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# Assessment of Detroit Hospital Preparedness for Response to an Improvised Nuclear Attack

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Abstract

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MHA, University of Phoenix 2011

BHSA, Baker College, 2009

Dissertation Submitted in Partial Fulfillment

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## Abstract

An improvised nuclear device (IND) is considered by the DHS to be the most catastrophic terrorist incident that could befall the United States, causing severe economic damage, extensive property damage, and enormous loss of life. Effective response to an IND is best accomplished with preparation including emergency operations plans (EOP) specific to an IND and training for staff on how to respond. The literature documents several areas of weakness in U.S. health services' preparation that affects entire communities and puts lives at risk. The purpose of this study was to assess the strengths, weaknesses, and gaps in Detroit, Michigan hospitals' EOP for responding to an IND terrorist attack. The conceptual framework used systems theory to look at how an event's complex individual components work as parts of a larger whole. Specifically, the interconnections that the individual parts of an event have on the outcome were assessed as means of evaluating the IND EOP that Detroit area hospitals have in place. This qualitative study consisted of an interview approach with the emergency management representatives of Detroit hospitals responsible for EOP development. Data analysis was completed using categorization based on research questions to look for commonalities and trends. This study revealed gaps that the 5 participating Detroit hospitals have in their preparation, training, and staff knowledge in response to an IND. Implications for positive social change, at local and national levels, include creation and dissemination of an improved model for disaster planning and training in the hospital setting, which correlates to improved community response and community care for health service organizations and throughout health services as a whole.

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# Dedication

For my husband Jeff, who supported and encouraged me to keep reaching for my goals no matter how hard it became or how discouraged I felt. For my sister Patty, who pushed me to keep going and would never allow me to quit. Your support means the world to me.

For my children, Matthew, Jaquelyne, and John, who are and always will be my inspiration to improve myself and the world around me. Your support for me has been unwavering and inspires me to imagine what could be. In the words of J.K. Rowling, "We do not need magic to change the world, we carry all the power we need inside ourselves already: we have the power to imagine better."

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To my colleagues in healthcare safety that listened to my ideas, assisted me along the way, and didn't turn away when I asked so many times for your opinions, I say thank you. Without you I would never have been successful in my quest to complete this dissertation.

Finally, to the various professors, instructors, and teachers who have worked with me throughout my education I am grateful. To continue my education is a lifetime commitment and I thank you for making it possible, interesting, challenging, and enjoyable.

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## Introduction and Background

A nuclear detonation is considered by The Department of Homeland Security (DHS, 2012) to be the most catastrophic terrorist incident that could befall the United States. This type of terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (DHS, 2012). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area and significantly damage response infrastructure (DHS, 2012). In particular, disasters that potentially impact the hospital infrastructure, directly or indirectly, create a need for hospitals to implement their facility emergency plans including evacuation or sheltering-in-place for their patients, visitors, and staff, implementation of medical surge, triage, and burn surge plans, and decontamination of staff, patients, and their facilities (DHS, 2012).

Following the terrorist attacks of September 11, 2001, the United States has taken steps at the federal, state, and local levels to prepare for a possible terrorist attack that includes a nuclear detonation (Combs, 2015). An improvised nuclear terrorist attack would require a complex and organized response that crosses jurisdictional boundaries and involves all levels of government as well as private sector agencies (DHS, 2012). The primary goal in response efforts to an improvised nuclear terrorist attack is to limit casualties while at the same time offering coordinated long-term support to the affected communities (DHS, 2012). It is expected that the local and state resources will be quickly overwhelmed, so preparation and planning are imperative to respond and reach this

primary goal (DHS, 2012). In my review of current literature, I found that most hospitals in the United States have developed an all-hazards approach to disaster preparedness and emergency management (Adini, Goldberg, Cohen, Laor & Bar-Dayan, 2012; James, 2011; Kano, Wood, Bourque, & Mileti 2011; McAlister, 2011; Satkowiak, 2014; Tan, Barnett, Stolz, & Links, 2011; Veenema, 2013).

Although the all-hazards approach is valuable, it does not truly prepare a hospital to respond to a terrorist attack involving an improvised nuclear device (IND) because this type of attack poses specific challenges that require specialized responses by a hospital (McAlister, 2011). The current literature on this topic indicates that hospitals should look to develop emergency operation plans specific to IND response, though it does not show the best approach for determining current preparedness levels, or developing and implementing IND specific plans (Tan, et al., 2011). It is this gap that I sought to help fill in this study by developing an approach that hospitals can use to become better prepared for IND response.

Chapter 1 includes the problem statement and a discussion of the purpose and nature of this study of the preparedness levels of Detroit hospitals to respond to a terrorist attack involving an IND. In this chapter, I also present the research questions and discuss the theoretical framework for the study. Finally, I show that the key social change implication of this study is the development of an improved model for disaster planning and training in the hospital setting as it relates to responding to a terrorist attack involving an IND.

## Problem Statement

The September 11, 2001 terrorist attacks on the United States revealed the lack of hospitals' preparedness to respond to terrorist attacks, and brought focus to disaster preparedness in the hospital setting (Kano et al., 2011). Mandates issued by United States Health and Human Services required hospitals to change their approach to emergency management and disaster preparedness by developing emergency operations plans and instituting new training (Kano et al., 2011).

In recent years there have been several notable terrorist attacks worldwide in addition to the September 11, 2001 attacks on the United States. In 2013, two brothers detonated improvised explosive devices near the finish line of the Boston Marathon, killing three people and injuring more than 260 others (Boston Globe, 2013). In 2011, the North Atlantic Treaty Organization (NATO) reported 960 terrorist incidents across the world, resulting in 493 deaths and 1,601 people injured through the use of improvised explosive devices (DHS, 2012). There have been a number of studies examining the preparation a hospital must have in place for an IND (Bliss, Hristovski, & Ulrich, 2013; Center for Biosecurity of UPMC, 2011; Centers for Medicare and Medicaid Services [CMS], 2014; DHS, 2012; Gale & Baranov, 2014; Kano et al., 2011; Lim, Lim & Vasu, 2013; Mauroni, 2012; Veenema, 2013).

An Integrated Planning Guidance (IPG) document was developed by DHS (2012) in 2008 that identified the Federal Emergency Management Agency (FEMA) as the departmental leader for response and recovery efforts associated with the terrorist use of an IND. Building on the 15 Emergency Support Functions of the National Response

Framework, FEMA determined that the number of anticipated casualties along with the expected level of injuries necessitates planning to care for a large number of patients who potentially have been contaminated with radioactive materials (DHS, 2012). The DHS then used these FEMA recommendations to develop and publish a strategy for improving response for hospitals and other response agencies to make their own response plans. These recommendations point to the need for specific training of health care professionals in treating victims of radiation and coping with a large surge of patients following a detonation (DHS, 2012).

Because the characteristics of terrorist attacks involving an IND are similar to those that use chemical and biological materials, it is prudent for a hospital to develop an emergency operations plan from an all-hazards approach (Satkowiak, 2014). The significant difference with an IND is the risk of exposure to radiation when people are not in contact with the original source (Satkowiak, 2014). Identification of a chemical attack is based on medical signs and symptoms of the victim, whereas radiological response for first responders and hospital first receivers is based on secondary indicators such as witness descriptions of mushroom cloud explosions (Satkowiak, 2014). Another method of identifying an IND incident for hospitals is the detection of radioactive contamination. This approach is not commonly used in hospitals, and approximately only 43% of hospitals in the United States have radiation detectors in use (Satkowiak, 2014). Consequently, although an all-hazard approach to disaster preparedness in hospitals is recommended by the Centers for Medicare and Medicaid Services (CMS, 2014), it is also important that hospitals include a specific plan for response to radiological incidents

(Satkowiak, 2014). The need for hospitals to develop plans specific to radiological incidents including terrorist attacks involving an IND often competes with the requirements for an all-hazards approach to hospital disaster preparedness (Kearns, Cairns, Holmes, Rich, & Cairns, 2013).

It is common in the hospital setting for a collaborative effort to be used in developing an all-hazards emergency operations plan and associated standard operating procedures (SOPs) with clinicians, administrators, safety professionals, and security personal involved (Kearns et al., 2013). The development of SOPs relating specifically to response to a terrorist attack involving an IND is key in preparedness (Adini et al., 2012). Although a well-trained and experienced staff is capable of response to familiar disaster situations, the response to an IND is a rare event that makes specific SOPs vital to effective response (Adini, et al. 2012).

In contrast to studies of the advancements made in preparation for a detonation, there have been very few studies that focus on the preparedness needs specific to hospitals (Kano et al., 2011). Although general guidelines have been developed to assist in triage and the development of patient care plans during a nuclear event, there is no clear guidance available for developing administrative and operational plans for a response (Veenema, 2013). The CMS has looked at the need to develop a more focused approach to preparing for individual types of disaster. In December 2013, the CMS published an opinion that current disaster preparedness requirements for hospitals that care for Medicare and Medicaid patients do not address the need for communication to coordinate with other systems of care, contingency planning for specific types of

disasters, and training of personnel (CMS, 2014). Additionally, the CMS stated that in a nuclear event, hospitals would not have the necessary emergency planning and preparation in place to care for the health and safety of the victims. Finally, concerns that there is a need for a consistent regulatory approach in requiring hospitals to plan for and respond to specific disasters led to the development of a proposed rule, by the CMS, related to emergency preparedness to specific disaster types.

The rule proposed by the CMS (2014) requires all hospitals that care for Medicare and Medicaid patients to establish disaster plans that are comprehensive, consistent, flexible, and dynamic as a condition of participation. The three essentials needed to provide health care in a disaster are safeguarding human resources, ensuring business continuity, and protecting physical resources (CMS, 2014). These three essentials are not included in current requirements for hospital disaster planning; the proposed rule would require these three essentials and add the requirements of risk assessment and planning, policies and procedures, communications plans, and training and testing (CMS, 2014). Public comment on the proposed rule closed in March 2014, and this proposed rule is expected to move forward toward approval.

The need for further research into hospital disaster preparedness overall, and specifically into response to a terrorist attack involving an IND is evident in hospitals' needs to continually validate the readiness and effectiveness of their disaster response plans, and incorporate new technology and advancements in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh et al., 2012). The problem that I addressed in this study is that with inadequate preparation specific to an

IND at the hospital level, the result of this type of a terrorist attack will result in devastation for a community because the hospital will not be able to properly respond. Although it is necessary for all hospitals to be prepared to respond to terrorist attacks, it is not possible to implement the same plans in all areas across the country because each has their own unique vulnerabilities. In this dissertation, I focus specifically on hospitals in Detroit, Michigan because Detroit is the busiest international land border crossing in the United States (Department of Transportation [DOT], 2013) and thus has an increased threat of international terrorist attacks (DOT, 2013).

## Purpose of the Study

I completed this study using a qualitative approach to evaluate Detroit, Michigan hospitals' the preparedness for responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness it is possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

## Research Questions

RQ1: How have the hospitals planned for response to an improvised nuclear attack?

RQ2: What type of training has the first receiver emergency department staff of the hospital had to respond to an improvised nuclear attack?

RQ3: How can the hospitals better prepare for response to an improvised nuclear attack?

## Theoretical Framework

I used systems theory to look at how an event's complex individual components work as parts of a larger whole (Patton, 2015). Systems theory requires the researcher to look at each individual part of an event to determine its strengths, weaknesses, and impact on the event outcome (Patton, 2015). I assessed the interconnections that the individual parts of an event have on the outcome as means of evaluating the IND response programs that Detroit area hospitals have put in place.

Systems theory is based on the concept that present and past events will affect future events, and it provides the philosophical and intellectual foundation for a more inclusive model of causality (Borradorri, 2013; James, 2011; Young & Leveson, 2014). Using a systems theory approach to IND disaster response will make it possible to better prepare for future events.

Systems theory is used to look at how a system or event functions as a whole, while at the same time viewing the event complexities as individual parts of a larger whole (Patton, 2015). Systems theory is also facilitates a look at the interconnections that the individual parts of the event have in relation to the ultimate outcome (James, 2011). To look at the individual parts of an event, it is necessary to look at them as a part of the whole event, which assists in reviewing them in terms of their strengths, weaknesses, and impacts on outcome (Patton, 2015). This type of evaluation is useful in program evaluation and analysis because it allows for review of individual parts without regard for how each is included in the whole, and focuses on each part in relation to the outcome

(Patton, 2015). Researchers use systems theory to answer the question of how and why the program works as a whole (Patton, 2015).

Terrorism is a method of war that has been used by individuals, groups, and governments for centuries, and is a method that has evolved in its approach as technology has advanced (Borradorri, 2013; James, 2011). Systems theory is based on the idea that present and past events will affect future events (Borradorri, 2013), and it provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). Using a systems theory approach to this topic and keeping in mind the idea that terrorist events have happened in the past and present, it is possible to better prepare for future events.

Previous research into guidance for accidental radiation exposure to the public has focused on avoiding low-level exposures from accidental transportation and nuclear plant releases (Lawrence Livermore National Laboratory, 2011). Additionally, U.S. government research and policy during the cold war period developed civil defense programs with guidance on the use of fallout shelters, though these methods of preparedness and planning for an IND would not work because they depend on advance warning of incoming missiles (Lawrence Livermore National Laboratory, 2011). The National Capital Region Key Response Planning Factors for the Aftermath of Nuclear Terrorism study completed by the Lawrence Livermore National Laboratory (2011) showed that the methodologies used to develop the civil defense program plans are valuable in developing disaster plans for IND attacks, given that devastation would be

expected for both types of radiation disaster. This use of past events and past practice to develop current disaster plans is an example of systems theory.

Another example of the use of systems theory in emergency preparedness planning was a study completed by Perko, van Gorp, Turcanu, Thijssen, & Carle (2013) who used past issues with communications during a disaster to develop guidelines to assist local and state governments in communicating with the public in the event of an IND. This study linked the inability of first responders and local government entities to communicate with the public during the September 11, 2001 terror attacks on the United States to an assumed increased number of casualties (Perko et al., 2013). The guidelines developed using the systems method included the use of the NIMS Incident Command System, and provided grounded examples of communication methods and scripting to assist in response to an IND.

Disaster preparedness is an ever-changing concept that relies on the events of the past to assist in determining what steps to take to mitigate loss of life and destruction of property in a future disaster. This is especially true for INDs because the delivery methods used in this type of terrorist attack change as technology changes (Lawrence Livermore National Laboratory, 2011). As the ability of terrorists to use an IND changes with the speed that technology evolves, further examination to determine different and effective approaches toward preparing for an IND is warranted (Borradorri, 2013).

## Nature of the Study

I completed this study using a qualitative case study approach to determine the best answer to the research questions and the most accurate solution to the research

problem. My use of the case study approach derived from my desire to understand a specific social phenomenon (Creswell, 2013). In this specific case, the case study approach had not yet been used by other researchers to understand and assess the readiness of hospitals in Detroit, Michigan to respond to an IND terrorist attack. I sought to understand and offer insight to this case by analyzing interviews with individual hospital employees, hospital preparedness programs, and after-action reports from full-scale exercises that the hospitals have participated in.

## Definitions

*All-hazards approach*: An integrated hazard management strategy that incorporates planning for and consideration of all potential natural and technological hazards (FEMA, 2014).

*Domestic terrorism*: A terrorist attack committed within the territorial jurisdiction of a country, though the perpetrator may or may not be a citizen of that country (Federal Bureau of Investigation [FBI], 2014).

*Highly enriched uranium (HEU)*: Uranium enriched to 20% or more of the uranium-235 isotope (DHS, 2012).

*Improvised explosive device (IED)*: A homemade bomb and/or destructive device used to destroy, incapacitate, harass, or distract (FBI, 2014).

*Improvised nuclear device (IND)*: Nuclear weapons that are fabricated by an adversary State or terrorist group from illicit nuclear material and that could produce nuclear explosions (FBI, 2014).

*International terrorism*: Attacks transcending national boundaries with the perpetrator's citizenship playing no role in the choice of target (FBI, 2014).

*Plutonium*: A radioactive metallic element similar chemically to uranium that is fissionable with slow neutrons to yield atomic energy (DHS, 2012).

*National Incident Management System (NIMS)*: A systematic approach which provides guidance for government and private sector organizations to work together in managing incidents regardless of cause, size, location, and complexity (FEMA, 2014).

*Nuclear event*: Involves the detonation of a nuclear device and is accompanied by the resulting explosions, mushroom cloud fireball, shock waves, pulses of gamma radiation, and radioactive fallout (DHS, 2012).

*Radiological event*: Occurs when radiological material is released into populated areas (DHS, 2012).

*Shelter in place*: Taking emergency refuge within the nearest designated safe area until notification or determination that the situation has been resolved (FEMA, 2014).

*Weapons grade:* A designation for uranium, plutonium, or other fissionable nuclear material identifying it as of a quality suitable for use in nuclear weapons (FBI, 2014).

*Weapon of mass destruction (WMD)*: Any weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of toxic or poisonous chemicals or their precursors, a disease organism, or radiation or radioactivity (FBI, 2014).

## Assumptions

The participants in this study are responsible for emergency preparedness in Detroit hospitals and are assumed to be experts in the preparedness of hospitals to respond to an IND. I assumed that all participants in this study were open and honest in their responses, and I maintained the anonymity and confidentiality of the participant's answers to encourage honesty. The participants were able to withdraw from the study at any time without ramification, which also assisted in ensuring honesty.

## Scope and Delimitations

This study was delimited to determining the ability of Detroit area hospitals to adequately respond to a terrorist attack that involves an IND. This study involved nine hospitals within the city limits of Detroit, Michigan. I chose these hospitals because they would be the first receivers of casualties from a terrorist attack of this type. I did not include hospitals located in the surrounding metropolitan area because these hospitals are not a part of the same planning groups as the hospitals within city limits. The participation in planning committees by the participant hospitals, and the resulting similarities in disaster planning programs gave better and more consistent result. However, the similarities between the participant hospitals may limit the generalizability of the findings.

## Limitations

Limitations in this study included the willingness of the Detroit area hospitals to share all aspects of their respective disaster preparedness plans for response to a terrorist attack that involves an IND. The ability of the respective hospitals to be completely

transparent in sharing of information can be hampered by internal policies. This study was also limited by the rapidly changing nature of disaster preparedness and emergency management. Although I gathered current data for hospital preparedness levels, the constantly changing nature of the topic can make the data outdated quickly.

## Significance

Social constructionists view the world as an effect of the individual's constant attempts to understand it (Creswell, 2013). This same concept relates to the way in which a researcher looks to create social change through studies. I looked to accomplish social change through a new approach to the way hospitals prepare for and respond to an improvised nuclear terrorist. Development of an improved model for disaster planning and training in the hospital setting also allows for improved community response and community care.

There are recommendations and proposed rules from governmental authorities intended to change the way that hospitals prepare for disaster response (CMS, 2014). These recommendations and rule have encouraged a change from a straight all-hazards approach to one that uses risk assessments and other methods. These recommendations and proposed rules are expected to become the future of how hospitals develop emergency operations plans and train staff. Although these recommendations and proposed rules are helpful in explaining the importance of looking at potential disasters from a specific topic when developing plans, they do not give direction or assistance in determining current readiness or actual incident-specific planning steps.

In this study, I reviewed the ability of hospitals in Detroit, Michigan to respond to a specific disaster situation. I used this review to develop a basic tool that can assist hospitals in determining their own readiness to respond to a terrorist attack involving an IND. Using the data that is gathered through determining readiness to respond to an IND, I also designed this study to assist in the development of tools to aid hospitals in creating incident specific plans. With these two areas and the tools that I have developed, this study serves as a significant contribution to the area of hospital disaster preparedness.

## Summary

A nuclear detonation is considered by DHS to be the most catastrophic terrorist incident that could befall the United States (DHS, 2012). This type of terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (Gale & Baranov, 2014). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area, and significantly damage response infrastructure (Gale & Baranov, 2014). In particular, those disasters that impact the hospital infrastructure, directly or indirectly, have the potential to create a need for hospitals to implement their facility emergency plans, evacuation or shelter-in-place for their patients, visitors and staff, implement medical surge, triage, and burn surge plans and institute decontamination of staff, patients, and their facilities (Gale & Baranov, 2014).

Following the terrorist attacks of September 11, 2001, the United States has taken steps at the federal, state, and local levels to prepare for a possible terrorist attack that includes a nuclear detonation (DHS, 2012). An improvised nuclear terrorist attack would

require a complex and organized response that crosses jurisdictional boundaries and involves all levels of government as well as private sector agencies (DHS, 2012). It is expected that the local and state resources would be quickly overwhelmed, so preparation and planning are imperative to respond and reach this primary goal (DHS, 2012).

In evaluating the current level of preparedness it is possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. This study consists of a qualitative approach, using a system theory framework, to evaluate the preparedness of Detroit, Michigan area hospitals in responding to a terrorist attack that includes an IND. The assumptions made that the participants were honest and transparent in their responses is limited by the ability of the hospital to share information bases on their respective internal policies. Finally, the hospitals chosen to participate in this study were determined by their location within the city of Detroit and their participation in local disaster planning committees.

Chapter 1 included the problem statement, purpose, and nature of this study I designed to determine the preparedness levels of Detroit hospitals to respond to a terrorist attack involving an IND. In Chapter 1 I have also outlined the research questions and introduced the theoretical framework for the study. Finally, Chapter 1 included the social change implication of this study—the development of an improved model for disaster planning and training in the hospital setting, as it relates to responding to a terrorist attack involving an IND. In Chapter 2, I offer a review of current literature on the topic of terrorist attacks using INDs and the current levels of hospital preparedness for such

attacks. Additionally, in Chapter 2 I discuss the research method and its relationship to the topic and literature review.

# Chapter 2: Literature Review

## Introduction

A nuclear detonation is considered by DHS to be the most catastrophic terrorist incident that could befall the United States (DHS, 2012). This type of terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (Gale & Baranov, 2010, 2014). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area and significantly damage response infrastructure (Gale & Baranov, 2014, 2010).

Following the terrorist attacks of September 11, 2001, the United States has taken steps at the federal, state, and local levels to prepare for a possible terrorist attack that includes a nuclear detonation (DHS, 2012). An improvised nuclear terrorist attack would require a complex and organized response that crosses jurisdictional boundaries and involves all levels of government as well as private sector agencies (DHS, 2012). The primary goal in improvised nuclear terrorist attack response efforts is to limit casualties while at the same time offering a coordinated long-term support to the affected communities (DHS, 2012). It is expected that the local and state resources would be quickly overwhelmed, so preparation and planning are imperative to respond and reach this primary goal (DHS, 2012).

Controversy exists over the seriousness of the threat that INDs represent, given that there are challenges that the terrorist must overcome in order to obtain the nuclear components essential to build the device (Klien, 2012). In the years since the development of nuclear weapons, the once-closely guarded secrets of designing and

constructing a nuclear device have become public knowledge (Klien, 2012). The availability of reference material on the internet makes the potential for a terrorist group to construct a rudimentary, yet effective device a real possibility (Klien, 2012). Additionally, the use of an IND in a terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (Gale & Baranov, 2014, 2010). Given that this threat to national security is real and is expected to continue, it is necessary to address this threat from a preparedness and response approach (Klien, 2012).

A nuclear terrorist attack would result in a massive federal response, though this response could take up to 72 hours, during which thousands of lives could be lost without an initial response locally (Cameron, 2011). With the time necessary to marshal a federal response, it is important that state and local governments, as well as private agencies, prepare to respond to an IND terrorist attack as well (Klein, 2012). The first steps in preparing for this type of terrorist attack is to develop response plans, educate responders, and then test the plans that have been put in place (Cameron, 2011).

When responding to and recovering from an IND terrorist attack, the primary goal is limiting the total casualties, and the seven key objectives developed by the U. S. Department of Homeland Security (Combs, 2015) become crucial for success. In managing the response, it is necessary to rapidly assess the scope of the event, establish incident command, and coordinate large numbers of human and material resources from local, state, and federal sources (DHS, 2012). Hospitals that have created plans using an all-hazards approach for terrorist attacks involving radiation have used the rationale that radiation can cause exposure even when a person is not in contact with it, and that it can

be detected easily with readily available equipment (Satkowiak,2014). Additionally, decontamination procedures are basically the same for all types of chemical, biological, and radiological exposure (Sheikh,et, al., 2012). Even with this all-hazards approach, hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011).

In this chapter, I review current literature on the topic of terrorist attacks using INDs and on current levels of hospital preparedness for such attacks. Additionally, I outline the research method I used, and its relationship to the topic and literature review.

## Search Strategy

I gathered the literature through searches of academic and government databases that I accessed using the Walden University Library. These databases included: CINAL, Homeland Security Digital Library, Medline, Military & Government Collection, Proquest, Ebsco Host, and PubMed. Keywords in the search process included*: terrorism, types of terrorism, IND, radiological terrorism, improvised terrorist weapons, terrorism weapons, terrorism preparedness, counterterrorism, terrorism prevention, domestic terrorism, international terrorism, state sponsored terrorism, weapons of mass destruction, impact of terrorist attacks, hospital disaster response,* and *hospital response to terrorism*. Using these search terms in various combinations, I retrieved 9 books, 52 articles and 8 government publications for a total of 67 sources. I excluded articles from the searches that focused on first responder actions to IND terrorist attacks and not on hospital responses to IND terrorist attacks, and I used government publications pertaining to IND terrorist attacks to provide additional information.

Systems theory is used to look at how a system or event functions as a whole, while at the same time viewing the event complexities as individual parts of a larger whole (Patton, 2015). Systems theory also provides a means to look at the interconnection that the individual parts of the event have upon the ultimate outcome of the event (Borradorri, 2013). When looking at the individual parts of the event, it is necessary to understand them as parts of the whole event. Doing so assists in assessing their strengths, weaknesses, and impacts on outcome (Patton, 2015). This type of evaluation is useful in program evaluation and analysis because it allows for review of individual event parts without regard for how each is included in the whole, and focuses on each part in relation to outcome (Patton, 2015). Systems theory seeks to answer the question of how and why the program works as a whole (Patton, 2015).

Terrorism is a war method that has been used by individuals, groups, and governments for centuries, and one that has evolved in its approach as technology has advanced (Borradorri, 2013). Systems theory is based on the idea that present and past events will affect future events (Borradorri, 2013), and it provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). By using a systems theory approach to the topic of nuclear terrorism, researchers can look to past and current terrorist events to gain insights into how to better prepare for future events.

Previous research into guidance for accidental radiation exposure to the public has focused on avoiding low-level exposures from accidental transportation and nuclear plant releases (Lawrence Livermore National Laboratory, 2011). Additionally, U.S.

government research and policy during the cold war period developed civil defense programs with guidance on the use of fallout shelters. However, these methods of preparedness and planning for an IND would not work because they depend on advance warning of incoming missiles (Lawrence Livermore National Laboratory, 2011). The *National Capital Region Key Response Planning Factors for the Aftermath of Nuclear Terrorism* study completed by the Lawrence Livermore National Laboratory (2011) showed that the methodologies used to develop the civil defense program plans are nonetheless valuable in developing disaster plans for IND attacks because the devastation would be similar for both types of radiation disaster. This use of past events and past practice to develop current disaster plans is an example of a systems theory approach.

Another example of the use of systems theory in emergency preparedness planning was a study completed by Perko, et. al. (2013), who used past issues with communications during a disaster to develop guidelines to assist local and state governments in communicating with the public in the event of an IND. This study linked the inability of first responders and local government entities to communicate with the public during the September 11, 2001 terror attacks on the United States to an assumed increased number of casualties (Perko et al., 2013). The guidelines these researchers developed using the system method included the use of the NIMS Incident Command System, and they provided grounded examples of communication methods and scripting to assist in response to an IND.

Disaster preparedness is an ever-changing concept and relies on the events of the past to assist in determining what steps to take to mitigate loss of life and destruction of

property in a disaster. This is especially true of the IND as the delivery methods used in this type of terrorist attack change as technology changes (Lawrence Livermore National Laboratory, 2011). As the ability of terrorists to use an IND changes with the speed that technology evolves, further examination to determine different and effective approaches to preparing for an IND is warranted (Borradorri, 2013).

## Terrorism Defined

Terrorism is defined as the conscious and deliberate use of organized, ideologically justified violence inflicted on civilians and government officials as a strategy to gain political power (Kano et al., 2011). Fridlund (2011) further defined the act of terrorism as the intentional infliction of intense fear or anxiety on individuals or a society, using an object, material thing, or practice. The term terrorism allows individuals to express their repulsion and inability to comprehend acts of violence perpetrated against them, while at the same time allowing spectators to express their own emotional shock (Rapin, 2011). These definitions of terrorism help to understand the phenomenon, but they do not completely outline what is essentially a vague and subjective concept (Rapin, 2011). The international community has not been able to agree upon a universally accepted, legally binding definition of terrorism (Global Terrorism: The U.S. Challenge and Response, 2011). The inability of the international community to develop a clear and concise definition of terrorism makes it difficult for planning activities at all levels.

The rationale for an individual or group in planning and carrying out a terrorist act is as subjective as the definition for the term terrorism (Fridlund, 2011). Terrorism is broadly divided into classifications based on sponsorship of the terrorist attacks

(Fridlund, 2011). Terrorism can also be given a subclassification based on the rationale or goals of the terrorist in perpetrating the attack (Fridlund, 2011).

The broad classifications of terrorist attacks based on sponsorship separate attacks into either domestic or international terrorism. The FBI (2014) has defined domestic terrorism as a terrorist act committed within the territorial jurisdiction of a country, though the perpetrator may or may not be a citizen of that country. Domestic terrorism is considered to be a much more common type of terrorism based on the frequency and size of attacks (Hinkkainen, 2013). International terrorism is defined by the FBI (2014) as transcending national boundaries, with the perpetrator's citizenship playing no role in the choice of target. International terrorism typically involves larger-scale methods of attacks, and larger numbers of casualties (Hinkkainen, 2013).

The number of classifications of rationales for a terrorist attack is infinite and subjective (Fridlund, 2011). One example is political terrorism, the most common form of terrorism which includes any action that is designed to influence political leaders to carry out certain actions or make certain decisions (Global Terrorism: The U.S. Challenge and Response, 2011; Rapin, 2011). Acts of political terrorism also strive to cause society to mistrust the government and its power structures, thereby degrading the stability of society (Global Terrorism: The U.S. Challenge and Response, 2011). A second example is religious terrorism, an act of terrorism that is perpetrated in the name of a specific religion by religiously motivated militants (Gunning & Jackson, 2011). Religious terrorism is also described by Gunning and Jackson (2011) as a sacramental act that is done in response to a divine duty or theological demand which has no relation to a

government or the people it is perpetrated on. The types of attacks in both political and religious terrorism range from small- to large-scale events (Hinkkainen, 2013). Ultimately, pinpointing the rationale for a terrorist attack is difficult because there may be more than one rationale for a terrorist's actions (Mantri, 2011).

## Types of Weapons Used in Terrorist Attacks

The choice of weapon for terrorist acts have evolved with advancements in technology, with progression from daggers, firearms, explosives, and finally to weapons of mass destruction (WMD) (Pratt, 2011). The WMDs used in terrorist acts can be classified into weapons including chemical agents, biological agents, radioactive agents, nuclear weapons, and explosives (Yamin, 2013). These classifications include WMDs that are professionally manufactured and those that are made by amateurs (Pratt, 2011). An example of a WMD that is made by an amateur includes weapons such as pipe and pressure cooker bombs whereas a nuclear warhead is an example of a professionally manufactured WMD (Horowitz & Narang, 2014; Pratt, 2011).

The weapons of chemical agent and biological agents are considered to be easy to develop and use as neither requires high technology to create (Yamin, 2013). The United States Government has compared the production of chemical and biological agents needed in the creation of WMDs to be no more difficult than the production of narcotics such as heroin (Gale & Baranov, 2014, 2010). These types of WMDs have been used commonly since World War I and can cause death and injury over a wide area (McComb, 2013). An example of a chemical agent WMD was a release of Sarin gas in the Tokyo subway by the Aum Skinrikyo religious cult in 1995 (Vicar & Vicar, 2011). This use of a

chemical agent WMD killed 12 people and injured 5, 500 (Vicar & Vicar, 2011). An example of the use of a biological agent as a WMD was seen in the weeks following the September 11, 2001 attacks on the United States. In the states of Florida, New York, Connecticut, New Jersey, and Washington DC there was a dissemination of anthrax spores into homes, the United States Senate, and major newsrooms (Bush & Perez, 2012). This biological WMD attack killed five people and resulted in 21 confirmed cases of exposure and despite the fact that there is much speculation, no clear perpetrator has been discovered (Bush & Perez, 2012).

The use of explosives and explosive devices fall into three general classifications: nuclear, mechanical, and chemical (National Disaster Life Support Foundation [NDLS], 2012). The nuclear explosion is the most powerful of the three and is catastrophic in nature (McComb, 2013). A mechanical explosion is the result of a physical process and though it can be large, is not as catastrophic in nature (NDLS, 2012). Chemical explosions occur when a rapid chemical conversion of a substance into a gas causes an energy release (NDLS, 2012). These chemical explosions are classified as high or low energy depending on the speed of the explosion (NDLS, 2012).

The use of WMDs containing radioactive agents are classified into two groups; nuclear and radiological events (McComb, 2013). A radiological event occurs when a release of radiological material into populated areas has occurred (NDLS, 2012). This type of event can be accomplished using various methods including water contamination, placing of a radiation source, and detonating a dirty bomb (NDLS, 2012). A nuclear event involves the detonation of a nuclear device and is accompanied by the resulting

explosions, mushroom cloud fireball, shock waves, pulses of gamma radiation, and radioactive fallout (NDLS, 2012).

## Trends in Terrorism in the United States

Although there have been no large scale terrorist attacks in the United States since September 11, 2001, terrorism continues to be a complex and diverse security threat to the nation (Hitz, 2012; Klarevas, 2011). In discussing the possible reasons why there has not been a large scale terrorist attack in this time period, Boyd (2016), argues that it cannot be determined if this is due to luck of the draw, the efforts of the government's actions, or a combination of both. Although the United States has not been the victim of a large scale terrorist attack, there have been 62,370 terrorist attacks worldwide between 2001 and 2010, with 88,135 people killed and 173, 902 (Klarevas, 2011). It is these large numbers of victims, and the fact that United States citizens have been in the top 25 nationalities targeted by terrorist groups, that makes it clear that terrorism is still a significant threat (Klarevas, 2011). This goal to attack citizens of the United States has been reinforced by the leadership of Al-Qaeda, specifically Al-Fah, who declared

> If a bomb that killed ten million of them and burned as much of their land as they have burned Muslims land were dropped on them it would be permissible, with no need to mention any other argument. (Mohammed 2015, p. 685)

Terrorist attacks that have been prevented or thwarted by various means lack the sophistication and coordination of the September 11, 2001 attacks (Boyd, 2016). An example of this type of unsophisticated attack was thwarted on December 25, 2009 with the case of the underwear bomber, Umar Farouk Abdulmutallab (Ed, 2014). In this case

the attempted terrorist attack was made on Northwest Airline flight 253 in route to Detroit, Michigan from Amsterdam, Holland (Ed, 2014). The weapon used in this attack was an explosive underwear device that contained no metal parts to be able to pass through airport security devices (Ed, 2014). The weapon failed to detonate as intended and instead produced only a fire that ignited portions of the plane's interior (Ed, 2014). As the device failed to work as planned, none of the 289 passengers on board were injured, though Abdulmutallab was significantly burned (Ed, 2014).

An example of a recent successful terrorist attack in the United States is the bombing at the finish line of the Boston Marathon. On April 15, 2013, two improvised explosive devices (IED) that were created using pressure cookers, were detonated 50 to 100 feet apart at the finish line of the Boston Marathon (Kolb, 2013). Two additional undetonated IEDs were discovered nearby (Kolb, 2013). The attack injured 275 people and killed 3 (The Boston Globe, 2014). The attack was carried out by brothers, Dzhakhar Tsarnaev and Tamerlan Tsarnaev, both of whom are described at self-radicalized Islamic extremists, as a retaliatory attack against the United States for the Iraq and Afghanistan wars (Kolb, 2013).

Counter terrorism efforts have proven to be as subjective and elusive as the definition of terrorism (Wormell, 2014). Following the September 11, 2001 terrorist attacks on the United States, President George W. Bush declared a global war on terror (GWOT) in a counter terrorism effort (Kano et al., 2011). The United States global war on terror has no clearly defined goals and the potential for an unending enemies list (Wormell, 2014). The GWOT has impacted the economy, political standing, and society

of the United States through the deaths of military personnel in the Iraq and Afghanistan wars (Dorschner, 2013). The repeated scandals of terrorism suspect torture and government surveillance of citizens has damaged the international prestige of the United States (Dorschner, 2013).

Actual terrorist attacks and the trends that have developed has ushered in a new approach to laws, regulations, and preparedness activities (Lucas, Dressman, Suchindran, Nakamura, Chao, Himburg, & Chute, 2014). The efforts of large terrorist organizations, such as Al-Qaeda, are not strong enough to match the United Stated military in battle, but makes them a challenge for law enforcement to deter and prevent attacks (Mantri, 2011). It is assumed by the United States Department of Homeland Security that these large terrorist organizations will continuously plan and attempt to employ all types of terrorist weapons in attacks and will continue their capability to obtain and develop chemical, biological, radiological and nuclear weapon components (Mantri, 2011).

## Developing an Improvised Nuclear Device

Although the thought of an IND being used in a terrorist attack is considered to be a relatively low probability, concern about this type of incident has been one of the areas of focus and the number one scenario in the National Planning Scenarios for DHS (Combs, 2015). The dissolution of the Union of Soviet Socialist Republics (USSR) in the 1990's has left some to question as to whether all nuclear weapons materials are fully accounted for and controlled (Combs, 2015). The International Atomic Energy Agency has confirmed a total of 18 trafficking incidents of stolen highly enriched uranium (HEU) or plutonium since the fall of the USSR (Klien, 2012). In addition, the International

Atomic Energy Agency maintains a database containing 540 incidents that involve trafficking of nuclear and radioactive materials that have been confirmed since the database began in 1993 (Orlov, 2011). The incidents that have been confirmed include deliberate attempts to acquire and sell nuclear or other radioactive materials as well as inadvertent incidents such as accidental disposal of contaminated products (Orlov, 2011). Additional theft incidents that government officials have been reluctant to admit have occurred.

The former USSR is not the only potential source for terrorists to obtain nuclear weapons. Pakistan has over 110 deployed weapons, making it the fifth largest stockpile in the world (Menesick, 2011). Although this stockpile is heavily guarded (Klein, 2012), it is by no means completely secure (Menesick, 2011). With Al-Qaeda having a strong presence in Pakistan these weapons are at risk from internal and external theft as well as state sponsored terrorism (Menesick, 2011). The small amount of fissionable material needed to make an effective IND, approximately 25 kilograms of weapons grade uranium or as little as 8 kilograms of weapons grade plutonium (Michael, 2012), makes the possibility of a terrorist group obtaining this material a real one.

Although there is significant and justified concern over the potential international sources for terrorists to obtain the materials to create and IND, there is also a threat in the United States from nuclear plant fuel diversion. An example of this type of threat happened in 1965 in Apollo Pennsylvania at a nuclear fuel processing plant. During a routine inspection at the facility by the Atomic Energy Council it was discovered that more than 100 kilograms of HEU were missing and possibly diverted to the government

of Israel (Sokolowski, 2013). Subsequently, the Chairman of the United States House Subcommittee on Energy Power of the Committee on Interstate and Foreign Commerce requested the U.S. Government Accountability Office to determine what had happened at the facility as there was concern that there were inadequate investigations of the incidents or even a cover up of the missing HEU (Sokolowski, 2013). This request was not made until 1977, twelve years after the detection of the mission HEU, and the final determination by the Government Accounting Office was that the

> GAO cannot say whether or not there was a diversion of material from the NUMEC facility. DOE has taken the position that it is aware of no conclusive evidence that a diversion of nuclear material ever occurred at the NUMEC facility, although it recognizes that the possibility cannot be eliminated. Though the investigations were uncoordinated, limited in scope and timeliness and less than adequate. (Sokolowski, 2013, p. 17)

The security risks associated with nuclear weapons are both internal and external. There is a real possibility of a government directly giving a nuclear weapon to a terrorist organization (Menesick, 2011) as well as senior insiders who have marketed stolen nuclear bomb technology worldwide (Klein, 2012). This security threat is also not just from outside countries, but also internally in the United States. The domestic risk for development of an IND has increased beginning in the 1980's with extreme right wing groups taking on revolutionary tactics and terrorism (Michael, 2012). An example of this type of extreme right wing terrorism was carried out in 1983 by a subgroup of the Aryan Nation, the National Alliance, who created a resistance group that used bombings to

terrorize the Pacific Northwest (Michael, 2012). In their attempt to create a new and separate white nation inside the United States, the National Alliance committed 119 separate crimes including firebombing of a Jewish community center, stockpiling of firearms and explosives, and the theft of more than four million dollars from multiple bank robberies (Michael, 2012). The rationale for these terrorist acts was that the monies obtained from the robberies would fund the crimes of bombings that would incite a race war that would lead to the destruction of the United States government (Michael, 2012). Although there was a trial for the 24 members of the group that planned the attack, none were convicted at trial for the potential terrorist acts, only for the individual parts played in the robberies and other crimes (Michael, 2012).

The remnants of nuclear weapons from the USSR and other countries are not the only source for the world's stock of potential IND material. There are approximately 130 civilian research reactors in over 40 countries that use HEU as fuel (Klein, 2012). Another source of nuclear materials are the 62 nuclear power plants in the United States with 100 commercially operating nuclear reactors, which could be a source of radioactive material for an IND or dirty bomb (Li, Fuhrmann, Early, & Vedlitz, 2012). It is noted that uranium is exceptionally difficult to machine into HEU and therefore not the first choice for any terrorist organization interested in developing an IND (Mantri, 2011). The alternative energy source, plutonium, is also difficult to develop into an IND as its basic properties are sensitive to processing (Li et al., 2012). It is with this in mind that the better option for a terrorist organization is to obtain weapons grade fissionable materials instead of creating the product (Li et al., 2012).

## Impact of an Improvised Nuclear Device Terrorist Attack

At the 2010 Nuclear Security Summit, United States Secretary of State Hillary Clinton warned that

> A 10-kiloton nuclear bomb detonated in Times Square in New York City could kill a million people. Many more would suffer from the hemorrhaging and weakness that comes from radiation sickness. And beyond the human cost, a nuclear terrorist attack would also touch off a tsunami of social and economic consequences across our country. (Boyd, p. 46, 2016)

Additionally, the detonation of a smaller sized IND in a U.S. city would be catastrophic and cause significant loss of life, societal disruption, property damage, and cause severe economic instability (DHS, 2012). An IND explosion has the potential to kill thousands and damage response infrastructure with the explosion itself and to present substantial radiological threats to life over a far reaching area (Boyd, 2016).

A successful IND terrorist attack would result in a large blast with powerful shockwaves and extreme heat (Trimble, 2013) which will reach tens of millions of degrees and be brighter than the noonday sun (Cameron, 2011). The extreme heat will vaporize materials around the site and this level of brightness will cause temporary blindness, which will increase non- blast related injuries due to automobile accidents and other related injuries over a wide area (Cameron, 2011). The blast will also disperse levels of radiation and radioactive fallout at lethal levels over a large area and a significant distance from the blast site (Trimble, 2013).

Within seconds of the successful IND terrorist attack there is an electromagnetic pulse (EMP) experienced (Cameron, 2011). The EMP is an oversized outburst of atmospheric electricity (Cameron, 2011), which causes damage to electronics in the immediate area (Trimble, 2013). The damage done by an EMP is caused by the intense magnetic fields produced that can be strong enough to burn out power lines and electronic equipment (Cameron, 2011). The EMP also has the potential to cause planes to crash, communications to be disrupted, and secondary blasts due to its effects on the infrastructure (DHS, 2012). The effects of the EMP are reduced as the distance from the incident is increased, however, it will also increase the number of casualties as well as the amount of destruction of the IND attack (DHS, 2012).

## Preparing for an Improvised Nuclear Device Terrorist Attack

A nuclear terrorist attack would result in a massive federal response, though this response could take up to 72 hours, during which thousands of lives could be lost without an initial response locally (Cameron, 2011). With the time necessary to marshal a federal response, it is important that state and local governments as well as private agencies prepare to respond to an IND terrorist attack as well (Klein, 2012). The first steps in preparing for this type of terrorist attack is to develop response plans, educate responders, and then test the plans that have been put in place (Cameron, 2011).

The first step in planning for local emergency managers was developed in the mid-2000's in the United States Department of Homeland Security's National Planning Scenarios, which described a 10-kiloton IND in a metropolitan area (Mauroni, 2012). This scenario includes nuclear weapons developed using HEU and the effects of heat,

blast, radiation, and EMP (Klein, 2012). This scenario includes massive damage to the metropolitan area, tens of thousands of injured people, and more than one million displaced people (Mauroni, 2012). Using this scenario, the U.S. Department of Homeland Security (Combs, 2015) determined that the seven key objectives in responding to a 10-kiloton IND in a metropolitan area include; managing the response, characterizing the incident, evacuation and shelter in place protection, medical triage, casualty and evacuee care, stabilizing the impacted area, and recovery and restoration of essential functions.

When responding to and recovering from an IND terrorist attack the primary goal is limiting the total casualties and the seven key objectives developed by the U. S. Department of Homeland Security (Combs, 2015) become crucial for success. In managing the response, it is necessary to rapidly assess the scope of the event, establish incident command and coordinate large numbers of human and material resources from local, state, and federal sources (DHS, 2012). Following the terrorist attacks of September 11, 2001, to assist in this effort NIMS was developed by the U.S. Department of Homeland Security to assist in management of mass casualty incidents and other disasters (FEMA, 2014). NIMS is a systematic approach which provides guidance for government and private sector organizations to work together in managing incidents regardless of cause, size, location and complexity (FEMA, 2014). The purpose of using the NIMS common approach in disaster response is to reduce loss of life, loss of property, and prevention of harm to the environment (FEMA, 2014). The NIMS program utilizes all aspects of traditional first responder agencies of police, fire, and Emergency Medical Services (EMS), it also includes partner disciplines such as public health,

hospital first receivers, and public works (Decker, 2011). To successfully manage the response to a terrorist attack includes rapid and effective pre-hospital care, appropriate casualty distribution, and proper management of surge capacity at receiving hospital facilities (Veenema, 2013).

Characterizing the incident involves communication and transfer of incident information that allows decision makers the ability to activate and utilize all hazard emergency response plans and those plans that are specific to an IND (DHS, 2012). This success of this objective relies heavily on use of the NIMS incident command protocol as it depends on the cooperation of federal, state, local, tribal, and civilian organizations to communicate information rapidly (FEMA, 2014). It is also necessary for these agencies to have coordinated agreements and standardized protocols in place prior to an incident that can utilize any and all available assets as well as a provision to request further assistance (DHS, 2012).

The mass evacuation and shelter in place objectives involve the ability of a community, an organization, or a single family to plan for, quickly execute an evacuation or shelter in an area of safe refuge (DHS, 2012). Shelter in place plans are essential in an IND attack as the use of buildings to minimize exposure to radioactive fallout is the most critical lifesaving action that will save the largest number of people as fallout can be blocked by the dense materials that are used in construction (Center for Biosecurity of UPMC, 2011). However, damage to buildings may necessitate a change in plans and necessitate an evacuation. An evacuation will then put more people at risk for injury or death due to exposure to radioactive fallout (Center for Biosecurity of UPMC, 2011).

This objective is one that is difficult to meet as success depends on outside factors including proper incident characterization, confirmation of radiation presence, expected progression of radiation based on weather factors, and the ability of people to use the planned areas of shelter (Bliss, Hristovski, & Ulrich, 2013).

The objectives of medical triage and care of casualties and evacuees are executed at the same time, beginning with first responders in the field and the first receiver hospitals who provide definitive care (Center for Biosecurity of UPMC, 2011). Success of these two objectives are dependent on medical first responders recognizing and treating radiation-induced injury and illness as well as the ability of the health care infrastructure to provide consistent definitive care (Center for Biosecurity of UPMC, 2011). The ability of the health care infrastructure to provide effective definitive care is key to limiting the total number of casualties (DHS, 2012).

The key objective of stabilization is based upon confidence in pre-existing planning policies, plans, and agreements (DHS, 2012). The objectives of recovery and restoration of essential functions are done during the stabilization phase. An IND terrorist attack would cause a disaster area that is large geographically as well as one that would have a wide spectrum of activities taking place (DHS, 2012). Bringing stabilization to the situation will necessitate the use of the NIMS Incident Command Structure to maintain organization of efforts and a central command system to reduce duplication of efforts (Veenema, 2013). This type of incident would also overwhelm local and state government agencies and would necessitate the inclusion of federal government agencies to provide assistance for stabilization and control (DHS, 2012). It is reasonable to assume

that the stabilization, recovery, and restoration of essential functions being complete after and IND terrorist attack has the potential to take years to complete (DHS, 2012).

Hospitals are the epicenter for community response to mass casualty events, whether man-made or naturally occurring (UPMC Centers for Health Security, 2013). Healthcare organizations must prepare for the challenges of any type of terrorist attack in the community they serve. A challenge to this is preparation is the need for hospitals to have a relationship in place with other organizations in the community that are a part of a response (James, 2011). During a disaster it is easy for a hospital to become overwhelmed which has necessitated the need for detailed emergency management planning (UPMC Centers for Health Security, 2013). Although the idea of an all hazards approach has been well established, this approach has left many emergency plans with large gaps that need to be addressed (James, 2011). These gaps include the ability of hospitals, who currently struggle to provide care and maintain operations on a daily basis, to be stressed in the areas of leadership, personnel, infrastructure, capacity, communication, logistics, legal, ethical, and triage challenges (Veenema, 2013).

Hospitals creating plans and using an all hazard approach for terrorist attacks involving radiation uses the rationale that radiation can cause exposure even when a person is not in contact with it and can be detected easily with readily available equipment (Sheikh,et, al., 2012). Additionally, decontamination procedures are basically the same for all chemical, biological, and radiological exposure (Sheikh,et, al., 2012). Even with this all hazards approach hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011). A survey

conducted by Campus Safety Magazine in 2011 of 127 hospital campuses located in an urban setting throughout the United States to determine the organization's perceived readiness for an improvised nuclear attack, the author indicates that 35% of the 216 responding hospitals consider themselves to be marginally ready for this type of event (Campus Safety Magazine, 2011). This number may be higher than the reality of the situation as the result of the Fukishima nuclear disaster in 2011 caused more than 250,000 people to require screening or treatment for radiological contamination (Campus Safety Magazine, 2011). Lim, Lim, and Vasu (2013) argue that health care workers have a poor perception of their individual and institutional preparedness in disaster preparedness and response. This study surveyed doctors, nurses, and allied health care providers in determining their current level of knowledge of how to respond to a disaster in their role at the hospital and their willingness to participate in training to respond to disasters (Lim, Lim, and Vasu, 2013). The results of this study show a low number of health care workers who are confident in their ability to respond and a high number that were willing to attend training to become prepared (Lim, Lim, and Vasu, 2013).

The use of terrorism is a war method that has been used by individuals, groups, and governments for centuries, and one that has evolved in its approach as technology has advanced (Borradorri, 2013). The use of system theory to research preparedness levels of hospitals to respond to terrorist attacks is based on the idea that present and past events will affect future events (James, 2011) and provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). In using a system theory approach to this topic, with the idea that terrorist events that

have happened in the past and present, will make it possible to better prepare for future events. The need for further research into hospital disaster preparedness overall and specifically response to a terrorist attack that includes the use of an IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012).

## Literature Related to Methodology

The system theory is used to look at how a system or event functions as a whole, while at the same time viewing the event complexities as individual parts of a larger whole (Patton, 2015). Systems theory is also a look at the interconnection that the individual parts of the event have upon the ultimate outcome of the event (Borradorri, 2013). To look at the individual parts of the event it is necessary to look at them as a part of the whole event, which assists in reviewing them in terms of strengths, weaknesses, and impacts on outcome (Patton, 2015). This type of evaluation is useful in program evaluation and analysis as allows for review of individual event parts without regard for how each is included in the whole and focuses on each part in relation to outcome (Patton, 2015). Systems theory seeks to answer the question of how and why the program works as a whole (Patton, 2015).

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past events will affect future events (Borradorri, 2013) and provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). In using a system theory approach to this topic, with the idea that terrorist events that have happened in the past and present, will make it possible to better prepare for future events.

Previous research into guidance for accidental radiation exposure to the public focused on avoiding low-level exposures from accidental transportation and nuclear plant releases (Lawrence Livermore National Laboratory, 2011). Additionally, U.S. government research and policy development during the cold war period developed civil defense programs with guidance on the use of fallout shelters, though these methods of preparedness and planning for an IND would not work as they depend on advance warning of incoming missiles (Lawrence Livermore National Laboratory, 2011). The National Capital Region Key Response Planning Factors for the Aftermath of Nuclear Terrorism study completed by the Lawrence Livermore National Laboratory (2011) showed that the methodologies used to develop the civil defense program plans are valuable in developing disaster plans for IND attacks as the devastation would be expected for both types of radiation disaster. This use of past events and past practice to develop current disaster plans is an example of the system theory.

Another example of the system theory being used in emergency preparedness planning was a study completed by Perko et al., 2013) where the past issues with communications during a disaster were used to develop guidelines to assist local and state governments in communicating with the public in the event of an IND. This study

compared the inability of first responders and local government entities to communicate with the public during the September 11, 2001 terror attacks on the United States and the assumed increased number of casualties that this inability to communicate resulted in (Perko et al., 2013). The guidelines developed using the system method include the use of the NIMS Incident Command System and provide grounded examples of communication methods and scripting to assist in response to an IND.

Disaster preparedness is an ever changing concept and relies on the events of the past to assist in determining what steps to take to mitigate loss of life and destruction of property in a disaster. This is especially true of the IND as the delivery methods used in this type of terrorist attack change as technology changes (Lawrence Livermore National Laboratory, 2011). As the ability of terrorists to use an IND changes with the speed that technology evolves, further examination to determine different and effective approaches toward preparing for an IND is warranted (Borradorri, 2013).

## Conclusion

The September 11, 2001 terrorist attacks on the United States revealed the lack of preparedness by hospitals to respond to terrorist attacks and brought focus to disaster preparedness to the hospital setting (Kano et al., 2011). Mandates issued by United States Health and Human Services required hospitals to change their approach to emergency management and disaster preparedness through development of emergency operations plans and development of training (Kano et al., 2011). Although there have been a number of studies conducted to determine the preparations that a hospital must have in place for an improvised nuclear device (Kano et al , 2011), there have been very few

studies that focus on the preparations that a hospital must have in place for an IND (Kano et al ,2011).

Controversy over the seriousness of the threat that INDs represent has been discussed as there are challenges that the terrorist must overcome in order to obtain the nuclear components essential to build the device (Klien, 2012). In the years since the development of nuclear weapons, the once-closely guarded secrets of designing and constructing a nuclear device have become public knowledge (Klien, 2012). The availability of reference material on the internet makes the potential for a terrorist group to construct a rudimentary, yet effective device a real possibility (Klien, 2012). Additionally, the use of an IND in a terrorist attack is capable of causing severe economic damage, severe property damage, and enormous loss of life (Gale & Baranov, 2014, 2010). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area and significantly damage response infrastructure (Gale & Baranov, 2014, 2010). Understanding that this threat is real and is expected to continue to be a threat of national security, it is necessary to address this threat from a preparedness and response approach (Klien, 2012). Although it is important to reduce or eliminate the threat of IND terrorist attacks, it is more important to control vulnerabilities of the target (Young & Leveson, 2014).

The international community has not been able to agree upon a universally accepted, legally binding, or criminal law that defines terrorism (Global Terrorism: The U.S. Challenge and Response, 2011). The inability of the international community to develop a clear and concise definition of terrorism makes it difficult for planning

activities at all levels. The rationale and reasons for an individual or group in planning and carrying out a terrorist act is as subjective as the definition for the term terrorism (Fridlund, 2011). Terrorism is broadly divided into classifications based on sponsorship of the terrorist attacks (Fridlund, 2011). Terrorism can also be given a sub classification based on the rationale or goals of the terrorist in perpetrating the attack (Fridlund, 2011). The number of classifications of rationale or reason for a terrorist attack is infinite and subjective (Fridlund, 2011).

The choice of weapon for terrorist acts have evolved with advancements in technology, with progression from daggers, firearms, explosives, and finally to WMDs (Pratt, 2011). The WMDs used in terrorist acts can be classified into weapons including chemical agents, biological agents, radioactive agents, nuclear weapons, and explosives (Yamin, 2013). These classifications include WMDs that are professionally manufactured and those that are made by amateurs (Pratt, 2011). The weapons of chemical agent and biological agents are considered to be easy to develop and use as neither requires high technology to create (Yamin, 2013). The use of explosives and explosive devices fall into three general classifications: nuclear, mechanical, and chemical (NDLS, 2012). The use of WMDs containing radioactive agents are classified into two groups; nuclear and radiological events (McComb, 2013). A radiological event occurs when a release of radiological material into populated areas has occurred (National NDLS, 2012).

An IND explosion has the potential to kill thousands and damage response infrastructure with the explosion itself and to present substantial radiological threats to life over a far reaching area (Boyd, 2016). A successful IND terrorist attack would result

in a large blast with powerful shockwaves and extreme heat (Trimble, 2013) which will reach tens of millions of degrees and be brighter than the noonday sun (Cameron, 2011). A nuclear terrorist attack would result in a massive federal response, though this response could take up to 72 hours, during which thousands of lives could be lost without an initial response locally (Cameron, 2011). With the time necessary to marshal a federal response, it is important that state and local governments as well as private agencies prepare to respond to an IND terrorist attack as well (Klein, 2012). The first steps in preparing for this type of terrorist attack is to develop response plans, educate responders, and then test the plans that have been put in place (Cameron, 2011).

When responding to and recovering from an IND terrorist attack the primary goal is limiting the total casualties and the seven key objectives developed by the U. S. Department of Homeland Security (Combs, 2015) become crucial for success. In managing the response, it is necessary to rapidly assess the scope of the event, establish incident command and coordinate large numbers of human and material resources from local, state, and federal sources (DHS, 2012). Hospitals creating plans and using an all hazard approach for terrorist attacks involving radiation uses the rationale that radiation can cause exposure even when a person is not in contact with it and can be detected easily with readily available equipment (Sheikh,et, al., 2012). Additionally, decontamination procedures are basically the same for all chemical, biological, and radiological exposure (Sheikh,et, al., 2012). Even with this all hazards approach hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011).

The use of terrorism is a war method that has been used by individuals, groups, and governments for centuries, and one that has evolved in its approach as technology has advanced (Borradorri, 2013). The system theory is based on the idea that present and past events will affect future events (Borradorri, 2013) and provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). In using a system theory approach to this topic, with the idea that terrorist events that have happened in the past and present, will make it possible to better prepare for future events. The need for further research into hospital disaster preparedness overall and specifically response to a terrorist attack that includes the use of an IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012). Although it is necessary for all hospitals to be prepared to respond to terrorist attacks, it is not possible to implement the same plans in all areas across the country as each has their own unique vulnerabilities.

Chapter 2 included current literature on the topic of terrorist attacks using INDs as well as current levels of hospital preparedness for such attacks. Additionally, Chapter 2 has outlined the research method proposed and its relationship to the topic and literature review. Chapter 3 consists of details on the proposed research method and its strengths and weaknesses as it relates to the topic.

# Chapter 3: Research Method

## Introduction

I completed this study using a qualitative approach to evaluate Detroit, Michigan hospitals' preparedness for responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness, it was possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the hospitals' approaches to managing this type of disaster.

An effective case study starts with a complete review of current literature (Yin, 2011), which was I have presented in Chapter 2. In the literature review I showed that the September 11, 2001 terrorist attacks on the United States revealed the lack of preparedness by hospitals to respond to terrorist attacks, and brought focus to disaster preparedness in the hospital setting (Kano et al., 2011). Mandates issued by United States Health and Human Services required hospitals to change their approach to emergency management and disaster preparedness through development of emergency operations plans and training (Kano et al., 2011).

In recent years there have been several notable terrorist attacks worldwide in addition to the September 11, 2001 attacks on the United States. In 2013, two brothers detonated IEDs near the finish line of the Boston Marathon, killing three people and injuring more than 260 others (Boston Globe, 2013). In 2011, the North Atlantic Treaty Organization (NATO) reported 960 terrorist incidents across the world, resulting in 493 deaths and 1,601 people injured through the use of IEDs (DHS, 2012). There have been a

number of studies examining the preparation a hospital must have in place for an IND (Bliss, Hristovski, & Ulrich, 2013; Center for Biosecurity of UPMC, 2011; Centers for Medicare and Medicaid Services, 2014; DHS, 2012; Gale & Baranov, 2014; Kano et al., 2011; Lim, Lim, & Vasu, 2013; Mauroni, 2012; Orlov, 2011; Perko et al., 2013; Veenema, 2013).

In contrast, there have been few studies examining the preparation that a hospital must have in place for an IND attack (Kano et al., 2011). There are many who feel that the threat of a terrorist attack using an IND is small as this method is more difficult than others to obtain (Klein, 2012). The United States National Security Strategy of 2012 identifies the threat of WMDs, specifically the ability of violent extremists to develop INDs, as one of the greatest threats to the American people (National Security Network, 2012). Given that this threat to national security is real and is expected to continue, it is necessary to address the issue from a preparedness and response approach (Klien, 2012).

The need for further research into the hospital disaster preparedness overall, and preparedness for a terrorist attack involving and IND in particular, is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012). The problem that this study addresses is that with inadequate preparation for an IND at the hospital level, the result of this type of a terrorist attack will result in devastation for a community (Sheikh, et. al., 2012). Although it is necessary for all hospitals to be prepared to respond to terrorist attacks, it is not possible to implement the

same plans in all areas across the country because each has their unique vulnerabilities (Kano et al., 2011). In this study I focused specifically on hospitals in Detroit, Michigan because Detroit is the busiest international land border crossing in the United States and thus has an increased threat of international terrorist attacks (DOT, 2013).

In this chapter I discuss the research design and rationale, and my role as researcher. I provide details concerning my relationship with participants, biases, and other ethical considerations. I also discuss the methodology and tools I used to complete this study, and offer details concerning participants. Finally, I outline the ethical procedures that I used to ensure the trustworthiness of this study.

## Research Design

I conducted this study to answer the following research questions:

RQ1: How have the hospitals planned for response to an improvised nuclear attack?

RQ2: What type of training has the first receiver emergency department staff of the hospital had to respond to an improvised nuclear attack?

RQ3: How can the hospitals better prepare for response to an improvised nuclear attack?

I used a case study design to gather the data necessary to answer the research questions. The case study is a design used for qualitative inquiry that allows the researcher to conduct an in depth exploration of a program (Creswell, 2013). It enables researchers to explore real-life situations or groups over time, using in depth data collection methods, to determine case themes (Creswell, 2013). The case study design is

appropriate when a researcher looks to study a real-life issue that must be understood in depth (Yin, 2013). The case study design is distinguished by the size of the bounded case, number of individuals involved in the case, or number of programs or activities (Creswell, 2013). A collective case study approach uses multiple cases or programs to show varying perspectives on the chosen topic (Creswell, 2013). I used a case study design with a collective case study approach to examine the ability of Detroit hospitals to respond to a terrorist attack that includes an IND.

## Role of the Researcher

In this study I played the role of observer. As a professional peer in the field of emergency management and disaster preparedness, I had a professional working relationship with the participants and did not have administrative of instructional power over them. This personal relationship and my own experience and expertise in the field of emergency management and disaster preparedness had the potential to influence my qualitative evaluation of the participants' responses to questions. I addressed this potential bias by contacting the participants for clarification regarding any data that were not completely clear to me.

## Methodology

I completed this study using a qualitative, collective case study approach to evaluate Detroit, Michigan hospitals' preparedness for responding to a terrorist attack that includes an IND. As of the date of this study, there are nine hospitals located within the Detroit city limits. The respective hospital emergency management and disaster preparedness representatives are responsible for developing and implementing plans for

responding to a terrorist attack that includes an IND for the hospitals located in the city. For the purposes of research, a population is a complete set of relevant units needed to conduct analysis (Frankfor-Nachmias & Nachmias, 2014). This group of nine emergency management and disaster preparedness professionals represents the population for this study.

Once the population size is determined, the researcher is then tasked with determining a sample to adequately represent the population (Frankfor-Nachmias & Nachmias, 2014). When determining the adequate sample size, it is necessary to ensure that there are enough participants in the sample to gather enough data to conduct credible analysis (Marshall, Cardon, Poddar, & Fotenot, 2013). There is no hard and fast rule in qualitative research to determine what the appropriate sample size is for a qualitative study (Marshall, et al. 2013). Commonly, the qualitative researcher will work with a small sample of the population to study in depth (Miles, Huberman, & Saldana. 2014), though there is no specific number that has been recommended by qualitative research experts. For example, Yin (2013) recommends a minimum of six for an adequate sample size in a case study, and Creswell (2013) recommends that the sample size for a case study be limited to three to five interviewees.

The key in determining the right number of participants to include in the sample is to determine when data saturation has been achieved (Marshall, et al., 2013). Data saturation is the process of bringing new participants into a study until the data set is complete because of data replication or redundancy (Dworkin, 2012). Using data saturation for determining appropriate sample size allows for a thorough examination of

data that addresses the research questions (Dworkin, 2012). Finally, using data saturation to determine appropriate sample size increases the possibility that enough data has been collected to maximize the chance that negative cases have been explored (Dworkin, 2012). Using the recommendation of Creswell (2013) for this study, I set the sample size at a minimum of five participants from the population of nine hospital emergency management and disaster preparedness professionals. I contacted each of the nine hospital emergency management and disaster preparedness representatives via telephone for inclusion in this study.

I collected the data for this study during face-to-face interviews using the Study Participant Data Collection Form that I developed specifically for this study (Appendix A).. Each interview session lasted approximately 60 minutes.

## Instrumentation

The instrument that was used to complete data collection was developed by the researcher specific to this study and the research questions being answered. The instrument used is named Study Participant Data Collection Form. This form was used during each interview session between participants and the researcher. The basis for the development of this instrument was taken from the U.S. Department of Homeland Security (Combs, 2015) seven key objectives in responding to a 10-kiloton IND in a metropolitan area. These objectives include; managing the response, characterizing the incident, evacuation and shelter in place protection, medical triage, casualty and evacuee care, stabilizing the impacted area, and recovery and restoration of essential functions (DHS, 2012).

The concept of empirical validity explains the relationship between a measuring instrument and the outcomes that are being measured (Frankfort-Nachmias and Nachmias, 2014). Empirical validity assumes that if the instrument used in measuring is valid, the results of applying those instruments and the resulting relationships among the variables measured is similar (Frankfort-Nachmias and Nachmias, 2014). Another factor to consider in the empirical validity of the measuring instrument is the skills of the researcher who is using the measuring instrument (Miles, Huberman, & Saldana. 2014). The researcher using the measuring instrument should be familiar with the phenomenon, be comfortable with the participants in the study, and have a heightened sense of objective awareness (Miles, Huberman, & Saldana. 2014). In using the seven key objectives in response to a 10-kiloton IND in a metropolitan area, the researcher being familiar with the phenomenon being studied, comfortable with the study participants, and being aware of the need for objectivity, it is possible to obtain the data necessary to answer the research questions of this study.

## Data Analysis Plan

This study includes data obtained through interviews in a collective case study approach to evaluate the preparedness of Detroit, Michigan hospitals in responding to a terrorist attack that includes an IND. The use of system theory has been applied to the data analysis with the assumption that the interconnection that the individual parts of the event have upon the ultimate outcome of the event (Borradorri, 2013). To look at the individual parts of the event it is necessary to look at them as a part of the whole event, which assists in reviewing them in terms of strengths, weaknesses, and impacts on

outcome (Patton, 2015). This type of evaluation is useful in program evaluation and analysis as allows for review of individual event parts without regard for how each is included in the whole and focuses on each part in relation to outcome (Patton, 2015). System theory seeks to answer the question of how and why the program works as a whole (Patton, 2015).

Coding, via the NVivo software system, was used to classify the data collected from interviews to find themes and dimensions. This approach in data analysis will allow for development of a detailed description of the data, which includes a description of what is seen in the data, and is a central part of case study analysis (Creswell, 2013). During the coding process the data text was separated into 25 to 30 separate categories of information using a database system. Analysis of data was revised and broadened to address discrepant cases to the point of identification of the inconsistency. This analysis will allow patterns and explanations for the inconsistency to be accomplished. Finally, once categorized and coded, the data was interpreted to understand the meaning of the data as it relates to answering the research questions.

## Trustworthiness

In conducting research, it is the job of the researcher to compile bits and pieces of information to formulate a compelling whole (Creswell, 2013). When compiling information, the researcher is looking for recurring behaviors or action that can be considered either confirming or disconfirming evidence in the conclusion of the study (Creswell, 2013). In considering the trustworthiness of the researcher's work it is necessary to weigh the evidence presented in a study to determine its persuasiveness

(Creswell, 2013). A rich, thick description of the information gathered, including how it was gathered, can assist with the reader's ability to trust the study as well as assisting in transferability (Creswell, 2013). In using this approach to recording and coding the data gathered from participants in this study, other researchers could transfer the information to other situations because of shared characteristics (Creswell, 2013). Using this approach also assists in the dependability of the study as it will make all of the aspects of the data collection process and data collected available for review and scrutiny.

Dependability in a qualitative study begins with thorough preparation prior to starting the study (Creswell, 2013). Dependability is tied primarily to the availability of data that is appropriate to the study as well as well-saturated (Frankfort-Nachmias & Nachmias, 2014) and can be verified through the researcher providing precise details on how the study was conducted (Creswell, 2013). In keeping a detailed record of the study from the start of developing the data collection tools to the study conclusion, the researcher can create an audit trail that will assist in the dependability of the study. In this study an audit trail was developed with copies of all documents being maintained in an electronic format. The audit trail includes electronic copies of all versions of the data collections form as the final version was determined. Electronic copies of documentation with the Walden IRB, including the application and approval documents are a part of the audit trail as well. Finally, the audit trail includes all documents, such as electronic copies of participant consent forms, completed data collection forms, researcher notes. This audit trail is being maintained as approved by the Walden University IRB and allows for additional scrutiny by other researchers.

When a researcher conducts qualitative research it is assumed that the perspective the researcher has on the topic is a source of bias (Creswell, 2013). The process of confirmability is used to establish whether or not this bias has compromised the study as well as the degree to results of the study could be corroborated by others (Creswell, 2013). Confirmability can be accomplished using an audit trail to demonstrate to other researchers how data was analyzed, the results of the analysis, and how determination of conclusions were made in a study (Creswell, 2013). The audit trail used for this study, including the components described previously, will assist other researchers to corroborate the data analysis, the results of the analysis, and the determination of conclusions of this study.

## Ethical Procedures

IRB approval was sought and obtained prior to any research conducted for this study (Walden University IRB# 08-14-15-0341742). Each participant in this study was provided with an overview of the study. This overview will include information on the purpose of this study, directions on withdrawal of participation in the study, study documentation storage, data storage and dissemination, and confidentiality of data collected. Each participant was given a participant consent form, which is maintained with the study documentation.

## Summary

This study is a qualitative approach to evaluate the preparedness of Detroit, Michigan area hospitals in responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness it is possible to determine strengths,

weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

Chapter 3 has included the research design tradition and rationale for the design as well as the role the researcher plays in the study. Details on concerning the researcher's relationship with participants, biases, and other ethical considerations have been listed in this chapter. The methodology used for this study, tools used to complete this study, and details concerning participants have been listed in this chapter. Finally, the ethical procedures that have been used to ensure the trustworthiness of this study have been included in this chapter.

Chapter 4 consists of the data collection procedures including number of participants, collection methods used in the study, and information concerning each data collection session. Chapter 4 will also include analysis of the data collected and examples of forms used to collect data. Finally, chapter 4 includes evidence of credibility, transferability, and dependability as evidence of trustworthiness of the study.

# Chapter 4: Data Analysis

## Introduction

In this study, I used a qualitative approach to evaluate Detroit, Michigan hospitals' preparedness for responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness, it is possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

An effective case study starts with a complete review of current literature (Yin, 2013), which was included in chapter 2. This literature review showed that the September 11, 2001 terrorist attacks on the United States revealed the lack of preparedness by hospitals to respond to terrorist attacks and brought focus to disaster preparedness to the hospital setting (Kano et al., 2011). Mandates issued by United States Health and Human Services (HHS) required hospitals to change their approach to emergency management and disaster preparedness through development of emergency operations plans and development of training (Federal Register, 2013).

In the last 15 years, there have been several notable terrorist attacks worldwide in addition to the September 11, 2001 attacks on the United States. In 2013, two brothers detonated improvised explosive devices near the finish line of the Boston Marathon, killing three people and injuring more than 260 others (Boston Globe, 2013). In 2011, the North Atlantic Treaty Organization (NATO) reported 960 terrorist incidents across the

world resulting in 493 deaths and 1,601 people injured through the use of improvised explosive devices (DHS, 2012).

A number of researchers have examined the preparation a hospital must have in place for an IND attack (Bliss, Hristovski, & Ulrich, 2013; Center for Biosecurity of UPMC, 2011; CMS, 2014; DHS, 2012; Gale & Baranov, 2014; Kano et al., 2011; Lim, Lim, & Vasu, 2013; Mauroni, 2012; Orlov, 2011; Veenema, 2013). In contrast, few researchers have examined the preparation that a hospital must have in place for an IND attack (Kano et al., 2011). There are many who feel that the threat of a terrorist attack using an improvised nuclear device is small, given that nuclear materials are more difficult than other potential weapons (Klein, 2012). The U.S. National Security Strategy of 2012 indicated that weapons of mass destruction, specifically the ability of violent extremists to develop INDs, are one of the greatest threats to the American people (National Security Network, 2012). Because this national security threat is real and is expected to continue, it is necessary to address the issue from a preparedness and response approach (Klien, 2012).

The need for further research into the hospital disaster preparedness overall and specifically response to a terrorist attack involving and IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012). The problem that I addressed in this study is that with inadequate preparation for an IND attack at the hospital level, the result of this type of a terrorist attack will result in

devastation for a community (Sheikh, et. al., 2012). Although it is necessary for all hospitals to be prepared to respond to terrorist attacks, it is not possible to implement the same plans in all areas across the country because each has their own unique vulnerabilities (Kano et al., 2011). I focused specifically on hospitals in Detroit, Michigan because the city is the busiest international land border crossing in the United States and thus has an increased threat of international terrorist attacks (DOT, 2013).

In this chapter I present the setting of the study, the demographics of the participants, and processes I used for data collection. I also discuss the processes I used to analyze the data collected from the participants, including the specific codes I used and the themes that emerged during analysis. Finally, I explain the ethical procedures I used to ensure the trustworthiness of this study.

## Setting

Over the course of the study, the participants expressed no personal or organizational conditions that may have altered their answers to questions. Additionally, study participants did not indicate any part of their experience with the study that influenced their participation in the study. Finally, there were no personal or organizational conditions that influenced my interpretation of the study results.

## Demographics

As of the date of this study, there were eight hospitals located within the Detroit city limits. The respective hospital emergency management and disaster preparedness representatives are responsible for developing and implementing plans for responding to a terrorist attack that includes an IND for the hospitals located in the city. This group of

eight emergency management and disaster preparedness professionals represents the population for this study. I contacted each of these eight hospital representatives via email to invite them to participate in the study. Of the eight representatives I contacted, five agreed to be included in the study. Two declined inclusion, and one did not respond to three separate invitations. The inclusion of these five representatives met the minimum number of participants that I determined was needed for data saturation.

## Data Collection

I conducted in-person interviews with the five emergency management and disaster preparedness representatives from hospitals in Detroit who consented to participate in the study. I held the interviews in a private room in my home. The five interviews lasted an average of 59.6 minutes, with the individual interviews lasting 75 minutes, 48 minutes, 65 minutes, 60 minutes, and 50 minutes respectively. I collected data collection using the instrument titled Study Participant Data Collection Form (Appendix A), which I described in Chapter 3. There were no variations in the data collection plan and no unusual circumstances that I encountered in the data collection.

## Data Analysis

I used coding, via the NVivo 10 software system, to classify the interview data and find themes and dimensions. During the coding process, I used the NVivo 10 system to separate the data into 13 separate categories. These categories were initially based on the specific questions I asked, and included: EOP is not specific to disasters, EOP is specific to disasters, hospital is not prepared to respond to an IND, and hospital is prepared to respond to an IND. Additional categorization was based on answers given by

the participants related to the specific questions. These categories included: hospital does not have an emergency department (ED), more training for all staff is needed, more training is needed for ED staff, requests for policy, training of ED staff is effective, training of ED staff is not effective, training program availability is not known, training program for IND response is available, and training program is needed to be able to respond to an IND.

I revised and broadened my analysis of the data to address discrepant cases and identify inconsistency. This analysis allowed me to identify patterns and and develop explanations for the inconsistencies. Finally, once the data was categorized and coded, I interpreted them to understand their meaning in relation to the research questions.

## Evidence of Trustworthiness

When conducting research, it is the job of the researcher to compile bits and pieces of information to formulate a compelling whole (Creswell, 2013). When compiling information, the researcher is looking for recurring behaviors or action that can be considered either confirming or disconfirming evidence in the conclusion of the study (Creswell, 2013). When considering the trustworthiness of the researcher's work, it is necessary to weigh the evidence presented in a study to determine its persuasiveness (Creswell, 2013). A rich, thick description of the information gathered, including how it was gathered, can assist with the reader's ability to trust the study, and can contribute to the study's transferability (Creswell, 2013). This approach to recording and coding the data gathered from participants in this study enables other researchers to transfer the information to other situations because of shared characteristics (Creswell, 2013). Using

this approach also assists in the dependability of the study because it makes all of the aspects of the data collection process and data collected available for review and scrutiny.

Dependability in a qualitative study begins with thorough preparation prior to starting the study (Creswell, 2013). Dependability is tied primarily to the availability of well-saturated data that is appropriate to the study (Frankfort-Nachmias & Nachmias, 2014) and can be verified through the researcher providing precise details on how the study was conducted (Creswell, 2013). In keeping a detailed record of the study from the start to conclusion, the researcher can create an audit trail that will contribute to dependability of the study. In this study, I developed an audit trail by maintaining copies of all documents in an electronic format. This audit trail included electronic copies of all versions of the data collection form that I developed before determining the final version. Electronic copies of documentation with the Walden IRB, including the application and approval documents, are a part of the audit trail as well. Finally, the audit trail includes all documents, such as electronic copies of participant consent forms, completed data collection forms, researcher notes. I have maintained this audit trail, with approval from the Walden University IRB, to allow for additional scrutiny by other researchers.

When a researcher conducts qualitative research, it is assumed that the researcher's perspective on the topic is a source of bias (Creswell, 2013). The process of confirmability is used to establish whether or not this bias has compromised the study, and to determine the degree which results of the study could be corroborated by others (Creswell, 2013). Confirmability can be accomplished using an audit trail to demonstrate to other researchers how data was analyzed, the results of the analysis, and how

conclusions were made in a study (Creswell, 2013). The audit trail I used for this study, including the components described previously, will assist other researchers in corroborating the data analysis, the results of the analysis, and the my conclusions in this study.

## Results

While conducting interviews with the participants, I expected that the answer to the question, "Do you feel that the hospital's EOP effectively addresses specific disasters that the hospital may need to respond to? If so why/why not," would be negative and that the hospital did not have a specific plan. Because most hospitals use the all-hazards approach to disaster preparedness outlined in the National Response Framework, it would have been surprising to receive answers to this question that did not follow this pattern. An example of the type of response to this question included, "No, we have more of a general plan in our EOP, it is based on an all-hazards approach." A complete listing of answers to this question is contained in Appendix B. One participant offered a clarifying statement asserting, "It is not possible to write the EOP to cover every specific disaster, as we would always have something missing from it." This statement was telling, as it explained further why it is not possible to include all possible situations in the EOP. One hospital representative initially indicated that their hospital's EOP did include specific instructions for disasters, and stated that, "Yes, it speaks to the emergency codes with plans and policies that go with those codes. The code 'violet plan' speaks to radiation emergencies, and the code 'triage external' speaks to the plans for a disaster." Later, the interviewee indicated that the hospital had not prepared for an IND specifically.

It was expected that the participants would give answers to indicate that the hospital was not prepared to respond effectively to an IND attack in response to the research question of "do you feel that your hospital is prepared to respond to an IND? If so why/why not?" All five hospital representatives indicated that their respective hospital was not prepared to respond effectively to an IND. One area of unexpected interest in this section of the data is a comment made by a participant that:

> We have to prepare our staff, but also our community for this possibility. If we don't have the community trained in what to do as well, it doesn't matter what our hospital can do for them. We will have a hard time keeping people away from our building if this happens because they look at us at the place to be in this situation. There is no way we could deal with this.

This is a facet of the scenario of an IND attack that was not originally considered as the focus of this study was completely on the preparedness of the hospitals. Looking at the comments made by the participant, it is clear that having community preparedness in place will play a significant role in how successful hospitals are in the case of an IND attack.

The question of the respective hospital's having an adequately trained emergency department (ED) staff to respond to an IND was answered mainly in a negative way, which was as expected. The participants indicated that "knowing what to do about fallout and the other things that are specific to an IND, we have never trained". As the participants indicated that they were not prepared to effectively respond to an IND, it follows that they would not have staff members trained to respond to an IND. One

interesting point that came up with more than one participant was the idea that the ED staff would respond adequately in the initial stages of this type of attack in response to the initial blast injuries and other trauma. It was the radiological component of an IND attack that these staff members would not be able to effectively respond to. As explained by one participant 'The radiation burns would not come in until the 2nd and 3rd wave. Those would be very difficult because we are not trained to respond specifically to these types of injuries".

When starting the interviews with the participants of this study it was expected that the most common response to what is needed for their hospital to be better prepared for an IND attack would be developing a specific plan. The interviews revealed that instead of the need for a specific plan, the participants indicated that they felt that training was the key thing needed for improvement at their respective hospitals. While coding the interviews with the NVivo 10 program it started to look like a trend that training was the top thing discussed for improvement efforts. It was when the word count and visualization tools in the program were used to look at the data that this unexpected trend became clear.

Despite an unexpectedly small number of responses to questions asked of the participants pertaining to plans in place at their respective hospitals for responding to an IND , as shown in Table 1, the majority of responses given by the participants were as expected. Additionally, Table 1 includes the expected responses from the participants pertaining to their opinion on what was needed to improve preparedness for an IND response.

Table 1

*Expected and Unexpected Participant Responses*

| Area of Inquiry | Expected Responses | Unexpected Responses |
|---|---|---|
| Prepared to respond | 5 | 3 |
| EOP Specific to IND | 5 | 1 |
| ED Staff IND Trained | 5 | 1 |
| How to better prepare | 1 | 5 |
| Aware of training available | 5 | 0 |

Using the word count option in the NVivo 10 program was the start of looking for trends and ideas that were not apparent during the interviews. The first version of the word count showed that training was the most commonly used word of the top 20 most used words. With the inclusion of the interview questions in the first word count, it wasn't clear if there really was a trend that was not expected, or if this result was due to the inclusion of the questions. A second word count was completed to review the top 20 words used by the participants while answering interview questions. This query was done with the interview questions removed to show a better picture of trends that may have evolved and like the initial query, it revealed training as the most commonly used word. The results of the second word count query shown in Table B.

Table 2

*Word Count With Interview Questions Removed*

| Word | Count | Weighted Percentage | Similar Words |
|---|---|---|---|
| training | 48 | 3.74 | conditions, developed, developing, directive, education, preparation, prepare, prepared, take, train, trained, training |
| planned | 36 | 3.08 | plan, planning, plans, preparation, prepare, prepared, program, programs |
| prepared | 30 | 1.92 | make, makes, preparation, prepare, prepared, prepped, readiness, ready |
| like | 22 | 2.25 | care, caring, like probably |
| need | 22 | 1.95 | ask, asked, need, needed, take |
| take | 22 | 0.75 | deal, directive, get, guide, issues, make, makes, take |

*(table continues)*

| | | | |
|---|---|---|---|
| specific | 21 | 2.49 | specific, specifically |
| just | 20 | 1.78 | good, hard, just, justify, right |
| think | 19 | 2.17 | reason, think, thinking, thinks |
| come | 19 | 1.47 | approach, become, come, coming, get |
| respond | 18 | 1.97 | answer, respond, responding |

*(table continues)*

| | | | |
|---|---|---|---|
| get | 17 | 0.77 | become, developed, developing, get, going, let, make, makes, receiver, start |
| hospital | 15 | 1.78 | hospital, hospitals |
| address | 15 | 0.87 | address, called, cover, deal, directive, handle, reference, speaks |
| care | 15 | 0.71 | care, caring, deal, handle, manage, management, manager, worry |

| | | | |
|---|---|---|---|
| really | 14 | 1.66 | actual, real, really |
| good | 14 | 0.82 | effectively, experts, good, practice, right, well |
| thing | 13 | 1.48 | matter, thing, things |
| see | 13 | 1.07 | look, looking, see, understand |
| happen | 12 | 1.42 | happen, happened, happens |

The first visualization of the data during analysis was the word cloud option. This visualization again showed that training was the centralized theme of the interviews. Although this visualization option was helpful, it did not show how the participants linked the idea of training to their preparations for responding to an IND. The second visualization of the data using the word tree option did assist in this aspect. Additionally, a query to see the comments that had to do with the word training was completed to review what the participant's opinions on training they have completed or needed to do to be prepared for responding to an IND. It was clear from the responses obtained from the participants that they did not know of a program or training standards that were available to them to train their staff for responding to an IND. This was something that was not expected at the beginning of the study. Some of the participants indicated that they had

concerns over the ability to complete training with staff as there would be a need to justify the cost of this training, regardless of the need to be prepared to respond.

## Summary

This study has been completed using a qualitative approach to evaluate the preparedness of Detroit, Michigan area hospitals in responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness it is possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

Chapter 4 has included the data collection procedures including number of participants, collection methods used in the study, and information concerning each data collection session. Chapter 4 has also included analysis of the data collected and examples of forms used to collect data. Finally, chapter 4 has presented evidence of credibility, transferability, and dependability as evidence of trustworthiness of the study.

Chapter 5 will include interpretation of data collected and ways in which the findings extend knowledge to bridge the gap in available literature as is included in chapter 2. Additionally, chapter 5 will include recommendations for further research into this topic as determined through the strengths and weakness of this study. Finally, chapter 5 consists of the social change that this study will impact.

# Chapter 5: Data Analysis

## Introduction

A nuclear detonation is considered by DHS to be the most catastrophic terrorist incident that could befall the United States (DHS, 2012). This type of terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (Gale & Baranov, 2014). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area and significantly damage response infrastructure (Gale & Baranov, 2014). In particular, those disasters that impact the hospital infrastructure, directly or indirectly, have the potential to create a need for hospitals to implement their facility emergency plans, evacuation or shelter-in-place for their patients, visitors and staff, implement medical surge, triage, and burn surge plans and institute decontamination of staff, patients, and their facilities (Gale & Baranov, 2014).

Following the terrorist attacks of September 11, 2001, the United States has taken steps at the federal, state, and local levels to prepare for a possible terrorist attack that includes a nuclear detonation (DHS, 2012). An improvised nuclear terrorist attack would require a complex and organized response that crosses jurisdictional boundaries and involves all levels of government as well as private sector agencies (DHS, 2012). The primary goal in improvised nuclear terrorist attack response efforts is to limit casualties while at the same time offering coordinated long-term support to the affected communities (DHS, 2012). It is expected that the local and state resources would be quickly overwhelmed, so preparation and planning are imperative to respond and reach

this primary goal (DHS, 2012). In my review of the current literature, I found that most hospitals in the United States have developed an all-hazards approach to disaster preparedness and emergency management (Adini et al., 2012; James, 2011; Kano et al., 2011; Kearns et al., 2013; McAlister, 2011; Sheikh,et al., 2012; Tan, Barnett, Stolz, & Links, 2011; Veenema, 2013).

Although the all-hazards approach is valuable, it does not truly prepare a hospital to respond to a terrorist attack involving an IND as this type of attack poses specific challenges and responses by a hospital (McAlister, 2011). The current literature on this topic suggests that hospitals look to develop emergency operation plans specific to IND response, though it does not show the best approach to determine current preparedness levels, developing IND specific plans, or plan implementation (Tan, Barnett, Stolz & Links, 2011). It is this gap that this study has addressed as well as having an opportunity to create social change through developing an approach that hospitals can use to become better prepared for IND response.

This study has been conducted using a qualitative approach to evaluate the preparedness of five Detroit, Michigan area hospitals in responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness, it is possible to determine strengths, weaknesses, and gaps in emergency management plans in these hospitals. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

This study has been completed using a qualitative case study approach to determine the best answer to the research questions and most accurate solution to the

research problem. Using the case study approach derives from the desire of the researcher to understand a specific social phenomenon (Creswell, 2013). In this specific case, the case study approach was used to understand and assess the readiness of hospitals in Detroit, Michigan to respond to an improvised nuclear device terrorist attack. Insight and understanding of this case has been assessed through an analysis of single individual hospital employees, hospital preparedness programs, and after action reports from full scale exercises that the hospitals have participated in.

## Interpretation of Findings

Hospitals are the epicenter for community response to mass casualty events, whether man-made or naturally occurring (UPMC Centers for Health Security, 2013). Healthcare organizations must prepare for the challenges of any type of terrorist attack in the communities they serve. A challenge to this is preparation is the need for hospitals to have a relationship in place with other organizations in the community that are a part of a response (James, 2011*).* During a disaster it is easy for a hospital to become overwhelmed, a situation that necessitates detailed emergency management planning (UPMC Centers for Health Security, 2013). Although the all-hazards approach has been well established, this approach has left many emergency plans with large gaps that need to be addressed (James, 2011*).* These gaps include the ability of hospitals, which currently struggle to provide care and maintain operations on a daily basis, to meet of leadership, personnel, infrastructure, capacity, communication, logistics, legal, ethical, and triage challenges in times of crisis (CDC, 2012).

The September 11, 2001 terrorist attacks on the United States revealed hospitals' lack of preparedness to respond to terrorist attacks and brought focus to disaster preparedness in the hospital setting (Kano et al., 2011). Mandates issued by the HHS required hospitals to change their approach to emergency management and disaster preparedness by developing emergency operations plans and staff training (Federal Register, 2013). Although there have been a number of studies conducted to determine the preparations that a hospital must have in place for an improvised nuclear device (Kano et al., 2011), there have been very few studies that focus on the preparations that a hospital must have in place for an IND (Kano et al., 2011).

The seriousness of the threat that INDs represent has been a topic of controversy because there are challenges that the terrorist must overcome in order to obtain the nuclear components essential to build the device (Klien, 2012). In the years since the development of nuclear weapons, the once-closely guarded secrets of designing and constructing a nuclear device have become public knowledge (Klien, 2012). The availability of reference material on the internet makes the potential for a terrorist group to construct a rudimentary, yet effective device a real possibility (Klien, 2012). Additionally, the use of an IND in a terrorist attack is capable of causing severe economic damage, extensive property damage, and enormous loss of life (Gale & Baranov, 2014). Nuclear explosions also have the potential to cause serious radiological threats to life outside of the immediate blast area and significantly damage response infrastructure (Gale & Baranov, 2014). Understanding that this threat to national security is real and is expected to continue is necessary to address this threat from a preparedness and response

approach (Klien, 2012). Although it is important to reduce or eliminate the threat of IND terrorist attacks, it is more important to control vulnerabilities of the target (Young & Leveson, 2014).

The international community has not been able to agree upon a universally accepted, legally binding definition of terrorism (Global Terrorism: The U.S. Challenge and Response, 2011). The inability of the international community to develop a clear and concise definition of terrorism makes it difficult for planning activities at all levels. The rationale for an individual or group in planning and carrying out a terrorist act is as subjective as the definition of term terrorism (Fridlund, 2011). Terrorism is broadly divided into classifications based on sponsorship of the terrorist attacks (Fridlund, 2011). Terrorism can also be given a subclassification based on the rationale or goals of the terrorist in perpetrating the attack (Fridlund, 2011). The number of classifications of rationales for a terrorist attack is infinite and subjective (Fridlund, 2011).

The choice of weapon for terrorist acts have evolved with advancements in technology, with progression from daggers, to firearms, explosives, and finally WMDs (Pratt, 2011). The WMDs used in terrorist acts include chemical agents, biological agents, radioactive agents, nuclear weapons, and explosives (Yamin, 2013). These include WMDs that are professionally manufactured and those that are made by amateurs (Pratt, 2011). Chemical and biological agents are considered to be easy to develop and use because neither requires high technology to create (Yamin, 2013). Explosives and explosive devices fall into three general classifications: nuclear, mechanical, and chemical (National Disaster Life Support Foundation, 2012). The use of WMDs

containing radioactive agents are classified into two groups: nuclear and radiological events (McComb, 2013). A radiological event occurs when a release of radiological material into populated areas has occurred (NDLS, 2012).

An IND explosion has the potential to kill thousands, damage response infrastructure with the explosion itself, and present substantial radiological threats to life over a far-reaching area (Boyd, 2016). A successful IND terrorist attack would result in a large blast with powerful shockwaves and extreme heat (Trimble, 2013) which would reach tens of millions of degrees and be brighter than the noonday sun (Cameron, 2011). A nuclear terrorist attack would result in a massive federal response, though this response could take up to 72 hours, during which thousands of lives could be lost without an initial response locally (Cameron, 2011). With the time necessary to marshal a federal response, it is important that state and local governments, as well as private agencies, prepare to respond to an IND terrorist attack (Klein, 2012). The first steps in preparing for this type of terrorist attack is to develop response plans, educate responders, and then test the plans that have been put in place (Cameron, 2011).

When responding to and recovering from an IND terrorist attack, the primary goal is limiting the total casualties and the seven key objectives developed by DHS (2012) become crucial for success. In managing the response, it is necessary to rapidly assess the scope of the event, establish incident command, and coordinate large numbers of human and material resources from local, state, and federal sources (DHS, 2012). Hospitals creating plans that use an all-hazards approach for terrorist attacks involving radiation use the rationale that radiation can cause exposure even when a person is not in contact with

it, and that can be detected easily with readily available equipment (Sheikh,et, al., 2012). Additionally, decontamination procedures are basically the same for all chemical, biological, and radiological exposure (Sheikh,et, al., 2012). Even with this all-hazards approach, hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011).

Terrorism is a war method that has been used by individuals, groups, and governments for centuries, and one that has evolved in its approach as technology has advanced (Borradorri, 2013). Systems theory is based on the idea that present and past events will affect future events (Borradorri, 2013) and provides the philosophical and intellectual foundation for a more inclusive model of causality (Young & Leveson, 2014). Using a systems theory approach that keeps in mind terrorist events that have happened in the past and present, makes it possible to better prepare for future events. The need for further research into hospital disaster preparedness overall and specifically response to a terrorist attack that includes the use of an IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012). Although it is necessary for all hospitals to be prepared to respond to terrorist attacks, it is not possible to implement the same plans in all areas across the country because each has their own unique vulnerabilities.

The literature review of this topic revealed a need for further research into hospital disaster preparedness overall and specifically response to a terrorist attack that

includes the use of an IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012).

The data analysis completed showed that the participants of this study expressed the same need for further research into hospital preparedness for response capabilities for a terrorist attack that includes an IND. This was revealed with the responses of the study participants, who all indicated that their respective hospital was not ready to respond to an IND incident. This response is similar to the 127 hospitals that participated in the survey conducted by Campus Safety Magazine in 2011 where 35% of the participants consider themselves to be marginally ready for this type of event (Campus Safety Magazine, 2011).

A nuclear terrorist attack would result in a massive federal response, though this response could take up to 72 hours, during which thousands of lives could be lost without an initial response locally (Cameron, 2011). This study revealed that despite the fact that the participants indicated that their respective hospitals did have an all hazards general response plan in place for disasters, none of these plans included something specific to a terrorist attack that includes an IND. Additionally, one participant of this study expressed his concern that the ability of the community to respond appropriately to a terrorist attack that included an IND. The participant's concerns centered around education of the community in the people of the community may over burden a hospital as it is looked at as a safe haven in a disaster. These concerns are similar to those of Klein (2012) who

explained that with the time necessary to marshal a federal response, it is important that state and local governments, private agencies, and communities as a w hole prepare to respond to an IND terrorist attack as well (Klein, 2012).

When responding to and recovering from an IND terrorist attack the primary goal is limiting the total casualties and the seven key objectives developed by the U. S. Department of Homeland Security (Combs, 2015) become crucial for success. In managing the response, it is necessary to rapidly assess the scope of the event, establish incident command and coordinate large numbers of human and material resources from local, state, and federal sources (DHS, 2012). Hospitals creating plans and using an all hazard approach for terrorist attacks involving radiation use the rationale that radiation can cause exposure even when a person is not in contact with it and can be detected easily with readily available equipment *(*Sheikh,et, al., 2012*).* With this all hazards approach hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011). In this study, the participants indicated that they did not have the adequate number of staff members trained to respond to an IND as they have not specifically planned in their emergency operation plan for this even, but instead have used an all hazard approach. Furthermore, although decontamination procedures are the same for all chemical, biological, and radiological exposure (Sheikh,et, al., 2012), and participants were confident that staff could respond appropriately to a common blast injury, the bigger challenge is with the extended injuries that are specific to an IND attack. As explained by one participant ‘The radiation burns

would not come in until the 2nd and 3rd wave. Those would be very difficult because we are not trained to respond specifically to these types of injuries".

Hospitals are the epicenter for community response to mass casualty events, whether man-made or naturally occurring (UPMC Centers for Health Security, 2013). Healthcare organizations must prepare for the challenges of any type of terrorist attack in the community they serve. During a disaster it is easy for a hospital to become overwhelmed which has necessitated the need for detailed emergency management planning (UPMC Centers for Health Security, 2013). Although the idea of an all hazards approach has been well established, this approach has left many emergency plans with large gaps that need to be addressed (James, 2011).

It was expected that this study would find that the participants would indicate what is needed for their hospital to be better prepared for an IND attack is developing a specific plan. However, the participants of this study instead focused on the need for that training as the key thing needed for improvement at their respective hospitals. This desire for training is similar to the study completed by Lim, Lim, and Vasu (2013), who argue that health care workers have a poor perception of their individual and institutional preparedness in disaster preparedness and response. This study surveyed doctors, nurses, and allied health care providers in determining their current level of knowledge of how to respond to a disaster in their role at the hospital and their willingness to participate in training to respond to disasters (Lim, Lim, and Vasu, 2013). The results of this study show a low number of health care workers who are confident in their ability to respond

and a high number that were willing to attend training to become prepared (Lim, Lim, and Vasu, 2013).

The system theory was used in this study to look at how a system or event functions as a whole and how the event complexities as individual parts of a larger whole (Patton, 2015). The system theory requires the researcher to look at each individual part of an event to determine the strengths, weaknesses, and impact on the event outcome (Patton, 2015). It is the interconnection that the individual parts of an event have on the outcome that will allow for the evaluation of IND response programs that Detroit area hospitals have put in place. The system theory is based on the concept that present and past events will affect future events and provides the philosophical and intellectual foundation for a more inclusive model of causality (James, 2011; Young & Leveson, 2014). In using a system theory approach to this topic, with the idea that terrorist events that have happened in the past and present, makes it possible to better prepare for future events.

## Limitations of the Study

Limitations in this study included the cooperation of only five of the available nine hospitals in the City of Detroit responding positively to invitations to participate in this study. Additional limitations include the willingness of the Detroit area hospitals to share all aspects of their respective disaster preparedness for response to a terrorist attack that involves an IND. The ability of the respective hospitals to be completely transparent in sharing of information was hampered by internal policies. These internal policies that set out permission in sharing organizational operational information prohibited the

participants from sharing copies of policies, plans, and procedures covering response to specific emergency situations as well as copies of emergency operation plans. This inability of the participants to share information meant that answers given would be of a broader nature rather than specific to policies, procedures, and plans set in place at their respective organizations. This study was also limited by the rapidly changing nature of disaster preparedness and emergency management. Although this study has gathered current data for hospital preparedness levels, the constantly changing nature of the topic can make the data outdated quickly.

## Recommendations

The need for further research into the hospital disaster preparedness overall and specifically response to a terrorist attack involving and IND is explained by the need to continually validate the readiness and effectiveness of the hospital's disaster response plans, incorporate new technology and advancement in knowledge through lessons learned in exercise evaluation and actual response situations (Sheikh, et. al., 2012). This study used a qualitative approach to evaluate the preparedness of Detroit, Michigan area hospitals in responding to a terrorist attack that includes an IND. By evaluating the current level of preparedness it is possible to determine strengths, weaknesses, and gaps in emergency management plans in the five hospitals that participated in this study. Revealing these strengths, weaknesses, and gaps allows for changes to be made in the approach to managing this type of disaster.

Hospitals creating plans and using an all hazard approach for terrorist attacks involving radiation uses the rationale that radiation can cause exposure even when a

person is not in contact with it and can be detected easily with readily available equipment (Sheikh,et, al., 2012). Additionally, decontamination procedures are basically the same for all chemical, biological, and radiological exposure (Sheikh,et, al., 2012). Even with this all hazards approach hospitals are lacking in their preparation, training, and staff knowledge in response to an IND terrorist attack (McAlister, 2011). This study revealed a need to develop an emergency operations plan that includes a specific action plan for hospital response to a terrorist attack that includes an IND. Without the development of an event specific emergency operations plan, the result of this type of a terrorist attack will result in devastation for a community (Sheikh, et. al., 2012).

At the five Detroit, Michigan hospitals that participated in this study, the hospital emergency management and disaster preparedness representatives are responsible for developing and implementing training for response to an IND. This study revealed a significant weakness in this area at all five of the hospitals that participated. All of the participants indicated that they did not have training that was specific to an IND. Additionally, the participants were not aware of any commercially available training that can be given to hospital staff on response to an IND. This lack of readily available training programs is a significant weakness as the response from an IND terrorist attack has the primary goal of limiting the total casualties (DHS, 2012). It is recommended that training programs be developed and made available to all hospitals in the United States to assist with preparation for response.

## Implications

The way the world is viewed by the social constructionist is where the individual is constantly trying to understand the world in which we live (Creswell, 2013). This same concept relates to the way in which a researcher looks to create social change through studies. This study has looked to accomplish social change through a new approach to the way hospitals prepare for an improvised nuclear terrorist attack and responding to this type of disaster.

Development of an improved model for disaster planning and training in the hospital setting will mean improved community response and community care. With the information gathered from this study, it is possible for hospital emergency preparedness coordinators to create this improved model for disaster planning and training in the hospital setting. This improved model can then be shared throughout the health care field as a whole nationally, which will bring about social change on a national level.

In addition to social change through an improved model of response, it is expected that social change is reflected with an improvement and an expansion to the number of training programs that are available for hospitals to use to train staff in response to an IND. This study revealed the serious need for the development and dissemination of training programs that specifically address the appropriate hospital response to an IND. With the expected improvements and expansion in the number of training programs available, accomplishing this has the ability to achieve social change at a national level. Finally, improved and expanded numbers of training programs for hospitals will mean an increase in the number of hospitals and hospital staff that are

prepared to an IND incident, which will correlate to an increased number of victims who will receive care and potentially save tens of thousands of lives in the event of a terrorist attack that includes an IND. It is the ability to increase the number of potential lives saved on a national level through changing the process that are currently used for response preparation that shows the most important part of the social change that was accomplished. Whereas saving one life is important, developing a program that can potentially save tens of thousands of lives is truly social change.

## Conclusion

At the 2010 Nuclear Security Summit, United States Secretary of State Hillary Clinton warned that

> A 10-kiloton nuclear bomb detonated in Times Square in New York City could kill a million people. Many more would suffer from the hemorrhaging and weakness that comes from radiation sickness. And beyond the human cost, a nuclear terrorist attack would also touch off a tsunami of social and economic consequences across our country. (Boyd, 2016, p. 46).

Additionally, a nuclear detonation is considered by DHS to be the most catastrophic terrorist incident that could befall the United States (DHS, 2012). This type of terrorist attack is capable of causing severe economic damage, severe property damage, and enormous loss of life (Gale & Baranov, 2014). The most important thing in the response of a terrorist attack that includes an IND is to save lives. This is best accomplished with preparation including emergency operations plans specific to an IND and training hospital staff on how to properly respond.

This study has shown the weaknesses and gaps in emergency operations planning for response to an IND at five of the eight hospitals located in Detroit, Michigan. These weaknesses and gaps must be addressed before there is a need to respond. Hundreds of thousands of lives depend on these hospitals and are dependent on their ability to respond. Without bridging these gaps and turning weaknesses into strengths lives are at risk.

# References

Adini, B., Goldberg, A., Cohen, R., Laor, D., & Bar-Dayan, Y. (2012). Evidence-based support for the all-hazards approach to emergency preparedness. *Israel Journal of Health Policy Research, 2*(1), 14-18. doi:10.1186/2045-4015-1-40.

Borradorri,G. (2013). Looking into the Fighting Against Terrorism from the System Theory Perspective. *University Of Gaziantep Journal Of Social Sciences*, *8*(1), 49-61.

Bliss, M. M., Hristovski, K. D., & Ulrich, J. W. (2013). Compliance of Community Hospitals with the Chemical Facility Anti-Terrorism Standards (CFATS) in the Western United States. *Journal Of Homeland Security & Emergency Management*, *10*(2), 433-445. doi:10.1515/jhsem-2012-0018.

Boston Globe. (2014). *A year since Marathon attacks, many of wounded struggle.* Retrieved from http://www.bostonglobe.com/metro/2014/04/14/year-after-marathon-bombings-survivors-struggle-with-invisible-injuries/NOJ8kKRewvPxjK7LZ3tjJP/story.html.

Boston Globe. (2013). *Terror at the Marathon.* Retrieved from https://www.bostonglobe.com/metro/specials/boston-marathon-explosions.

Boyd, D. (2016). Revealed preference and the minimum requirements of nuclear deterrence. *Strategic Studies Quarterly*, 10(1), 43-73.

Bush, L., & Perez, M. (2012). The anthrax attacks 10 years later. *Annals of Internal Medicine*, *156*(1), 41-44.

Cameron, S. K. (2011). Improvised nuclear attack. *Journal of Counterterrorism & Homeland Security International.17*(4), 30-34.

Campus Safety Magazine. (2011). *1 in 3 hospitals struggle with radiological disaster response*. Retrieved from http://www.campussafetymagazine.com /Channel/Hospital-Security/News/2011/03/24/1-in-3-Hospitals-Not-Well-Prepared-for-Radiological-Disasters.aspx.

Center for Biosecurity of UPMC. (2011). *Rad resilient city: a preparedness checklist to save lives after a nuclear detonation.* Retrieved from http://www.radresilientcity .org.

Centers for Medicare and Medicaid Services. (2014). *Emergency Preparedness Requirements for Participating Providers and Suppliers*. Retrieved from http://www.regulations.gov/#!documentDetail;D=CMS-2013-0269-0002.

Combs, T. (2015) *Ongoing crisis communication; Planning, managing and responding* (4th ed.). Thousand Oaks, CA. Sage Publishing.

Creswell, J. W. (2013). *Qualitative inquiry and research design* (3rd ed.). Thousand Oaks, CA: Sage Publishing.

Decker, R. J. (2011). Acceptance and utilization of the Incident Command System in first response and allied disciplines: An Ohio study. *Journal of Business Continuity & Emergency Planning, 5*(3), 224-230.

Department of Homeland Security. (2012). Improvised explosive devices: A global review January & February 2012. Retrieved from https://www.dhs.gov/xlibrary /assets/prep_ied_fact_sheet.pdf.

Department of Transportation. (2013). *Ambassador bridge crossing study.* Retrieved from http://www.ops.fhwa.dot.gov/freight/freight_analysis/ambass_brdg/ambass_brdge_ovrvw.htm.

Dorschner, J. P. (2013). The United States' "War on Terror" has been overtaken by events. *American Diplomacy*, 1-6.

Dworkin, S. L. (2012). Sample size policy for qualitative studies using in-depth interviews. *Archives of Sexual Behaviors, 41*(6), 1319-1320. doi:10.1007/s10507-012-0016-6.

Ed, W. (2014). Detroit underwear bomber's convictions affirmed. *Michigan Lawyers Weekly.*

Federal Bureau of Investigation. (2014) *Definition of terrorism.* Retrieved from http://www.fbi.gov/about-us/investigate/terrorism/terrorism-definition.

Federal Emergency Management Agency. (2014). *National Incident Management System*. Retrieved from http://www.fema.gov/national-incident-management-system.

Federal Register. (2013). *Medicare and Medicaid programs; Emergency preparedness requirements for Medicare and Medicaid participating providers and suppliers.* Retrieved from https://www.federalregister.gov/articles/2013/12/27/2013-30724/medicare-and-medicaid-programs-emergency-preparedness-requirements-for-medicare-and-medicaid.

Frankfort-Nachmias, C., & Nachmias, D. (2014). *Research methods in the social sciences* (8th ed.). New York, NY: Worth Publishers.

Fridlund, M. (2011). Buckets, bollards and bombs: towards subject histories of technologies and terrors. *History & Technology*, 27(4), 391-416. doi:10.1080/07341512.2011.622149.

Gale & Baranov (2014). *Planning guidance for a response to nuclear detonation*. Retrieved from www.fema.gov/CBRNE.

Global Terrorism: The U.S. Challenge and Response. (2011). *American Foreign Policy Interests*, 33(3), 129-135. doi:10.1080/10803920.2011.593982.

Gunning, J., Jackson, R. (2011). What is so religious about religious terrorism? *Critical Studies on Terrorism*.Vol. 4 Issue 3, p369-388. 20p.

Hinkkainen, K. (2013). Homegrown Terrorism: The Known Unknown. *Peace Economics, Peace Science, & Public Policy*, *19*(2), 157-182. doi:10.1515/peps-2012-0001.

Hitz, F. P. (2012). U.S. intelligence in the wake of September 11: The rise of spy commando and reorganized operational capabilities. *Harvard Journal of Law & Public Policy*, 35(1), 245-258.

Horowitz, M., & Narang, N. (2014, April). Poor man's atomic bomb? Exploring the relationship between "weapons of mass destruction". *Journal of Conflict Resolution*, *58*(3), 509-535.

James, K. (2011). The organizational science of disaster/terrorism prevention and response: Theory-building toward the future of the field. *Journal of - Organizational Behavior*, 32(7), 1013. doi:10.1002/job.782.

Kano, M., Wood, M. M., Bourque, L. B., & Mileti, D. S. (2011). Terrorism Preparedness and Exposure Reduction since 9/11: The Status of Public Readiness in the UnitedStates. *Journal Of Homeland Security & Emergency Management*,8(1), 1-17.doi:10.2202/1547-7355.1807.

Kearns, R. D., Cairns, C. B., Holmes, I. H., Rich, P. B., & Cairns, B. A. (2013). Blast injuries & burn care. *EMS World*, 42(5), 34-40.

Klarevas, L. (2011). Trends in terrorism since 9/11: is terrorism still a threat to the United States?. *Georgetown Journal Of International Affairs*, (1), 76.

Klein, J. J. (2012). Deterring and dissuading nuclear terrorism. *Journal of Strategic Security.* 5(1), 15-29. doi: 10.5038/1944-0472.5.1.2.

Kolb, J. J. (2013). Boston legal, *Journal of Counterterrorism & Homeland Security International*, 19(3), 42-45.

Lawrence Livermore National Laboratory. (2011). *National capital region key response planning factors for the aftermath of nuclear terrorism*. Lawrence Livermore National Laboratory.

Li, Q., Fuhrmann, M., Early, B. R., & Vedlitz, A. (2012). Preferences, knowledge, and citizen probability assessments of the terrorism risk of nuclear power. *The Review of Policy Research.* (2), 207.

Lim, G. H., Lim, B. L., & Vasu, A. (2013). Survey of factors affecting health care workers' perception towards institutional and individual disaster preparedness. *Prehospital Disaster Med, 28(4),1-6.*

Lucas, J., Dressman, H. K., Suchindran, S., Nakamura, M., Chao, N. J., Himburg, H., & Chute, J. P. (2014). A Translatable Predictor of Human Radiation Exposure. *Plos ONE*, 9(9), 1-12. doi:10.1371/journal.pone.0107897.

Mantri, G. (2011). Homegrown Terrorism. *Harvard International Review*, 33(1), 88-94.

Marshall, B., Cardon, P., Poddar, A., & Fotenot, R. (2013). Does the sample size matter in qualitative research? : A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, *54*(1), 11-22.

Mauroni, A. (2012). Nuclear terrorism: Are we prepared?. *Homeland Security Affairs.* 8(1), 2-13.

McAlister, V. (2011). Drills and exercises: the way to disaster preparedness. *Canadian Journal of Surgery. Journal Canadien De Chirurgie*,54(1), 7-8.

McComb, J. M. (2013). Closing Pandora's Box: The Threat of Terrorist Use of Weapons of Mass Destruction. *Global Security Studies*, 4(1), 71-92.

Menesick, S. (2011). Preventing the unthinkable: An overview of threats, risks, and US policy response to nuclear terrorism. *Global Security Studies*, 2(3), 30-40.

Michael, G. (2012). Strategic nuclear terrorism and the risk of state decapitation. *Defense Studies.* 12(1), 67-105. doi: 10.1080/14702436.2012.683974.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). Qualitative data analysis; A methods sourcebook. Sage Publications, Thousand Oaks, CA.

Mohammed, K. (2015). When the Victims are not so Innocent. *Cross Currents*, 65(3), 380-391. doi:10.1111/cros.12147.

National Disaster Life Support Foundation. (2012). *Basic disaster life support* (3rd ed.). The United States of America, American Medical Association.

National Security Network. 2012. *Combating the most dangerous threat*. Retrieved from http://nsnetwork.org/combating-the-most-dangerous-threat/.

Orlov, V. (2011). Illicit nuclear trafficking & the new agenda. *The International Atomic Energy Agency*, Retrieved from http://www.iaea.org/Publications/Magazines/Bulletin/Bull461/illicit_nuclear_trafficking_3.html.

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). Thousand Oaks, CA: Sage Publishing.

Perko, T., van Gorp, B., Turcanu, C., Thijssen, P., & Carle, B. (2013). Communication in nuclear emergency preparedness: a closer look at information reception. *Risk Analysis: An Official Publication Of The Society For Risk Analysis*, 33(11), 1987-2001. doi:10.1111/risa.12048.

Pratt, A. (2011). Terrorism's Evolution: Yesterday, Today, and Forever. *Connections* (18121098), 10(2), 1-33.

Rapin, A. (2011). What is terrorism?. *Behavioral Sciences Of Terrorism & Political Aggression*, 3(3), 161-175. doi:10.1080/19434472.2010.512155.

Sheikh, S., McCormick, L. C., Pevear, J., Adoff, S., Walter, F. G., & Kazzi, Z. N. (2012). Radiological preparedness-awareness and attitudes: A cross-sectional survey of emergency medicine residents and physicians at three academic institutions in the United States. *Clinical Toxicology* (15563650), 50(1), 34-38. doi:10.3109/15563650.2011.637047.

Satkowiak, L. (2014). Technical Solutions to Nonproliferation Challenges. *AI Conference Proceedings*, 1596180-193. doi:10.1063/1.4876468.

Sokolowski, H. (2013). Nuclear weapons material gone missing: What does history teach?. *Strategic Studies Institute of the United States Army War College*, Retrieved from http://npolicy.org/books/2014muf/Nuclear%20Weapons%20Materials%20Gone%20Missing.pdf.

Tan C. M., Barnett D. J., Stolz A. J., Links, J. M. 2011. Radiological incident preparedness: planning at the local level. *Disaster Med Public Health Prep*, 5(Suppl 1):S151-S158.

Trimble, D. C. (2013). Nuclear terrorism response plans: Major cities could benefit from federal guidance on responding to nuclear and radiological attacks. *GAO Reports.* 1-63.

UPMC Centers for Health Security. (2013). *Hospitals rising to the challenge: The first five years of the U.S. hospital preparedness program and priorities going forward*. Retrieved from http://www.upmchealthsecurity.org/website/resources/publications/hppreport.htm.

Veenema, T. (2013). *Disaster nursing and emergency preparedness: for chemical, biological, and radiological terrorism and other hazards* (3rd ed). New York, NY. Springer Publishing.

Vicar, D., & Vicar, R. (2011). CBRN Terrorism; A contribution to the analysis of risks. *Journal of Defense Resources Management*, 2(2), 21-28.

Wormell, P. (2014) Developing Policies for Countering Terrorism. *Criminology & Public Policy*, 13(3), 493-497. doi: 10.0000/1745-9133.12098.

Yamin, T. (2013). Chemical & Biological Weapons: Positions, Prospects and Trends. *Policy Perspectives*, 10(1), 142-154.

Yin, R. (2011). *Applications of case study research* (3rd ed.). Thousand Oaks, CA: Sage Publishing.

Yin, R. (2013). *Case study and research design methods* (5th ed.). Thousand Oaks, CA: Sage Publishing.

Young, W., & Leveson, N. G. (2014). An integrated approach to safety and security based on system theory. *Communications of the ACM*. 57(2), 31-35. doi: 0.1145/2556938.

Appendix A

**Data Collection Form**

Name of person interviewed_____ Role _____

Date_____Start time_____ End time_____

Demographic Information

Hospital_____

RQ1: How have the hospitals planned for response to an improvised nuclear attack?

1. Do you feel that the hospital's EOP effectively addresses specific disasters that the hospital may need to respond to? If so why/why not)

2. Do you feel that your hospital is prepared to respond to an IND? If so why/why not?

RQ2: What type of training has the first receiver emergency department staff of the hospital had to respond to an improvised nuclear attack?

1. Do you feel that the training given to emergency department staff to respond to an IND is effective in preparing them to respond effectively?

2. Is there additional training that you believe that would better prepare emergency department staff to respond specifically to an IND?

RQ3: How can the hospitals better prepare for response to an improvised nuclear attack?

1. Do you feel that hospital has effectively prepared to respond to an IND? Why/Why not?

2. Do you feel that there are steps that your hospital can take to better prepare for an IND? If so, what are the steps?

Appendix B

**RQ1: How have the hospitals planned for response to an improvised nuclear attack?**

Do you feel that hospital has effectively prepared to respond to an IND?

Why/Why not?

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [12.91% Coverage]

Reference 1 - 12.91% Coverage

No, we are generally prepared to respond to disasters, but not specific to an IND. We have to prepare our staff, but also our community for this possibility. If we don't have the community trained in what to do as well, it doesn't matter what our hospital can do for them. We will have a hard time keeping people away from our building if this happens because they look at us at the place to be in this situation. There is no way we could deal with this.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [13.97% Coverage

Reference 1 - 13.97% Coverage

Nope. Not effectively. Not at all. Like I said, we really haven't done anything to prepare since we had that one exercise years ago. It was like we did ok on that, then we stopped thinking about it. Yeah, we say that we can respond to anything that happens in our community, but really we are not ready. I think if it happened here it would be chaos and confusion for a response, not a real response. There are people here that disagree with me on our readiness for all disasters, so I am sure they would disagree here too.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [7.90% Coverage]

Reference 1 - 7.90% Coverage

No. No way. No one in the country is ready. If they say they are they are wrong. Just talking about this makes me feel less ready and less confident.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [10.89% Coverage]

Reference 1 - 10.89% Coverage

No, not at all. As I said, we have not trained on this topic and have not really done any preparation for it. Although, I think our not being ready to respond is not as significant as if we were a regular hospital. I think the level ones and regular ones need to be prepared more than we do.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [10.12% Coverage]

Reference 1 - 10.12% Coverage

We have prepared plans and policies for the Emergency Operations Plan, Incident Command, and general emergency conditions. Nothing specific to an IND, so no. No, we are not ready to respond to this.

Do you feel that the hospital's EOP effectively addresses specific disasters that the hospital may need to respond to? (If so why/why not)

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [12.11% Coverage]

Reference 1 - 12.11% Coverage

No, we have more of a general plan in our EOP, it is based on an all hazards approach. This plan is not a micromanagement type of plan for specific situations, but more of a general plan to help you manage, help a manager take care of a situation, an emergency. The plan can be changed as you go through a situation but doesn't specifically address a possible problem.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [11.87% Coverage]

Reference 1 - 11.87% Coverage

The EOP is developed using an all hazards approach with the concept coming from the National Response Framework. Because of this we don't address all specific disasters that could happen but look at a response plan that can be applied to a variety of instances. It is not possible to write the EOP to cover every specific disaster as we would always have something missing from it.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [10.98% Coverage]

Reference 1 - 10.98% Coverage

No, it is not specific to any one actual thing that might happen. It is generic and not all encompassing. It is meant to be a guide to help people respond, not tell them specifically what to do.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [16.32% Coverage]

Reference 1 - 16.32% Coverage

Our EOC doesn't address specific situations entirely. There are a few instances listed, but it is more of an overview of what we will do in a disaster. Our HVA (*Hazard Vulnerability Assessment)* and Four Phases documents outline specific disasters and what our response would be. These documents are available to the people responding, but are not all encompassing. They wouldn't say what to do for each and every disaster situation.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [12.09% Coverage]

Reference 1 - 12.09% Coverage

Yes, it speaks to the emergency codes with plans and policies that go with those codes. The code violet plan speaks to radiation emergencies and the code triage external speaks to the plans for a disaster.

**RQ2: What type of training has the first receiver emergency department staff of the hospital had to respond to an improvised nuclear attack?**

Do you feel that the training given to emergency department staff to respond to an IND is effective in preparing them to respond effectively?

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [14.28% Coverage]

Reference 1 - 14.28% Coverage

Our employees would respond to what they see in front of them, what the patients came in with. Things like injuries and burns, they would not respond specifically to an IND. They are really good at responding to the general injuries and issues that would come up from an explosion. The radiation burns would not come in until the 2nd and 3rd wave. Those would be very difficult because we are not trained to respond specifically to these types of injuries.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [14.31% Coverage]

Reference 1 - 14.31% Coverage

Not even close. Again, we train for all the standard stuff like trauma and decon. But we don't look at INDs specifically. Our staff would be ok if someone told them that there would need to be decon for the patients coming in. But for things like knowing what to do about fallout and the other things that are specific to an IND, we have never trained.

This goes back to the idea that nuclear attack is low on the HVA (*Hazard Vulnerability Assessment)*and so we just don't focus on it.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [12.06% Coverage]

Reference 1 - 12.06% Coverage

No they are not. I really don't think they are dedicated to this type of response. I think it would be a disaster. Maybe the bigger places that are level ones (*Level one trauma center)* might be better ready, but we aren't.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [13.70% Coverage]

Reference 1 - 13.70% Coverage

We don't have an emergency department, so I can't really answer this one. I can say that the hospital staff has had absolutely no training for an IND. As a part of the larger health system we will be called on to assist the other hospitals, probably to take their less acute patients, but not to respond in a triage and treatment role.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [9.29% Coverage]

Reference 1 - 9.29% Coverage

No, absolutely not. No, we have not prepared them for this specifically. We have for other things, but not for this.

Do you feel that there are steps that your hospital can take to better prepare for an IND? If so, what are the steps?

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [16.19% Coverage]

Reference 1 - 16.19% Coverage

We are not looking specifically at plans for an IND attack. This is not a warm and fuzzy topic that people will get behind, like get the bad guys and save the kids

It is hard to wrap our heads around this idea and to know what steps to take. Right now it is the anniversary of the bombings in Hiroshima and Nagasaki, and we see the results of that still to this day. I don't think there is any city in the US or even in the world that could survive or handle this type of attack well. We have not done much in the world in preparation for this type of thing.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [14.06% Coverage]

Reference 1 - 14.06% Coverage

To do any type of training at all for the staff would be the first place to start. You can't expect people to respond until you teach them how to. We don't need any more equipment because we have everything that is needed based on all hazard approach. There is nothing new that we would need. It would be good if we had an MOD (*management operating directive)* or policy or something that spoke specifically to the idea of an IND. That way they would have something to reference when it happened.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [16.05% Coverage]

Reference 1 - 16.05% Coverage

Yes, better and more education to be available. Look at the programs that might be out there already. We need to train and exercise on just this and nothing else. I don't know if that will happen though. The cost of training and exercising makes it hard for us to do anything new unless we can show a real benefit. Since this is such a long shot thing, we probably won't.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [12.55% Coverage]

Reference 1 - 12.55% Coverage

To do any preparation at all would be the first step. It would be good to do some training for staff and make some plans with the other hospitals in our system as to what our role would be. I think without their input it is a waste of time for us to make any preparation plans because we are not a first receiver hospital.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [19.09% Coverage]

Reference 1 - 19.09% Coverage

I hope so, and I hope someone is working on it for the industry in general. We are not looking specifically at plans for an IND attack but more at an overall all hazard approach. Now that we have talked about this, it makes me really wonder if we should be looking at all of our disasters separately and planning separately. Though I have no idea how we would do that or what is possible with it. It is something to think about.

**RQ3: How can the hospitals better prepare for response to an improvised nuclear attack?**

Do you feel that your hospital is prepared to respond to an IND? If so why/why not?

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [25.00% Coverage]

Reference 1 - 25.00% Coverage

I would have to ask how far the device is from the hospital, we may not need to respond at all if it is close. We would be wiped out and wouldn't have to worry about anything. *(researcher indicated that the device would be far enough away from the hospital that a response would be necessary)*

I don’t think any hospital is ready based on the number of casualties that would present for care, we couldn’t handle all the patients that would come. The whole health care system would be overwhelmed for the whole city. Even with just caring for pediatric patients we would be overwhelmed and not able to care for everyone.

People don’t know as a community how to respond to a nuclear attack, let alone in a hospital. No one in the United States is prepared and we as a country need to do more to become prepared.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [16.73% Coverage]

Reference 1 - 16.73% Coverage

We participated in the Region 2 South Operation Shared Burden exercise a few years Ago and that went well. I think the reason that it went well was because we prepared for the exercise, it was announced, and staff were prepped. Do I think if the real thing happened we could respond? My answer is no. We could care for injuries like we always do, no problem. But to deal with an IND, no way. We don’t talk about it, we don’t plan for it, and we don’t practice it. So, no, we are not ready.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [21.74% Coverage]

Reference 1 - 21.74% Coverage

No. I just think that it is the last thing that anyone thinks could happen or that we could have to deal with. The staff would respond but it would be bad. I just don’t know how they would act. I also don’t think that the staff are dedicated enough to stay at the hospital or show up at the hospital if there is one of these types of attacks. They would leave to go be with their family. I know I would think about leaving.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [22.12% Coverage]

Reference 1 - 22.12% Coverage

In a way yes and in a way no. I say yes because we are not the same as a regular hospital. We don't have an emergency department, we only take rehab patients. With that in mind, we probably won't be the ones that take in patients in a disaster. But, we could get people coming to the door only because they see the word hospital in our name and where we are located. It has happened before, where someone runs in the door hollering for help because they think we are a regular hospital. So, because of that we are not really prepared.

<Internals\\Auto Code Survey\\CHM> - § 1 reference coded [10.18% Coverage]

Reference 1 - 10.18% Coverage

There has to be some type of training that would be helpful for the staff, but I am not familiar with any. I am sure the government would offer it if we asked, but we just don't know what to ask for.

<Internals\\Auto Code Survey\\DRH> - § 1 reference coded [20.14% Coverage]

Reference 1 - 20.14% Coverage

Since we don't train for this right now, any IND response training would be good. Though it may be difficult to get done based on what we would have to do to accomplish this. The cost of training everyone is prohibitive. We would have to justify the need for the cost of the training. Unless we could get something from the region (*Region 2 South),* FEMA or something like that. I just don't see our developing something like this unless we have a real threat. Kind of like with Ebola. The USA didn't do anything at all to

prepare for it, until someone came here with it. It would need the same thing. An IND going off somewhere for anyone to take action.

<Internals\\Auto Code Survey\\HUH> - § 1 reference coded [18.59% Coverage]

Reference 1 - 18.59% Coverage

Yes. Maybe they could have specialty teams like the FBI or ATF come in to train. There is so much, so many misconceptions on what would happen with an IND. What types of injuries, what types of patients, the problems would happen if there is an attack, we just don't know, don't understand it. We need the experts to tell us what we need.

<Internals\\Auto Code Survey\\RIM> - § 1 reference coded [13.51% Coverage]

Reference 1 - 13.51% Coverage

We have never had any training on this, so yes, training would be good. I am familiar with the CBRNE program that gives some basic information, but would like to see that expounded on. I am not sure if there are already programs available or not.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [17.39% Coverage]

Reference 1 - 17.39% Coverage

I am sure there is specific training and drills for it. Have we done that, no. We have done CBRNE *(Chemical, Biological, Radiation, Nuclear, Explosion)* stuff, but nothing specific to nuke training. We have no one here that can do that training. We need help with this.

<Internals\\Auto Code Survey\\SGH> - § 1 reference coded [18.81% Coverage]

Reference 1 - 18.81% Coverage

I would like to think that we are, however, we have not been trained specifically for the idea of an IND. Chaos will come along with this type of thing and people will panic.

Even our staff will panic and not know what to do. Yeah, we have plans, but I know things will go really wrong pretty fast.