 2016 also highlighted challenges with response and coordination among the six agencies (including two campus based agencies) who responded to the event (Straub, Cowell, Zeunik, Gorban, 2017).

The focus of this qualitative case study was to gain a better understanding of these issues by exploring the perceptions of participants associated with law enforcement agencies on school campuses in 4-year universities in the state of California. Specific topics included (a) the participants' communications interoperability capabilities, (b) impediments and barriers to achieving interoperability capabilities, (c) interoperability performance from past examples of multijurisdictional or multiagency response events, and (d) perceptions of policy related to interoperability. I encountered a dearth of research regarding the barriers to interoperability of campus-based law enforcement agencies during multijurisdictional or multiagency responses.

The safety of citizens during response and recovery is paramount. In his analysis of past communications failures, Uzarski (2007) highlighted the need for first responders to communicate in both single agency and multiagency methods, within a single jurisdiction or in expansion to multiple jurisdictions. Through effective communication

among all responders, emergency situations can be responded to more quickly and more efficiently, thus mitigating the harm and leading to faster recovery.

Positive social change may result from the findings of this study by providing a deeper understanding of existing barriers and challenges faced by campus-based law enforcement organizations when involved in multiagency or multijurisdictional response. Enhanced information sharing among responding agencies can lead to more efficient response and recovery and greater protection of responders, students, and other citizens.

This chapter begins with background information regarding the problem and a problem statement. I explain the purpose of the study and describe its nature. I formulate specific research questions to guide the study and present a conceptual framework. The definition of terms used in this study are followed by a brief synopsis of the significance of the study and its implications for positive social change. Assumptions, limitations, and scope are presented. The chapter ends with a summary and overview of the study.

Background of the Problem

The major catastrophic events of 9/11 in 2001 and Hurricane Katrina of 2005 illuminated the importance of first responders' ability to communicate with one another both in response to the event and during recovery operations. Locally based school campus incidents, including the Sandy Hook Elementary School shooting in 2012 and the Reynolds High School shooting in 2014 brought to light failures of radio communication during incident response and recovery. Krauss (2007) and the Sandy Hook Advisory Commission (2015) highlighted that the capability to openly communicate across agency

or jurisdictional boundaries must be established before the event. Interoperability challenges among responding agencies and jurisdictions can impede resolution of the event and make the situation difficult to manage (Krauss, 2007). Multnomah County (2015) highlighted the importance of interoperable communications to create shared situational awareness in response to the Reynolds High School shooting. In their critical incident report of the Kalamazoo, Michigan mass shooting, Straub, Cowell, Zeunik, and Gorban (2017) highlighted key themes of needed improvement, including more frequent training and exercises, standard operating procedures [SOPs] development and publication, and multiagency command and control planning. Interoperability of first responders has an impact on the emergency response to the situation because first responders need to communicate and share information; yet, interoperability challenges have plagued emergency responders for decades (Desourdis, 2012; *Oversight of FirstNet,* 2013).

Following the terrorist events of 2001, the United States federal government began a proactive campaign to increase the capabilities of all first responders nationwide to communicate and exchange information with one another regardless of affiliation or jurisdiction when responding to emergency events. In less than a month after the events of 9/11, President George W. Bush created the DHS through Executive Order 13228, as described by Woolley and Peters (2008). The DHS was chartered with addressing emergency preparedness and response policy initiatives to increase first responder

effectiveness, communications abilities, cooperation, and cohesiveness (Bea & Hogue, 2006; Woolley & Peters, 2008).

One year after the establishment of the DHS, on February 28, 2003, President Bush sanctioned Homeland Security Presidential Directive-5 (HSPD-5), which established the Office of the Secretary of Homeland Security as a cabinet position. The charter of the Secretary of DHS was to "to enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system," later abbreviated to NIMS *(Homeland Security Presidential Directive/HSPD-5, 2003,* Purpose section, para. 1). A basic premise of NIMS, as well as of HSPD-5, is that all incidents are local in nature (Buck, Trainor, & Aguirre, 2006).

Leaders within DHS created the SAFECOM program and housed the program in the Office of Interoperability and Compatibility. (DHS, 2013; *Project SAFECOM, 2*004*).* Tasked with interoperable communications, the SAFECOM program administrators created the Interoperability Continuum, which graphically defined and identified elements to achieve interoperability. These elements included exercises and usage of interoperability technology, technology that enables interoperability, SOPs, governance regarding compatibility and interoperability, training and exercises of interoperable events, and usage of technology to maximize communications interoperability. Created in 2001 with the initiative to increase federal preparedness and interoperability, SAFECOM's focus was later increased to include state and local levels of government. The interoperability continuum denotes the multifaceted impact that each of these

elements has on emergency response agencies suitably to address interoperable communications (DHS, 2015).

The Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act (Clery Act) was enacted in 1990, through 20 U.S.C. Section 1092 (f) and in subsequent decades modified to serve as policy for crime reporting on educational campuses across the United States. The Act was named for a 19-year-old student, Jeanne Clery, who had attended Lehigh University of Pennsylvania and died on campus at the hands of another student. The court ligation of this homicide revealed that the university had records of 38 violent crimes within the preceding 3 years; yet, this information had not been disseminated among the public at large or disclosed to students at the university. Today, the Clery Act requires that all educational institutions that offer federally funded financial aid to produce crime statistics, policies on crime and safety, and describe crime prevention programs in use at the institution on an annual basis. A 2008 amendment requires that emergency response procedures must be documented and tested annually (Higher Education Opportunity Act, 2008).

Throughout the United States, the level of interoperability of an agency varies in position along the SAEFCOM interoperability continuum, with the goal to reach maximum interoperability (Desourdis, 2009). Although significant progress has been made in operations planning, first responders still have problems communicating and coordinating effectively (Desourdis, 2012; DHS, 2014; Morris, Morris, & Jones, 2007).

The range of inefficient interoperability varies by degree at all levels of government agencies throughout the United States.

Funding for interoperability improvements paralleled policy creation and execution. The DHS (2012) reported that, since 2003, over $18 billion in grants have been awarded to agencies in the United States to fund improvements of systems, governance, training, and technology purchases to enhance capabilities. Although these systems have improved, full interoperability remains a distant goal (U. S. Government Accountability Office [GAO], 2012). Funding is a necessary component of enhancing interoperability and measuring performance is vital. Unfortunately, state and federal funding that specifically includes campus public safety agencies is still lacking (*Security on America's college campuses*, 2007).

Efforts to improve interoperable communications vary in degree of success, and some challenges remain during emergency response to multijurisdictional or multiagency emergencies (*Oversight of FirstNet*, 2013). Less than half of campus law enforcement agencies at campuses with more than 2,500 students use a radio system that is fully interoperable with neighboring responder agencies (Reaves, 2015). To date, no researcher has explored communication interoperability challenges among campus law enforcement agencies in California. Research is needed to reveal what barriers to interoperability of campus-based law enforcement organizations exist in order to improve the situation and enhance campus safety, responsiveness, and recovery from incidents.

Statement of the Problem

Natural disasters, mass shootings at the local level, and terrorist attacks are most often responded to by local emergency responders as a multiagency or multijurisdictional event. In these events, the first responders deploy from their local jurisdictions and neighboring jurisdictions and continue to interact with their home agency by using their existing radio communications equipment, while also becoming part of a broader emergency response team. Interoperable communications among first responders involved in multiagency or multijurisdictional events continue to be problematic. Researchers who conducted studies and after-action reports have shown that effective and efficient emergency response was often hampered because of challenges the first responders faced when trying to communicate with one another, impeding an effective emergency response (Desourdis, 2012; Hamilton & Kean, 2004; Lester & Krejci, 2007; Multnomah County, 2015; *Oversight of FirstNet*, 2013; Sandy Hook Advisory Commission, 2015; Sedensky, 2013; Systems Planning Corporation, 2009; Townsend, 2006).

Often, such failures are attributable to the lack of proactive planning within the first-responder organizations. This problem has negatively affected emergency response timeliness and efficiency, the safety of the responding personnel, and the safety of civilians (*Oversight of FirstNet*, 2013). Because interoperable events begin locally, the technology leaders at the local level determine the type of technology that is used in their respective geographic areas. In a survey of campus law enforcement agencies of large 4-

year colleges and universities, only 48% of the participants reported using a radio system that was fully compatible with neighboring emergency response organizations (Reaves, 2015). Although numerous trade publication articles and after-action reports exist regarding this issue, no empirical research has been undertaken to examine the interoperability challenges within campus law enforcement organizations.

Purpose of the Study

The purpose of this qualitative case study was to gain better insight into the interoperability capabilities and performance of campus-based law enforcement agencies in order to improve multijurisdictional emergency response. This study will contribute to the discipline and increase knowledge regarding communications interoperability within campus law enforcement agencies by identifying (a) possible gaps in communication sharing that impede response, (b) impediments and barriers to achieving interoperability capabilities, and (c) perceptions regarding policy gaps for mutual aid response between the campus-based law enforcement agency and surrounding jurisdictions. Included in the research paradigm is an exploration of factors that may enhance interoperability across jurisdictional lines. Such factors would enable first responders to make expeditious and cohesive decisions during an event involving multijurisdictional or multiagency response. Erickson (2001), Virginia Tech (2007), Multnomah County (2015), and the Sandy Hook Commission (2015) stated that, during the response to school campus shootings, emergency response suffered as a result of communication challenges among the responding organizations.

Nature of the Study

I applied a qualitative exploratory case study method for this study and utilized interviews and archival-data triangulation to understand interoperability capabilities and performance of campus law enforcement agencies in California. A qualitative method was superior to quantitative methods because important factors such as perceptions of impediments to interoperability would remain outside the context of a quantitative design. In an effort to overcome the paucity of empirical research regarding campus-based law enforcement interoperability, I used this exploratory qualitative research method to contribute to a better understanding of the factors affecting emergency response communications in this sector. McNabb (2013) recommends the exploratory approach when little is known about a topic.

I used the case study method because the purpose of this research was to answer exploratory questions in a descriptive manner. Yin (2013) remarked that the case method is appropriate when research addresses descriptive or exploratory questions. I sought a greater understanding of the phenomenon of interoperability by asking questions directly of the participants with recent first-hand experience. Through semistructured interviews using open-ended questions, I gathered and analyzed data on the interoperability capabilities and performance from a purposeful sample of members of campus-based law enforcement agencies. Because I used thematic analysis in this exploratory multicase study, the sample size was predicated upon thematic saturation. McNabb (2010) emphasized that no ironclad rule exists regarding the number of cases to include in a

qualitative case study, and Creswell, Hanson, Clark, and Morales (2007) noted that studies involving the perceptions of the participants generally require 10-12 participants.

I purposefully selected potential participants from campus-based law enforcement agencies within the state of California. The participants were limited to California to provide a reasonable commute by car to each participant's location for the face-to-face interview. By utilizing maximum variation sampling (Patton, 2002), the small number of cases selected provided diversity relevant to the research questions.

Two basic inclusion criteria were applied for case selection. First, the case must be from a 4-year university in California. Second, the case must have experienced an interoperability event within the last 5 years that required a multiagency or multijurisdictional response. Further, the chosen cases achieved a balance between urban and rural locations, varied in law enforcement agency size, and were geographically dispersed throughout the state. I sent e-mail invitations to prospective participants, which explained the purpose of the study. Data collection was accomplished through open-ended questions in a semistructured interview protocol and review of archival material including reports, documents, and the annual security report (ASR). I implemented the same protocol with all participants for consistency. This qualitative method provided in-depth information relative to the phenomenon under study.

Data analysis consisted of thematic identification, aggregation, and analysis. This analytical method was appropriate for answering the case study questions of what is happening, why it is happening, and how it happens in an organization as recommended

by McNabb (2010). I tape-recorded the interviews with the participants' permission and submitted the recordings to the NVivo-11 transcription service for transcription. Upon thematic review, I separated the participants' responses into logical categories. Tracy (2012) noted that qualitative research is built from inductive data analysis, through organizing the data into a comprehensive set of themes. Triangulation with the use of several data sources enabled me to cross-check the data for consistency (McNabb, 2013). This technique is valued for increasing the details perceived in the cases and improving the accuracy of the results (McNabb, 2013). Details of the research procedures are presented in Chapter 3.

Research Questions

The research questions for this study were as follows:

1. What are the interoperability capabilities of campus law enforcement agencies in California as viewed by the agency?
2. What are the participants' perceptions regarding the barriers to achieving full interoperability capability of campus law enforcement agencies in California?
3. What is the interoperability performance of campus law enforcement agencies in California during multiagency or multijurisdictional response?

4. How can government-wide policies and procedures improve the interoperability performance of campus law enforcement agencies in California?

Conceptual Framework

The conceptual foundation for this study rests upon the existing literature of the domains of public administration and technology and is based on general systems theory (GST) and the unified theory of acceptance and use of technology (UTAUT) model. The GST provides the conceptual foundation and theoretical framework necessary to conceptualize communications (Ruben, 1992; Thayer, 1968; von Bertalanffy, 1950, 1968). All open systems comprise input and output (Denhardt, Denhardt, & Aristigueta, 2009), and first responders convening in a multijurisdictional response represent a larger system of multiple responding agencies, tasked with emergency containment and resolution. Information flow and exchange in this larger system is an essential aspect of communications among the responders to create a common operating picture and shared knowledge (DHS, Federal Emergency Management Agency [FEMA], 2010).

The primary communications-enabling device for information exchange is the radio and the radio communications system. These radios and systems can vary in interoperability capacity and, potentially, impede communication due to varying stages of technology acceptance among the responding agencies. Technology implementation has been studied through the lenses of several theoretical models to provide a better understanding of acceptance behaviors.

Adapted from eight prior theories of technology use and acceptance, the UTAUT model (Venkatesh, Morris, Davis, & Davis, 2003) is an accepted and widely used model for understanding user behavior with respect to the adoption of new technology. The UTAUT model consists of three contributing causal factors for intention to use technology: social influence, effort expectancy, and performance expectancy. In addition, the UTAUT model includes two determinants that drive usage behavior: facilitating conditions and the intention to use the technology.

In this qualitative study, I utilized the GST to conceptualize multijurisdictional communication among responding agencies and the role of communication during the response and recovery phases of the emergency management event. Because of the multidisciplinary composition of crisis response teams, they fluctuate in size, openness, and scalability, and they form in an ad hoc, expedient manner (Gonzalez, 2010). As emergency response communication relies heavily on technology, I also utilized the UTAUT model for a better understanding of the perceptions prevailing within the agencies. A more thorough review of the conceptual framework is provided in Chapter 2.

Definition of Terms

The following terms are defined as used in this study.

Campus law enforcement: Campus-based law enforcement personnel act in the capacity of law enforcement officials. They patrol colleges and universities and respond to incidents on campus. Campus police forces often consist of both sworn police officers and nonsworn security officers (U. S. Department of Justice, 2015b).

Capability: Capability indicates the ability to accomplish a mission or task (DHS, 2008c).

Common operating picture: The core situational awareness capability for effective decision making during mission execution (DHS, FEMA, 2010).

First responder: Personnel who respond to emergencies, including law enforcement personnel, firefighters, and medical personnel. Responders can be from the same or different jurisdictions depending upon the size of the event (Yang, Prasanna, & King, 2009).

Interoperability: The ability for first responders to communicate with one another during an event using radios (Mayer-Schonberger, 2005, p. 832). The ability of emergency responders to communicate as needed using a variety of frequency bands regardless of jurisdiction, agency, discipline, or level of government (DHS, 2008c, p. 2).

Jurisdiction: A political subdivision with the responsibility for ensuring the safety of citizens within its legal geographic boundaries; it commonly has the primary role in emergency response (Barbera & Macintyre, 2007).

Significance of the Study

The significance of this research study is that campus law enforcement agencies can use the information gained regarding communications capabilities and performance barriers that affect interoperability with neighboring agencies and jurisdictions. This information can improve the state of interoperability between campus law enforcement organizations and neighboring emergency response agencies, which leads to better

coordination and faster response to and recovery from emergency events. This information can increase the safety of the citizens of the United States; citizen safety is an important core function of emergency response organizations. This information can also be used to enhance the safety of the first responder personnel.

The ability of first responders to interoperate on-scene during an emergency event can mitigate the effects of the event and lead to quicker recovery. "Communication is the one constant that forms the foundation for all other public safety disciplines. It is the bedrock of every response plan, the core of every procedure. Without reliable communications, effective command and control cannot be achieved" (*Oversight of FirstNet*, 2013, p. 38). Responders acting in a coordinated effort to emergencies, whether man-made or natural, diminish loss and provide maximum recovery in a reasonable amount of time. Interoperability among various responding agencies enhances response and recovery (Buck et al., 2006). The findings of this study may benefit campus-based law enforcement agencies and assist them with decision-making processes to improve interoperability capability and performance. Policy makers at all levels of federal, state, and local government may benefit from the findings in this study and create policies aligned with improving the effectiveness of multijurisdictional and multiagency response to campus-based emergencies.

Implications for Social Change

Interoperability challenges are common among responders operating in a multiagency or multijurisdictional event (Buck et al., 2006; Krauss, 2007). Solving these

interoperability challenges can enhance communication and information sharing during response and recovery and create a common operating picture. Maximizing communications interoperability capabilities between campus law enforcement and common responding agencies creates an environment conducive to effective information sharing. Understanding the exercise of these capabilities and the barriers to maximum performance of interoperability of campus law enforcement agencies could promote positive social change through improved communications interoperability among responding jurisdictions. Such positive social change would benefit law enforcement and the safety of citizens.

Assumptions, Limitations, and Scope of the Study

This study included several assumptions. First, it was assumed that the participants possessed the necessary knowledge to discuss interoperability and communication. This assumption enhanced richness of detail as expressed through the participants based upon their knowledge and background. The validity of the study was based on the participants responding accurately and honestly to the interview questions and reviewing interview transcripts for accuracy. Another assumption was that the previous experience of the participants contributes to local leadership and policy decisions within their agencies regarding interoperability in their respective campus-based law enforcement agencies. In addition, it was assumed that the participants responded truthfully and openly to the interview questions, notably with respect to their past experiences and such factors as they deem important to the improvement of

communications interoperability. It was assumed that the participants considered their contributions to this study valuable and that they perceived this study as an important contribution to the field. Another assumption was that the participants were not fearful of responding and that they believed that the researcher protected their anonymity. Additionally, it was assumed that the audio recordings of the interviews reflected the true nature of the interview and the participants' points of view. Last, it was assumed that the review of archival and documents enabled triangulation, provided clarity of purpose, and enriched further analysis for answering the research questions.

The scope of this qualitative multicase study encompassed the 2016-2017 time frame. The study was set to utilize cases that have experienced at least one multijurisdictional or multiagency event during the last 5 years. The study was limited to campus based law enforcement agencies within 4-year universities in the state of California. Excluded from this study are K-12 educational institutions, community colleges, and educational institutions that do not have a campus-based law enforcement agency. These assumptions and scope of the study were considered appropriate and allowed an objective examination of the data obtained. The results of this study are potentially transferable to other campus-based law enforcement organizations in the United States and beyond.

Summary

In this chapter, I provided the background of the problem and the problem statement. I explained the purpose and the nature of the study, formulated four research

questions to guide the study, and presented the foundation and conceptual framework including definitions of key terms as used in the study. I discussed assumptions, limitations, and scope and the potential generalizability of the results to other campus-based law enforcement organizations. The chapter concluded with an explanation of the research significance and implications for positive social change.

Chapter 2 contains a comprehensive review of the literature concerning interoperability and the conceptual framework of this study, based on GST and the UTAUT, which considers technology acceptance behaviors. Chapter 3 includes the research methods, including a discussion of the case method and a rationale for using it in this qualitative study. I discuss data collection and data analysis procedures; trustworthiness; the role of the researcher; and ethical considerations, including measures taken to protect the participants' rights and anonymity. The results of the study are reported in Chapter 4. In Chapter 5, conclusions are drawn based upon the findings, and recommendations are offered for practical application and further research on this topic.

Chapter 2: Literature Review

Introduction

The purpose of this study was to investigate the attitudes and perceptions of participants associated with campus-based law enforcement agencies concerning their interoperability capabilities and performance in a multijurisdictional or multiagency emergency response. Interoperability and communication impediments among first responders became evident 17 years ago, beginning with the terrorist attacks on the United States on September 11, 2001, and continue to disrupt effective emergency response today.

Current literature and after-action reviews of multijurisdictional and multiagency events highlight that effective response continues to be challenged by communication failures among the responders. Although some progress has been made in strengthening interoperability among disparate public safety agencies and jurisdictions, researchers have devoted little scholarly attention to campus-based law enforcement agencies.

This chapter begins with a description of the literature search strategy, including databases accessed and key search terms used. Next, I describe the phenomenon of interoperability in light of the conceptual framework of this study and synthesize the concepts of GST (von Bertalanffy, 1968) and the UTAUT (Venkatesh et al., 2003) as they relate to interoperability. A discussion of the current literature is included in the literature review section. The chapter concludes with a summation of major themes and existing gaps in the body of knowledge, which provided the impetus for this study.

Literature Search Strategy

The literature search strategy included searching peer-reviewed journals and government publications utilizing Walden's Thoreau search engine and Google Scholar to obtain relevant literature for this review. The Walden library research databases accessed included EBSCOhost, Education Research Complete, ERIC, ProQuest, SAGE Premier, and the Homeland Security Digital Library database. Search terms included *campus-based law enforcement, communications, general systems theory, emergency response, interoperability, school safety incidents,* and *technology acceptance theory.* I used an iterative search process within the databases to refine the literature review by combining the interoperability search terms with terms pertaining to the conceptual framework such as *technology acceptance* and *general systems theory* to find significant or substantive contributions to the field of study. In addition, I found government documents relative to interoperability and communications policy and after-action reviews and reports primarily through the use of Google Scholar. Due to the paucity of scholarly research studies specifically focused on interoperability of campus-based law enforcement organizations, literature and documents regarding interoperability among law enforcement agencies and the public responder community as a whole were collected to permit a comprehensive review of the subject matter.

Conceptual Framework

In this study, I examined communications interoperability of campus-based law enforcement agencies during multijurisdictional or multiagency events. Derived from the

domains of public administration and information technology, communications interoperability shares frameworks with both the GST and the UTAUT model. The GST, developed by von Bertalanffy (1950, 1968), provides the framework for conceptualizing communications because all open systems comprise input and output and can be understood when approached from a systems perspective (Denhardt et al., 2009). Most systems are composed of multiple subsystems, while simultaneously being part of a larger system (Winter, Berente, Howison, & Butler, 2014). Because crisis response can form in an ad hoc manner, involve multidisciplinary organizations, and fluctuate in size, communications must be adaptable to the situation (Gonzalez, 2010).

Since the 1930s, the primary communications device for first responders has been the two-way radio and the radio communications system. I utilized the UTAUT model, posited by Venkatesh, et al. (2003), to study communications interoperability in the light of technological adoption. Both communications interoperability and technology were contributing factors to the loss of lives during the evacuation of the World Trade Towers on September 11, 2001 (Peha, 2005). Technological advances and policy initiatives since 2001, and involving radio communication, have provided a path to enable interoperability among disparate agencies and jurisdictions.

The GST and the UTAUT model were the foundation for the research design of this study. The design was intended to (a) facilitate identification of the factors that contribute to interoperability capabilities of campus-based law enforcement organizations

when involved in multiagency or multijurisdictional events, and (b) identify the interoperability performance of these campus-based law enforcement organizations.

General Systems Theory (GST)

The conceptual framework for this study draws on systems theory, a sociological theory that demonstrates interconnectedness and interdependencies among component parts and processes within a system and its surrounding environment. Von Bertalanffy (1968) researched systems theory as early as the 1940s, published his seminal work on GST in 1968, and revised it in 1972. Von Bertalanffy's (1968) systems concept demonstrates the interrelatedness of components of objects and phenomena and shows that all open systems have the following elements in common: input, output, process, feedback, environmental controls, and goals. Von Bertalanffy's systems concept aligns with SAFECOM's interoperability continuum (DHS, 2015), whereby five interrelated systems contribute to interoperable capabilities of first responders.

In an effort to combat reductionism and foster the unity of science, von Bertalanffy (1968) suggested that systems are complex equations of interacting elements that function as open systems, meaning that they interact with their environment. Interrelatedness and interdependence of phenomena in a system emphasize the principle of organization while holding intrinsically dynamic qualities (Drack, 2009). Further, Drack (2009) emphasized that GST is not derived from a single process, but rather from all of the processes within systems. Communication within and among organizations has roots in GST because communication is the flow of information among individuals and

groups. The need to communicate information in an emergency situation can arise within a single agency or involve a multiagency response (Bharosa, Lee, & Janssen, 2010).

Organizational coordination through communication among disparate agencies during incident response impacts the effectiveness of the response effort (Agranoff & McGuire, 2003; Levinson & Granot, 2002). Kapucu (2006) remarked that "emergency management requires multiorganizational communication and coordination" (p. 221). Kapucu found that timely information flow across agencies and jurisdictions is critical for emergency response effectiveness in dynamic situations. Public safety interoperability includes sharing of voice or data information among authorized first responders, as needed in real time (*Interoperability in public safety communications equipment*, 2010).

Communication during a crisis situation, explained Cheng (2013), is associated with transferring information to persons on a need-to-know basis in an effort to prevent a crisis, recover from an emergency event, or enhance situational awareness. According to Kuehn, Kaschewsky, Kappeler, Spichiger, and Riedle (2011), groups maximally benefit when information is shared in an open communications system. Crisis communication, remarked Seeger and Ulmer (2002), "concerns the processes whereby organizations create and exchange meanings among stakeholders regarding the risk of crisis, cause, blame, responsibility, precautionary norms, and crisis-induced changes in the organization and its relationship to stakeholders" (p. 128). Hu, Chen, Hu, Larson, and Butierez (2011) suggested that both timely knowledge and access to information are critical for effective law enforcement response. Communication between emergency

responders who are not in the vicinity of one another is carried out over critical infrastructure that enables transmitting and receiving voice communications over hand-held devices (Kuehn et al., 2011; *Oversight of FirstNet*, 2013; Simpson, Lasley, Rockaway, & Weigel, 2010).

These technological tools are important for improving interorganizational information distribution and decision making during multiagency or multijurisdictional response by emergency responders (Bharosa et al., 2010; Graves, 2004; Longstaff, 2005; Obama, 2010). Manoj and Baker (2007) highlighted that effective communication is the primary challenge when responding to emergency events, inferring that the "technological, sociological, and organizational" (p. 53) issues in communication must be resolved to ensure reliable communications during crisis events. Jenkins (2010) and *Oversight of FirstNet* (2013) were in agreement and stated that effective communications technology and systems are essential to first responders, as highlighted by the events of Hurricane Katrina and 9/11. Kuehn et al. (2011) noted that, in catastrophic situations, collaboration and coordination of emergency response requires interoperable technologies, including applications, devices, and networks, because most, if not all, challenges are technological in nature.

Unified Theory of Acceptance and Use of Technology (UTAUT)

In addition to the GST, I also used UTAUT as the framework for this study. Theories of technology adoption that draw from psychology and sociology include the diffusion of innovations theory (Rogers, 2004a), the theory of reasoned action (Ajzen &

Fishbein, 1980; Fishbein & Ajzen, 1975), the theory of planned behavior (Ajzen,1991), and the technology acceptance model and its revisions (Venkatesh & Davis, 2000). The latest models to study acceptance of technology are the UTAUT, created by Venkatesh et al. (2003), to study employee technology acceptance, and the UTAUT-2, as modified in 2012, to study consumer acceptance (Venkatesh, Thong, & Xu, 2012).

Two previous theories to assess attitudes related to information technology—the theory of reasoned action (TRA) and the theory of planned behavior (TPB)—have received widespread use (Dillon & Morris, 1996). However, I chose neither of these theories for the theoretical framework for this study because both the TPB and the TRA assume that intention to act or to adopt a technology is free from limitations such as economic or environmental constraints. Additionally, the TRA requires that behavior be volitional; therefore, it is not useful for measuring situations of low volitional control (Yousafzai, Foxall, & Pallister, 2010). Although the TPB solves for volitional control, it lacks comprehensive variables for behavioral intention (Davies, Foxall, & Pallister, 2002) and falls short for studying populations that are not university students. In addition, the self-reported measurements of the TBP do not appear to report outcomes reliably when the self-reports are compared to objective outcomes (Sniehotta, Presseau, Araújo -Soares, 2014).

The Technology Acceptance Model (TAM) theory is also a widely used model for assessing technology acceptance; however, I did not chose the TAM as the theoretical framework for this study because it does not always explain systems use, as Legris,

Ingham, and Collerette (2003) pointed out in their meta-analysis of TAM studies. Legris et al. (2003) further observed that the TAM could not explain more than 40% variance in behavioral intention and usage (Bagozzi, Davis, & Warshaw, 1992; Sun & Zhang, 2006). This observation was, however, subsequently criticized by Schepers and Wetzels (2007) for inadequate selection of research studies in the meta-analysis.

The TAM and its revision, TAM-2, were not selected because the behavioral-intention attenuation effects required large sample sizes, which are not representative of case study research (Schepers & Wetzels, 2007). In addition, the TAM has limited ability to assess the outcomes of technology adoption (DeLone & McLean, 1992; Lucas, Swanson, & Zmud, 2007; Sun & Zhang, 2006) and to explain the association between intention to use the technology and the actual usage of it (Legris et al., 2003). Finally, applications of the TAM's indicator of perceived ease of use to predict perceived usefulness and attitude were found to be useful only during early stages of adoption (Agarwal & Prasad, 1998; Chau & Hu, 2002; Tarhini, Hassouna, Abbasi, & Orozco, 2015). Rogers's (2004b) diffusion of innovations theory as the theoretical framework for this study was not used because it fails to consider the environmental framework of constraints to diffusion and, conversely, opportunities for diffusion in the organizational setting (Oliveira & Martins, 2011) and also because of the bias that adoption of innovation is beneficial to all adopters equally (Rogers, 2004b).

Venkatesh et al. (2003) formulated the UTAUT model based upon the empirical comparison of eight models of user acceptance of technology, namely, (a) the theory of

planned behavior, (b) the technology acceptance model, (c) the theory of reasoned action, (d) a model that combined the technology acceptance theory and the theory of planned behavior, (e) the social cognitive theory, (f) the innovation diffusion theory, (g) the model of personal computer utilization, and (h) the motivational model (Pullen, Swabey, Abadooz, & Ranjit-Sing, 2015; Straub, 2009). Although published less than 2 decades ago, the UTAUT model has served and been validated as a model of research acceptance and use of technology. A recent search with the use of Google Scholar turned up more than 800,000 articles on the UTAUT, including more than 12,000 of Venkatesh's seminal work, published in 2003. Although the UTAUT was recently adapted as UTAUT-2 to incorporate the three constructs of hedonic motivation, price value, and habit to study consumer use, I employed the UTAUT model because its focus is on employee technology acceptance (in this study, technology acceptance by law enforcement officials employed within a campus-based law enforcement organization), not on consumer acceptance (Venkatesh et al., 2012).

Coeurderoy, Guilmot, & Vas (2014) utilized the UTAUT model to provide performance information. Research data (N = 215) from a period of 6 months, across four organizations, were compared with the aforementioned eight models of technology acceptance to explain "between 17 and 53 percent of the variance in user intentions to use" new technology (Coeurderoy, Guilmot, & Vas, 2014, p. 1085). This validation and comparison formed a baseline assessment to compare with the UTAUT model. The researchers employed the UTAUT model with four determinants of usage and intention

on the same data set to reveal a 69% explanation of variance in usage intention, outperforming any of the previous models (Venkatesh et al., 2003). Taiwo and Downe (2013) validated Venkatesh et al. (2003) findings and remarked that the UTAUT model outperformed the eight individual models of R2 by 70%. Subsequently, Birch and Irvine (2009) employed the UTAUT model on a limited sample size study of teacher user acceptance of communications technology employed in the classroom and revealed the four UTAUT constructs were significantly correlated with behavioral intention.

Researchers further tested the UTAUT model with two new organizations ($N = 80$ for voluntary use and $N = 53$ for mandatory use), revealing a similar 70% explanation of variance, thus cross-validating the model (Venkatesh et al., 2003). Three key determinants were derived from the UTAUT model for intention to use technology: performance expectancy, effort expectancy, and social influence, and two key determinants for usage behavior: intention and facilitating conditions.

The concept of technology adoption utilizing the UTAUT model has been applied in previous research studies and benefits the framework of the this study. Notably, Chau and Hu (2002) highlighted that technology-acceptance decision making can vary based upon professional context. Hu et al. (2011) suggested that user acceptance of technology by law enforcement professions may differ from other professions because of the specialized need for information and knowledge support under time constraints and their strong psychological attachment to their agency and partners. Hu et al. (2011) remarked, "Law enforcement officers represent a particular user group, characterized by specialized

work tasks and arrangements, extensive information technology support, and constant challenges to improve their timely and effective work performance" (p. 14).

Performance expectancy. The determinant performance expectancy is defined as the degree to which an adopter of technology believes that using the technology will provide benefits or enhance job performance. Of the four determinants of acceptance and usage of technology, performance expectancy is the highest predictor of intention to use technology, according to Venkatesh et al. (2003). Studies have confirmed performance expectancy is a strong predictor of intention to use (Casady et al., 2015; Pullen et al., 2015), including in specialized working conditions and professions (Chau & Hu, 2002; Mun, Jackson, Park, & Probst, 2006). Within the law enforcement setting, Hu et al. (2011) and Lin, Hu, and Chen (2004) noted that perceived usefulness had the greatest impact on acceptance and use.

Effort expectancy. Defined as the amount of exertion of effort needed to use the new technology, or conversely, the ease associated with the use of technology, effort expectancy is also a determinant of usage behavior and user acceptance. The significance of this determinant exists in both voluntary or mandatory usage environments; however, effort expectancy is most influential during the introduction of the technology and becomes less important over time when usage is extended or sustained (Venkatesh et al., 2003). Effort expectancy changes over time because process hurdles are more prevalent in the early stages of technology use and they are replaced by instrumentality concerns later on (Davis, 1989; Szajna, 1996; Venkatesh et al., 2003). Hu et al. (2011), however,

found that law enforcement officers placed less emphasis on ease of use, but it was a contributing factor.

Social influence. Social influence is defined as the degree to which users consider the opinions of others as valuable regarding the adoption and use of the technology. The adoption behavior is influenced by societal perceptions of others predominantly in the mandatory acceptance of technology and to a lesser extent in the voluntary adoption of technology. In mandatory contexts, compliance is the predominate factor for adoption, whereas in voluntary contexts, identification—related to social status gains and prestige of using the technology, and internalization,—the number of influential groups using the system, and the social acceptance and support for technology usage predominate (Venkatesh et al., 2003). Lin et al. (2004) noted that, in the law enforcement setting, social influence has been determined to be an important indicator of user acceptance; however, Hu et al. (2011) found that peer influence had no distinct effect on intention to use. Additionally, Hu et al. determined that social influence can boost perceived usefulness, but it does not specifically drive intention to use or the actual usage of technology.

Behavioral intention. Sheppard, Hartwick, and Warshaw (1988) proposed that behavioral intention focuses on the use of technology and can be influenced by available choices and whether the use is mandatory or voluntary. Behaviors that influence successful use of technology include understanding the advantages of usage, preparing for usage, and envisioning improvements potentially realized by usage of the technology.

Within law enforcement technology acceptance, behavioral intention was a driver of acceptance (Lin et al., 2004).

Facilitating conditions. Venkatesh et al. (2003) defined facilitating conditions as the degree of perception that organizational and technical infrastructures exist to support the use of technology. Examples include the ability to seek help for using the technology, the availability of resources necessary to use the system, and the compatibility of the technology with job duties. Lin et al. (2004) found that technology that promoted efficiency in job duties was a driver of acceptance. However, Hu et al. (2011) found that law enforcement officers placed less emphasis on organizational support or facilitating conditions.

Application of UTAUT in communications research. Within the realm of communications research, Williams, Rana, and Dwivedi (2015) noted that the UTAUT model has been used in 25 research studies on communications systems and four research studies utilizing the case study method. In addition, 90% of the studies were cross-sectional rather than longitudinal. The case study was employed as a research method by Samoutis et al. (2008) and Trimmer, Beachboard, Wiggins, and Woodhouse (2008). A study conducted by Chen and Chang (2013) utilized the UTAUT model to understand user acceptance of a new technology—near-field communication—on an existing device, the mobile telephone. Chen and Chang's research is beneficial to the framework of this research because the device under review, the portable and mobile radio used by first responders, has also been in use for a period of decades, similar to the mobile phone.

Additionally, the radio user can now utilize it beyond original expectations to communicate multijurisdictionally, and not merely within the home agency. Further, Carlsson, Carlsson, Hyvonen, Puhakainen, and Walden (2006) utilized the UTAUT model to explain acceptance of mobile devices. Zuiderwijk, Janssen, and Dwivedi (2015) applied the UTAUT to open data technology, designed to promote the benefits of transparency, participation, and innovation; this use shares similarities with the public safety arena's need for open, transparent communications with widespread participation.

Literature Related to Key Variables and Concepts

Interoperability capabilities and performance are the two key concepts in this study of campus-based law enforcement organizations during multijurisdictional or multiagency incidents. Capabilities categorizations are the outcome of key legislative and presidential policy actions since 2001 and are described within the interoperability continuum created by the DHS (2015). Interoperability performance has been studied through after-action reports of noteworthy incidents. A serious gap in the professional literature pertains, however, to studies in the realm of campus-based law enforcement.

Interoperability Capabilities

Kuehn et al. (2011) defined emergency response interoperability capability as follows:

> The ability of disparate and diverse public safety agencies and their emergency response units to interact in emergency situations towards common goals, involving the sharing of information and knowledge between involved

> organizations and the public via defined or ad-hoc processes to achieve coordinated actions, by means of the exchange of data between their respective information and communication systems. (Kuehn et al., 2011, p. 45)

The National Task Force on Interoperability (2005) and *Oversight of FirstNet* (2013) summarized the key impediments to interoperability capabilities as follows: aging and failing communications equipment, incompatible equipment or frequencies, inadequate planning and funding, a limited and disjointed radio communications spectrum, and deficiencies in coordination and cooperation among agencies.

Interoperability policy and presidential directives. Federal policy initiatives to enable capabilities gained considerable momentum following the 2001 terrorist attacks with an emphasis on general systems coordination with state and local agencies. The President, in HSPD-5 (*Homeland Security Presidential Directive/HSPD-5,* 2003) articulated that all emergency response starts at the local level, and local response is initially responsible for coordination and control of the event. According to this presidential directive, federal response is enabled only when local or state resources are overwhelmed and federal assistance is requested. This presidential directive created NIMS and the National Response Plan (NRP). Together, NIMS and NRP provide a general systems management strategy that coordinates federal, state, and local government preparation, response, and recovery from emergency incidents. NIMS is adaptable to emergency incidents of varying complexities and sizes (*Homeland Security Presidential Directive/HSPD-5,* 2003). Implementation of this presidential directive

impacted educational institutions with the expectation that emergency response plans be developed in collaboration with other agencies and neighboring jurisdictions (Griffin, 2009).

HSPD-7, issued by the president in December 2003, established a national policy for critical infrastructure protection through the cooperative efforts of federal, state, and local governmental and private agencies. *Critical assets* were defined as energy-producing facilities, nuclear facilities, water treatment systems, and any physical or virtual asset vital to security, economic well-being, or public health and safety (The White House, 2003b).

HSPD-8 (The White House, 2003c), implemented at the same time as HSPD-7, focused on national preparedness to events, including the prevention of, response to, and recovery from terrorist attacks, disasters, and emergencies. Annex-1 supplemented HSPD-8 by providing for a national planning process in the federal government, leading to the creation of the National Preparedness Goal. HSPD-8 and HSPD-8 Annex-1 were later replaced by Presidential Policy Directive 8 (PPD-8) in 2011 (The White House, 2011), which places more emphasis on the concept that the response to incidents should be from an all-nation and all-hazards approach, which fuses together the strengths of federal, state, and local agencies to react to a crisis with a reinforcement on mitigation and resilience.

HSPD-8 initiated and also provided further definition of federal funding dissemination to state and local agencies. Three of the seven priorities of the national

preparedness goal of HSPD-8 were relevant to emergency communications: (a) improving information sharing and collaboration among responders, (b) enhancing interoperability of communications, and (c) implementation of NIMS methods (Hawkins, 2007). DHS Secretary Tom Ridge issued guidance to all state governors, indicating that, beginning in Fiscal Year 2005, in order for state and locals to access billions of dollars of eligible federal grant money to improve their communications interoperability scenarios, adoption of NIMS was required.

NIMS is still widely used today and prescribes a common operating picture as the cornerstone for standardizing interoperable communications. According to Secretary Ridge (as quoted in DHS Office of the Press Secretary, 2004), "The National Incident Management System . . . fully puts into practice the concept of 'One mission, one team, one fight'" (p. 1). A basic premise of NIMS, as of HSPD-5, is that all incidents are local in nature (Buck et al., 2006). The main components of NIMS are response preparedness; communications/information management for information sharing; resource management for personnel and equipment; command/control management primarily on-scene; and recovery from the incident, once the response phase has concluded (Anderson, Compton, & Mason, 2004). These components of NIMS function cohesively and flexibly to enable the incident management framework (DHS, 2008a). NIMS specifies communications interoperability as the ability of responders to communicate with one another. Interoperability among first responders is a critical element of all emergency response communications. Hawkins (2007) asserted that communication is an inseparable

component of command and control. Equipping for emergency response is an important phase along the NIMS preparedness cycle (DHS, FEMA, 2010). Peak, Barthe, and Garcia (2008) studied the NIMS preparedness of campus police departments and determined that 77% of campus police departments follow some of the NIMS guidelines related to coordination, mutual aid, and multijurisdictional task forces.

Funding for the interoperability initiative at the local level, following the 9/11 attacks, gained momentum through federal grants. One of the first and largest grants was the one-time funded Public Safety Interoperable Communications (PSIC) grant program through the Department of Commerce in consultation with the DHS. The grant awards, distributed in 2007, were conditioned upon the states' creating and submitting an approved Statewide Communications Interoperability Plan (SCIP) and approved Investment Justifications (IJ), prior to the release of funds. Policymakers within the states created and submitted SCIPs and IJs—initiating a plan that spearheaded the creation of a process in local interoperability collaboration and planning (Moore, 2008). Educational institutions were not always included as a stakeholder in these plans.

The creation of the SCIP provided the first investment in efforts of state executive committees to meet with government officials at the state and local level to investigate communications challenges, consult on approaches and solutions to the challenges, and create plans to improve interoperability. The overarching SCIP governance model provided two paths of technology implementation for each state to consider: a statewide shared system or a system of systems approach. The statewide shared system model

included a communications system led by the state, with state agencies on the system and the local option of election by the agencies to participate as either a primary user or a secondary user. The system of systems approach eliminated the deployment of a statewide system and required, instead, technology implementation at the local levels, with the anticipation of local coordination and cooperation to expand the system beyond a city, town, or county to a larger interconnected regional system implementation. Each model was designed to mitigate interoperability barriers among disparate jurisdictions, especially for emergency response coordination that required a multijurisdictional response (DHS, 2008a).

The success of interoperability policy to build shared open-standards systems lacked research and analysis. The only nationwide study to determine the effectiveness of the policy initiatives is a DHS baseline study, conducted in 2006. Participants in this study included 6,819 agencies. More than two-thirds of the participants reported using interoperability to some degree, but only one-third interoperated on a day-to-day basis. A large proportion (87%) of local agencies stated that they were focused on improving their interoperability and that they planned a significant upgrade to their radio system within the next 10 years (DHS, 2006). By 2008, policymakers in all 56 states and territories of the United States had developed a Communications Interoperability Plan that outlined how the state or territory would move toward interoperability with input from local, tribal, and county entities (*Assessing the framework and coordination,* 2008).

Within the realm of campus-based security, policymakers created the Jeanne Clery Disclosure of Campus Security Policy & Campus Crime Statistics Act (Clery Act) in 1990, and regularly amended over the past decades. The language in the Clery Act requires colleges and universities who provide federally assisted financial aid programs to their students to publicly disclose crime statistics and personal safety information both on campus and nearby. The Clery Act also instituted basic requirements for handling violent or emergency situations and mandated an ASR that includes 3 years of crime statistics and summaries of certain security policies. Among notable security policies included are the authority of law enforcement personnel; the relationship between campus and local law enforcement including the existence of a memorandum of understanding (MOU); and emergency response procedures, including one test per year (Higher Education Opportunity Act, 2008). Griffin (2009) noted that the authors of the Clery Act holds higher education institutions responsible for crime reporting and crime prevention through leadership within the university and in the community.

Interoperability continuum. The interoperability continuum was developed in 2004 by administrators within SAFECOM, the communications program of the Office of Interoperability and Compatibility within the DHS, as an outcome to the Intelligence Reform and Terrorist Prevention Act of 2004 and serves as an interoperability guide today. SAFECOM identified five interrelated systems that are essential to multidisciplinary and multijurisdictional: governance within the agency and between agencies, SOPs to enhance response and recovery, compatible technology attainment,

training exercises, and usage of technology and policies (*Ensuring operability during catastrophic events*, 2005). The continuum is a general system of interrelated parts that provides a pictorial view of interoperability capabilities for all first-responder communities, including campus-based law enforcement organizations. SAFECOM developed this continuum to primarily help technology decision makers to understand their roadmap toward achieving degrees of interoperability ranging from fully inoperable to fully interoperable. Standards development, including the standards-based Project 25 initiative, was a key goal of the SAFECOM administrators in an effort to facilitate large regional or statewide shared-systems deployment and to avoid scenarios where the only way to communicate was by swapping radios among responding agencies (*Project SAFECOM*, 2004). Policymakers modified the continuum in 2008 to add data elements to the technology highway (Werner, 2009). It continues to serve as an interoperability guide for assessing interoperability capabilities today (DHS, 2015; see Figure 1).

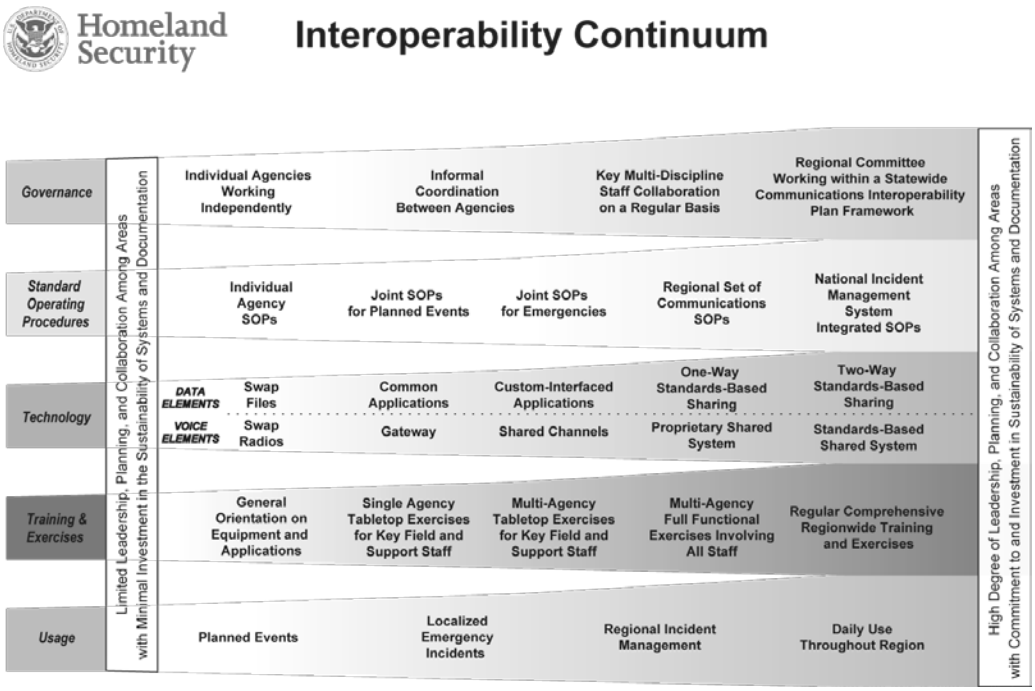

Figure 1. Pictorial description of interoperability. Each highway represents a lane toward achieving interoperability. The lane moves from left to right as increasing levels of interoperability are achieved. From "Interoperability Continuum," by DHS, 2015.

The developers of the continuum depict interoperability as a multidimensional general system with five interdependent elements, termed *lanes* or *highways*. These lanes comprise elements of interoperability; methods to improve interoperability through the creation of SOPs; technology improvements that range from inoperable to fully operable; training and exercises to practice procedures, policies, and use of technology through scenarios; and use of interoperable communications by emergency response personnel (Dwarkanath & Gusty, 2010; Miller, Granato, Feuerstein, & Ruffino, 2005). The interoperability continuum established criteria for measuring an organization's achievement toward maximum information exchange and interoperability (DHS, 2015; Dwarkanath & Gusty, 2010). The left side of the continuum reflects lower levels of

interoperability. As an agency improves interoperability, it moves toward the right side of the continuum. This creators of the interoperability continuum made a valuable contribution to the professional literature in that the continuum defines the measurement of interoperability capabilities achieved by first responders within an organization and serves as a roadmap for policy makers and practitioners for short- and long-range planning of interoperability (DHS, 2015). Each process, or highway, in the continuum contributes to the general system of interoperability.

Technology is an important medium for enhancing interoperability and serves as a critical enabler for enhanced interoperability. Although the categorical highways are also essential drivers to enhancing interoperability, none of those highways can operate without a technological backbone. In addition, those highways can be impeded by ineffective technological solutions (Dwarkanath & Gusty, 2010). Contributors to enhancing the technological capabilities include addressing the limitations of the current infrastructure already in place, costs of deploying new technologies versus benefits received from these new technologies, scalability, and sustainability. The technological voice categories on the technology highway of the interoperability continuum from least to most effective interoperable communications are as follows:

Swapping radios. Swapping radios is a simple method to achieve interoperability during an event. In this scenario, a cache of radios is held to be dispersed to agencies responding to a wide-scale event that lack the ability to communicate with other locals using their existing radios. This method is viewed as ineffective because it is time

consuming and provides limited results due to the number of radios available and the number of channels that can be used during the event (Damanik & Gunawan, 2011; Facella, 2005; Jones & McGrath, 2005; McFarland, 2007; Miller, et al., 2005; Upham, 2009; U. S. Government Accountability Office, 2007).

Deploying gateways. Operators deploy gateways during events as a temporary interoperability solution. The gateways retransmit across several frequency bands as needed and are manually set up during the event, providing a short-term solution to enhance communications (Li & Qian, 2011; Marsden, Treglia, McKnight, 2012; Wang, Ghosh, & Challapali, 2011). However, gateways are ineffective because they "require twice as much spectrum because each participating agency must use at least one channel in each band per common talk path and because they are tailored for communications within the geographic coverage area common to all participating systems" (DHS, 2008b, p. 3).

Sharing channels. Sharing channels is a method for interoperability utilized by known participants in an event because the channels are preprogrammed into the responders' radios prior to the anticipation in an event. Shared channels can also be deployed on-scene utilizing a master radio to manually clone other radios with its channel scheme. Although this method can be limited in some geographic areas due to frequency congestion, sharing channels increases interoperability. In this scenario, interoperability is achieved because agencies share common frequencies with standardized channel names, known users have access to the channels, and operating procedures are

established usually in advance of an event. However, shared channels limit interoperability because the users are not operating on a shared system; also, sharing channels is event-based rather than long-term interoperability planning (Careless, 2009; Guo & Huang, 2011; Hallahan & Peha, 2010; Lehr & Jesuale, 2009; Upham, 2009).

Proprietary shared systems. A proprietary shared system is a system that may have multiple agencies, cities, or counties using it; however, this system is not standards based. Generally, this limits the devices, or hand-held radios, that can be used on the system to the branded radios also manufactured by the same manufacturer as the system. Choice can be limited if the system is proprietary and thus constrains the procurement of components and radios for the system users. In addition, radio users in proprietary systems do not seamlessly communicate with other systems that are not of the same vintage or from the same manufacturer. This can be disadvantageous when an event is of such magnitude that it crosses multiple systems' boundaries and can require gateway deployment to tie the proprietary systems together in an event that is large enough to cross system boundaries. (Bacchus, Taher, Zdunek, & Roberson, 2010; Buracchini, 2000; Kuehn et al., 2011; *Oversight of FirstNet,* 2013).

Standards-based shared system. This method is the most advantageous scenario for achieving maximum interoperability among diverse responders who need to communicate during a wide-scale event because standards-based systems such as Project-25-compliant systems and radios provide maximum interoperability. With the proper preplanning of talk group assignments, radio users who equipment is from various

manufacturers can communicate with one another without intervention. However, standards-based systems must still be tied together in events that cross system boundaries, limiting their true effectiveness beyond proprietary systems. Frequency bands can also be an issue in shared systems, whether proprietary or standards based. In events where one system is on a UHF, VHF, or 800 MHz system, and the other system is a different frequency band, the systems have difficulty operating together. Subscriber radios that have more than one frequency band can mitigate this issue (Khan, 2011; Lin, Wu, & Jin, 2012; Moore, 2010; Rounds & Doll, 2009; Yu, Zhang, Tang, Chan, & Leung, 2009).

In 2010, the Major Cities Police Chiefs Association noted that the need for campus-based law enforcement interoperability capabilities is similar to noncampus-based law enforcement capabilities. The Association stated that guidelines for preparation and coordination should include (a) coordination and training, including joint exercises and written agreements and coordination plans, (b) interoperable communications technology and equipment, and (c) comprehensive information sharing. Administrators should write policies cooperatively between the local organizations and include specific information unique to the campus law enforcement organization, including roles, responsibilities, and procedures. In addition, MOUs should be developed to evaluate capacity and unique needs, tailored to specific events. Field training exercises should be conducted, modeling real-life scenarios to maximize preparedness among the multijurisdictional organizations, utilizing the MOUs. Interoperable communications

equipment should include channels from each organization and a mutual aid channel where available (Major Cities Police Chiefs Association, 2010).

Interoperability Performance

Authors who produced reports and analyses of widely publicized events, including the 2001 terrorist attacks along the east coast of the United States, the hurricane that struck the gulf area of the United States, known as Hurricane Katrina, and Superstorm Sandy of 2012, arrived at the conclusion that emergency responders' ability to communicate was impeded (Barnes et al., 2008; Cheng, 2013; Comfort & Haase, 2006; Hamilton & Kean, 2004; Lien, Jang, Tsai, 2009; *Oversight of FirstNet*, 2013; Simpson et al., 2010; Stephan, 2006; U. S. Senate, 2006). McKinsey (as cited in Petrescu-Prahova & Butts, 2008) noted that, during emergency response to the 9/11 World Trade Tower terrorist attack, less than half of the emergency responders were able to decipher and understand the communications over the radio system. More than 60 police officers and 121 firefighters did not hear the calls to evacuate, and radio-communications failures may have been partly accountable for the loss of life at the World Trade Center, which included 343 firefighters (Comfort & Kapucu, 2006). The U.S. Senate (2006) revealed that both intra- and interagency communications were impeded during Hurricane Katrina and the months following the natural disaster. The communications interoperability failures experienced during Hurricane Katrina, in 2005, were due to a lack of effective communications planning (Lester, 2007). Similarly, during the response to the bombing of the Oklahoma City Alfred P. Murrah Federal Building, in

1995, first responders could not communicate between responding agencies because the radios were on different frequencies and different radio systems (Oklahoma City Police Department, 1995). In 2008, Contestabile testified before Congress that little action has occurred:

> We sit before you almost seven years to the day of one of the most tragic events on American soil: September 11, 2001. Following that event there was significant rhetoric about the failures of public safety communications systems and the need to improve them throughout the country. While there may have been small pockets of improvement in limited areas throughout the country, most of the rhetoric has not resulted in action. (*Interoperability in the next administration*, 2008, p. 3)

In his congressional testimony, Boyd remarked that billions of dollars have been invested in existing public safety communications systems to enhance interoperability, and this amount excludes additional expenditures incurred for training, maintenance, or staffing. The replacement and upgrading of communications infrastructure to enhance interoperability will, in Boyd's opinion, take decades to accomplish (*Interoperable communications,* 2009, p. 292). Within state and local governments, according to the *Tenth Anniversary Report Card*, citing progress made since the 9/11 terrorist attacks, both unity of command and efforts toward interoperability remain unfinished (Bipartisan Policy Center, 2011). In citing the commission's recommendations, the Bipartisan Policy Center (2011) highlighted that implementation continues to languish and stall. The

authors further emphasized that technology deployment across urban areas, regions, and states lacks coordination and planning. In 2012, the Office of Inspector General (OIG) concluded that, even within the DHS agencies, interoperability was a distant goal. The report revealed that (a) only 1 of 479 radio users could access the predetermined common channel to communicate, (b) only 20% of the radios contained the correct channel programming, and (c) the DHS governing structure for interoperability was ineffective (DHS, OIG, 2012). In the two years following the report, the DHS had made little progress toward achieving interoperability (DHS, OIG, 2015). The failures of the DHS to provide interoperability within its departments has led to the newly enacted Public Law 114-29 (H.R. 615, 2015), which amends the Homeland Security Act of 2002 and requires the DHS to make substantial progress in implementing interoperability. The congressional hearing on FirstNet (*Oversight of FirstNet*, 2013) concurred with previous accounts that emergency communications by first responders continued to impede response and recovery.

Conversely, the multijurisdictional emergency response to the 2007 bridge collapse along Interstate-35, in Minnesota, was hailed as a success because the fire department could communicate over the radio system with most mutual-aid responders on the 800 MHz radio system (Cook, 2009); however, some responders did not have access to the system. In addition, the after-action report of the emergency response to the Pentagon terrorism attack in 2001 noted that the majority of the first responders at the scene were able to communicate effectively and interoperate with one another (Arlington

County, 2002). Interoperability plagued police officers during the Ferguson, Missouri, riots because not all officers were able to receive information on their radios and had to rely on information obtained in person. In addition, the state police radio system required adjustments and patches during the police response. The report contained the conclusion that interoperability issues were significant because of different technologies, lack of available mutual-aid channels, and the wide range of responding organizations on-scene (U. S. Department of Justice, 2015a).

Reports of campus-based communications incidents included the 1999 Columbine High School shooting in Littleton, Colorado, where incompatible radio systems caused mutual-aid slowdowns among the 46 public safety agencies that responded; command posts sent runners to communicate information to those who were not on the same radio systems (Erickson, 2001). In 2007, an emergency response to a gunman on campus at St. John's University in New York was hailed as a success because of the strong partnership between campus security personnel and local law enforcement (Major Cities Police Chiefs Association, 2010). However, that same year, 2007, at a different university campus, Virginia Tech, an emergency response to a shooting was hampered due to interoperability issues, leading to a less than effective coordinated response (Systems Planning Corporation, 2009).

Institutions adopting the Clery Act and subsequent policy legislation (following the 2001 events) continue to suffer interoperability failures, as shown in the 2010 University of Texas at Austin emergency response to an active shooter on campus.

Although the university planned for multijurisdictional law enforcement response, it failed to execute during an active-shooter situation because responders did not know on which channel to communicate, dispatch could not monitor or transmit on the selected channel, and the command post did not know if everyone had switched to the chosen channel (University of Texas Police Department, 2010). The after-action review of the 2012 mass shooting at Sandy Hook Elementary School revealed that multiagency capabilities were not present because responders had difficulty communicating as they were operating on different frequencies and different radio systems, and some agencies lost communication within the buildings (Sandy Hook Advisory Commission, 2015; Sedensky, 2013).

In an after-action report of the active shooter response to a student who shot and killed another student and injured a teacher before killing himself at Reynolds High School in 2014, authored by Multnomah County (2015) in Oregon, several major challenges were lessons learned from this incident. The incident command structure (ICS) at the incident site was challenging and required coordination of nontraditional response partners in the ICS, radio and cellular phone reception was challenging, the process for developing the common operating picture for shared situational awareness created communications difficulty between Multnomah County's emergency operations center, the school officials, and the responders on scene due to additional incident command posts established by the school district office, and Gresham Fire and Emergency services. In addition, the police department and responders were on different

radio frequencies and could not communicate directly. Those agencies utilizing the separate frequencies also saturated the channels leading to distorted and ineffective communications. Radio communications within the school buildings were poor because the school buildings lacked in-building repeaters to transmit and receive voice traffic over the radio system (Multnomah County, 2015).

In 2016, the Kalamazoo, Michigan mass shooting incident by a 45-year old male Uber driver created a fluid law enforcement event involving response from six law enforcement organizations including two campus-based law enforcement agencies: the Western Michigan University police department and the Kalamazoo Valley Community College public safety department. The suspect was responsible for shooting several people, while also picking up and dropping off passengers at a Western Michigan University dormitory. In a report published after the event, interoperability delays were created for several reasons. First, the Kalamazoo Valley Community College was called upon by the Michigan State Police to set up the emergency operations center on the Groves campus due to its close proximity to one of the shooting scenes. However, this plan was abandoned due to the issues with the 800 MHz signal on that campus and an alternate location was established. Second, the responding agencies cited lack of frequent training and exercises to prepare for an event of this magnitude. Additional reasons mentioned including the need for a fully integrated multiagency command management structure, standardized policies and procedures, and the ability to manage an influx of

data from voice, email, text, pictures and video and the transmission of this information to front line personnel (Straub, Cowell, Zeunik, & Gorban, 2017).

Gaps in the Literature Promoting Positive Social Change

Few scholarly studies have been published analyzing the interoperability between campus-based law enforcement agencies and neighboring agencies and jurisdictions. Researchers with existing studies do not adequately address the collaboration between local law enforcement and campus-based police agencies. Peak et al. (2008) and Reaves (2015) touched on campus-based agencies through quantitative descriptions, but they missed subsequent qualitative information, including capability assessments, collaboration, and performance. In the updated statistical report, Reaves noted that 70% of campus law enforcement agencies had some form of agreement or operating policy with outside law enforcement agencies, and half of campus law enforcement organizations on campuses with student populations of 2,500 or more used radio systems that were compatible with neighboring responding agencies. Reaves stopped short of providing an analysis of the effectiveness of collaboration or interoperability. Peak et al. (2008) utilized an online survey tool to gather descriptive information concerning demographics and issues of concern to campus-based law enforcement organizations. Among the chief concerns cited was lack of preparedness training for large-scale events. Notably, no analysis was conducted regarding collaboration or multijurisdictional interoperability capabilities and performance.

Kapucu and Khosa's (2013) research on disaster resiliency and preparedness identified key elements to producing a disaster-resilient university (DRU). Through an online survey, distributed to DRU members of a listserv, they recruited participants that were in the professions of emergency management and risk management, and found key indicators for creating a prescription for disaster resiliency. High-impact indicators related to interoperability were building strong community partnerships, managing information, and leadership structure. Interoperable capabilities were encapsulated in the need for training and exercises. The researcher's results showed that more than 75% of the participants reported regular exercises and training to demonstrate capabilities, and 96% of the campus-based participants indicated collaborative partnerships with local police departments. However, Kapucu and Khosa (2013) used only self-reported data of capabilities and opinions and did not correlate these data with performance results.

Giblin, Haynes, Burruss, and Schafer (2013) studied critical-incident preparedness and multijurisdictional collaboration, using paired survey response data between 116 campus-based public safety agencies and their matched local law enforcement departments. The study was limited to campuses with greater than 2,500 student enrollment, nonprofit, and awarding either 2- or 4-year degrees together with their matching local law enforcement agencies. A key result of the study revealed that relying solely on the campus-based law enforcement organization self-reports to measure communications capabilities can be misleading. Performance data were not studied. The researchers noted that discordance existed among planning activities, advanced written

communications plans, and the duties and responsibilities of each agency during a multiagency response. Findings from this study also pointed out the importance of joint training activities.

Researchers to date have synthesized the elements of collaboration, interoperability planning, leadership, and training and exercises as closely aligned with the concept of interoperability capabilities (Manoj & Baker, 2007). However, the synthesis of the capabilities with the actual performance of a campus-based law enforcement agency during a multiagency or multijurisdictional event has been neglected and remains to be studied. This research study pursued answers to key questions regarding the determinants of interoperability capabilities and barriers to full interoperability that have not been fully explored in previous studies. To address such critical gaps in the literature is both important and timely. Research focused on the performance of campus-based law enforcement organizations, when faced with a multiagency or multijurisdictional event, has been limited to after-action reviews, many of which remain unpublished and inaccessible for analysis. Despite policy creation by administrators at the federal, state, and local levels, interoperability performance among campus-based law enforcement agencies has not been researched. Employing a framework of GST and the UTAUT model as the conceptual framework for this study enabled me to answer the research questions regarding capabilities, barriers, performance, and policy improvements more fully.

Summary and Conclusions

Throughout the literature, barriers to interoperability among first responders operating in an unplanned multijurisdictional or multiagency event were cited. Reaves's (2015) quantitative study of campus-based law enforcement organizations provided ample evidence along with a multitude of after-action reports whose authors documented that shortcomings existed and barriers stood in the way of full interoperability during response events. The challenges of interoperability are well-known; however, research is lacking that synthesizes capabilities and performance of campus-based law enforcement organizations, including their perceptions of barriers to interoperability. Little is known about the perceptions held in campus-based law enforcement organizations regarding policies that could improve interoperability. This study fills a gap in the current body of research and enhances understanding while extending the knowledge about the capabilities and performance of campus-based law enforcement organizations.

In this chapter, I provided a description of the literature search strategy, followed by a synthesis of a conceptual framework based on GST and the UTAUT model. I reviewed pertinent literature and prior studies related to communication and law enforcement technology acceptance in light of the framework's concepts. Key concepts of interoperability capabilities including policy and presidential directives were researched concluding with the interoperability continuum. Next, interoperability performance was examined through key after-action findings over the last 15 years. The chapter closed with an explanation of the gap in the literature regarding interoperability

of campus-based law enforcement organizations and a chapter summary. In Chapter 3, I present the research methods for this study, including a rationale for choosing the qualitative multiple case study approach. Next, a description of the role of the researcher is provided along with a restatement of the research questions and discussion of data collection and data analysis procedures. The measures taken to assure ethical procedures in the research are described including safeguarding the participants' rights and anonymity.

Chapter 3: Research Method

Introduction

The purpose of this qualitative case study was to explore the perceptions of participants from campus-based law enforcement agencies about interoperability capabilities and shared performance between the campus-based law enforcement organization and local law enforcement organizations. I also explored potential gaps that impede the information and communication flow to and from campus-based law enforcement agencies during multiagency or multijurisdictional events.

In this chapter, I present an overview of the research methods for this study and provide a rationale for choosing the qualitative case study design. I present the research questions guiding this study and discuss the role of the researcher and describe data collection and data analysis procedures, including the use of face-to-face interviews and triangulation with other data sources such as documents and archival materials. Trustworthiness is discussed and the steps taken to ensure validity and reliability of the data, including member checking. I also describe the measures taken to protect the participants' rights and anonymity.

Rationale for Qualitative Research

The qualitative exploratory multicase method was chosen for this study because it was the best fit to explore the problem of interoperability performance and to answer the research questions posed. Yin (2013) notes by applying multicase exploration with cases from multiple sources, the researcher can create a holistic picture with in-depth

information. The qualitative research approach enabled inquiry through open-ended questions and accommodated the exploratory characteristics of this study. The qualitative multicase approach assumes that there is not one measured phenomenon at a single point in time, but rather multiple constructions and interpretations of the data that can change over time or across cases (McNabb, 2013). This method aligned with my goals and the purpose of this study.

McNabb (2013) notes that a function of qualitative research is exploring interpretations of reality within a context at a defined point in time. Gathering descriptive and illustrative data are a central part of the qualitative design (Patton, 2015). The qualitative process allowed me to create a description of the interactions affecting interoperability capabilities and performance, which fit the goals of this study. In addition, the qualitative design enabled me to describe the circumstances of interoperability on the basis of interviews and archival documentation, identify themes during data analysis, and derive conclusions. I chose the exploratory method for this case study research because of the apparent lack of academic research devoted to the problem at hand.

Selecting the appropriate research method required considering alternative options of quantitative and mixed methodologies (McNabb, 2013). I considered a quantitative design, but deemed it inappropriate for studying the experiences, attitudes, and perceptions of participants from the selected cases because a quantitative design would have resulted in numerical measurements with deductions from correlations among

variables. Tracy (2012) proposed that the quantitative approach generally yields statistical data and employs a post positivist framework for expanding knowledge, using methods such as surveys and experiments. In quantitative methods, data collection is done with validated instruments to reveal numerical and statistical values with deductions from correlations among variables (McNabb, 2013). In addition, a quantitative research method was inappropriate for this exploratory study because the focus of the study was not on evaluating the effect of a stimulus on an outcome (Vanderstoep & Johnston, 2009). Important factors such as perceptions of impediments to interoperability would remain outside the context of a quantitative design because the distinctions and interactions involved are not easily quantifiable. Tracy (2012) remarks that research on perceptions or ideas is best performed through the qualitative method in order for the researcher to capture rich detail. While some studies of interoperability, undertaken under the auspices of the DHS and the U. S. Department of Justice, have been quantitative in nature, no qualitative studies have focused specifically on campus law enforcement interoperability capabilities and performance.

A mixed methods design was also considered for this study, but this approach was rejected for two reasons. First, researchers utilizing the mixed methods research framework employs the use of both quantitative research (i.e., statistics through surveys or experimentation), and qualitative research (i.e., understanding the meaning behind the statistics), as explained by McNabb (2013). The aforementioned discussion of the reasons why quantitative inquiry is not appropriate in this study applies here as well. Second, the

purpose and the goals of the study were focused on a rich and deep exploration to answer the research questions. Numerical values are not included in this research study because rich detail and conceptual understanding is a primary objective. Moustakas (1994) remarks that qualitative studies are not numerical. Because the focus was to explore the ways in which the participants construct meaning based on the phenomenon under study, the qualitative method fit the philosophy of this research as supported by Tracy (2012).

Rationale for Qualitative Exploratory Multicase Study

Tracy (2012) asserted that the goal of qualitative research is experiential meaning making, and there are five main approaches to qualitative inquiry. The first approach is through a phenomenological study, which examines the meanings of lived experiences about a concept or phenomenon. Grounded theory is the second approach, which seeks to generate a substantial discovery or theory. The third approach is biography; it focuses on the life of an individual. Ethnographic studies comprise the fourth approach, which describes a group or cultural system, seeking interpretation. The fifth approach is the case study, which focuses on describing and explaining a phenomenon, using a single case or multiple cases, with data collected from multiple sources (McNabb, 2013).

This study did not involve the examination of different cultures; the ethnographic design was, therefore, not applicable. The grounded theory design was also not appropriate because I did not seek to develop a new theory. The biographical approach was not appropriate because the research goals were not focused on the life experiences of an individual. The phenomenological approach was rejected because this study did not

focus on the meaning of lived experiences, subjective interpretations of reality, or the understanding of how individuals view themselves (Willis, 2007). Because this study's core theme was focused on understanding the experiences made within agencies, or cases, the case study approach is the best design. Through this study, I described the capabilities and performance of interoperability within campus-based law enforcement agencies with the main focus was on gaining a better understanding of the cases and examining their functioning and activities.

McNabb (2013) stated that case study research "in public management has proven to be an effective way of identifying and disseminating knowledge on the successes and failures of public managers" (pp. 2-3) in organizations. McNabb (2013) further explained that case study inquiry is an accepted form of inquiry and Public Administration Review (PAR) by stating that PAR "has accepted the case study method as a mainstream research approach" (p. 4). Most importantly, Gerring (2004) pointed out that the case study method is the most appropriate method when the researcher studies performance measurement. The case study approach was, therefore, the best qualitative inquiry method for this study.

Case study research can be grouped into three main categories: interpretive, critical, or exploratory (McNabb, 2013). In interpretive case studies, the researcher goes beyond explaining the phenomenon and proceeds to interpreting the meaning of the phenomenon. Interpretive studies are context laden with a phenomenon under constant change; they are used primarily to study culture and social relationships (McNabb, 2013).

Critical research studies are used to expose alienating or harmful social conditions, with the purpose to emancipate members of a society from harmful conditions (McNabb, 2013). White and Adams (1994) further explained that the primary objective of this type of research is to encourage people to change their beliefs and thereby change their circumstances. The exploratory case study, according to McNabb (2013), is the most common research strategy, "conducted to develop causal explanation of some social phenomenon" (p. 28). McNabb goes on to explain that an exploratory case study seeks to "gather fundamental information about a topic, its contributing factors, and the influences it might have on various outcomes" (p. 29).

The critical research design was not appropriate for this study because the population studied was not under duress or harmful conditions. The interpretive research study was not appropriate because the phenomenon of interoperability capabilities and performance is not constrained to social relationships alone. The exploratory case study was the most effective research design for the study because I sought causal explanations of interoperability gaps and performance by gathering information about the phenomenon, the contributing factors, and influences.

A qualitative research design utilizing the case study method is necessary in order to explore issues and perceptions in depth (Yin, 2013). McNabb (2010) remarked that "a goal of case study research is to describe what is happening, why it is happening, and how it happens in an organization" (p. xvix). The case study method is one of the most popular approaches in public administration research, tracing its roots back to an

administrative research study at Harvard University, in 1948; the case study method was later promoted as a credible way to perform public administration research by Harold Stein in 1952 (McNabb, 2013). Further, Yeager (as cited in McNabb, 2013) noted that case studies share characteristics of interviews, archives of documents and other media, and observation.

Researchers employing the case study approach can choose between two different methods of case selection: a single case or multiple cases for a multicase study. McNabb (2013) asserted that three main points determine the decision to use a single case versus a multicase research design. First, the single case is the preferred method when the intent of the case study is to broaden, challenge, or confirm a well-developed theory using a clear hypothesis or proposition. Second, single case design should be used when studying a rare or unique phenomenon. Third, the single-case research design is appropriate to reveal information that is not fully understood.

Conducting multicase research is similar to conducting experiments on related topics and should be used to develop a greater understanding of the phenomenon (McNabb, 2013). In a multicase study, the phenomenon can be studied in varied settings (Stake, 2013). Researchers using the multicase design follow the same data collection methods as the single-case design; however, multi-case design is employed when a single case will not provide enough evidence of the issues the researcher wants to emphasize and a more robust analysis is desired (McNabb, 2013).

The objectives for this study were to deepen the understanding of the phenomenon of interoperability capabilities and performance, to draw out the issues through multiple perceptions of the problems, to identify the commonalities and differences, and to frame the issues with core concepts. McNabb (2013) and Stake (2013) recommended that the best method to achieve those objectives is the multicase exploratory design. The multi-case method was therefore most appropriate for this study.

Role of the Researcher

My role as the researcher was to investigate the phenomenon under scrutiny and seek answers to the questions posed for the study. I was engaged in the research environment through interpreting information from document reviews and interactions and discussions with participants. Qualitative findings are dependent on the researcher's abilities to draw conclusions and interpretations (Tracy, 2012).

I have more than 10 years of experience in public safety communications interoperability, which I acquired through my positions in account management for two major suppliers of communications solutions. My present position as a senior account manager includes interacting with and recommending solutions to local public safety agencies in northern California and Texas. Although I am a professional in the public safety technology industry, I had no current or previous relationships with any of the cases selected for participation in this study.

Research Questions

The following research questions guided this study:

1. What are the interoperability capabilities of campus law enforcement agencies in California as viewed by the agency?
2. What are the participants' perceptions regarding the barriers to achieving full interoperability capability of campus law enforcement agencies in California?
3. What is the interoperability performance of campus law enforcement agencies in California during multiagency or multijurisdictional response?
4. How can government-wide policies and procedures improve the interoperability performance of campus law enforcement agencies in California?

Data Collection Procedures

Before data collection began, I reviewed the laws of the state of California to ensure compliance with all applicable state and federal regulations. Complying with state and federal regulations includes obtaining the informed consent of participants and providing them with notices regarding confidentiality. This study conformed to the National Institutes of Health (NIH) training conducted for Walden researchers. Approval to conduct this study was sought from the Institutional Review Board (IRB) of Walden University prior to conducting any data collection.

I obtained contact information for potential cases and participants in this study from the campus' Websites. To obtain a list of potential participants, a list of universities

in California that have a campus-based law enforcement agency was compiled with Microsoft Excel. The list contained key distinguishing dimensions in order to utilize maximum variation sampling (Patton, 2002). The dimensions were geographic location, law enforcement agency size, type of university (private or public) and whether the university is in an urban, suburban, or rural setting. Participants were purposefully selected from the list to achieve a balance among the dimensions. The letter of invitation was transmitted through e-mail to potential cases within the campus-based law enforcement agencies to explain the study and ask for participation. Letters of invitation were sent and interviews conducted until thematic saturation occurred.

Participants were contacted by telephone or e-mail with a request to set an appointment to discuss the study. The participants were emailed an invitation to participate in the study with informed consent and the demographic survey. The questions regarding the participants' demographics pertained to (a) the name of the agency the participant represents, (b) how long the participant has been employed at the agency, (c) the size of the agency and the numbers of sworn and nonsworn officers, (d) the type of radios and radio systems used, and (e) confirmation that a multijurisdictional event involving the agency has occurred within the past 5 years survey (see Appendix A). If the participant met the inclusion criteria, specifically an affirmative response to (e), the researcher set up an initial interview to last no more than 1 hour at a time and place convenient for the participant.

The interview began with a reiteration of the purpose of the study and informed consent, as explained in the initial e-mail invitation. The participant's answers from the demographics questionnaire were discussed and confirmed (see Appendix A). Upon completion of the demographics survey and if the case met the inclusion criterion of a multijurisdictional event within the last 5 years, an appointment was set up with the participant at a mutually agreeable time and place. If the case did not meet this criterion, another case was selected. Upon informed consent from the participant, the appointment commenced with a semistructured interview protocol conducted in person.

The primary data collection method was an in-depth semistructured interview utilizing my research protocol (See Appendix C). The interview protocol, which was developed prior to conducting the interviews, consisted of a research guide that included sections for notes for the researcher, the interview method, the interview time and place, the interview overview, components of the interview, and the interview questions (see Appendix C). This interview consisted of open-ended questions to encourage participants to answer the questions in detail. This protocol was used to guide the interview and facilitate consistency of interviews across the cases. For the sake of confidentiality and the protection of the participants' rights and anonymity, the cases and the participants within the cases were given pseudonyms, marked as C1 to C10.The interview questions drove the conversation between researcher and interviewee, giving me opportunity to ask for more information to enhance richness of detail. In interviews, probing for additional details and depth is appropriate (McNabb, 2013; Stake, 2013). The interviews were

scheduled to last approximately 1 hour and were digitally recorded. Each participant was asked at the beginning of the interview for permission to record the interview (Blau, Elbow, & Killgallon, as cited in McNabb, 2013). In addition, a field journal with reflective notes was archived regarding personal thoughts, impressions, and observations made during the interviews.

I supplemented the information from the interviews with documents and archival data. McNabb (2013) states that information should be gathered from several sources. Marshall and Rossman (1999) noted that document review strengthens the research and permits data triangulation for corroboration of conclusions. I collected documents to review relevant to the cases sampled from the public domain. The types of documents collected for each case included (1) a list of frequencies in use by each case and its local mutual aid partners within the region published by the Federal Communications Commission (FCC) and (2) the most recent ASR for each case, published on each case's university website. The list of frequencies published by the FCC represents the best source of data for understanding the types of radio frequencies in use for each case. The FCC is the authoritative source for this information. The ASR is an annual disclosure required of the Clery Act for all colleges and universities that receive federal funding. This report must include the annual crime statistics for 3 calendar years and include details on efforts taken to improve campus safety. Specifically, this report is required to include a statement of the policies concerning campus law enforcement and the working

relationship with state and local police agencies and whether written agreements exist between the agencies.

Each participant was given the opportunity to review the transcribed interview and make any corrections to answers to the interview questions. Participants could return any comments or corrections to the researcher by email or postal mail. Participants exited the study at the conclusion of the interview validation and document collection period. Participants will be debriefed by receiving a two-page summary of the key results from the study once the study is published.

Trustworthiness

Issues of trustworthiness of the study might involve credibility, dependability, confirmability, and transferability. Credibility (or internal validity) involves the believability of the research and can be enhanced by saturation of themes and data triangulation of interview and archival information (McNabb, 2013; Thomas & Magilvy, 2011). Transferability refers to the applicability of the results to other similar settings or contexts (Thomas & Magilvy, 2011). Transferability was achieved through a thorough and thick description of the research context and the assumptions made and a deep characterization of interview results. Thick description and richness in detail enhance transferability (Creswell, 2013; Tracy, 2010). Transferability was also enhanced by aiming for maximum variation during participant selection (e.g., geographic location, size of agency within the campus).

Dependability exists when a subsequent researcher can follow the decision trail of prior research (Thomas & Magilvy, 2011). The issue of dependability was addressed by accounting for any changes during the data collection phase and an assessment of the potential impact of such changes to outcomes of the study. Dependability was also addressed with preservation of tape recordings, transcriptions, audit trails and triangulation, and allowing the participants to review their transcripts for accuracy.

Confirmability refers to the extent to which the results of this research can be corroborated by other researchers undertaking similar studies, as well as by the participants in the current study. Confirmability exists when credibility, dependability, and transferability are also present (Thomas & Magilvy, 2011). In this study, I addressed confirmability by documenting the procedures used to check the collected auditing the data collection and analysis procedures for bias or distortion. The participants also had the opportunity to review their interview transcripts. In addition, confirmability was strengthened through the use of reflexivity, which I exercised by reporting preconceptions, beliefs, and values during the research process.

Data Analysis

Data analysis was comprised of information obtained in interviews and through the document review to answer the research questions posed for the study. I used NVivo-11 for Microsoft Windows to transcribe, organize, and analyze the content obtained from interviews, surveys, and documents. The cases were coded with pseudonyms to protect the identity of the participants and the names and locations of the agencies constituting

the cases. Yin (2013) recommended that applying a coding scheme with a database allows for analysis of large amounts of data in a qualitative study.

The interview recordings were transcribed using NVivo and returned to the participants for confirmation of accuracy. Any necessary clarifications were conducted through follow-up interviews either in person or by phone. Once validated as an accurate transcription of the interview data, I analyzed the responses given in answer to the interview questions and explored factors and themes of interoperability capability and performance. This analysis was conducted in light of the conceptual framework of this study, which is based on the GST (von Bertalanffy, 1968) and the UTAUT model (Venkatesh et al., 2003).

Document review included documents, reports, listings of radio frequencies in use by the participants, and any other unobtrusive written or visual materials about the cases, which I collected where available. Webb, Campbell, Swartz, & Sechrest (2000) noted that documents can be written, visual, or audio in nature. Web pages and documents used for document analysis were gathered using NVivo's NCapture. I used inductive reasoning to develop patterns and correlations in order to draw conclusions. Yin (2013) highlights the importance in inductive reasoning in qualitative analysis. I coded the data to identify themes to be stored in nodes and later connected through patterns to develop explanations and theory.

Case Selection

The sampling technique used in this study was nonprobability sampling, or purposeful sampling employing maximum variation. Emmel (2013) noted that purposeful sampling allows the researcher to best answer the research questions by selecting cases that are rich and provide the best insight. Patton (as quoted in Emmel, 2013) remarked in an earlier work, "The (purposeful) sampling strategy must be selected to fit the purpose of the study, the resources available, the questions being asked, and constraints being faced" (p. 34). Further, Patton (2015) emphasized that purposeful sampling is appropriate when the researcher is focused on a distinct population. Patton (2002) synthesized that maximum variation sampling from diverse cases can produce significant common patterns that “cut across cases and derive their significance from having emerged out of heterogeneity” (p. 235). Because sample-size decisions regarding the number of cases in a qualitative study should reflect the study's purpose (Suzuki, Ahluwalia, Kwong-Arora, & Mattis, 2007) and there is no immutable rule for the number of cases to include (McNabb, 2010), I selected cases until thematic saturation occurred. In studies involving the perceptions of participants, 10-12 cases have been deemed appropriate for saturation (Creswell et al., 2007).

The target population for this qualitative case study was campus-based law enforcement agencies at 4-year universities in the state of California. To be included in the study, the case must have experienced an interoperability event in the last 5 years that required multiagency or multijurisdictional response. In addition, I achieved balance by

including cases from rural, suburban, and urban schools, schools with various agency sizes, and geographic dispersion throughout the state. Trade schools, K-12 schools, and community colleges are excluded from the study.

The participants that were selected for the interviews had relevant knowledge about their agency including interoperability capabilities and performance. The position and responsibilities of the participants were characteristically among the supervisory or command staff of the agency. Position titles of the participants included Sergeant, Lieutenant, Captain, Assistant Chief, Chief, or Director. The participant also had knowledge about one or more interoperable events within the last 5 years at their respective campus. All participants in this study were volunteers, and no remuneration was offered for participation.

Informed Consent and Ethical Considerations

Approval by the IRB of Walden University was obtained to conduct the study under its auspices. The IRB approval number was 05-19-16-0142648. I followed all institutional guidelines and the laws of the state of California. I was certified by the NIH to conduct research with human subjects (see Appendix B). Participants in this study were adult volunteers from campus law enforcement agencies in the state of California. This study did include any participants from vulnerable or protected populations.

Tracy (2012) pointed out that all participants must consent to take part in the study and have the opportunity to withdraw at any time. I explained the importance of informed consent in the e-mail invitation and again at the beginning of each interview. I

obtained informed consent before the commencement of the interview. I also informed the participants that they can elect to withdraw from the study at any time and that they may choose not to answer any of the questions in the study with which they felt uncomfortable (Ritchie, Lewis, Nicholls, 2013). All communications with participants was honest and open, with no compensation provided for participation in the study, and the participants were protected from any harm the study could inflict on their lives. I assured confidentiality and the participants' anonymity (Patton, 2015) by using codes and pseudonyms, instead of the participants' names. No information was used that could identify either the participants or their agencies.

The results of the study were reported in aggregate form. I also informed the participants about my own employment and my employer and assured them that this research study is independent of and not affiliated with my employment; it was conducted as part of the requirements of my doctoral studies at Walden University. Computer-stored data were password protected, and all audio recordings on hard media and hard-copy files were stored in a locked file cabinet. Access was restricted to myself, as the researcher of this study. All materials relevant to this study will be retained in a locked cabinet for a period of 5 years, as required by the IRB. Five years after completion of the study, the data will be destroyed and rendered unreadable.

Summary

In this chapter, I presented the research methods for this qualitative multicase study, including a rationale for choosing a qualitative exploratory multicase design. I

provided a description of the role of the researcher and a restatement of the research questions. I described the data collection und data analysis procedures and discussed issues of trustworthiness and the measures taken to protect the participants' rights and anonymity. The results of the study are reported in a future chapter. The research questions are answered and conclusions drawn based on the findings. Recommendations are offered for practical application and further research on this topic.

Chapter 4: Findings

Introduction

The purpose of this qualitative case study was to explore the perceptions of participants from campus-based law enforcement agencies about interoperability capabilities and performance between their campus-based law enforcement organization and the local mutual aid organizations when involved in a multiagency or multijurisdictional event. The potential gaps that impede the information and communication flow to and from campus-based law enforcement agencies during multiagency or multijurisdictional events were examined. Through the perspectives of the campus based law enforcement population who have been involved in at least one multiagency or multijurisdictional event in the preceding 5 years, interoperability capabilities and performance were explored to answer the research questions.

The following research questions were addressed by this study:

1. What are the interoperability capabilities of campus law enforcement agencies in California as viewed by the agency?
2. What are the participants' perceptions regarding the barriers to achieving full interoperability capability of campus law enforcement agencies in California?
3. What is the interoperability performance of campus law enforcement agencies in California during multiagency or multijurisdictional response?

4. How can government-wide policies and procedures improve the interoperability performance of campus law enforcement agencies in California?

The primary data were obtained from semistructured interviews with participants and archival data; each audio recorded interview was transcribed. During the interviews, the participants described their perceptions of their interoperable capabilities and performance when involved in multijurisdictional or multiagency response events. Archival documents provided triangulation of interoperable capabilities and complemented the interview data. The collected data were thematically analyzed within the cases and cross-case analysis was performed. I explored the issue of interoperability through multiple perceptions of the issues achieved through a multicase comparative design as recommended by McNabb (2013) and Stake (2013), I identified the commonalities and differences, and framed the issues with core concepts and themes.

This chapter is divided into eight sections. In the first section, I introduce the findings and present the research setting. In the second section, I describe the demographic features of the cases. In the third section, I describe the methodology and procedures that I used to collect, organize, analyze, and interpret the data. I discuss variations in data collection, and I also describe the steps taken to protect participant confidentiality. In the fourth section, I describe the procedures employed to enhance the rigor of the research trustworthiness evidenced through credibility, dependability, confirmability, transferability and reliability. In the fifth section, I present the data

analysis followed by the findings of the study to address the research questions. In the final section, I provide a summary of the research findings.

Setting

This study took place in the state of California. The 10 participants were from campus based law enforcement agencies of 4-year universities. I conducted face-to-face interviews over a period of four months from October 2016 to January 2017; interviews were recorded and held at the place and time chosen by the participants. The setting of the interview was chosen by the participant and provided a safe environment conducive to exploration of the research questions without interruption or undue stress to the participant. Miller (2017) highlights that rich detail can be obtained from face-to-face interviews and the social interaction can build rapport. The face-to-face interviews enabled me to establish a rapport with the participants, interlace prompts where needed during the questioning, and capture the tenor of the responses and the nonverbal body language throughout the interview.

During the period of the study, personal and organizational conditions remained steady and without significant influence on participants or their experience at the time the interviews were conducted. In addition, conditions remained steady between the time of the interview and return of the interview transcripts to the participants. Participants were still serving in their roles at leader of their law enforcement organization without change to their role or organizational structure. No adverse or significant events transpired between the interview and when I returned the transcripts to the participants.

Demographics of Research Participants

The selection criteria for inclusion in the study was that of chiefs of police or similar position who were currently employed at campus based law enforcement agencies of 4-year universities in California, had the knowledge of their agency's interoperability capabilities and performance, and had experienced at least one multiagency or multijurisdictional event in the preceding 5 years. I purposely selected participants that I had no prior relationship with or had no direct contact with through my employment or trade association membership. Purposeful recruitment of participants took place through email invitation and telephone.

Eighteen chiefs were contacted to participate in the study from a population of 34 California 4-year universities with campus police departments. Two recruits declined to participate, and 11 chiefs of police responded to the invitation to participate in the research study. Ten participants consented to the study. Six chiefs did not respond to the invitation. Of the two chiefs that declined, one cited a busy schedule as the reason not to participate, and the other chief stated a lack of time and that she would only participate if I was a student at her university. One participant proceeded through the demographic questions but did not consent to the study. Recruitment and participant size characteristics are found in Table 1.

Table 1

Recruitment and Participant Characteristics

Size of law enforcement agency within campus	Number of Campuses	Contacted	Participated
All Campuses	34	18	10
Number of law enforcement employees			
Less than 26	8	4	2
26-50	17	10	5
Greater than 50	9	4	3

To protect confidentiality, I did not include the names of the participants in the research notes or transcripts, and instead assigned labels to the participants as Case 1 through Case 10, and represented as C1 through C10. Of the 10 chiefs that consented to participate, two were women and eight were men. To further protect participants, the gender of the participant was not identified and all participants were labeled the pronoun "he" or "his" including the two female participants. Length of employment at the agency ranged from 8 months to 23 years. The size of agency ranged from one to 115 sworn officers and nine to 120 unsworn officers. All participants reported using radios and radio systems as a communications medium. All participants affirmatively stated they had knowledge of their agency's interoperability capabilities and performance and had been involved in at least one multijurisdictional or multiagency event in the last 5 years. Participants were purposefully chosen and the balance of participant selection was achieved with representation of participation from rural, suburban, and urban schools, agency size, and geographic dispersion throughout the state.

The participants responded affirmatively when asked if their agency had been involved in a multijurisdictional or multiagency event in the last 5 years. All participants stated they possessed knowledge of their agency's interoperability capabilities and performance and agreed to participate in the study, which was further supported by comments to my request for interview with remarks such as "I look forward to discussing my agency's capabilities and my concerns" (C3), and "yes, I will agree to your request to participate in an interview to discuss our interoperability with other agencies" (C10).

Data Collection

My primary data collection method was in-depth semistructured interviews utilizing my research protocol (See Appendix C). The interview protocol, which I developed prior to conducting the interviews, consisted of a research guide that included sections for notes for the researcher, the interview method, the interview time and place, the interview overview, components of the interview, and the interview questions. Opdenakker (2006) stated that by carefully following the protocol in each interview, the researcher can benefit from reduced stress by following the sequential roadmap in the protocol. The researcher also benefits from the reduced chance of straying from the interview questions or injecting interviewer subjectivity, as the protocol has prompts for the researcher when needed. Therefore, I followed the interview protocol attentively each time. In concurrence with the recommendations of the Belmont Report (The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979), I used the interview protocol to brief the participants of the purpose of

the study, the procedures used to protect the participant's rights, the confidentiality protections, and informed consent. After the briefing, with the participant's written consent, I then proceeded with the interviews, using the interview guide as a roadmap, to engage the participants in rich dialogue during their interviews and to obtain information for the research questions as recommended by Doody & Noonan (2013).

As the researcher, I served as the data collection instrument for this case study. Pezalla, Pettigrew, & Miller-Day (2012) note that the researcher is the data collection instrument in interview studies. The data sources included the interviews, handwritten notes during the interviews, demographic questions, and documents related to the cases. The research questions were sufficiently supported from the collection of evidence that included semistructured interviews and documents collected for all 10 cases. I proceeded to collect after Walden IRB approval was obtained and I complied with all applicable institutional, state, and federal regulations. The participants were interviewed at the date, time, and location chosen by each participant. Consent was obtained prior to inclusion in the study.

I was the sole researcher and conducted semistructured interviews with 10 participants who consented to the study; the interviews were organized and progressed through a series of questions contained within my interview protocol (Appendix C). I conducted the interviews in person during the months of October, November, December 2016 and January 2017 and I scheduled the interviews as participants agreed to participate in the study. Interviews ranged from 11 to 49 minutes in length and were

recorded using a digital voice recorder and transcribed. Each transcript was emailed to the participant for the purposes of review and comment. The interview transcripts provided the data to perform inductive coding of the data.

I wrote notes by hand during the interview for redundancy in the event the interview failed to record; however, all interviews successfully recorded and were transcribed. During the interviews, the participants provided their perceptions with interoperable capabilities and performance, as aligned with the research questions. The handwritten notes also provided opportunities to record participants' attitudes and nonverbal cues and the my impressions of the interview. At the conclusion of each interview, I reminded the participants that I may need to contact them for follow up questions or clarifying questions and that each participant would receive a transcript of the interview for review. Each participant was provided the opportunity to review his or her interview transcript and make any clarifications or corrections. Moustakas (1994) highlights the importance of researchers documenting their reflections and perceptions of each interview. Therefore at the conclusion of each interview, I documented my perceptions and reflections of the interview and my perceptions and reactions to the information provided during the interview. Vaismoradi, Turunen, & Bondas (2013) note that through content and thematic analysis, researchers can label categories of content. I conducted content and thematic preliminary analysis of the interview data immediately after each interview to begin to discover emerging categories, frequencies, and themes.

Upon completion of each interview, I performed a detailed search of relevant documents available in the public domain. To do this I used Google to search for ASRs for each university, information on the radio systems used at each university, and frequencies of the radio systems related to the universities participating in this study. All applicable documents related to the cases were saved and stored on my computer. For consistency, I used NVivo 11 to transcribe, organize, and analyze the content obtained from the demographic survey, interviews, and documents. All data were stored on my password protected computer to ensure protection from unauthorized access. Paper files were protected in my home office in a locked file cabinet. I am the only person who has access to the data. Documents obtained from the public domain enabled cross-checking of interview data for clarity regarding radio system composition and radio sharing among interoperable partners. The documents further added to the depth of discovery and examination of interoperability capabilities and performance among the cases and important points were recorded within NVivo 11 and Excel spreadsheets.

Variations in Data Collection

There were challenges in data collection. Recruitment of participants by email followed my expected recruitment procedure; however, I encountered a low response rate. In order to overcome lack of response, I followed up with a telephone call to the potential participants in order to enlist participation. This additional step in my procedure enabled me to set an appointment with each potential participant, explain the study using a printout of the email I had sent to each participant which included the e-mail invitation

and informed consent. During this appointment, I answered any questions and enlisted participation. I provided a copy of the email invitation and informed consent to the potential participants. In Chapter 3, I discussed that the demographic survey would be administered over the telephone as a screening for inclusion to the study. Instead, the demographic survey was administered in person. Informed consent from each participant was obtained prior to conducting the interview.

I encountered an unusual circumstance in the data collection due to the reluctance of participants to provide documents or 911 recordings regarding their interoperable performance. Student privacy was the primary stated reason. Some of the participants did state that their ASR was current and available for disclosure. I extended my document search and obtained documents from the public domain where available to cross-check the data for consistency and accuracy as recommended by McNabb (2013). This served useful in validating the types of radios and radio systems used by the participants.

Participant Confidentiality

I informed the participants that both their name and the name of their agency would be protected from disclosure. Cases were given numerical codes and no names were used. Due to the small population from which the participants were drawn, demographic information was presented in summary form only, and any references to the participant's specific gender was removed and standardized with "he" or "his" pronouns. In instances where a participant is quoted, additional care was taken to ensure the

participant's identity remained anonymous. In some instances, this required names of agencies or interoperable partners to be omitted from the study.

Evidence of Trustworthiness

Each of the participants was a chief of police with knowledge of his or her agency's interoperability capabilities and performance which contributes to evidence of trustworthiness. Care in participant selection provided (a) balance in participation geographically throughout California with no cluster of participants from any one specific geographic area, (b) participation across diverse campus sizes as measured by the number of law enforcement officers at the agency, and (c) balance of campus setting among rural, suburban, and urban locals. Evidence of trustworthiness was reinforced by establishing credibility, dependability, confirmability, and transferability (Elo, Kaariainen, Kanste, Polkki, Utrianinen, & Kyngas, 2014), as described below.

Credibility

Credibility is an important aspect of qualitative research internal validity, as the research should link the study's findings with reality. In establishing the credibility of the study by considering (a) if the findings made sense, (b) are the findings believable, and (c) if an authentic portrait of the issues was portrayed (Miles & Huberman, 1994). Triangulation was a technique I used to strengthen credibility among the findings by exploring the results of the analysis of the available data sources to the results of the interview data analysis to reveal ensure that the results paint a clear picture of the experience of the participants and reinforce the results of each analysis. This was

particularly useful in vetting the interoperability capabilities of the cases. Credibility is also strengthened through self-awareness of the researcher (Koch, 1994) to avoid leading participants or subjecting bias into the research. In order to fortify the objectivity of the interviews, I followed my interview protocol carefully, inserting prompts when needed throughout the questioning to enable rich detail and perceptions without manipulation. I asked the broad question and then enabled elaboration of the participant as they desired. Selecting the sample size of 10 participants from a population of 34 potential cases strengthened credibility along with prolonged engagement of the data. Prior to the interview, I spent time building rapport with the participants where they felt protected to share their perspectives with me and reinforcing the confidentiality of their identities. The sample size was effective as saturation was reached by the seventh interview. Elo et al. (2014) states that conducting research until saturation enhances credibility through comprehensiveness.

Dependability

Elo et al. (2014) states that dependability exists when the data and the process of the study is stable over time and under varying conditions. To provide opportunity for high dependability, I described in detail the selection factors for inclusion of participants in the study. In addition, I used multiple sources of data collection including interview, field notes, and documents. I compared the results of the analysis of the interviews with the results of the document analysis to gain a more thorough understanding of the issues and corroborate potential analyses and findings. In addition, each interview was

compared to the others to increase the dependability of the results. I reported my analysis process with focus on the steps in the process and highlighted the salient themes in the data with vivid detail. Elo et al. (2014) remarks that high dependability of a research study in conditioned upon the ability of another researcher to replicate the steps and can follow with ease the decisions made by the preceding researcher. Through describing the research process analysis in records and field notes, I reinforced the study's dependability through proof of systematic procedures. I also performed coding checks of the data analysis to test for agreement as well as data quality checks for bias. Miles and Huberman (1994) recommend checking the data for agreement in the analysis and also performing checks for bias.

Confirmability

Confirmability relates to the objectivity of the research and can include the replicability of the study by other researchers (Miles & Huberman, 1994). I strengthened confirmability by describing the methods and procedures explicitly and with detail. I also provided tables of data that correlate to the conclusions. I established an audit trail by providing a record of the methods and procedures in the study and maintained my self-awareness to alleviate bias through any personal opinions I had about the research or the results. I also have retained the data and they are available to future analysis by others.

Transferability

Transferability of the conclusions of the study was operationalized by the use of several methods. First, the audit trail provided a technique for future researchers to apply

the methods to different settings or groups. I employed purposeful maximum variability sampling to select participants for the study chosen in California and summarized the demographics of the participants for replication in another geography or class of institutions. Overall, to enhance transferability, I provided information on the sample size, inclusion criteria, the data collection methods, the length of the interview sessions, the questions explored, and the time period of the data collection. Shenton (2004) states that researchers should provide detailed background information to allow for comparisons by future researchers. I provided thick description of the topic of the investigation to provide understanding and potential comparative emergence. To maximize knowledge of transferability, I defined the scope, boundaries, and limitations of the study to enhance applicability to other populations or situations.

Data Analysis

Qualitative data analysis in research studies involves converting essence and experience into the form of words (Miles & Huberman, 1994). I followed an iterative process which involves data coding soon upon completion of the interview and document retention, systematically moving back and forth between acquiring new interviews and processing completed interviews. Upon completion of the interviews and document retrieval, I organized the data into interview, field notes, and public documents within NVivo 11. Each interview was imported into NVivo 11 and transcribed. To begin the analysis, each interview was read multiple times. During this process, I made notes about word usage, patterns, and any thoughts I had while reading each transcript. I combined

this with the field notes I took during each interview to ensure I captured as much information as possible. I used NVivo 11 to code the data using an inductive data analysis approach and source linked the codes back to the transcript or document from which it originated.

Thematic Analysis

Once the transcripts were completed, I began the process of analysis with organizing the raw data. I conducted an inductive qualitative analysis on the textual data contained in the interview transcripts as recommended by Thomas (2006). I used NVivo 11 as a tool to code the narrative data to create themes. For qualitative researchers, themes capture the quintessence of the data; that is the meaning that encompasses the participant experiences in a succinct, understandable manner (Braun and Clark, 2006).

To prepare the data for analysis, all interviews were transcribed then loaded into NVivo 11 as recommended by Leech & Onwuegbuzie (2011). I employed NVivo 11 as a means to organize and manage data during the process of data analysis. I began by using Braun & Clarke's (2006) thematic analysis data analysis method. One of the strengths of this method was that it is not linked to any specific qualitative philosophy, which enables researchers to use it regardless of methodology (Braun and Clarke, 2006). Thematic Analysis is a six-step data analysis plan that was refined by Braun and Clarke (2012) to its current implementation. Braun and Clarke (2012) indicated that thematic analysis employs a list of steps for qualitative researcher uses to identify, analyze, and report patterns and themes within the gathered data. The six stages of thematic analysis are used

in a recursive manner, with a researcher moving back and forth between stages as necessary. Using this six-step method, I explored the entire dataset and uncovered repeated patterns of meaning.

Stage 1: Read and re-read the data. During this initial phase, it is essential to become familiar with the data through immersion, by reading and rereading the transcribed interviews multiple times. This method concurs with Braun & Clarke (2006) who stated it was essential to listen to audio-recorded data at least once to note analytic observations. Braun & Clarke (2012) suggested making notes on the datum while it is being read or while audio-recorded data are being listened to. This note-making assists a researcher in reading the transcripts for data discovery. Importantly, this means that a researcher is not simply taking the data at face value, but reading the words actively including analyzing what is read and starting to think about what the data might mean. After listening to the interviews, I began to slowly and carefully read each interview transcript making notes of my observations. I read each transcript at least five times, and reread certain sections repeatedly during the analysis process if I was searching for deeper understanding. Once this process was complete, I uploaded all transcripts into NVivo 11. Table 2 contains samples of data with associated notes.

Table 2

Sample of Data and Associated Notes

Data	Associated Notes
So you think more money spent, perhaps, there's not enough policy around it so that it's spent to maximize what it was meant for.	Money is not the only answer – policy is also important.
At this time, I don't see any major barriers. However, in my time in this jurisdiction, matter of fact, in 2012, there were major barriers in an incident that occurred in my area, California, the CHP, California Highway Patrol, did not have the ability to go to our radio system and it could have been detrimental because of gunmen on the campus area.	Although there used to be issues – today communication is very good.
Well, I have to get on the radio [cell phone] and contact the local PD, because we don't have direct radio contact. These are serious, serious officer safety issues as far as I'm concerned. You have a cell phone that could be in a dead area. You got a radio that may or may not work depending upon where the officer is	Officer safety can be effected by a lack of interoperability

Stage 2 - Parse the data and identify specific phrases or sentences and assign a descriptive code. Braun & Clarke (2006) suggested that coding is not simply a method of data reduction, but is more complex, involving an analytic process that leads to defining both a semantic and conceptual reading of the data. Braun & Clarke (2012) stated that codes identify and provide a label for a feature of the data that may be relevant to the research question. Codes are the most basic element of the data and represent instances where the researcher labels portions of data with the prevalent topic discussed

in the data (Bazeley & Jackson, 2013). Codes can summarize parts of the data, describe the content of data, and provide an interpretation of data content.

I utilized the CAQDAS NVivo 11 to create codes for words, sentence fragments, or sentences that hold significant meaning. I continued the analysis process by generating codes across the dataset in order to ultimately create themes. To begin analysis, I opened each transcript individually in NVivo 11. As I read through the interview, referring to any field notes, observations, or notes I made during the initial reading process, I began to highlight chunks of text and assign codes. The chunks of data, segments of sentences, or complete sentences were assigned code, which are called nodes in NVivo. Initially each code was created as a node in NVivo 11. Across all interviews any data that was associated with the code was sorted into each appropriate node. Examples of this process are found in Table 3.

Table 3

Sample Codes and Associated Data

Codes	Associated Data
Backup for radio system	We have also cars that have convertacoms. I don't know if you've ever heard of those, where you slide them into the box. The convertacom, it's a similar type of fashion, but instead of the box that you slide the radio into, it's just a connector that adapts to the side like this.
Money effects equipment quality	It really is. It comes down to money. The CHP, just to re-upgrade their entire system, was over $1 billion [laughter]
Delays are serious	These are serious, serious officer safety issues as far as I'm concerned. You have a cell phone that could be in a dead area. It caused lots of problems because you don't know what buildings they're clearing. You don't know where they're at. The problematic thing with the patch is it's always a little slight bit of a delay, and so that delay sometimes is problematic,
Too many people on a frequency	Then they also run an issue of a system where you're used to having 2, 6, 10 or 15 people on. Now all of a sudden you have 20 to 25 people on, and everybody's talking, and reality is instead of now having three frequencies you usually just have one. Now everybody's talking and nobody has a chance to really listen or talk. There was a lot of radio traffic— I had about 100 officers

Phase 3 - Gather like codes into categories and then combine categories to form tentative themes. According to Braun & Clarke (2006), a theme is a coherent and meaningful pattern in the data that is relevant to the research question. When combining categories to form tentative themes, I looked for similarities in the data. Braun & Clarke (2012) suggested that searching for themes is an active methodical process where the researcher generates themes rather than discovering them. During this phase the researcher must review the coded data multiple times to recognize areas of similarity and overlap between codes.

During phase three, I searched for themes once the whole dataset was coded. Because NVivo 11 is a software program, I was able to toggle between screens of participant data and the list of raw codes. I began by using the list of raw codes and sorted those codes into clusters of codes with associated meanings. Using NVivo 11, I was able to use my mouse to drop and drag codes as I sorted through the data. The newly created clusters were labeled according to their relationships and served as tentative themes. Because the codes were attributed to words, fragments of sentences, and full sentences, I was able to cluster those codes together without concern about the loss of narrative data. This process continued through multiple iterations until no further reduction of data was possible. An example of this process is displayed in Table 4.

Table 4

Samples of Codes, Clusters, and Tentative Themes

Sample Codes	Sample Clusters	Tentative Themes
Using Technology Types of Radio Governing rules Standard procedure Training across departments Desktop training Who is in charge Working with others SOPs Manuals – written policy Local governance groups	Technology Governance Training Procedures SOP	Interoperable capability
Not enough money Need more funding How do we coordinate Communication between agencies Working together is challenging Integrating technology Training Lack training Left out of training	Money Policy Coordinating and integration of technology Need training	What gets in the way

Phase 4 - Review the themes to ensure quality and depth. Braun & Clarke (2006) stated that during this step or stage a qualitative researcher checks that the themes make sense when comparing both the coded extracts and the full data relevant to each theme. This state of reviewing the themes requires reflection on the part of a qualitative researcher on to determine if the themes tell a compelling story about the data. A researcher may also have to decide if it may be necessary to merge two themes together as one theme, or to further split the themes into two or more themes. Vaismoradi, et al.

(2013) cautioned not to count only the frequency of codes and suggested that researchers are sometimes accused of removing meaning from the context. It is more important to understand the essence of what was said by the participants in the transcripts and its relevance to the research question, rather than simply noting frequency of various themes. At this point, a qualitative researcher strives to understand how each theme was generated from the raw data including the components of the relational fit of the themes to the research question, and how the developed themes tell the story of the participants' experiences.

During this process, I revisited the data by comparing the themes to the interview transcripts. I searched the data to ensure that I accurately reflected the experiences of the participants. I explored the existing themes to see if any changes needed to be made and finalized all themes. The themes I created stood as analyzed and no changes, additions, or reductions were made during this step. Table 5 lists the final themes and subthemes.

Table 5

Final Themes and Subthemes

Themes	Subthemes
Participants described the interoperable capabilities of their agencies	How local governance was perceived
	Standard operating procedures
	Participants described technology employed for interoperable communications
	Employing voice communication for interoperable communication
	Participants spoke about training in relation to interoperable communication
	Participants spoke about how they used interoperable communication
Participants identified barriers to interoperability	
Communication worked smoothly	
Challenges with and learning from communication Issues	
Polices need to be defined and changed	

Stage 5 - Define and name the themes. Braun & Clarke (2012) stated that when defining themes, a researcher should be able to clearly identify how each theme is unique. The authors further posited that a good thematic analysis (a) contains themes with a specific focus, (b) that themes are related but do not overlap in content or meaning, and, (c) themes directly address or answer each of the research questions. By reflecting on the story each theme tells, a qualitative researcher constructs a name for each theme that reveals the essence of each theme.

During this phase of the analysis, I explored the initial identifiers that I assigned each theme. I chose not to make changes to the names because I felt that the already created identifiers accurately reflected the experience of the participants in the study. I wrote a brief definition of each theme that reflected the meaning in more detail as I represented in Table 6.

Table 6

Themes and Associated Definitions

Themes	Definitions
Participants described the interoperable capabilities of their agencies	The participants spoke about how their agencies implement interoperable communications, areas of strength and weakness, standard policy, their systems and technology. Included in here was also a review of their frequencies, radio systems, and annual security reports.
Participants identified barriers to interoperability	The barriers associated with implementation of interoperability.
Communication worked smoothly	Participants spoke about times when communication and interoperability worked well.
Challenges with and learning from communication issues	Participants spoke about the challenges they faced with the implementation of interoperability and what they learned from those challenges.
Policies need to be defined and changed	One of the major issues participant spoke about was policy and how it needed to be changed. This included interagency rivalry, funding priorities, and perceptions of university security and policing.

Stage 6 - Report the results. Braun and Clarke (2012) reminded us that we do not complete data analysis and then write it up; rather, writing and analysis are

interwoven and iterative in qualitative research. This interweaving includes moving from informal note and memos, to more formal analytic processes, and into report writing. During the report writing, consideration should be paid to the logical interconnectedness of the themes and the progression of one theme to another, building upon previous themes. Vaismoradi, et al. (2013) suggested that the result of the report writing is the narrative of the story, and that the qualitative researcher functioned as a narrator by placing the results suitably in alignment to the research questions. In this phase, I carefully constructed a written report of the findings. The results of the thematic analysis are reported in the results section of this chapter.

Content Analysis

A content analysis of the gathered public data was conducted following the completion of the thematic analysis. The documents explored included (a) each agency's ASR, (b) the frequencies in use by each agency and their mutual aid partners in nearby jurisdictions, and (c) data about the various radio systems deployed by the agencies. This data were used in order to better answer Research Question 1. The type of content analysis employed was conventional content analysis because the purpose of this study was to describe the phenomenon of interoperability (Hsieh & Shannon, 2016). This type of method was appropriate given the limited existing research, and involved content categories and category names to derive from the research rather than imposing preset or pre-established categories (Elo & Kyngäs, 2008).

I began by uploading the data into NVivo 11 for analysis. Once the data were uploaded I read and reread the information to gain a deeper understanding of the gathered documents. As I read and reread the data, I made notes of my impressions. I highlighted the text that captured the key concepts. Once this process was completed I used NVivo 11 to search for commonly employed words to uncover patterns in the data. Searching for word frequencies is the most commonly employed method of content analysis (Krippendorf, 2004). The words were then sorted into categories. Using the most frequently used words, as well as the notes and memos I created, I coded the data. This process paralleled the thematic analysis process described previously. I sorted this data into the categories created while analyzing the interview data. Once the data were coded, I began to cluster the codes together into categories. Once the data could not be reduced further, I examined the data to see what information was relevant to the research questions. Any data not relevant was discarded. The results of the content analysis were reported in the results section of this chapter and organized under Research Question 1.

Research Findings

The data analysis produced themes and patterns central to the study's research questions to contribute new knowledge relevant to the phenomenon of interoperability examined in this study. Manifesting through themes and patterns, the results contributed to the significance of the study's findings to convey meaning and knowledge to the leaders, emergency management community, constituent multijurisdictional partners at the state, local, and federal levels, and citizens to consider relative to campus safety and

law enforcement response to events. The themes described served to highlight a widespread emergency response concern among campus based law enforcement agencies and impart opportunities for improvement and policy guidance.

Research Question 1

The first research question was employed to identify as a baseline in order to capture the actual capabilities of the campus based law enforcement agency as viewed by the participants. Research question 1 was "What are the interoperability capabilities of campus law enforcement agencies in California as viewed by the agency?" During the interview phase, I posed this question focused on the participant's own capabilities, enabling a free flow response with prompts including the technologies used, how often interoperability was used, what types of events drove usage, what types of training and exercises for interoperable communications existed in the participant's area, if the participant's agency participated in training and exercises and the existence and participation of a local governance group for interoperable communications. When analyzing the documents, I explored the agencies usage of frequencies, radio systems, and declarations of existence of SOPs for interoperating with other agencies within their ASRs.

Theme 1: Participants described the interoperable capabilities of their agencies. Each of the participants in this study provided their perceptions regarding interoperable capabilities including technology, governance, SOPs, training and exercises, and usage. Figure 2 represents the elements of the capabilities of

interoperability and each of the participants expressed varying degrees of success among the elements. Utilizing the interoperable continuum (DHS, 2015), the following discussion depicts the participants responses of capabilities.

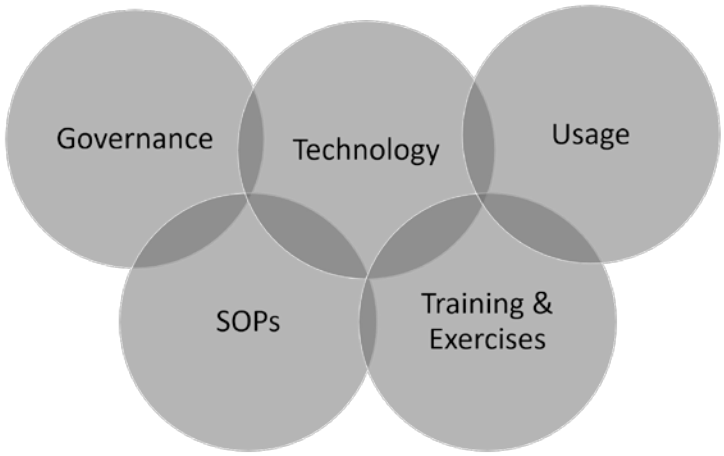

Figure 2. Interoperability capabilities

Subtheme 1. How local governance was perceived. Within the bounds of the capabilities discussion, I asked participants if a local governance group existed, the capacity and reach of the group, and whether the participant's agency was a member of the group. Table 7 depicts the responses to governance, modeled within the framework of the Interoperability Continuum (DHS, 2015), whereby the level of governance is minimal at the left of the table, moving to better levels of governance towards the right of the table.

Table 7

Interoperability Continuum - Governance

Individual Agencies Working Independently	Informal Coordination Between Agencies	Key Multi-Discipline Staff Collaboration on a Regular Basis	Regional Committee Working within a Statewide Communications Interoperability Framework
C4	C1 C3	C2 C6 C7 C8 C9	C5 C10

Nine of 10 participants stated that governance was coordinated in some manner, either formally or informally. One participant reported that he was not part of a local governance group and was unsure if one existed. Seven participants reported that local governance was discussed on a regular basis through formal coordination and the participants participated in scheduled meetings, with five of these participants noting that collaboration took place between key multidiscipline staff on a regular basis, and the other two participants reported the collaboration reaching the highest level of governance as represented on the Interoperability Continuum (DHS, 2015) with the committees formed regionally within the statewide framework for interoperability.

Participant C2 described his departmental interactions and stated, “the county chiefs and the sheriff's department meet monthly in regard to anything that deals with portable radios, radios in a car, anything radio 800 megahertz, Motorolas, or their upgrades.” He felt the system worked well and reported, “we're real close-knit, and then

we have an active chief of police organization that discuss these procedures and keeps them fairly common among us." Participant C2 believed that the goodwill engendered through these meetings aided the working relationships and further felt that the coordination improved communication between agencies on a technological level. Two participants stated that governance minimally included informal coordination between agencies. Participant C5 reported a similar experience and remarked:

> We participate in a monthly meeting that brings together our responding partners. I think this is why our communication is so well coordinated. Attendance in this meeting includes the county sheriff, ourselves, the highway patrol, the chiefs in the nearby cities, the district attorney's office, and patrol and probation departments. In these meetings we talk about a number of things. One of those things is communication and mutual aid.

Similar to Participant C2, he believed that this local governance group was one of the reasons coordinated responses worked well in his region.

Subtheme 2: Standard operating procedures. Participants spoke about their use of SOPs. Participants noted that their campus based law enforcement organizations had SOPs involving interoperable communications when the response involved one or more mutual aid partners. The majority of the participants (80%) reported that communications SOPs were written at a regional level, with one participant reporting attaining the highest level of SOP integration as represented in the Interoperability Continuum (DHS, 2015) with the SOP integrated within the NIMS framework. Participant C10 spoke about his

community and stated, “We have a countywide protocol that talks about all this, from earthquakes to major criminal incidents.” Having a unified protocol ensured that all agencies followed similar procedures and reacted in a similar manner during emergency situations.

One participant noted they shared no SOPs with partners, but the SOPs did exist within their individual agency. Participant C4 said his agency did not have any shared SOPs He said, “we have MOUs with the local police department but [it has] nothing to do with the radios.” Table 8 represents the levels of realization of SOPs of the cases, modeled within the framework of the Interoperability Continuum (DHS, 2015), whereby the SOP is minimal at the left of the table, moving to higher levels of SOP coordination with constituents towards the right of the table.

Table 8

Interoperability Capabilities – Standard Operating Procedures

Individual Agency SOPs	Joint SOPs for Planned Events	Joint SOPs for Emergencies	Regional Set of Communications SOPs	National Incident Management System Integrated SOPs
C4			C1 C2 C3 C5 C6 C7 C9 C10	C8

An exploration of the ASRs of the universities revealed the existence of policies with interoperable partners. Very little variation existed with most ASRs noting policies

existed. No differences from what participants reported were noted. The contents of these reports supported the observations of the participants. As no materials from coordinating agencies were available in the public domain, it was not possible to compare or analyze the details of the SOPs between the universities and other agencies in their areas.

Subtheme 3: Participants described technology employed for interoperable communications. Participants provided thick description of their interoperable capabilities by stating the ways they communicate both within their agency and communication with other agencies. Most (7) of the participants did not cite a method for interoperating through employing shared data. Participant C3 said, “We get notifications regarding crimes that have occurred, situational awareness notifications, notifications regarding special events. So we're dialed in. But again, that's not technology based. A lot of that is Internet emails. But again, some of it is just telephone calls.” Their capability for communication with other agencies was not based on any one system of shared data, instead, they received information more informally, employing email or the telephone. Participant C4 agreed and remarked:

> I need to tell you that we are not on anybody's or any other law enforcement's frequencies so when we have a problem we have to use the cell phone that the officer's carrying on duty to contact the local agency, or the local sheriff, or CHP, whoever we need, but mostly it's we have to contact the local agency.

Because their radio systems lacked interoperability, they used other means such as cell phones to send and receive information, or for interpersonal contact when aid was

necessary. He indicated that this often added to response times and made it challenging to coordinate responses or receive aid. Participant C4 perceived this to be an issue and said, “these are serious, serious officer safety issues as far as I'm concerned. You have a cell phone that could be in a dead area. You got a radio that may or may not work depending upon where the officer is.” He believed the lack of modern communication systems that were interoperable compromised officer safety and their ability to effective respond to emergency situations.

Three of the participants reported employing data methods, with all mentioning the use of Computer Aided Dispatch (CAD) and Records Management Systems (RMS) as the interoperable communication method of choice. Table 9 represents the data technology elements.

Table 9

Interoperability Capabilities – Technology – Data Elements

Swap Files	Common Applications	Custom-Interfaced Applications	One-Way Standards Based Sharing	Two-Way Standards Based Sharing
	C1 C7	C10		

Participant C1 spoke at length about the system available to his agency and said:

> It's a satellite radio system that was done through the [omitted]. But for all intents and purposes for us, let's say all hell breaks loose and we lose our radio system and everything else, we have a mechanism now to get outside of the area to get other help from sister campuses, be able to talk to them because they have the

> same satellite link as well as talking to the [omitted] County EOC via that mechanism to at least get help.

He indicated that having the system was reassuring, and in order to ensure effective use during an emergency the agencies on the system ran monthly tests. Participant C1 believed this to be important and remarked, “the chances of using that are far higher than they are of any other type of thing.” He believed that in a situation where interoperability was key, using the satellite system would be the typical method of communication.

Participant C10 reported robust interoperable capabilities. He spoke at great length and said:

> We are currently working with another law enforcement agency so that we can not only patch radio channels, but we can actually integrate dispatch stations. So that we can-- in an emergency here, if I don't have enough staff or if there's an extra 911 or whatever and for redundancy purposes, that dispatch center can then dispatch as well for us. Throughout the county here, we do have a channel. It can be used by every agency that works in the county, and we can all go to there. And we generally go to there for interoperability and major incidents. The agency that has jurisdiction of the event continues to maintain the dispatching just using that channel.

He indicated that the agencies in his area worked with a consultant to create their interoperable system. He believed the design of the system gave his department an ability to easily communicate with other agencies when necessary.

Participant C7 reported employing a variety of methods to communicate with other agencies. He stated, “We do use cell phones. We also have CAD, so we can communicate through CAD. We have satellite phones. Certainly the Internet, email, lots of instant messaging.” He felt this combination of methods was effective and enable his agency to communicate and share information with others.

Subtheme 4: Employing voice communication for interoperable communication. All participants reported that interoperable methods between agencies occurred through the use of voice communication. Two of the 10 participants utilized a standards-based shared system. Notably, these two participants who discussed their voice communications interoperability on a standards-based shared system did not discuss multiple methods of voice interoperability such as gateways, shared channels or swapping radios.

Participants who lacked shared standards-based voice communications systems discussed using several types of technology including shared channels, gateways, and the swapping of radios depending upon the partners involved in the mutual aid response. Table 10 provides a representation of the responses to the use of technology.

Table 10

Interoperability Capabilities – Technology – Voice Elements

Swap Radios	Gateway	Shared Channels	Proprietary Shared System	Standards-Based Shared System
C1	C1	C1	C1	C2
C3	C6	C6	C6	C5
C4	C7	C7		
C10	C9	C8		
	C10	C9		
		C10		

When asked about technology employed for interoperable capabilities, all participants noted the use of radio communications as the primary technology used within the agency. Participant C2 was particularly pleased with the system employed and stated:

> We have probably one of the better communications in southern California. As a matter of fact, I know it's much better than some of the Los Angeles areas and some other areas because we're able to interact with them [other agencies] immediately by using one specific crime channel and also being able to switch to each one of their channels at any given moment.

Participant C2 believed that the instant nature of communication with other departments was essential. He felt that this enabled coordinated responses and helped ensure that resources were correctly distributed during emergency situations. Participant C7 also used radios but had to create the interoperability. He said:

> So generally I have my radios all programmed. I have 16 local channels that I have programmed into my radios where I can speak to, certainly all the

> surrounding local agencies-- I think it's working. So that gives me capabilities just to talk to 16 of them right away.

Thus, he was able to speak with agencies in his area, but had to spend the time to create the system and turn to the correct radio channel, it was not a built-in instantaneous method of communication.

Six of 10 participants cited the use of cellular phones as an additional device to gather information during response situations. Participant C5 remarked that most of the management and command staff used their cell phones to interact with the local city police department. Thus, this interoperable communication was available to management, but not as easily available to officers on the street. Participant C8 reported that cell phones were used by most people in his department for communication with other outside agencies. He recollected:

> I would really kind of categorize that [cell phones] as really an informal network. For example, I mean, I certainly have-- and as part of a local chiefs' association, we have contact list for all the chiefs in the area and all of the major commanders so we have all of their particular contact information. And I know that our guys on shift, day shift and the night shift, they've got that all programmed in for their level as well, the sergeants and the officers from the sheriff's department that they typically work with. I know that that goes on but I don't think that's a real formal kind of passing of information, just more informal.

He felt that it was good that communication existed, but was very clear that this communication was informal. In an emergency situation, the use of cell phones could hinder efforts to coordinate as information was shared with no real system in place to manage the communication.

All but one participant cited the use of radio communications as the primary technology used for interoperability among agencies or jurisdictions in planned and or unplanned events. The disparate participant, C4, stated that portable radios were used as the primary communications device within the agency, but cellular telephones are used when interoperability or mutual aid was needed in unplanned events. C4 emphasized:

> I need to tell you that we are not on anybody's or any other law enforcement's frequencies so when we have a problem we have to use the cell phone that the officer's carrying on duty to contact the local agency, or the local sheriff, or CHP, whoever we need, but mostly we have to contact the local agency.

C4 further provided evidence of swapping radio during planned events, such as graduation:

> We have to give two of our radios one to their command staff, one to their officer-in-charge of the graduation. And when we have a graduation, you got 5,000 people sitting in the auditorium or sitting in the graduation area. All my officers have the radios, but because again no communications with the local PD, we provide them a pair of our portable radios. And that's how we communicate to

them if we need assistance, either medical assistance or any problems that we have in the field.

He acknowledged the cumbersome nature of communications during large events. For this participant, the ability to communicate with other agencies during large events was limited by their ability to get radios to the other agencies or the use of cellular technology.

Subtheme 5: Participants spoke about training in relation to interoperable communication. Participants provided examples of training and exercises. Unsolicited information provided by the participants in seven of 10 cases noted active shooter training as a specific training that was offered. C1 remarked “We do drills on all kinds of things, like active shooter. In fact, we run the largest multidisciplinary active shooter drill in the area.”

Table 11 provides types of training and exercises discussed by the participants, correlated with the Interoperability Continuum (DHS, 2015) with basic low level training at the left, followed by more comprehensive training moving to the right of the table.

Table 11

Interoperability Capabilities – Training & Exercises

General Orientation on Equipment & Applications	Single Agency Desktop Exercises for Key Field and Support Staff	MultiAgency Tabletop Exercises for Key Field Personnel and Support Staff	MultiAgency Full Functional Exercises Involving All Staff	Regular Comprehensive Regionwide Training & Exercises
	C4	C6		C1 C2 C3 C5 C7 C8 C9 C10

Seven of the 10 participants remarked training was an important aspect of preparing for interoperable scenarios. They indicated that participation in regular comprehensive training and exercises occurred and was important. Two participants indicated that training only occurred using a desktop simulation program. One participant mentioned annual desktop training was conducted only within the agency and that no other cross training with other agencies occurred. One participant did speak about multiagency tabletop exercises. Participant C6 stated:

> Our agency also has a health system and we do a yearly table top with the health system which usually involves some sort of either active shooter incident or it might be a contaminant, like a flu - we've done like the swine flu type thing - to where we have an influx of patients in the health system, to where our resources would be taxed, and we'd have to use other agencies. So we do table tops with

> them about once a year. We do a county-wide table top once a year, and that usually involves an active shooter incident. We test our dispatch center monthly with our neighboring agency.

He found these practice sessions, enabled the disparate departments to work together well. By holding rehearsal sessions, he believed they were better prepared to deal with any eventuality.

Subtheme 6: Participants spoke about how they used interoperable communication. Some participants provided multiple examples of how they used interoperable communication. Seven of 10 participants remarked that interoperable communications were used daily, while three participants noted that interoperable communications were used less frequently. Examples of less than daily usage included responses to occasional localized incident medical emergencies. Six participants noted planned events such as a protest, union strikes, dignitary visits, high visibility speaking events, commencement, political rallies, and concerts drove usage. C8 provided an example of daily usage and stated:

> Our other primary public safety partner is the [name omitted] Sheriff's Office. So our campus is located in an unincorporated area of [name omitted] County. And so our primary law enforcement partner is the sheriff's office. And so if we have a situation on campus where they're coming as well to help—[our] officers making a felony traffic stop at night time. We've got two officers on duty. There are multiple subjects. Maybe some have left the car. We need some day-to-day

> mutual aid. And so even in this area of the county that's unincorporated, the sheriff's department has one car assigned to the area. And so there's one deputy that's out here, and if they're making a stop somewhere out there, they need backup and we've got to go to that. Or if we're here and we need it, they've got to come as well.

This participant indicated that interoperable capabilities were used regularly to ensure officer safety. As backup was not always easily accessible for other agencies, his department employed this cross communication to help other agencies.

Table 12 highlights the data results; some participants stated more than one category of usage. The participants indicated that there were four main areas where they employed any interoperable capabilities. It was interesting to note the overlap in usage among the participants with many reporting a similar combination of use.

Table 12

Interoperability Capabilities – Usage

Planned Events	Localized Emergency Incidents	Regional Incident Management	Daily Use Throughout the Region
C1	C1		C1
C4	C3		C2
C6	C4		C3
C7	C5		C5
C9	C6		C7
C10	C9		C8
	C10		C10

Research Question 2

The second research question employed to explore the participants perceptions regarding barriers to achieving full interoperability with local mutual aid partners. This research question provided a means for the participants to discuss the inhibitors related to interoperability when engaged in a multijurisdictional or multiagency response. Research question 2 was, "What are the participants' perceptions regarding the barriers to achieving full interoperability capability of campus law enforcement agencies in California?"

Theme 2: Participants identified barriers to interoperability. The most frequently mentioned barrier to interoperability was identified as money and access to funding by nine out of 10 participants in the study. Seven participants remarked that the lack of policy for standards was a barrier to their agency achieving interoperability. The third most mentioned barrier, with six out of 10 participants responding, was the coordination and integration of technology as well as the relative lack of understanding of the importance of interoperability for campus based law enforcement agencies. Table 13 lists all of the mentioned barriers and the number of participants discussing the barrier.

Table 13

Barriers to Full Interoperability

Barrier	Number of Cases
Money	9
Lack of policy for standards	7
Coordination & integration of technology	6
Lack of understanding of the importance	6
Focused on operability, not interoperability	2
Physical obstructions	2
Access to training	2
Not a high enough priority	1

Although nine out of 10 participants noted barriers to achieving full interoperability, one participant remarked they currently had no barriers to interoperability. C2 stated:

> At this time, I don't see any major barriers. However, in my time in this jurisdiction, matter of fact, in 2012, there were major barriers in an incident that occurred in my area. The CHP, California Highway Patrol, did not have the ability to go to our radio system and it could have been detrimental because of a gunman on the campus area. That would have been a technical one that CHP has overcome.

He believed that although issues had existed in the past, currently the communication he was able to access with other agencies was adequate to the agency needs.

Participants in the study felt that of all the barriers they discussed, one of the most significant barriers they faced was a lack of funding/money. Participant C3 spoke at length and remarked:

> Well, I think the biggest hindrance is the expectation or the assumption that because I work for a private university - it's not just our university - private universities tend to be looked at as they're not tied into government, they're not tied into the state, they're not tied into the city, of the private entities. They're tend to be looked at as like they're business or a security company in the sense that they're self-sufficient, and that's not the case. I'll give you an example. Our university has about [omitted] students and we're private. There is a similar sized public institution in the same city, and they are entitled to grant funding, grants equipment that they can request through Department of Homeland Security and other places. We can't, but technically because we're private.

He believed that the fact that his university was private served to put them at a disadvantage. In spite of their size, they could not access public funds to aid in increasing their interoperable capabilities. Unlike public universities, they were regarded as a business, with the underlying assumption being that they should have money because they were a private institution.

Participant C4 also believed that access to funding served as a significant barrier to interoperability. He remarked:

> I think it's money. I think it's access to funding. I think some of the larger PDs and some of the administrators and police departments that have an in with certain governmental agencies get first preference [to funding]. I think it's the will of the city councils and the board of supervisors and the people that think they know what they're doing to impede by not supporting the radio communications. Like it'll never happen here situation. And they're putting the lives of not only the officers but the community in jeopardy.

Unlike the previous participant, he did not ascribe this lack of funding to a public/private split. Instead he attributed their lack of funding to the size of the institution he served. He believed they could not access the funding necessary because of their small size. He felt that larger agencies received preferential treatment because of their numbers.

Participant C9 also saw finances as a large barrier to interoperability. He simply stated, “I think some of the biggest barriers to that is the finance.” He continued on to state:

> Everybody already has a system they've invested a ton of money into, that does what they want and that has the capacity, handles what they want done. Trying to jump on board is always difficult because, again, there you have, it's their system. It may not do everything we want it to do, or it may cost more than what we're willing to pay for it.

In his opinion, agencies were happy with their equipment and reluctant to invest further money to a new system because they were used to it. Although their systems may have not been perfect, they were used to using them and when weighing the balance, they did not see the value in investing further dollars. Participant C7 also commented on funding and said, “There's no central funding for all this equipment. So you may have a local agency who is not financially sound and then one that is, and they aren't going to be on the same page.” He believed that the variability found from agency to agency was a simple matter of budget. Some agencies could afford the investment while others could not.

Policy was mentioned as another barrier to interoperability. The participants felt that policies differed by agency with many different views on how to communicate. Participant C7 spoke about this and said:

> I'd say the biggest barrier is just, for being able to operate really smoothly would be, there's no single oversight over this whole big interoperability thing. The feds do their own thing, locals do their own thing, the state does their own thing, and there's no single sheet of music that we are all playing off of. So I'd say that's the biggest barrier for us.

He identified that the lack of a single governing agency effected interoperability significant. With no one agency appointed to take the lead, each agency had its own set of rules they followed with little regard to how others functioned.

Participant C8 was worried about the source of information about interoperability; he believed that no one seemed to have an answer he could trust. Participant C8 said:

> Nobody's really coming to me that says, 'Here's kind of the comprehensive solution,' something that I trust and understand at an executive level. And so I think that's a huge barrier because I know we've been talking about fully interoperable communication in the 35 years that I've been in this field. I think the complexity is a big issue. I just think over the years, the different reports I've seen, whether it's been plans on how to implement CLEMARS for the state, all this interoperability stuff, and it's just really difficult for me to get a grip on, okay, what's the way to go here? What do I need to support?

He mentioned that the issue of interoperability was large, and that no one had clearly visualized an appropriate solution.

Participant C6 spoke about how he saw a lack of training as a primary issue towards inoperability. He described his view point and said:

> The actual, 'How do you get your radio over to that other channel?' People forget. It's not something that we practice all the time, so usually there's one techy [technical] person that says, "Oh, here it is," and, of course, the dispatch supervisor is very up on that, and they know how to do it. So it's usually a little training piece at the event, and that's a barrier. That's probably the biggest one.

He mentioned that until people were fully trained with frequent refreshers, their lack of expertise would negatively affect interoperability.

Participant C3 also spoke about training and lack of access. He expressed his concerns and said:

> There's training that we're not even-- we can't participate in, because we're private. But we can't go…Because, one, we can't-- we can go if we're invited or if there's room, but the reality is they don't send out a notice to my department, which is over 300 officers. They don't send a notice to our department and say that this is mandated by as a requirement for the Department of Homeland Security or whatever, just by virtue of us being private. So we're left out of that. I mean, we find ways to get in there, but we're not reimbursed for any of the training. We're not notified. Our training isn't tracked. We mirror that by our own efforts, but we're out of the loop. And again, that is a serious gap in our ability to address these threats. That's a weak link in-- I would even say national security, because on an American university such as ours, you get students from around the world.

He expressed that until all universities were included in training opportunities, barriers to interoperability would continue to exist.

Participant C4 believed a major barrier to interoperability was the lack of a statewide policy. He believed basic standards in equipment needed to be created and remarked:

> I'd say there needs to be a state initiative that all radios are capable of at least on a county-wide basis. Somebody has to take, whether it's the Office of Emergency

> Services, whether it's the California Highway Patrol, but somebody here needs to take the lead, and let's get all the same radios, and get on the same frequencies. I speak from those departments and those administrators that have an in [inside track].

Participant C9 also believed that a lack of policy standards interfered in interoperability. He stated:

> Different groups have different policies that put stuff together, and obviously their policy exists for their needs, and it conflicts with us in some ways. Probably the last piece again, for this challenge is bringing all these people together and then trying to get them all to agree. And the person usually who's at the table who has the biggest agency typically would mean they're bringing the most to the table, and so they're expecting to have that level of a say when reality is we're all there for one purpose, it's cooperation and so we all have to have an equal amount of say.

Participant C5 discussed priorities and believed that different agencies had different agendas. He believed this interfered in creating a unified policy and spoke about his agency:

> What we have, it works for us. But we have to balance priorities internally and with our partners. Of course we wish we had more high tech technology. But there is only so much money and so much time. We have to prioritize, and it’s just not at the top of our priorities.

Participant C3's viewpoint underscored how priorities between departments could differ. He mentioned the lack of understanding of the importance of interoperability. Participant C3 said:

> When you look at what are the threats, that potential threats to both [public vs. private university campuses], they're exactly the same. An active shooter at my university versus a public university, that doesn't cross an active shooter's mind. He's not going to say, 'Well, should I go to the private... or the public institution, because they're more equipped to defend themselves.' Actually, it's part of the opposite, 'Let me go to the private because there's pretty much-- I know what their limitations are, I know what they can't do and what they have access to.' And again, those are things that I know about. But I know that in the aftermath, after there's an after-action report, people are going to question and it's going to come to light, 'Well, why don't you have the same capability as a public institution?' Well, because we're private and the law prohibits it. But if you're truly interested in addressing a constant threat that we all know exists on different American universities - which is active shooters and all the other things that happen in places where you have mass homicides - the reality is, a situation exists on private universities that allows for an unequal level of protection, just because we're not afforded the access to those things, if that makes sense.

These participants could see how it was important to have interoperability but also noted many barriers to achieving such a system that could be used to make communication easier.

Research Question 3

The third research question was asked to collect information regarding the performance of campus based law enforcement agencies when involved in a multiagency or multijurisdictional event. The participants were asked, “Thinking back to your last multijurisdictional or multiagency event, how effective were you in communicating with all agencies involved?”

Theme 3: Communication worked smoothly. Three of the 10 participants mentioned there were no problems interoperating with their mutual aid partners during their last multijurisdictional event. Each of the cases responded that their communications were satisfactory. Participant C5 stated the communications in routine events with partners is effective. C1 discussed a recent shooting that occurred near the campus, which involved multiagency response among the campus police, city police, and fire department. Participant C1 simply stated, “We had no trouble at all. We communicated great. And generally, that is the case.”

Participant C10 similarly said,

> We are very effective. I mean, everybody was on our channel. That everybody was able to hear what was going on. Whether that was because they changed the dial or we handed them a radio, there were no barriers to communication.

For these participants interoperability at times of crisis was effective. They were able to speak with other agencies and coordinate responses with little to no effort. He

found that everyone worked together well and said, “There were no issues that impeded interoperability such as someone being on the wrong channel.” The one issue he noted was coverage area. He remarked that his agency was currently working on expanding their coverage area but faced some barriers. He indicated, “that's a very slow-going process because of the funding and then some of the federal rules and regulations that we have to-- all the hoops that we have to jump through to be able to do that.

Theme 4: Challenges with and learning from communication issues. Seven of the 10 participants cited problems with interoperable events occurring in the last 5 years and also described the lessons learned and changes made to enable better performance. C2 described a situation with a gunman who entered the university campus. The event began off-campus with the local police department. The gunman entered the campus seeking to evade police. The campus police were unaware the event was occurring because the two police agencies operate on different channels. Although no loss of life occurred, the lack of situational knowledge and effective coordination prompted C2 to increase interoperability. A recent event involving law enforcement response was noted by C2 as “extremely effective”. He continued on to state,

> As a matter of fact, it was easy for us to mobilize and keep in contact with over, I believe it was, 165 SWAT operators that were on the campus area from numerous jurisdictions. Three SWAT teams that were made up by numerous jurisdictions and we were able to communicate.

He found that the changes that occurred over the past 5 years greatly increased the various agencies ability to work cooperatively and communicate effectively. Participant C3 also felt that the experience of working together had improved communication. However, he noted that this was only effective during planned events.

Participant C3 specifically remarked that in planned events, such as recent football games, the implementation of the unified command post has led to effective communications. He went on to speak about unplanned events and said that in an unplanned event involving an on-campus shooting, interoperability was “very difficult” and there were significant delays in information transfer. Participant C3 stated the agency was now in the process of obtaining a new radio system.

C4 also described delays in information transfer between his campus agency and the city police department during an unplanned event. C4 described the situation and remarked:

> We had some female students that met some males online and invited them to ‘party’ at their dormitories. They were also having alcohol. These non-guests, young men come to the campus - I believe there was four of them - they proceed to party with the young females who were students. The party got loud. We received a cell phone complaint. We went up there. There was an RA [resident assistant] female there trying to control the situation. My officer arrives there, sees one of the males leaving the area or the apartment area, pushes the RA up against the wall, and continues to walk and he does not heed to the officer's

> instructions to stop. And at the same time, that officer and another officer were dealing with three other individuals who were rude and obnoxious. They decided to-- they had to stop and dial the local police department because we have no radio communications with the department. So it took time for them to get the phone out - obviously to dial the numbers on speed dial - to get [name omitted] to respond. Once [name omitted] responded, one of the subjects was arrested for intoxication and another subject tried to fight one of the officers and fight one of the local PD officers and was also arrested.

Because of a lack of communication, the amount of response time was greater than necessary. Participant C4 believed that if they had more ease of communication, the situation could have been handled more easily and smoothly.

Participant C4 commented on another recent event involving an attempted suicide:

> Well, we had an issue where we had a jumper that we thought was going to commit suicide and we couldn't communicate with the police department radio system, nor could we communicate with the fire department, emergency responders system. That's serious. So we had to get one of my officers to make sure they're right with that local agency. So basically, if I'm radioing my guy, he's going to verbally say to him what I'm saying-- both communications can be misinterpreted.

Participant C4 stated that for unplanned events, no progress had been made to improve interoperability for communications. However, for planned events, the practice remained to provide a radio to mutual aid partners for access to the campus radio system. The participant remained concerned for the future, stating, “In a real emergency, there probably won't be time to give them a radio. And will the phones be up or down? All unknown”.

C6 discussed that during their recent planned events, communications were sufficient due to the stockpile of radios on hand to issue to officers working the event. However, in a recent unplanned event involving use of force with approximately 50 officers responding, the command structure was problematic and information was delayed to the field officers as well as information from the field to central command was ineffective. C6 noted that performance would be improved today and the tactics would be more swiftly communicated.

C7 also noted that in planned events, communication was satisfactory. In an unplanned event involving an active shooter at one of the hospitals, responders included city and federal agencies. One of the agencies could not communicate, which caused difficulty clearing buildings and disseminating information. This one agency acted autonomously, causing duplicate search and clear procedures of buildings. C7 noted:

> It caused lots of problems because you don't know what buildings they're clearing. You don't know where they're at. Obviously, they're all police officers in uniform, but it caused a problem because we're trying to cover as much ground as we can,

> as quickly as we can. And you don't really know where they're at. And you're probably repeating places that they've already cleared, and just no coordinated effort with them. As a result of this event, the campus has distributed some of their radios to potential mutual aid partners: We have actually handed out our radios to some of the local agencies, just so if there's an event, they can grab our radio and go. That's helping for now, that we know they at least have one of our radios.

Participant C8 spoke of a recent large wildfire that engulfed most of the region. He saw some issues with interoperability as it related to the speed of an event and remarked:

> While we had the technology to communicate interoperably, we didn't really use it. And I think that's because the event itself was so massive, so quick moving, and so confusing that it was difficult to know who to talk to, what to do, who was in charge. That was a real problem for us. And then, the second thing which may have been a bigger issue, and it's ironic because it's not necessarily related to the radio system exactly, is that in this particular situation, one of the things we failed to do is have a representative from our campus public safety group at CAL FIRE's Incident Management Team command post…Our group in the field reports to our EOC. Our EOC deals with a certain situation. And we tested those communication lines. But in this particular situation, our EOC really wasn't the EOC. Our command post really wasn't the command post because we were part of

> a much larger event. And so the EOC and the command post was at a totally different location, 15 miles away from the campus. And we really needed to have somebody at that location to be gathering that information real time and then communicating back.

This experience illustrated how even missing one detail could quickly derail efforts to interoperability. He learned from this experience that it was important to consider all agencies that might need to be involved in a coordinated response. He spoke about the lessons learned and reported:

> One [lesson] that we learned, and since then it's part of annual drills with fire department have really worked on with what is the incident command structure in one of these large events like this, because we had a different view of what it--well, whether we want it to or not, it's going to be a certain way. And in these large events, natural or man-made, it more than likely is going to be driven by Ventura County and the operational area instead of us. And so our communication and our interoperability had to test that and control for that. And that's a bigger thing than just communicating with the fire department or the sheriff's department. It's really communicating with the operational area and the operational area EOC. So one of the biggest things we've done is develop the ICS communication lines and the concept of where our operational component fits in with the larger structure.

Participant C8 came to understand interoperability was more than just a radio system. To him, interoperability was also an understanding of the command and organization structure that occurred or changed depending on the event in question.

Research Question 4

The fourth research question was asked to collect information from the participants regarding the role that policy makers play in enhancing interoperability. The participants were asked, “How can government-wide policies and procedures improve the interoperability performance of your campus law enforcement agency?”

Theme 5: Polices need to be defined and enhanced. Participants commented policies were needed to define standards and expenditures and communicating the importance of campus based law enforcement communications interoperability including access to funding.

Participant C1 emphasized the need for standards and control of funding. He stated:

> There's no standards, a set of standards as to the systems and how that's going to work, much like radio lingo over the air. It's some agencies that use 10 codes, some that use plain English, some that don't. It's the same thing with the equipment. You saw that come out and there's still some lingering problems from all that money that was spent on that-- throughout the country, not us-- but I mean just through the country. So you think more money spent, perhaps, there's not enough policy around it so that it's spent to maximize what it was meant for.

He continued on to speak about how standards should be created and that leadership needed to exercised by some of the overarching organizations that regulated communication. Participant C1 said:

> But one of the things for communications is APCO [the Association for Public Communications Officials]. If there's something that needs to be done, APCO should be jumping on that because they're the leader of the industry when it comes to setting standards. And I don't know what their interoperability standards are, but APCO is the one that I would be going to and saying, 'Hey,' because that's it, 'what are you guys saying we should be doing?' Just like I do when we're talking about use of force or anything else. Go to those accrediting bodies and say, 'Look, what is the best practice in this area for jail operations or for patrolling?' I mean, anything. And communications is one, but really when you start on interoperability, I think APCO's probably the best place.

Participant C2 supported this thought. He mentioned the need for policy that extends beyond locals and the need to change. Participant C2 said, "The problem is we should be thinking more global when it comes to our radio communication, not only county, state, but country-wide. It's time to be moving in that direction."

Case 3 also stated the need for standards and policy guidance, as well as the understanding of the importance of campus based communications. He said:

> [It] comes down to: one, someone articulating what that [communication] need is. And then two, someone saying, 'It's a worthwhile cause.' A lot of universities, it's

> an afterthought. Security is an afterthought. I think the universities should be able - even though they're private - to put in those requests for those grant fundings, because it's in the best interest of the public. I think it's an individual case-by-case assessment. But to just flat out say they're not qualified and they don't meet the requirements simply because they're private, I think that's short-sighted. I think that it's-- and it's a little reckless and dangerous too.

One of his chief concerns was the fact that universities did not seem to understand the importance of interoperability until after a serious event occurred.

Participant C3 further emphasized the importance of campus based interoperability for communications, the need for policy consistency, and policy for training. He stated:

> But if you're truly interested in addressing a constant threat that we all know exists on different American universities - which is active shooters and all the other things that happen in places where you have mass homicides - the reality is, a situation exists on private universities that allows for an unequal level of protection, just because we're not afforded the access to those [grants]...there needs to be some consistency when it comes to how-- what our capabilities are, what our training is. And those that say, "They're private, they can do this for themselves," is a weak link in the chain of American law enforcement…the reality is we haven't addressed those soft spots, and that can only be addressed through consistent training. And ensuring that regardless of what the entity is, if

> you're responsible for large groups of students, there should be a standard that requires everyone to have the same consistent training and the interoperability to talk to responding municipal first responders.

Participant C3 continued to speak about the need for attention to the problem and called for action. He said:

> We have a national model. We have ICS. We have all of the national protocols for setting up incident commands and unified commands, and all of that. We have that. All that came about as a result of 9/11. I think there needs to be a serious reassessment of, what are the needs of universities?

He believed that that the national protocols that were created after 9/11 needed to also be applied to private universities. He wanted to see people discussing these needs and how to increase communication so that campus would be safer.

Participant C4 similarly highlighted the need for coordination and funding. He felt that a great deal of in-fighting and jockeying for control hindered efforts for interoperability. He said:

> Well, the government, whether it be city government, or state government, or regional government, need to cut out the jealousies, and actually have a real planning and steering committee that actually solves the problems instead of sitting around talking about them. They need to come up with some kind of funding. And I'm talking funding not only for radios, I'm talking-- this covers emergency preparedness, for Christ's sake. You need radios and communication,

> emergency preparedness. How much cross-training is done between agencies on emergency preparedness, because everybody just worries about their own little domain, more or less?

He believed that people needed to stop worrying about separate fiefdoms, and instead concentrate on what was most effective and safe.

Participant C5 mentioned the ongoing need to assess the incident command system (ICS) by increasing awareness of how it is used, routine training for mutual aid partners on a regional basis, and localize governance based upon the national Project 25 standards guidance. Participant C6 similarly called for the need for ICS and said,

> There has to be some sort of regulation about how we set up our command structure of who's responsible. And that authority needs to be understood by the other agencies that are helping out in regards to use of force, time, place, tactics type.

Participant C7 cited the need for coordination and stated,

> I prefer a policy directive to us that says, 'We want everybody on the same frequency. We want everybody following, generally, the same policy, be it you must run an ICP, EOC,' just some kind of policy directive to us putting us all on the same, at least close to, the same page.

Participant C8 also mentioned the desire for policy guidance and said, "I think, from my small kind of rural perspective, somebody's got to come and say, 'Hey, this is the way you're going to handle communications, and here is the infrastructure that's in

place to do that.’” Participant C10 also spoke about the need for policy standards and funding control and remarked:

> If we're talking about a legislative piece to this-- if there was a legislative piece, it would be great to have some standards as to what the maintenance should look like, what they should be able to do, what the funding should look like. Because there are many, many, many needs that we have, including staffing and techs, and consultants and people that can maintain these radio systems operable, but that funding does not exist to the level that it needs to exist. Being on a campus, most people think that we can just rely on another dispatch center, or we can rely just get on another person's channel. They have no real clue as to the world of law enforcement, and fire and public safety. They are part of our events but don't understand the impacts of some of the decisions they make from a policy perspective or from a funding perspective.

He believed until people began to understand the needs of universities, change would not occur. Participant C10 thought that people needed to be educated on the realities that universities faced in order for change to occur.

Summary

A diverse population of cases participated in this study. Participants were from large and small universities, rural, suburban and urban universities, private and public universities, and were located in many geographic areas within the state of California. Despite this diversity in the demographic representation, the voices of the participants

were uniform and homogeneous. The participants emphatically and passionately stated that communications interoperability is paramount to campus safety and security. The participants collectively expressed that interoperability performance hinges on capabilities, collaboration, training, funding, and policy standards and direction. Even the participants who possessed advanced stages of capabilities expressed desire for policy guidance and the resolution that society must consider campus based law enforcement communications interoperability to be just as important as municipal law enforcement communications interoperability. Chapter 5 discusses the findings in light of the literature, the conclusions and recommendations, and the implications of social change. Chapter 5 concludes with recommendations for further research.

Chapter 5: Discussion, Implications, and Recommendations

Introduction

The purpose of this qualitative case study was to explore the perceptions of campus-based law enforcement personnel regarding interoperability capabilities and performance between campus-based law enforcement organizations and local mutual aid responding organizations during multiagency or multijurisdictional response. The study was based on the premise that communication between agencies is essential to effective responses to events that require mutual aid from local public safety partners and campus-based law enforcement agencies.

This was a qualitative multiple case study. I interviewed study participants to explore their perceptions of their organizations' capabilities and performance regarding interoperable communications. Participants described (a) their communications capabilities, (b) their lived experiences of past events that required mutual aid and interoperability with neighboring jurisdictions and agencies, (c) their perceived barriers to achieving full interoperability, and (d) prescribed measures needed for policy improvement. I conducted semistructured interviews with law enforcement leaders from select 4-year universities in California. These leaders represented small and large universities from rural, suburban, and urban settings.

This chapter includes a discussion and interpretation of study results. The chapter begins with an interpretation of study findings, as contextualized against previous research and the theoretical framework. Next, limitations and recommendations for future

research are presented. Finally, I discuss research implications and close with a brief conclusion.

Interpretation of the Findings

Through thematic analysis of interviews and content analysis of study documents, I identified five themes and six associated subthemes. The five main themes to emerge from the analysis included: (a) participants described the interoperable capabilities of their agencies, (b) participants identified barriers to interoperability, (c) communication worked smoothly, (d) challenges with and learning from communication issues, and, (e) policies need to be defined and changed. Six associated subthemes emerged for the main theme: participants described the interoperable capabilities of their agencies. These subthemes included: (a) how local governance was perceived, (b) SOPs, (c) participants described technology employed for interoperable communications, (d) employing voice communication for interoperable communication, and, (e) participants spoke about training in relation to interoperable communication.

In this chapter, I discuss each of the themes and subthemes in relation to the research questions. Although interoperability performance has been studied through event after-action reports at local levels, addressed through trade literature, and described as an important issue in emergency response at the national level (DHS, 2015; Giblin et al., 2013; Kapacu & Khosa, 2013; Reaves, 2015), a dearth of research existed on the capabilities and performance of campus-based law enforcement interoperability.

Participants Described the Interoperable Capabilities of their Agencies

Study participants discussed the interoperable capabilities of their individual agencies at length. The areas they focused on included governance, technology level, use of technological capabilities, SOPs, and training scenarios. Each of these areas was broken into a subtheme.

How local governance was perceived. Most participants reported that governance was coordinated and collaboratively operated with regular communication between agencies. Prior to this investigation, little research existed on the specific interoperable capabilities between campus and local law enforcement agencies and no research could be found focused on governance and interoperability. A novel finding in this study is that, although the majority of participants participated in local governance on a regular basis, most did not participate at a regional level within a statewide communications interoperability framework. Griffin (2009) noted that higher education institutions were responsible for crime reporting and prevention through leadership, which was echoed in data from the current study. Based on the interoperability continuum (DHS, 2015), study participants perceived and shared supportive evidence they thought were important relative to governance. Participants remarked that participation in collaborative governance enhanced interoperability, coordination, and mutual aid.

Standard operating procedures. Results from participant interviews, as well as the content analysis of written documents, indicated that SOPs existed between campuses

and mutual aid partners. This subtheme indicated that universities in the current study were aware of, and possessed, such policies. Participants stated that existing standard procedures helped university law enforcement departments develop uniform methods for responding to incidents and guidelines for interoperability. This supported guidelines for preparation provided by the Major Cities Police Chiefs Association (2010). In addition, Reaves (2015) quantitatively described some of the communications characteristics of campus-based law enforcement agencies at educational institutions and found that 88% had some type of written understanding or agreement, which is consistent with the findings of this study. Giblin et al. (2013) explored the perceptions of campus-based and local law enforcement personnel through a paired match survey of municipal and campus-based law enforcement organizations. Giblin et al. (2013) found that the vast majority (95%) of campus based law enforcement agencies had reported they possessed a written plan and shared the plan with local law enforcement partners, which is consistent with the findings of this study. Kapucu and Khosa (2013) found that 96% of the respondents to their study reported collaboration with community police, fire, and first responders, and that a high-impact indicator of interoperability was strong community partnerships. Participants from the current investigation echoed this sentiment, expressing beliefs that SOPs were important and helped to build these partnerships.

Participants described technology employed for interoperable communications. Participants described using a variety of communication equipment in use for response. This subtheme was similar to previous studies and pinpointed areas of

weakness in interoperable capabilities. For example, some participants explained that equipment from various agencies was stored in boxes to use during emergencies, a strategy that many previous researchers reported as unsuccessful (Damanik & Gunawan, 2011; Facella, 2005; Jones & McGrath, 2005; McFarland, 2007; Miller, Granato, Feuerstein, & Ruffino, 2005; Upham, 2009; U.S. Government Accountability Office, 2007). Despite this widely published information on the futility of this strategy, such practices continue, justifying concerns shared by many in the field.

Of note was the wide range of equipment available for use by the campus agencies. Participants described various implementations including a regional command center, deployable gateways, interoperable channels, and swapping radios, supporting findings from previous research on this weakness in interoperable communications. The findings of this study align with those from the National Task Force on Interoperability (2005) and Oversight of FirstNet (2013), which reported the following key impediments to interoperability: aging and failing communications equipment, incompatible equipment or frequencies, and a limited and disjointed radio communications spectrum.

The findings of this study differ from Giblin et al. (2013) and Reaves (2015). Giblin et al. (2013) found that agencies tended to agree on the existence of an interoperable communications system for incident response, noting that more than 68% of campus law enforcement agencies claimed to have interoperable communications systems. However, results from the current study indicated a lack of implementation of interoperable communications systems. The findings of this study also demonstrated a

lower degree of success of full radio system interoperability than Reaves (2015), who reported that 48% of all 4-year campuses had achieved full interoperability. Only one participant from the current study claimed the achievement of maximal interoperability via an open-standards communications system with mutual aid partners.

Findings from the current study illustrate a lack of substantial progress to adopting open-standards systems since the DHS baseline study (2006) of law enforcement organizations without specificity to municipality or campus policing. Although findings from the DHS baseline study indicated that 87% of local agencies focused on improving interoperability and planned significant upgrades to their radio systems within the following 10 years, such upgrades have not occurred in campus-based policing.

Employing voice communication for interoperable communication. Although not mentioned in the literature, a novel finding from this study was that many departments bypassed the use of radio communication and defaulted to the use of cellular technology to communicate during interagency incidents. Cell phones were perceived as more effective than existing radio equipment, although they were nonsecured and sometimes unreliable due to dependence on signal quality.

Participants spoke about challenges associated with communicating across departments because of discrepancies in equipment and lack of access to shared channels, which increased reliance on cell phone technology. Reaves (2015) noted that half of campus based law enforcement agencies provided handheld smart devices such as smart

phones to officers, but did not investigate whether these devices were used in addition to, or in replacement of, radio systems during mutual aid events while neither Giblin et al. (2013) nor Kapacu and Khosa (2013) explored cellular phone use for interoperability.

Participants spoke about training in relation to interoperable communication. Although study participants described attending joint training opportunities, many believed that more training was necessary. Findings from Giblin et al. (2013) revealed the importance of joint training which was supported by data from the current study. This study, however, found the majority of participants participated in joint training and exercises, which are higher than Giblin et al. (2013) who reported only 66% of the agencies had participated in emergency simulations within the past 12 months, and Kapucu and Khosa (2013) who reported 78% of respondents noted regular participation in training. Findings are aligned with Reaves's (2015) study that reported 95% of campus agencies participated in training and exercises. Current findings support the Clery Act (Griffin, 2009), with SOPs between campus and municipal partners, and training exceeding once per year. Respondents from the current study reported regular training, but believed that additional training would be helpful.

Findings in this study indicated successful and mature implementation of NIMS and ICS (DHS, 2008; Hawkins, 2007; Peak et al, 2008) throughout campus-based law enforcement organizations, with the majority of participants reporting practiced use of NIMS and ICS. This finding is consistent with Presidential Directive-5 implemented through DHS, which requires universities to be compliant with NIMS (Edwards and

Goodrich, 2009). This finding complements Kapacu and Khosa (2013), who also reported high usage of NIMS and ICS for compliancy with campus all hazard planning. Findings also revealed that participants were focused on the Interoperability Continuum for capabilities (DHS, 2015) including (a) technology is an enabler for interoperability, (b) governance is an enabler for collaboration, (c) SOPs are essential for delineation of responsibilities during multijurisdictional or multiagency response supportive of NIMS and ICS, (d) training and exercises contribute to interoperability knowledge, situational awareness and can enable performance, and (e) frequency of usage of interoperability is an indicator of performance success.

Participants Identified Barriers to Interoperability

Researchers agree on the communications difficulties that first responders face when involved in multijurisdictional or multiagency events (Bharosa et al, 2010; Bipartisan Policy Center, 2011; Desourdis, 2012; Sandy Hook Advisory Commission, 2015; Stack, 2015); however, previous researchers had not explored the need for policy through the lens of campus-based law enforcement. The participants in this study provided information to help address this gap in the literature. Barriers identified in this study included the lack of funding, the lack of policy standards, the need for understanding the importance of campus-based law enforcement response, and the need for more inclusive and frequent training. Griffin (2009) discussed key nationwide policy implementation needed to enhance interoperability, as represented through the Presidential Directives. Findings from the current investigation highlighted the lack of

access to funding and policy guidance for technology needed to improve interoperable communications among campus-based agencies. Thus, findings from this study support and expand upon Griffin's work.

Communication Worked Smoothly

Some study participants discussed effective communication during incidents. They found that communication with other agencies was smooth and they were able to coordinate responses to incidents. One participant who claimed effective communications was a participant of an open-standard shared radio system, highlighted as maximum interoperability on the Interoperability Continuum (SAFECOM, 2015). However, two participants were not. Despite the use of suboptimal communication technology from these two participants, including shared channels and gateways, they were able to speak with other agencies and coordinate responses. This finding calls into question the edict for open-standards shared Project 25 communications systems and provides evidence of effective multiagency communication through lower levels of technological achievement on the interoperability continuum (SAFECOM, 2015).

Challenges with and Learning from Communication Issues

Participants cited problems with interoperable events that occurred during the previous 5 years, as well as lessons learned and procedural changes made to improve responses to events. Many of their responses supported information found in the literature about challenging emergency responses. Participants indicted that although some planned events went well, unplanned events were often chaotic and characterized by poor

communication. Participants reported issues, such as (a) using different channels that did not facilitate information-sharing, (b) difficulties sharing information and learning what actions needed to be taken, and (c) increased response times. These findings echo analyses from multiagency actions in which necessary coordination across agencies did not go well (Desourdis, 2012; Multnomah County, 2015; Sandy Hook Advisory Commission, 2015; Straub, Cowell, Zeunik, Gorban, 2017; Systems Planning Corporation, 2009; University of Texas Police Department, 2010, Virginia Tech, 2007). These studies reported similar difficulties and indicated the need for significant changes and technology upgrades.

Policies Need to be Defined and Changed

The participants of this study were the key leaders of their respective campus-based law enforcement agencies and reported perceptions of being left out of key policy guidance. Participants remarked on the ongoing need for policy guidance and assistance with planning efforts to enhance interoperability. Notably, findings of this study highlighted participants' perceptions of feeling excluded from policy decisions at the local, state, and federal levels. Participants also indicated being treated as inferior to local municipal law enforcement agencies. The participants uniformly remarked that their responsibilities were similar to leaders at municipal policing agencies, as they were responsible for their campus and nearby boundaries. These findings support those provided by Bromley, as cited by Giblin (2013), of university campuses encompassing *cities within cities*. Participants in the current study believed their responsibilities were as

extensive as other law enforcement agencies, but that they received less support and had less influence. Participants expressed concerns regarding inadequate access to funding, technology, and information.

Theoretical Implications

GST Alignment. Von Bertalanffy's General Systems Theory (1968) stated that systems are open and have the common elements of input, output, process, feedback, environmental controls, and goals. GST posits that systems are complex and consist of elements that interact with their environment and intrinsic dynamic qualities. Findings from the current study support GST through the five interrelated systems expressed through the Interoperability Continuum (DHS, 2015).

In order for campus-based law enforcement organizations to maximize interoperability capabilities, all elements of the Continuum must interact during an interoperable event. The complex interplay of the capabilities encompassing technology, SOPs, governance, training, and usage can create or inhibit the performance of campus-based law enforcement agencies during multijurisdictional or multiagency responses. Findings from the current study indicated that the insufficient capabilities of campus law enforcement agencies contribute to diminished performance during events.

Kapucu (2006) reported that emergency communication is multi-organizational and requires coordination. As synthesized by Cheng (2013), the effectiveness of the response, or performance, is judged by maximizing coordination among disparate agencies, which is indicative of GST as expressed through the Continuum (DHS, 2015).

Findings of the current study support the enhanced need for policy direction and guidance that can enhance communications flow and situational awareness among all event responders, which supports Kuehn et al.'s (2011) contention that groups maximally benefit through rich information-sharing in open communications systems.

UTAUT Model Alignment. Findings from this study support the UTAUT Model in several ways. Notably, most campus-based law enforcement agencies examined in this study did not perform optimally during interoperable events, due to sub-optimal interoperable capabilities. The UTAUT element of performance expectancy provided some insight into this phenomenon. Performance expectancy refers to the degree to which the adopter of technology believes it will provide benefits or enhance performance (Venkatesh et al., 2003).

Findings from this study also highlight decision-makers' desire to understand their options to maximize capabilities, with most participants expressing a thirst for knowledge and a need for more policy guidance. Similarly, findings from this study support the need for more collaboration and policy guidance. Because campus-based organizations are not participants of regional governance groups with access to statewide interoperability planning and direction, they lack access to key learning opportunities from governance group collaboration and coordination. Within the law enforcement setting, Hu et al. (2011) and Lin et al. (2004) reported that the greatest influence of acceptance and use was perceived usefulness. Findings from this study revealed that the key campus-based law enforcement decision-makers had low levels of knowledge of

enhancing key technological capabilities related to their performance. Also, because campus agencies felt excluded from policymaking, they believed they could not collaborate and discuss interoperability, which drives performance expectancy.

Another UTAUT element essential to the findings of this study was effort expectancy, which describes the amount of effort associated with technology use. Most campus agencies regarded their technical capabilities as inferior to their mutual aid partners, and no participant stated that they felt their technical capabilities were superior to those of mutual aid partners. The leaders of campus-based law enforcement agencies who had not maximized their capabilities expressed the need for policies that were delivered to them. This passive position suggests that campus-based leaders do not actively engage with policymakers to advance their agency's technical capabilities. The results of this study indicated that leaders who applied effort, and engaged and collaborated with interoperable partners, had the greatest performance success.

Social influence was an important factor in this study. As defined in the UTAUT model, social influence describes the degree to which decision-makers value the opinions of others, regarding technology adoption and use. Social perception seemed to have a small effect on voluntary adoption of technology. Campus organizations were not mandated to advance interoperable capabilities, and social status or prestige was not improved after the adoption of technology. In other words, it is unlikely that a campus police chief will elevate his or her standing with his peers or campus staff by increasing the agency's interoperable capabilities. Because many study participants felt that their

organizations were regarded as inferior to municipal policing agencies, they might not feel pressure or social influence to improve interoperable capabilities. Although most participants expressed disdain for not being treated as equals to municipal law enforcement organizations, in the context of social influence, findings suggest such inequalities foster flexible technology adoption.

Aligned with Lin et al.'s (2004) findings in a law enforcement setting, social influence was an important factor of user acceptance; society (students, employees and parents) was perceived to be unaware of the capabilities of campus law enforcement agencies charged with their protection. Social influence would have a more substantial influence on campus-based agencies if the public was more aware of the consequences of inferior technology acceptance as it relates to emergency response, or if interoperable capabilities were determinants of school choice. Although the mutual aid partners and local responding agencies were aware of the campus's interoperable capabilities, this has little effect on social influence. This finding supports Hu et al.'s (2011) conclusion that peer influence has no distinct effect on intention to use technology.

Another influence of intention to use technology in this model was behavioral intention, which refers to the influences of available choices such as understanding the advantages of use, preparing for usage, and envisioning improvements upon using the technology (Sheppard et al., 1988). Findings from this study reveal that interoperability can be achieved through a myriad of possibilities, as expressed through the participants, including swapping radios, gateways and patches, and shared channels. Although these

choices are inferior to shared, open-standards systems, participants universally concluded that factors, such as lack of money and policy guidance, hindered the achievement of maximum interoperability.

The participants utilized various approaches to interoperability, operating under the adage of *getting the job done*, regardless of barriers or obstacles. Participants clearly articulated the advantages of maximizing interoperability communications and expressed interests in using it, but were unable to create visions or plans to achieve maximum interoperability. Lin et al. (2004) postulated that behavioral intention drives technology acceptance, which was supported by findings from the current study. This study's findings support Lin's findings because participants achieved interoperable communications through several methods, arriving at an acceptable and tolerable standard of performance, instead of seeking maximum interoperable performance.

Facilitating conditions is the final element of the UTAUT model. Venkatesh et al. (2003) described facilitating conditions as the organizational and technical infrastructures that exist to support the use of technology. Although Hu et al. (2011) found that law enforcement officers placed less emphasis on facilitating conditions, findings from the current study revealed that facilitating conditions were a substantial and primary driver of communications interoperability and performance. Study results also indicated that collaboration, training, governance, funding, and policy guidance were essential organizational infrastructures needed for enhanced communications interoperability. The availability and coordination of frequencies, channels, shared radio systems, and radio

technology were essential infrastructure requirements for interoperable communications capabilities and performance. These findings challenge Hu et al. (2011), unequivocally discerning that facilitating conditions are substantial drivers of technology usage.

Limitations of the Study

This study was bound by a few limitations. First, findings were limited to the perceptions of campus-based law enforcement agencies in the state of California. Although California lacks a statewide radio communications network, other states have invested in this technology. Thus, results may not be transferable to other settings.

The selection of 10 cases from a population of 34 universities with campus police departments represents a small sample size. Individuals with community colleges, trade schools, institutions granting less than 4-year degrees, or K-12 educational institutions were not included. In addition, participants were only selected if they possessed knowledge of an interoperable, multijurisdictional or multiagency event that occurred in the previous 5 years. These inclusion criteria precluded the participation of individuals who may have knowledge of the subject but had not experienced such an event.

Participants for the current study were chosen and interviews were conducted until thematic saturation occurred, instead of contacting the entire population of potential research candidates. Also, only campus-based law enforcement agencies were chosen to participate in the study; their respective mutual aid partners were not included, thus their partner’s perspectives were not included. It is important to note that other campus based

first responders, such as fire and medical response personnel who also used interoperable communications during emergency incidents, were not included in this study.

Recommendations for Further Research

Several recommendations for future research as related to this study's parameters may be made. These areas for future research are important, given the minimal amount of research that currently exists in campus-based law enforcement communications. While the following recommendations are not exhaustive, they serve to improve the continuance of knowledge for this important research topic.

The first recommendation is to expand the current analysis to include more types of educational institutions, other than 4-year universities. Some examples of such target populations may include community colleges, trade schools, and K-12 educational environments. Another recommendation is to include the perceptions of the mutual aid partners, such as local, state, and federal law enforcement partners who share response efforts with educational institutions. An additional recommendation is to examine methods of interoperability since this study revealed (1) the use of cellular phones as a communication medium during interagency response, and (2) agencies were satisfied with interoperable communication despite achieving maximum technological interoperability. A final recommendation is to replicate the current study in another state that has implemented a statewide open-standards interoperable communications system that is leveraged by the majority of the local agencies including campuses.

Implications for Positive Social Change

This study provided knowledge needed to address an important gap in public safety communications research. Campus-based law enforcement organizations are responsible for the safety and security of university students, employees, and campus visitors. This study highlights the serious need of universities to maximize the capabilities of officers charged with protecting campus occupants. When first responders have maximum communication during an event, regardless of agency or affiliation, responses are more effectively coordinated and lives may be saved.

The implication for social change within campus-based law enforcement agencies is increased productivity and enhanced officer safety. Productivity enhancement includes attention to training needs, knowledge transfer, and improved command and control during situations. Coordinated responses facilitate the quick and effective resolution of situations. For example, during an active shooter event, when all responding agencies share equal access to communications, the event may be resolved more quickly with increased officer safety.

The implication for social change for society, particularly those who visit, are employed by, or attend universities, is increased campus safety and security. Citizen safety is a core function of emergency response and law enforcement organizations. Improving interoperable communications may facilitate quick event resolution that reduces losses to life and property. Improving interoperable communications may also assist with recovery efforts.

The implications for those charged with policy creation and guidance is an awareness of the needs of this subset of law enforcement agencies. Through awareness of the important issue of collaborative response among campus-based law enforcement organizations and mutual aid partners, policy guidance can be created to improve the effectiveness of communications capabilities, provide planning and guidance for enhancing performance, and develop opportunities for funding campus law enforcement communications, such as grants and other forms of financial support. The final implication for policy makers is the realization that campus-based law enforcement agencies must be treated with the same respect as municipal policing agencies, and afforded the same opportunities to enhance communications performance.

Conclusions

Participants from this study discussed their use of interoperable communication. Although the leaders were located throughout the state of California and represented diverse campus settings, their responses were predominately uniform, as all respondents believed that communications interoperability was paramount to success during responses to multijurisdictional or multiagency events. Collectively, study participants agreed that interoperable capabilities were indicators of performance, and that maximizing communication was essential to effectively protecting campus students, employees, and visitors. Participants believed that communications involved inputs and outputs, which aligned with the GST model that formed the study's theoretical framework. Participants highlighted the need for money and funding to improve

communications interoperability, as well as the need for policy improvement. Correlating to the UTAUT model, participants recounted that technology is essential to effective communication. Findings from this study provide a deeper understanding of the barriers to effective, interoperable communications faced by campus-based law enforcement agencies. Participants provided real examples of interoperable events from the past 5 years, and discussed policy implications.

This study contributes to the knowledge of communications interoperability in emergency responses. The findings from this multiple case study revealed that communications interoperability is problematic for campus-based law enforcement agencies, and the problems are systemic across university size and geographic location. This study gave a voice to a neglected group of law enforcement agencies tasked with citizen protection. Viewing the capabilities and barriers to performance through the lens of the leadership of campus-based law enforcement agencies, via interoperable events fraught with challenges, provides an impetus of the need for more effective policies. As one of the few studies focused on campus-based law enforcement, and the scarcity of existing research on their communications capabilities, the findings of this study may help policymakers to improve the interoperable communications of campus-based law enforcement organizations when involved in events that exceed their capabilities and necessitates mutual aid from outside public safety agencies.

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Appendix A: Demographics Survey

(Administered Verbally)

This survey and questions are designed to collect information pertaining to your case as it relates to campus-based law enforcement interoperability. Data collection will be used for dissertation purposes only. Pseudonyms will be assigned to safeguard participants' anonymity.

1. Which agency do you represent?
2. How long have you been employed at this agency?
3. What is the size of your agency: How many sworn and unsworn officers?
4. What type of radios and radio systems do you use?
5. Has your agency been involved in a multijurisdictional or multiagency event within the last 5 years?

Appendix B: Researcher's NIH Certification

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Tammie Massirer** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 07/13/2014

Certification Number: 1503352

Appendix C: Interview Protocol

Notes for the Researcher

Audiorecord the interview if permission is granted.

Hold the interview in a setting free from interruptions.

Each interview should last approximately 60 minutes.

Interview Method

The interview questions are administered in an open-ended format, allowing for in-depth answers. Follow-up questions will be used to enhance the depth of the responses. I will use a semistructured research design with four predetermined, open-ended questions. All predetermined questions will be the same in each interview for consistency.

Interview Place and Time

I will work with the participant to set an agreeable place and time, which is convenient for the participant. I will ask the participant to choose a place that will be free from interruption.

Interview Overview

The interview will last approximately 60 minutes.

Components of the Interview

1. Review purpose and procedures of the study with the participant.

2. Review confidentiality and informed consent.

3. Administer the demographic survey.

4. Discuss the purpose of the interview as follows:

The purpose of this interview is to gain an understand the interoperability of your agency with other agencies in your area using your radios and radio system. During this time, I look forward to learning what your perceptions are regarding your interoperability capabilities and performance during multijurisdictional events.

5. Ask for permission to audio record the interview, as follows:

As we go through our discussion today, I will be taking some notes. I would also like to audio-tape this interview to get an exact record of our conversation that I can transcribe and review. No one besides myself will listen to this recording, and I will be the only person with access to the transcription. Your confidentiality will be protected. Do I have your permission to audio-record our interview?

6. Provide an overview of the questions, as follows:

The questions I will be asking are intended provide me with an understanding of your perceptions and personal experiences. There are no right or wrong answers to these questions. This interview should last about 1 hour. Do you have any questions before we begin?

Interview Questions

1. What are your interoperability capabilities when your law enforcement agency is involved in a multijurisdictional or multiagency event?

Probes: What technologies do you use? How often would you say that interoperable is being used, and what types of events drive the use? What types of

training and exercises for interoperable communications exist in your area, and does your agency participate? Do you have standard operating procedures (SOPs) for interoperating with other agencies, and can you describe them? Is there a local governance group in your area for interoperable communications, and is your agency a member of this group?

2. What barriers do you perceive that inhibit your agency from achieving full interoperability with your neighbors?

Probes: For each barrier you named, how large of an effect does it have on your interoperability? Of the barriers you named, which barriers would be ranked 1, 2, and 3 and why?

3. Thinking back to your last multijurisdictional or multiagency event, how effective were you in communicating with all agencies involved?

Probes: What were specific issues impeding interoperability? Since the event, what improvements or changes have been made? Can you please describe the important lessons you learned from your last multiagency or multijurisdictional event as it relates to interoperability? Would your performance in the event you described be different today if it were to occur now? How would it be different?

4. How can government-wide policies and procedures improve the interoperability performance of your campus law enforcement agency?

Probes: What roles do policymakers play in enhancing interoperability performance for campus-based law enforcement agencies such as yours? To what extent have the NIMS protocols influenced your interoperable communications and why?

6. Conclude the interview, as follows;

Ask the participant for permission to follow up if clarification is needed for any point raised in the interview. Remind participants that they will receive a copy of the transcript with a request to verify that it correctly reflects the information the participant has provided during the interview. Ask the participant to respond within 2 weeks with confirmation or corrections, if necessary.

Thank the participant for their time and information provided.