Analysis of Records that Represent an Active Shooter Response Model with 32 Large-Scale Exercises

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Approval Page

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Abstract

Active shooter events in the United States have risen dramatically in the last 15 years, both in frequency and lethality. Public safety agencies, including police, fire, and emergency medical services must respond quickly and efficiently to minimize the loss of life at these events. In the last couple years, there is a push to integrate fire and emergency medical personnel quickly with law enforcement response, even when the scene is not safe from all hostile threats. Researchers have opined several different public safety integrations options at active shooter events. In 2013, the City of Charlotte, North Carolina, began a comprehensive 18-month project to create a unified public safety active shooter response plan. Following creation of the plan, all Charlotte firefighters received training on the new joint response plan. The plan was then tested using 32 large-scale simulated exercises. All 1,100 members of the Charlotte Fire Department were required to participate in two exercises. The first exercise was duplicated 17 times, and the second exercise was duplicated 15 times. Members of the Charlotte Fire Department Training Academy staff collected data on the efficacy of the simulated exercises. Primary data collection included time from dispatch to point-of-wounding victim care and time from dispatch to victim extraction from the building. The Charlotte Fire Department also collected observations from five instructors who led the training exercises. This descriptive case study used both quantitative and qualitative data to evaluate the effectiveness of the protocol, as well as lessons learned from the large-scale exercises. This research used archival data and observations from the large-scale exercises to create interpretations of the results of the protocol implementation and recommendations for improvement of the protocol.

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Dedication

I dedicate this research to all of the victims of active shooter events and the many lives touched by those atrocities. In particular, I want to specially dedicate this work to Dawn Anna and Carlee Soto: two people whose lives were forever changed by the events at Columbine High School and Sandy Hook Elementary School. If one life is saved from this research, the time spent is beyond measure.

“***If you are going to tell my child to stay put, you’re going to go get her. Either go in there and do something, or take off your uniform and find another job. On this day, it was your job to put her life above yours.***”

– **Dawn Anna, mother of Columbine victim Lauren Townsend, as interviewed on CBS’ 60 Minutes, April 20, 2001**

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Chapter 1: Introduction

Active shooter events have increased steadily in the United States in the last 20 years (Blair & Schweit, 2014; Department of Homeland Security & Federal Bureau of Investigation [DHS & FBI], 2012; Dillon, 2013; Dumitriu, 2013; Madfis, 2014). Between 2000 and 2013, there were 160 active shooter events in the United States (Blair & Schweit, 2014). An average of 6.4 incidents occurred in the first seven years of the study, and an average of 16.4 incidents happened during the last seven years of the study (Blair & Schweit, 2014). At these 160 events, 486 people were killed, and an additional 557 injured (Blair & Schweit, 2014). On October 20, 2013, United States Attorney General Eric Holder stated that active shooter events have tripled since 2009 and the lethality of these events have increased 150% (Farr, 2013).

The shooting at Columbine High School in Littleton, Colorado, on April 20, 1999 changed the methods by which law enforcement responds to active shooter events (Nichols, 2010). Several other high profile active shooter events have now required fire department and emergency medical service (EMS) agencies to change their response methods (Goodwin, 2013; Rielage, 2009). Active shooter events such as the Aurora Theater shooting in Aurora, Colorado, demonstrated the need now for a change in medical response and victim rescue response at active shooter events (Goodwin, 2013). Physicians have recognized that responders can save many victims at active shooter incidents if responders provide rapid treatment and transport of victims to the hospital (Goodwin, 2013). For the sake of ease of reading, the term *victim* in this manuscript refers to injured people at these events (these injured people are often referred to as victims, patients, casualties, or injured, depending on the author or publication source). Many victims at these events die because of the delay in medical responders accessing the victims (Jacobs, 2014).

From the moment an active shooter event starts, a *stopwatch of death* starts ticking (Stepien, 2010). Public safety members have five top priorities at active shooter events, including (1) identify the shooter(s), (2) locate the shooter(s), (3) neutralize the shooter(s), (4) treat the victims, and (5) extract the victims to a location outside where ambulances await to transport victims to hospitals with surgical capabilities. Research conducted in combat found that victims of major ballistic injuries have a 67% mortality rate within 30 minutes if the victims are not treated (Strawder, 2006). Additional research has found that active shooter victim survival rate doubles with early medical intervention (Adams, 2013).

Law enforcement agencies, fire departments, and EMS agencies must plan and prepare for active shooter events in their jurisdiction. The City of Charlotte, North Carolina, formed a taskforce January, 2013 with the purpose of creating a unified public safety response protocol for active shooter events. The Charlotte Fire Department then spent a year developing an integrated response protocol. Following creation of the protocol, the Charlotte Fire Department trained 1,100 firefighters on the protocol and conducted 32 large-scale active shooter drills to test the effectiveness of the protocol. The focus of this research was the testing of the active shooter response model created by the Charlotte-Mecklenburg Active Shooter Taskforce (CAST) and lessons learned from the 32 large-scale active shooter drills. This research will provide other public safety agency leaders information on developing and implementing a similar protocol.

Background

The Department of Homeland Security defines an active shooter as "An individual actively engaged in killing or attempting to kill people in a confined and otherwise populated place" (Department of Homeland Security [DHS], 2008a, p. 1). The Department of Homeland Security (2011) further states, "The active shooter operates in a target-rich, threat-poor environment" (p. 1). Active shooters target different venues where people gather in large numbers, including businesses, schools, malls, churches, and theaters (Nichols, 2010).

Active shooter events have increased in frequency and atrocity (DHS & FBI, 2012; Washington State Fusion Center & Oregon Titan Fusion Center [WSFC & OTFC], 2014). The average number of victims killed in these incidents is three and median number of people injured is two (Blair & Schweit, 2014). However, there have been several incidents with extremely high casualty counts, including Aurora Theater with 12 dead and 100 injured, Virginia Polytech Institute with 32 dead and 17 injured, Fort Hood Soldier Readiness Processing Center with 13 dead and 32 wounded, and Sandy Hook Elementary School with 27 killed and two wounded (Blair & Schweit, 2014; Tri-Data Corporation, 2014). Active shooter incidents outside of the United States demonstrate similar high lethality counts. The 2011 Oslo, Norway, active shooter attack left 69 dead and 110 injured (Lewis & Lyall, 2012).

Active shooter events have now become one of the highest priorities for which public safety agencies must plan and prepare (Drysdale, 2010; Fletcher, 2010; Nichols, 2010; Goodwin, 2013; Washington State Fusion Center and Oregon Titan Fusion Center [WSFS & OTFC], 2014). However, many jurisdictions fail to prepare for an active shooter event because community leaders have thought that these events will not occur in their jurisdiction; only to have a shooting occur (Baldanza, 2005). Ninety-eight percent of United States active shooter events have occurred in small communities served by a police department with less than 100 police officers (Schweit, 2013). The majority of school active shooter events have happened in isolated semi-rural or rural areas known for affluence and stability (Newman & Fox, 2009). These statistics underlie the importance of every community planning for active shooter events, regardless of the population size.

Prior to the shooting at Columbine High School in 1999, law enforcement tactics at active shooter events consisted of the following: (1) assume perimeter protection, (2) wait for backup, (3) gather intelligence, (4) create a plan, (5) negotiate with the shooter or shooters; and, (6) use *Special Weapons and Tactics* (SWAT) teams to apprehend the perpetrator (Buerger & Buerger, 2010). At the Columbine shooting, responding law enforcement officers employed these tactics. Law enforcement did not enter into the structure to engage the two shooters until plenty of backup arrived (Mell & Sztajnkrycer, 2005). This backup included specialized units, such as the SWAT team (Mell & Sztajnkrycer, 2005). During the 40-minute delay in sending police officers in the school, the two perpetrators continued to shoot and kill many students (Columbine Review Commission, 2001; Cullen, 2009; Mell & Sztajnkrycer, 2005).

Additional active shooter events since Columbine demonstrated fire department and EMS personnel continue to wait outside while law enforcement secures the building from all threats. Events such as the American Civic Association shooting in Binghamton, New York; District of Columbia Navy Yard shooting; and the Los Angeles International Airport shooting all had fire department and EMS personnel waiting blocks away and not quickly entering the scene to provide care (Kaplowitz, Reece, Hershey, Gilbert, & Subbarao, 2007, Adams, 2013). In each of these cases, fire and EMS responders staged blocks away waiting for law enforcement to provide assurance that the scene was entirely free of any threats.

Fire departments and EMS agencies frequently do not participate in active shooter training exercises with law enforcement and thus lack an understanding of the role they will perform at these events (Baldanza, 2005). Other jurisdictions have reviewed their fire department and EMS active shooter response capabilities and found that the fire and EMS personnel lack the training and equipment necessary to respond (Fletcher, 2010). Failure to plan adequately and prepare for such an event will result in lives lost as fire and EMS wait for law enforcement to clear the building of all threats (Fletcher, 2010).

The law enforcement response to active shooter events is understood (Morrissey, 2011). However, the fire and medical response is much less clear and is not well-defined (Morrissey, 2011). Response to active shooter events requires a paradigm shift by law enforcement and other public safety responders (Rivera, 2008; WSFS & OTFC, 2014).

Statement of the Problem

Active shooter events have continued to increase in the last decade (Blair & Schweit, 2014; DHS & FBI, 2012; Dillon, 2013; Dumitriu, 2013; Madfis, 2014). The number of people injured and killed continues to increase at each event. A review of 100 active shooter events in the United States found that there is an average kill/serious injury occurring every 15 seconds after the shooting begins until the shooter is neutralized or gets tired of killing (Peppers, 2010; Police Executive Research Forum [PERF], 2014). Many active shooter perpetrators have demonstrated a strong desire to make their attack even deadlier than previous active shooter events (Cullen, 2009; Fast, 2009: Sinai, 2013; Slayton, 2014). Multiple active shooter perpetrators have demonstrated extensive pre-attack planning and research (Cullen, 2009; Fast, 2009: Sinai, 2013; Slayton, 2014). These facts show that active shooter events continue to have a serious likelihood of a high number of victims.

Public safety officials continue to focus on responsive methods to active shooter attacks. Starting in 2013, government agencies and active shooter researchers placed an increasing emphasis on the importance of rapidly accessing victims at active shooter events (Fabbri, 2014; Goodwin, 2013; Williams, 2013). Retrospective analysis of multiple active shooter events demonstrates that victims are dying inside while waiting for care (Goodwin, 2013, Jacobs, 2013).

Traditional fire department and EMS response to potentially violent incidents require fire and EMS personnel to wait blocks away until the scene is declared safe by law enforcement (Morrissey, 2011). Once the scene is declared safe, fire and EMS personnel move in to provide care and transport the injured. This model offers the highest amount of protection for unarmed fire and EMS personnel. However, data from active shooter events and large-scale drills demonstrated that use of this model results in EMS care delays of one to two hours, if not longer (Goodwin, 2013; Iselin & Smith, 2009).

Half of the victims at an active shooter event will have moderate to severe gunshot wounds (Kaplowitz, et al., 2007; Linkous & Carter, 2009). Shooting victims frequently suffer injuries that are critical in nature, requiring emergent treatment (Federal Emergency Management Agency [FEMA], 2014). Research conducted on ballistic injury shows that half of all deaths that occur from ballistic injury in combat occur in the first 60 minutes after the injury (Strawder, 2006). Half of the victims at active shooter events have moderate to severe gunshot wounds and without basic medical care, 67% of these victims will die within 30 minutes (Kaplowitz, et al., 2007; Linkous & Carter, 2009; Strawder, 2006).

A new public safety model is required to save as many lives as possible at active shooter events (Frazzano & Snyder, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). This new model aggressively incorporates fire and EMS personnel into potentially hostile areas to treat and extract the wounded (Fabbri, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). These fire and EMS personnel operate under the protection of law enforcement in areas without obvious perpetrator threats, but areas with the potential of encountering hostile actions. Creation of these protocols is very difficult and complex because of the several factors, including (1) nature of the events, (2) a lack of general consensus on the type of training needed,

(3) different opinions on the optimal response protocol; and (4) a lack of formal research on integrated response protocols.

The general public expects that every police, fire, and EMS agency is prepared to respond to active shooter events. Frazzano and Snyder (2014) stated, "The high-profile lethality of mass casualty violence events has raised the public's expectations that first responders will be poised to rapidly and skillfully protect victims from these events" (pg. 1). Because of the repeat occurrence of active shooter events, the public expects that emergency responders will not be taken by surprise when these events occur, regardless of the size of the community.

Purpose of the Study

This descriptive case study utilized a mixed methods design with both quantitative and qualitative research. The purpose of this study was to analyze the testing of the unified police/fire/EMS active shooter response protocol in Charlotte, North Carolina. Law enforcement response is the focus of most active shooter exercises. However, these exercises frequently neglect the immediate care and removal of the injured. This research explored the rapid integration of medical providers with law enforcement officers.

There has been very limited formal published research that examined the efficacy of a unified police/fire/EMS active shooter response plan. The creation of the Charlotte, North Carolina, response plan was an 18-month process that began in 2013 and involved multiple active shooter subject matter experts. This process was one of the largest joint active shooter response plan initiatives in the United States. This research analyzed the results of protocol implementation in which Charlotte Fire Department conducted 32 large-scale active shooter exercises to test the new protocol. Instructors scripted the exercises based on previous real active shooter events and simulated realistic problems encountered by public safety responders. In addition, the scripted scenarios maintained consistency at each of the exercises. The recorded data came from archived data collected by the Charlotte Fire Department Training Academy staff during the exercises and observations submitted by the instructors who led the large-scale exercises.

Public safety administrators can use the detailed information gathered from this case study to design a similar active shooter response protocol for the areas they serve. In addition, the research will give public safety policy makers data to determine if protocol development and implementation will affect victim outcome at active shooter events. Last, the research will give the members of the CAST a candid evaluation of the effectiveness of the protocol.

The researcher analyzed the data obtained from the large-scale exercises to examine two critical benchmarks, including time from dispatch to first treatment for each victim, and time from dispatch to extraction from the building for each victim. The purpose of the quantitative data analysis was to determine if the victims were treated in less than 15 minutes from responder dispatch and evacuated from the building in less than 30 minutes from responder dispatch. Both of these timeframes represent high levels of survivability for gunshot victims if accomplished (Cain, 2008; Champion, Bellamy, Roberts & Leppaniemi, 2003; Crandall, M., Sharp, D., Unger, E., Straus, D., Brasel, K., Hsia, R., & Esposito, T., 2013; Eastridge, et al., 2012; Flynt, 2012; Smith & Callaway, 2014). The researcher then analyzed the multiple observations made by the lead instructors during the drills to determine trends, patterns, and recommendations for decreasing the time to treat and extract the victims.

This research study provides two benefits. The first benefit is analysis of the Charlotte protocol implementation for effectiveness. This benefit is primarily limited to the responders in Charlotte, North Carolina. More importantly, this study analyzed observations made during the drills to provide all public safety leaders information and recommendations to reduce the time to treat and evacuate victims at active shooter events.

Significance of the Study

Multiple government and public safety professional organizations are now recommending aggressive, integrated public safety response to active shooter events (Frazzano & Snyder, 2014; IAFC, 2013; Fabbri, 2014; Kue & Kearney, 2014; Moore-Merrell, 2013; NFFF, 2013; Roberts, 2013). However, there is very little information and almost zero formal research on issues with a unified response plan. In addition, there are no formal published research articles that demonstrate testing results of an integrated response plan. Active shooter events have now become one of the highest priorities for which public safety agencies must plan and prepare (Drysdale, 2010; Fabbri, 2014; Fletcher, 2010; Nichols, 2010; Goodwin, 2013).

When an active shooter event occurs, the stopwatch of death begins ticking for victims inside the building (Stepien, 2010). Law enforcement is focused on rapidly accessing and neutralizing the shooter or shooters to stop the active killing (Moore, 2011). Fire personnel and emergency medical personnel are also fighting a stopwatch of death. Once a victim suffers a major ballistic injury, the victim has a 67% chance of dying if basic care and extraction is not provided in the first 30 minutes after injury (Strawder, 2006). Research conducted from numerous active shooter events in the last decade demonstrate that victims continue to die from potentially survivable injuries (Jacobs, 2014). Fire and EMS personnel must rapidly access these victims, initiate basic treatment, and remove the victim from the crisis site. However, the response of fire and EMS personnel into the crisis site is a very new concept and few public safety agencies have adopted this type of aggressive response procedure.

This new research adds to the body of knowledge of the active shooter response from the perspective of law enforcement, fire department, and EMS. In addition, other agencies can emulate the response procedures developed and understand the challenges faced with creation of an active shooter protocol in a large public safety system. Responders will have a better understanding of how to integrate successfully fire department and EMS into law enforcement response at high-threat events. Lack of this research will result in fire departments and EMS agencies continuing to duplicate effects to find methods to increase victim survivability at active shooter events.

In addition, the research examined the effectiveness of the Charlotte response model. The data provides Charlotte police, fire, and EMS leaders scientific evidence that proves or disproves the benefit of the protocol implementation conducted with large-scale exercises in Charlotte, North Carolina. This data and subsequent analysis of the observations made during the drills will aid other agencies in creating similar protocols.

The information obtained from this research is not just limited to active shooter events. The lessons learned from protocol implementation can work in any high-threat event requiring the joint response of police, fire, and EMS. Researchers have agreed that first responders are now required to respond more frequently to high-threat events (Callaway, D. W., Smith, E. R., Cain, J., Shapiro, G., Burnett, W. T., McKay, S. D., & Mabry, R., 2011; Fletcher, 2010; Newman & Fox, 2009; Sztajnkrycer, 2010). Examples of other high-threat events include civil unrest, terrorism events, and routine violent assaults. Every day in the United States, emergency personnel respond to thousands of violent or potentially violent calls. Responders can utilize the RTF model as needed for these violent calls in addition to active shooter events.

Theoretical Framework

This study examined the lessons learned during the testing of the new Charlotte, North Carolina, joint public safety active shooter response model. Prior to creating the model, the three primary public safety response agencies in Charlotte (Charlotte Fire Department, Charlotte-Mecklenburg Police Department [CMPD], and MEDIC) did not have an integrated active shooter response protocol. The CAST understood the increase in active shooter events and that a response protocol was necessary to ensure optimal public safety.

Several high profile active shooter events happened nationwide prior to the formation of the CAST. The catalyst for creating the CAST was the Sandy Hook Elementary School shooting in Newtown, Connecticut. Members of the CAST were aware the public perception was emergency responders would be prepared and able to respond efficiently to active shooter events to minimize loss of life (Frazzano & Snyder, 2014). Members of the CAST were also aware that data demonstrated that victims were dying needlessly at active shooter events from delays in receiving medical care (Adams, 2013; Cullen, 2009; Flynt, 2012; Goodwin, 2013). Although Charlotte, North Carolina, has not had a significant active shooter event, the members of the CAST all recognized the high probability of an active shooter event in the community.

In 2000, CMPD began training all police officers with the department on active shooter response (E. Peterson, personal communication December 2, 2014). For the next 13 years, CMPD was the only public safety agency in Charlotte that had trained all agency responders in active shooter response. Fire Chief Jon Hannan with the Charlotte Fire Department and Police Chief Rodney Monroe with CMPD recognized a need to train all emergency responders in active shooter response. Chiefs Hannan and Monroe convened the CAST comprised of active shooter experts to coordinate the creation of a unified response protocol and the subsequent training of nearly 4,000 responders in Charlotte. Before the CAST convened in 2012, there had not been such a large, comprehensive public safety active shooter training initiative in one jurisdiction in the United States.

Prior to 2012, multiple government agencies and public safety experts stated that there needed to be a joint public safety response initiative to active shooter events (DHS, 2008a; Drysdale, 2010; Fletcher, 2010; Nichols, 2010; Rielage, 2009). Despite the recommendations for a unified response plan, experts offered little to no instruction on how to create this plan. For many, the easiest part of implementing an active shooter response plan is recognizing the need for such a protocol. The actual implementation is much more tedious and time-consuming. Active shooter events are one of the most complex events to which public safety agencies will respond (Clark, 2014). These events frequently involve multiple complex events, including heavily armed perpetrators intent on high body counts, multiple victims, fire-as-a-weapon, explosives, chemical munitions, and barricades preventing emergency responders from accessing the building (Cullen, 2009; Fast, 2009: FEMA, 2013; Mell & Sztaknkrycer, 2005; Nichols, 2010; Sinai, 2013; Slayton, 2014; Tri-Data Corporation, 2014).

The literature is full of various hypotheses as to why active shooter events are increasing. In addition, the literature is replete with recommendations telling public safety responders that a joint response plan is required to mitigate active shooter events successfully with the best outcome possible. However, the research is limited to very few theories on how public safety can jointly respond to active shooter events. Despite the lack of research on the methods of implementing a joint active shooter response plan, most scholars agree that fire and EMS must quickly integrate with law enforcement response (Fabbri, 2014; Frazzano & Snyder, 2014; Goodwin, 2013; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013; Williams, 2013).

These fire and EMS providers must rapidly treat and extract the injured so that responders can transport the injured to hospitals with surgical capabilities (Fabbri, 2014).

Fire and EMS providers face potential risks at active shooter events. The new response recommendations aggressively incorporate fire and EMS personnel into potentially hostile areas to treat and extract the wounded (Fabbri, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). These fire and EMS personnel operate under the protection of law enforcement in areas without obvious perpetrator threats, but still with the potential of encountering hostile actions. The potential for hostile engagement has caused many fire and EMS administrators to have reservations about implementing such a protocol. In some jurisdictions, fire and EMS administrators have adamantly refused to adopt such a policy because of the perceived danger to their responders.

Among the most relevant response theories to this research are the methods published by the Committee for Tactical Emergency Casualty Care, the International Association of Fire Chief, the International Association of Fire Fighters, the National Fallen Firefighters Foundation, the Hartford Consensus, and the United States Fire Administration (Callaway, D. W., Smith, E. R., Cain, J., Shapiro, G., Burnett, W. T., McKay, S. D., & Mabry, R., 2011; IAFC, 2013; Jacobs, 2014; Moore-Merrell, 2013; NFFF, 2013; USFA, 2013). Each of these active shooter response theories advocates a joint public safety response of police, fire, and EMS personnel. While each theory states that there needs to be an integrated response, there exists almost no data to demonstrate the effectiveness of an integrated response when compared to previously published times to treat and extract active shooter victims. Therefore, the CAST and the researcher focused on methods to test and refine an integrated active shooter response protocol.

Research Questions

This mixed methods case study research included both quantitative and qualitative questions. Mixed methods research provided the researcher with the ability to examine multiple aspects of the exercises. The quantitative questions examined the effectiveness of the exercises, while the qualitative questions examined the lessons learned from the exercises.

The purpose of the quantitative research questions was to determine the effectiveness of the Charlotte public safety response models utilizing 32 large-scale active shooter exercises. The quantitative data determined if the exercises accomplished the objectives established by the CAST. The qualitative research examined the lessons learned from the testing of the protocol.

The Charlotte Fire Department Training Academy staff collected data during the large-scale exercises. The researcher examined this data to determine the effectiveness of the new protocol. This study answered the following four quantitative research questions below with each question's hypotheses listed:

> **Q1.** What effect does the new integrated public safety active shooter response model have on time to treatment when compared to previously published research of non-integrated active shooter response?
>
> $H1_0$: The new public safety active shooter response plan has no significant effect on time to treatment when compared to previously published research of non-integrated active shooter response.
>
> $H1_a$: The new public safety active shooter response plan decreases time to treatment when compared to previously published research of non-integrated active shooter response.

$H1_b$: The new public safety active shooter response plan increases time to treatment when compared to previously published research of non-integrated active shooter response.

Q2. What effect does the new integrated public safety active shooter plan have on the time to victim extraction compared to previously published research of non-integrated active shooter response?

$H2_0$: The new public safety active shooter response plan has no significant effect on to victim extraction when compared to previously published research of non-integrated active shooter response.

$H2_a$: The new public safety active shooter response plan decreases time to victim extraction when compared to previously published research of non-integrated active shooter response.

$H2_b$: The new public safety active shooter response plan increases time to victim extraction when compared to previously published research of non-integrated active shooter response.

Q3. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving treatment within the target goal of 15 minutes from dispatch of the call?

$H3_0$: Implementation of the new active shooter response protocol failed to result in all victims receiving initial treatment within 15 minutes of dispatch from the call.

$H3_a$: Implementation of the new active shooter response protocol resulted in all victims receiving initial treatment within 15 minutes of dispatch from the call.

Q4. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving extraction from the building within the target goal of 30 minutes from dispatch of the call?

$H4_0$: Implementation of the new active shooter response protocol failed to result in extraction of all victims from the building within 30 minutes of the call dispatch.

$H4_a$: Implementation of the new active shooter response protocol resulted in the extraction of all victims from the building within 30 minutes of the call dispatch.

The researcher then utilized qualitative data created when the lead instructors for the 32 large-scale exercises documented lessons learned following the exercises. The five lead instructors created several pages of observations that they made during the training sessions. The researcher analyzed these observations to find themes and patterns to reduce the time for treatment and evacuation of the injured. The researcher then correlated the themes and patterns with the quantitative data to finds methods to increase the effectiveness of this integrated response protocol.

In qualitative research, hypotheses are not tested (Ritchie & Lewis, 2003). Rather, hypotheses emerge from the research and findings (Ritchie & Lewis, 2003). The following questions guided the qualitative portion of the research:

Q1. Did responders demonstrate inappropriate response tactics during the exercises?

Q2. Where there any observed tactics that resulted in delays for either victim treatment or extraction?

Q3. Did responders encounter issues with communication or incident command? The researcher correlated instructor observations to answer the qualitative questions. The researcher also examined the led instructors' observations to determine which themes and patterns occurred most frequently during the exercises.

Nature of the Study

This study was a mixed methods descriptive case study. The case study method was appropriate for this study, focusing results achieved by a particular group of people working to solve a problem in a confined geographical location. A case study was an appropriate research method because the research focused on the study of a significant event (Schram, 2006). The purpose of the case study is to research the complexity of a single event and the potential relationship that this event would have at similar future events (Yin, 1994). According to Yin (2003), qualitative case study research allows the researcher the opportunity to answer *how* and *why* questions when the researcher cannot manipulate the behavior of the participants. Yin (2003) recommended the qualitative case study approach when there are relative contextual conditions to the phenomena studied and when the researcher cannot clearly understand the boundaries between context and the phenomena.

This descriptive case study utilized mixed methods research with both quantitative and qualitative research. Mixed methods research combines both qualitative and quantitative research methods (Creswell, 2009). Mixed method research uses different collection and analysis methods to research a single paradigm. The focus of quantitative research is numbers and hard objective data. The researcher can use quantitative research if qualitative research cannot meet the research objective (Zikmund, Babin, Carr, & Griffin, 2010). Quantitative research provides measureable results; whereas qualitative research provides results left to interpretation (Anderson, 2006). Mixed method research provides stronger research than a study where the research uses either quantitative or qualitative research independently.

Definition of Key Terms

The following definitions represent key terms used in active shooter response and the formation of the Charlotte-Mecklenburg active shooter response procedure. The definitions were determined based on a literature search of active shooters and terms used in the active shooter exercises conducted by the Charlotte Fire Department.

Active shooter. An active shooter is an individual or individuals actively engaged in killing or attempting to kill people in a confined and otherwise populated place (DHS, 2008a).

Battalion chief. A battalion chief supervises significant emergency scene operations in an assigned district and typically supervises five to six fire stations with the accompanying personnel and apparatus (City of Foster City, 2015).

Black swan event. A black swan event is an event that is unprecedented and unexpected, but can reasonably occur because of similar incidences in the past (Taleb, 2010).

Breaching. Breaching is the process of forcibly gaining entry into a locked and secured room or building (Nichols, 2010).

Carbine weapon. A carbine weapon is a firearm that is more power than a handgun; has a higher magazine capacity than a handgun, rifle, or shotgun; is more accurate than a handgun or shotgun; and has minimal recoil allowing for the weapon fire rapidly (Piccione, 2012).

Care under fire (CUF). Care under fire is the care provided to a victim when the medical provider is under attack by hostile forces (C-TECC, 2013)

Casualty collection point (CCP). A casualty collection point is a location where victims can be assembled for triage and treatment of life-threatening injuries while awaiting extraction from the building (Flynt, 2012)

Charlotte-Mecklenburg Active Shooter Taskforce (CAST). The CAST is a group of subject matter experts from Charlotte Fire Department and Charlotte-Mecklenburg Police Department tasked with creating a unified public safety response protocol for active shooter events in the City of Charlotte and Mecklenburg County, North Carolina.

Command post (CP). A command post houses the scene's incident command and management organization (United States Department of Education [US DOE], 2007).

Cold zone. The cold zone is an area surrounding an active shooter event in which law enforcement has determined that there are no suspects and no improvised explosive devices. The cold zone will be the location for victim transfer and transportation points, external casualty collection points, Command Post location, and the staging area (FDNY Center for Terrorism and Disaster Preparedness with International Partners [FDNY], 2012).

Crisis site. The crisis site is a geographical area at an active shooter event where civilians and responders have a significantly increased risk of danger from violent actions committed by the perpetrator or perpetrators (Texas State University, 2014).

Direct to threat. Direct to threat is the law enforcement tactic at active shooter events where the first arriving police officers quickly advance to the shooter to engage the perpetrator and stop the homicide (Garrett, 2007).

Direct threat care (DTC). Direct threat care is limited medical care provided to a victim when hostile forces are attacking the medical provider (C-TECC, 2013)

Extraction. Extraction is the technique of providing rapid and secure evacuation of the victim from the crisis site to an appropriate level of care, such as a transport ambulance (Committee for Tactical Emergency Casualty Care [C-TECC], 2013).

Exsanguination. Exsanguination is gross, uncontrolled hemorrhage resulting in death to the victim. (Geeraedts, Kaasjager, Van Vugt & Frolke, 2009)

Familicide. A familicide is a multi-victim homicide in which the perpetrator kills their spouse and one or more children. (Wilson & Daly, 1995).

Hot zone. The hot zone is an area surrounding an active shooter event where there is a clear and present danger from an active shooter (Meoli & Rathburn, 2014).

Improvised explosive device (IED). An improvised explosive device is an explosive device that ranges from small pipe bombs to large-scale devices with sophisticated remote controlled detonation or timer detonation (Dowle, 2006).

Indirect threat care (ITC). Indirect threat care is care provided to a victim when there is no direct threat, but there is a constant threat of engagement or reengagement by hostile forces (C-TECC, 2013).

Inject. An inject is information injected by a controller or exercise planner to simulate an event within an exercise. (International Atomic Energy Agency, n.d.)

Law Enforcement Sensitive. Law enforcement sensitive is a term that denotes documents that should not be disseminated beyond law enforcement circles because of the potential adverse effect on public safety and security (Federal Bureau of Investigation [FBI], 2003).

Mass casualty event. A mass casualty event is an incident where the number of injured exceeds the normal resources and capabilities of the emergency care provider agency. (State of Utah Department of Health, 2011).

Mass shooting. A mass shooting is a shooting that occurs where four or more people are killed not in the commission of a crime involving drugs or gang activity (Citizens Crime Commission of New York City [CCCNYC], 2013; Dillon, 2013).

Mecklenburg Emergency Medical Services Agency (MEDIC). MEDIC is the primary paramedic-level emergency medical service for the City of Charlotte and Mecklenburg County, North Carolina (Mecklenburg County Emergency Medical Services [MEDIC], 2013).

Primary search. A primary search is search rapidly performed by firefighters in a hazardous area to find viable victims (Lee, 2008).

Rampage violence. Rampage violence is an incident where an individual or individuals kill in public, plan the attack well, commit the crime with a powerful arsenal of weapons, and expect to die during the incident (Harvard Kennedy School: Joan Shorenstein Center on the Press, Politics, and Public Policy [Harvard], 2012).

Secondary search. A secondary search is performed by firefighters after the primary hazards have been abated; the secondary search is slow and very thorough to ensure no victims remain (Rhodes, 2010).

Shock. Shock is a life-threatening state that occurs with inadequate tissue perfusion resulting from a lack of oxygenated blood to tissue or organs (Holmes & Walley, 2003).

Special Weapons and Tactics (SWAT). SWAT is a specialized division of law enforcement capable of responding to high-risk situations utilizing specialized equipment and tactics to gain control of the situation and minimize the risk of death or injury to persons (Charlotte-Mecklenburg Police Department [CMPD], 2013).

Staging. Staging is a parking an emergency vehicle a safe distance from an emergency scene (Beebe & Funk, 2001).

Stopwatch of Death. The Stopwatch of Death is a term that refers to active shooters continuing to kill as long as they can and as quickly as they can (Stepien, 2010).

Tactical Combat Casualty Care (TCCC). TCCC was developed by the military and is first aid procedures for hemorrhage and airway obstruction; the most common types of wounds seen in combat (FDNY, 2012).

Tactical Emergency Casualty Care (TECC). TECC is the concept of providing trauma care to a victim in a civilian tactical environment in which the provider is attacked by hostile forces or is under immediate threat of attack (Committee for Tactical Emergency Casualty Care [C-TECC], 2013).

Tactical evacuation (TACEVAC). TACEVAC is the concept of providing rapid and secure extraction of a victim in a tactical environment to an appropriate level of care (C-TECC, 2013).

TACEVAC inertia. TACEVAC inertia is a termed coined by the researcher to describe the delay in extracting victims when the victims are moved first into a casualty collection point.

Warm zone. The warm zone is an area surrounding an active shooter event where personnel and victims are not directly exposed to perpetrator threats from gunfire, explosives, or hazardous material releases (Meoli & Rathburn, 2014).

Summary

Active shooter events have increased steadily in the last 20 years in the United States (Blair & Schweit, 2014; DHS & FBI, 2012; Dillon, 2013; Dumitriu, 2013; Madfis, 2014). Not only are these events increasing in frequency, but the incidents are also increasing in lethality (Farr, 2013; WSFC & OTFC, 2014). The average number of people killed at active shooter incidents is three and the median number of people injured is two (Blair & Schweit, 2014). However, there have been several significant active shooter events in the United States with extremely high death tolls and number of injured casualties (Blair & Schweit, 2014; Tri-Data Corporation, 2014). Events such as the Aurora Theater shooting, Virginia Tech shooting, and 2008 Fort Hooding shooting all had more than 35 dead and injured (Blair & Schweit, 2014; Tri-Data Corporation, 2014).

The Department of Homeland Security defined an active shooter as “An individual actively engaged in killing or attempting to kill people in a confined and otherwise populated place” ([DHS, 2008a, p. 1). An active shooter typically targets areas with a high concentration of unarmed people to achieve the highest body count possible (Nichols, 2010). Active shooter perpetrators frequently target facilities such as schools, malls, churches, and theaters (Nichols, 2010).

The April 20, 1999 shooting at Columbine High School in Littleton, Colorado, changed the way that law enforcement responds to active shooter events (Nichols, 2010). Prior to 1999, law enforcement officers would surround the building and call for specialized law enforcement agencies, such as SWAT to come and confront the perpetrator (Buerger & Buerger, 2010). At Columbine, the delay in sending officers into the building resulted in numerous deaths as the perpetrators continued to shoot victims (Columbine Review Commission, 2001; Cullen, 2009;

Mell & Sztajnkrycer, 2005). In addition, several victims bled to death while waiting hours for medical personnel to enter the building and begin treating and removing the injured (Columbine Review Commission, 2001; Cullen, 2009; Mell & Sztajnkrycer, 2005).

Additional active shooter events after Columbine have demonstrated that victims continue to die needlessly because medical personnel would not enter the structure until law enforcement assured providers the scene was completely safe (Adams, 2013; Kaplowitz, Reece, Hershey, Gilbert, & Subbarao, 2007). Physicians have recognized that responders could save many of the victims who die at active shooter incidents if the responders quickly provided care and rapidly transported the victims to hospitals (Goodwin, 2013; Jacobs, 2014). Active shooter events, such as the one at the Aurora Theater in Colorado, demonstrate that a change is required in the way that fire and EMS providers respond to active shooter events (Goodwin, 2013).

Response to active shooter events is now one of the top priorities facing public safety agencies in the United States (Drysdale, 2010; Fletcher, 2010; Goodwin, 2013; Nichols, 2010; WSFS & OTFC, 2014). Despite the numerous recommendations for fire and EMS agencies to prepare for active shooter events, many agencies have no plans in place for active shooter events (Baldanza, 2005; Fletcher, 2010: Morrissey, 2011). Many jurisdictions have assumed that an active shooter event would never happen in their community, only to have a major event occur (Baldanza, 2005; Linkous & Carter, 2009; Lipshultz & Hilt, 2012; Rocque, 2011).

Police, fire, and EMS responder must use a new, integrated model to active shooter events (Frazzano & Snyder, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). This new model aggressively incorporates fire and EMS personnel into potentially hostile areas to treat and extract the wounded (Fabbri, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). These fire and EMS personnel operate under the protection of law enforcement in areas without obvious perpetrator threats but still with the potential of encountering hostile actions.

In 2012, the Charlotte Fire Department and Charlotte Police Department in Charlotte, North Carolina, recognized the need to create a unified, integrated public safety active shooter response plan. Prior to creating the plan, there was no unified active shooter response plan. In addition, prior to creating the plan, the majority of fire department personnel had never received any training on active shooter response. During 2013 and 2014, the Charlotte Fire Department and Charlotte Police Department created an integrated active shooter response plan. Following creation of the plan, all 1,100 members of the Charlotte Fire Department received training on the new plan. The capstone of the training was completion of 32 large-scale active shooter drills utilizing personnel from the Charlotte Fire Department and Charlotte-Mecklenburg Police Department.

This research was a descriptive case study with both quantitative and qualitative research. The purpose of this study was to analyze the creation of a unified police/fire/EMS active shooter response protocol and the subsequent testing of the protocol in Charlotte, North Carolina. Current active shooter exercises primarily focus on law enforcement response and neglect to address the immediate care of the injured. Literature searches find very limited formal published research that studied the efficacy of a unified police/fire/EMS active shooter response plan.

The Charlotte Fire Department conducted 32 large-scale active shooter exercises with scripted scenarios based on previous real active shooter events. These exercises simulated realistic issues encountered by public safety responders. In addition, the scripted scenarios maintained consistency at each of the exercises. The recorded data came from archived data collected by the Charlotte Fire Department Training Academy staff during the exercises and observations submitted by the instructors who led the large-scale exercises.

The researcher analyzed the data obtained from the large-scale exercises to examine the time from dispatch to first treatment for each victim and the time from dispatch to extraction from the building for each victim. The purpose of the quantitative data analysis was to determine if the victims were treated in less than 15 minutes from responder dispatch and evacuated from the building in less than 30 minutes from responder dispatch. Both of these timeframes represent high levels of survivability for gunshot victims if accomplished (Cain, 2008; Champion, Bellamy, Roberts & Leppaniemi, 2003; Crandall, M., Sharp, D., Unger, E., Straus, D., Brasel, K., Hsia, R., & Esposito, T., 2013; Eastridge, et al., 2012; Flynt, 2012; Smith & Callaway, 2014). The researcher then analyzed the multiple observations made by the lead instructors during the drills to determine trends, patterns, and recommendations to reduce treatment and evacuation times for victims.

There is a growing body of literature with recommendations for public safety responders that a joint response plan is required to successfully mitigate active shooter events and achieve the best outcome possible. However, the research is limited to very few theories on how public safety can jointly respond to active shooter events. Despite the lack of research on the methods of implementing a joint active shooter response plan, most scholars agree that fire and EMS must quickly integrated with law enforcement response (Fabbri, 2014; Frazzano & Snyder, 2014; Goodwin, 2013; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013; Williams, 2013). These fire and EMS providers must rapidly treat and extract the injured so that the victims can be transported to hospitals with surgical capabilities (Fabbri, 2014).

This research will give public safety decision makers a framework for developing similar active shooter response protocols. In addition, this research provides an examination of the effectiveness of the protocol implementation from large-scale active shooter exercises. Last, this research examined lessons learned from the exercises and provides public safety administrators with key findings for large-scale active shooter exercises.

Chapter 2: Literature Review

Documentation

The literature used in this research came from a variety of searches, including library searches of peer-reviewed journal article both with the Northcentral University Library and the University of Phoenix Library. Key words used in the searches included "active shooter", "school shooter", "school shooting", "rampage violence", "mass killing", "spree killing", "tactical medical care", "tactical combat casualty care", "ballistic injuries", and "gunshot wound mortality". In addition, the researcher conducted similar searches for the same key phrases using Google Scholar. Since 2013, daily Google alerts have been received when authors used any of the following phrases in literature, news articles, or on websites. Additional sources of information included official after-action reports published by investigative and oversight committees formed after major active shooter events, such as Columbine High School, Aurora Theater, and the Virginia Poly Tech Institute shootings.

History of Active Shooter Events

Active shooter events have plagued the United States, with the first recorded event occurring on July, 26 1764 in Williamson, Pennsylvania (Strait, 2010). This attack was known as the Enoch Brown School massacre, in which four Delaware American Indians stormed a log school house, shooting, scalping, and killing 11 children and the head master (Strait, 2010). Since 1764, hundreds of active shooter events continued to plague the United States and other countries.

Active shooter researchers have almost universally agreed that empirical data and scholastic research on active shooters is very limited (Ferguson, Coulson & Barnett, 2014; Huff-Corzine, L., McCutcheon, J. C., Corzine, J., Jarvis, J. P., Tetzlaff-Bemiller, M. J., Weller, M. &

Landon, M., 2014; Madfis, 2014; Sinai, 2013). There exists a plethora of published literature on serial killers, but very limited research on active shooters and mass killers (Madfis, 2014). Also, there exists no central repository for data reporting and collection on school shootings in the United States (Flannery, Modzelski & Kretschmar, 2012). Similar to school shootings, there is also no single data repository for active shooter or mass killing events (Huff-Corzine, et al., 2014; Newman & Fox, 2009). This lack of central information reporting has led to no uniform data on active shooter events.

Federal laws, such as the Health Information Portability and Accountability Act as well as the Federal Educational Rights and Privacy Act place restrictions on information that can be shared about perpetrators and victims (Flannery, Modzelski & Kretschmar, 2012). Researchers frequently cannot access data from criminal investigations and are left to attempt to hypothesize information that is not available (Huff-Corzine, et al., 2014). Researchers are also often left to obtain data from media sources, which often is not updated with the correct information after publication (Huff-Corzine, et al., 2014). The lack of a database repository, limited information on criminal investigations, and consistent misinformation in the media makes the study of active shooters a daunting task for researchers (Huff-Corzine, et al., 2014). In addition, deliberate law enforcement cover-ups, such as those perpetrated by the Jefferson County Sheriff's Department at the Columbine shooting have created almost insurmountable hardships for researchers (Cullen, 2009, Fast, 2009). The lack of availability of data on active shooter events causes scholastic research to have a wide range of incongruent information.

The definition of an *active shooter* varies in the literature. The White House, Federal Bureau of Investigation, United States Department of Education, and the Department of Homeland Security define an active shooter as "An individual or individuals actively engaged in killing or attempting to kill people and a confined and populated area" (Schweit & Martindale, 2014, pg. 5). Other researchers have attempted to further refine the definition to limit an active shooter event to a situation in which three or more people are shot in the absence of gang activity, drug activity, or in the commission of a secondary crime, such as a bank robbery (FBI, 2013; Blair & Schweit, 2014; Madfis, 2014). Throughout research, scholars have defined and refined the definition of an active shooter, with limited consensus.

Active shooter events can occur in any location where people congregate (Blair & Schweit, 2014). Approximately 46% of active shooter events from 2000-2013 took place in commercial businesses (Blair & Schweit, 2014). Active shooter events occurred in schools approximately 30% of the time (Blair & Schweit, 2014). The other 25% of shootings occurred in malls, theaters, hospitals, and outdoors. Perpetrators target areas where there are a large number of unarmed people, creating a phenomenon described as *target-rich, threat poor* for the perpetrator (Baldanza, 2005, DHS, 2008a). Although this research does not focus on the raging debate of gun control, it is worthy to note that the majority of active shooter events occurred in locations where weapons were prohibited (Schweit & Martindale, 2014).

This research focused on active shooter events that occurred in the United States. However, the active shooter problem is not limited just to the United States. Numerous nations around the world have experienced active shooter events (Agnich & Miyazaki, 2013). In China, firearms are prohibited. This prohibition on firearms has not reduced mass murder events in China (Hilal, Dempsey, Li & Ma, 2014). In China, perpetrators armed with knives continue to commit mass homicide on a regular occurrence, similar to the American active shooter events (Hilal, et al., 2014).

The deadliest recorded active shooter event in world history occurred on July 22, 2011 in Utoya, Norway when Anders Behring Breivik killed 69 people (Ritter, 2014). The second deadliest active shooter event in world history occurred on April 26, 1982 in Gyeongsangnam-do, Korea when Woo Bum-kon killed 57 people (Spreekillers, 2014). The third deadliest active shooter event occurred on April 28, 1996 when William Unek killed 36 people in Malampaka, Tanzania (Spreekillers, 2014). The United States does not enter the list of deadliest active shooter events until number five, with the April 16, 2007 attack by Seung-Hui Cho at Virginia Tech (Linkous & Carter, 2009).

In 93% of active shooter attacks, the perpetrator premeditated the attack and planned the attack in advance (Dumitriu, 2013; FBI, 2013b; Phillips, 2007, Sinai, 2013). Dr. O'Toole is a retired Special Agent with the Federal Bureau of Investigation where she was a senior criminal profiler. Dr. O'Toole has extensively studied active shooters and found that many of the active shooter perpetrators are *mission-oriented shooters* (O'Toole, 2014). These mission-oriented shooters are calm, cool, and collected during the mass killing event (Phillips, 2007; O'Toole, 2014). The sole purpose of the perpetrator is to kill as many victims as possible in the shortest amount of time (O'Toole, 2014). These perpetrators extensively plan their assault using logical, complex, detailed, and very effective planning to execute the mass murder attack (O'Toole, 2014). O'Toole recognized that many of these perpetrators may have a mental illness; however, the detailed and logical planning of their murderous assault demonstrates a mental illness that does not have severe cognitive impairment.

Many people inaccurately think that active shooter events primarily occur in large cities known for high crime rates. However, 98% of all active shooter events occurred in jurisdictions served by a police force of less than 100 officers (Schweit, 2013). The data for mass killing events is just as telling. Seventy-four percent of all *familicides*, 71% of all workplace mass killings, and 74% of all public shootings occurred in cities with a population less than 250,000 (Duwe, 2007; Hilal, et al., 2014). One of the most prevailing themes heard after nearly every active shooter event is, “How could this happen here?” (Linkous & Carter, 2009; Lipshultz & Hilt, 2012; Rocque, 2011).

Dillon (2013) examined mass shootings in the United States from 1982-2012 to determine a trend in mass murders during this timeframe. The number of single victim homicides in the United States decreased 40% during this time; however, the number of mass murder attacks gradually increased (Dillon, 2013; Ferguson, Coulson & Barnett, 2014). From 2000-2013, there were more than 160 active shooter events that left 1,043 killed or wounded (Blair & Schweit, 2014). During this time, there was an average of 11.4 active shooter events each year, with active shooter events tripling in the last seven years of the study (Blair & Schweit, 2014). Active shooter events have happened in just about every state in the United States and the United States’ territories (Blair & Schweit, 2014). From 1978 to 2008, there has been a steady increase in active shooter events in the United States, with a frequency of at least two per month (Madfis, 2014).

There are several different types of mass killers (Madfis, 2014). Madfis defined eight typologies of mass killers, including (1) family annihilators, (2) disgruntled citizens, (3), school shooters, (4) disciple killers, (5), set-and-run killers such as those similar to the Boston bombers, (6) criminal opportunists; and, (7) workplace avengers. Each of these mass killers can present active shooter situations that require the response of police, fire, and EMS personnel.

There are several hypothesized reasons for the increase in mass killing events. The reasons include accessibility to guns, unemployment of young males, increasing social isolation of individuals, declining marriages, increasing divorce, and the media influence for copycat killers (Dillon, 2013). Other reasons attributed to the increase in active shooter and mass killing events include health-related issues, mental health issues, cultural influences, perceived injustices, perception of persecution, and antisocial personality traits (Ferguson, Coulson & Barnett, 2014).

From 1900-1998, a *carbine weapon* was used in two percent of the mass killing attacks (Dillon, 2013). From 2009-2013, a carbine weapon was used in 28% of the mass killing attacks (Dillon, 2013). The average number of victims killed at a mass shooting in the United States is 4.92 (Hilah, et al., 2014). Dillon also found that the number of victims doubles in an attack when a carbine weapon is used, compared to a non-carbine firearm. The increased use of carbine weapons at active shooter attacks demonstrates the potential for high victim counts with a significant potential for morbidity and mortality.

The data on increasing active shooter events demonstrates that additional active shooter events will continue to occur in the United States. In addition, these events will most likely happen in locations where there are a high number of victims with limited ability to defend themselves against the attack (Baldanza, 2005; DHS, 2008a; Blair & Schweit, 2014). Active shooters typically plan the attack in advance and employ complex assault tactics to achieve the highest victim count possible (O'Toole, 2014). In addition, data are limited on the exact number and activities at active shooter events, often resulting in conflicting research reports by scholars.

Active Shooter Events in Educational Institutions

Although schools account for only 30% of active shooter events, these events tend to garner the most media attention and post-event analyses. This occurs because of the public's view of the innocence of the victims, the atrocities of the crimes, and the community belief that schools should be immune from violence (Cowan & Rosen, 2014). School violence continues to increase in the United States, and schools are at significant risk for an active shooter event (Agnich & Miyazaki, 2013; Cowan & Rosen, 2014; Dumitriu, 2013; Ferguson, Coulson & Barnett, 2014; Rocque, 2011). Gun violence in schools is not limited to large cities. Active shooter events have taken place in numerous small towns throughout the United States (Cowan & Rosen, 2014). The majority of school shootings have occurred in isolated semi-rural or rural areas known for stability and affluence (Newman & Fox, 2009).

Most schools are still not prepared for active shooter events (Stone & Spencer, 2010). It is very difficult to predict active shooter events in schools (Stone & Spencer, 2010). Because of the poor predictive factor, the focus must be on response (Stone & Spencer, 2010). Many schools fail to address critical safety considerations, such as ballistic-resistant building material, and adequate locations for student and staff to shelter-in-place (Stone & Spencer, 2010).

The United States leads the world in the number of school active shooter events each year, but the United States does not lead the world in the amount of school violence (Agnich & Muyazaki, 2013). Twenty percent of all school shootings in the last 100 years in United States' history occurred from 2009-2013 (Ferguson, et al., 2014). Youth violence has continued to decline in the last decade, yet the number of youth perpetrated mass killings on school campuses has increased (Ferguson, et al., 2014).

From 1974 to 1999, there was a continued increase in school shooting events (Newman & Fox, 2009). From 1999 to 2004, the attacks abruptly decline (Newman & Fox, 2009). From 2004 to current, the number of school shootings has again continued to increase (Newman & Fox, 2009). Since 2002, there has been a sharp increase in the number of shootings that have occurred at colleges and universities (Newman & Fox, 2009). Newman and Fox hypothesize that this increase in school active shooter events will continue to increase.

Researchers Newman and Fox (2009), Rocque (2011), and Daniels, et al. (2010) have noted an alarming increase in the number of averted school shooting rampages. In the majority of averted school shootings, there were multiple perpetrators (Daniels, J.A., Bradley, M.C., Cramer, D.P., Winkler, A., Kinebrew, K. & Crockett, D., 2007). One event even had six perpetrators (Daniels, et al., 2007). The increasing trend in averted school shooting rampages demonstrates a high probability for repeat active shooter events. School shooters only have to be successful one time; law enforcement investigators must be successful every time to prevent an attack.

Many school shooters used extensive planning, extreme violence, and target multiple victims during the attack (Dumitriu, 2013; Rocque, 2011). More than half of all school shooters planned their attack for at least two weeks, with several school shooters planning their attacks for a year or more (Cullen, 2009, Fast, 2009; Kass, 2009; Phillips, 2007; Sinai, 2013; Slayton, 2014). School shooters are different from most killers in that the perpetrator is not singling revenge on a particular person but making a statement with violence (Rocque, 2011).

School personnel are taught to lockdown students inside of the building during an active shooter event (Buerger & Buerger, 2010). During active shooter events, it is easier to hide the students than it is to conduct a mass evacuation (Buerger & Buerger, 2010). First responders need to understand that many students will shelter-in-place during an active shooter event, requiring the rapid response of providers into the building to treat the wounded and evacuate the students (Buerger & Buerger, 2010).

Although active shooter events at educational institutions account for only 40% of active shooter events, these attacks are often considered the most heinous and egregious because of the innocence of the victims. The number of active shooter attacks on educational facilities continues to increase, and a large number of averted school attacks demonstrate the high potential for additional future attacks (Daniels et al., 2007; Newman & Fox, 2009; Rocque, 2011). School rampage attacks are too complex for a single cause and often result from multiple influences on the perpetrator (Langman, 2009). Emergency responders must consider the potential for attacks on educational institutions in their response jurisdictions, and make plans for complex attacks with a high victim count.

Active Shooter Response

Many elements of society have a poor understanding of active shooters, including public safety (Sinai, 2013). Active shooter events pose one of the greatest risks to homeland security (Frazzano & Snyder, 2014; Sinai, 2013). The Department of Justice has recognized active shooter events as "The most serious problem facing today's law enforcement" (Clark, 2014, pg. 1). Public safety agencies must have a comprehensive understanding of active shooter events and develop response protocols for these situations (Newman & Fox, 2009; Sinai, 2013). Authors Frazzano and Snyder (2014) stated the following about active shooter events, "The increasing frequency and high lethality of these events raises the public's expectations for public safety to rapidly and skillfully respond to these types of events" (pg. 4). During the Mumbai terror attack, the lack of engagement by law enforcement and the lack of response by fire and EMS personnel significantly increased the lethality of the attack (Frazzano & Snyder, 2014). Fire and EMS providers must now change their tactics in the face of lethal assaults. It is no longer acceptable for fire and EMS personnel to wait blocks away until the scene is declared safe by law enforcement.

During an active shooter attack, the perpetrator is focused on killing as many people as possible as quickly as possible (Clark, 2014; O'Toole, 2014). At the 2009 Virginia Tech school shooting, perpetrator Seung-Hui Cho shot 170 rounds killing 30 people in nine minutes (Garrett, 2007). During that attack, there were 7.9 murder attempts occurring during each of the 17 minutes of the attack (Stepien, 2010). A review of 100 active shooter events in the United States found that there is an average kill/serious injury rate occurring every 15 seconds after the shooting starts (Peppers, 2010; PERF, 2014). Following the 1999 Columbine attacks, the number of murders and murder attempts at active shooter events has doubled (Stepien, 2010).

Most active shooters fail to plan out how their attack will end (Phillips, 2007). Because of this lack of terminal planning, active shooters continue until one of three objectives occur; (1) the perpetrator gets tired of killing, (2) the perpetrator runs out of ammunition; or, (3) the perpetrator is confronted by law enforcement (Phillips, 2007). Mass shootings can often be a copycat crime, so as shootings increase so will the copycat events (Phillips, 2007; WSFC & OTFC, 2014).

Researcher Stepien (2010) had coined the term *Stopwatch of Death* to describe the lethality of active shooter events. The average shooter can kill between 17 and 34 people in a congested area using a standard handgun (Stepien, 2010). In one minute, a perpetrator can fire anywhere between 68 and 136 accurate shots at victims (Stepien, 2010). Using an average law enforcement response time of six minutes, a perpetrator can fire anywhere between 408 and 816 shots (Stepien, 2010). This data reinforces the potential for a very high lethality count at active shooter events.

Giduck (2008) found that the two most important tactics at active shooter events is the rapid deployment of heavily armed law enforcement officers, quickly followed by tactically trained emergency medical personnel. The law enforcement officers are responsible for locating and neutralizing the perpetrator(s) and emergency medical personnel must quickly treat and remove the injured victims (DHS, 2008a; Giduck, 2008). Both of these actions must occur simultaneously to achieve the highest survivability.

Rescue teams comprised of medically trained personnel and law enforcement officers must quickly enter the structure. The rescue teams focus on the immediate treatment for victims and evacuation of the injured and uninjured (DHS, 2008a; Garrett, 2007; Giduck, 2008; Heightman, 2014; Meoli & Rathburn, 2014). The rescue teams must have the proper equipment to treat multiple trauma victims and train to operate with law enforcement force protection (Heightman, 2014). The rescue teams operate in areas void of obvious threats, but in locations where a threat may emerge.

Law Enforcement Response at Active Shooter Events

Preventing active shooter attacks is extremely difficult (WSFS & OTFS, 2014). Active shooter perpetrators are very different from a criminological perspective than most other violent criminals (Schiele & Stewart, 2001). Among active shooter perpetrators, there are limited common traits (WSFS & OTFS, 2014). Each active shooter perpetrator has very different physical, mental, emotional, and motivational characteristics (WSFS & OTFS, 2014). Active shooter perpetrators are different from most perpetrators in that these perpetrators are not looking to enact retaliation against specific individuals, opting instead to make a statement with a high degree of violence (Rocque, 2011). Multiple researchers have agreed that there is no standard profile of an active shooter, and the use of profiling is potentially very dangerous (Ferguson, et al., 2011; O'Toole, 2000; Borum, R., Cornell, D.G., Modzelski, W. & Jimerson, S.R., 2010). Because of the poor predictive factor of active shooter perpetrators, the focus must be on active shooter response (Stone & Spencer, 2010).

Although there are many differences with active shooter perpetrators, there are several identified commonalities (Borum, et al., 2010; Ferguson, et al., 2014). Seventy-eight percent of the active shooters had a history of threatening or attempting suicide prior to the incident (Borum, et al., 2010; Ferguson, et al., 2014). Sixty-six percent of active shooter perpetrators were bullied, threatened, attacked, or injured prior to the incident (Borum, et al., 2010; Ferguson, et al., 2014). Sixty-one percent of active shooter perpetrators had a history of depression or feelings of desperation preceding the attack (Borum, et al., 2010; Ferguson, et al., 2014).

Approximately 93% of school active shooter perpetrators planned their attack in advance (FBI, 2013b; Phillips, 2007; Kass, 2009; Sinai, 2013; Cullen, 2009; Fast, 2009). More than half of all school shooters planned their attack for at least two weeks before the event (FBI, 2013b; Phillips, 2007). Many school shooters studied previous school shootings and campus attacks prior to their event (Brunt, 2012; Cullen, 2009; Fast, 2009; FBI, 2013b; Kass, 2009; Nichols, 2010; Phillips, 2007; Sinai, 2013; State of Connecticut Division of Criminal Justice, 2012; United States Fire Administration, 2008). The extensive degree of preplanning by active shooter perpetrators demonstrates that public safety must prepare for a comprehensive attack with a high victim count.

Following the 1999 attacks at Columbine High School, law enforcement tactics were revolutionized (Clark, 2014; Hawkins, 2009; Moore, 2011). At Columbine, law enforcement officers setup a perimeter and waited outside for the assault to end before making entry into the building (Columbine Review Commission, 2001). Table 1 Dave Sanders Timeline at the

Columbine High School Shooting demonstrates in detail the delays involved with treating a victim who died in the attack.

Table 1

Dave Sanders Timeline at the Columbine High School Shooting

1126 Harris shoots Sanders on the second floor above the cafeteria; the shot severed a vein in his head and lacerated his carotid artery[a,b]
1127 Sanders staggered into Science Room #3 where students locked the doors[a]
1142 A teacher in the room with Sanders placed a 911 call and stayed on the phone the entire time with the dispatchers[a]
1158 Students placed the sign *"One Bleeding to Death"* in the window[a]
1200 Command Post personnel are made aware of the sign in the window[a]
1206 The first SWAT team arrived and made entry on the side of the building farthest from Sanders[a]
1208 Harris and Klebold committed suicide[a]
1241 SWAT operators requested fire personnel to respond inside the school for a fire in the cafeteria and a natural gas leak[a]
1310 SWAT team members made entry into the side of the building where Sanders was located[a]
1310 to 1400 The SWAT teams cleared rooms near Sanders, never told by the Command Post of Sanders' location or condition[a]
1400 The Command Post notified SWAT of Sanders, but the SWAT team did not know where the classroom was located[a]
1442 A SWAT team made entry into Science Room #3 and located Sanders[c]
1443 The SWAT team attempted to evacuate Sanders but heard gunfire on the first floor (from another SWAT team conducting shotgun breaching)[c]
1445 Sander is pulled into a utility closet at the top of the stairs[c]
1446 Sanders went into cardiac arrest
1530 The bodies of perpetrators Harris and Klebold are discovered[a]
1645 A paramedic accessed Sanders and officially declares him dead[d]

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[a] Kohn, D. (2009-April 19). What really happened at Columbine? *CBS News Evening Report*. Retrieved at www.cbsnews.com.
[b] Fast, J. (2009). *Ceremonial violence: Understanding Columbine and other school rampage shootings*. New York, NY: Overlook Press.
[c] McDonald, J. (Personal communication, 2014-May 20).
[d] Kass, J. (2009). Columbine: *A true crime story*. Denver, CO: Ghost Road Press.

After the Columbine attack, law enforcement focused on active shooter response and response to hostage-taking events (Moore, 2011). Since Columbine, law enforcement agencies have continued to refine active shooter response protocols (Clark, 2014). In 2008, law enforcement agencies again revisited their response protocols to active shooter events following the Mumbai terrorist attacks (Moore, 2011). Author Moore stated that public safety responders must prepare for terrorist attacks against the United States, including active shooter events.

Nichols (2011) reviewed four major active shooter events from 2007 to 2009. Nichols found that law enforcement demonstrated several areas where additional training is needed. Nichols found that most local law enforcement agencies are grossly underprepared for significant active shooter events. Law enforcement officers have trained extensively on engaging active shooters in buildings but have failed to train to engage active shooters in outdoor areas (Nichols, 2011).

The most important action that public safety personnel must perform at an active shooter event is to quickly deploy law enforcement officers to neutralize the threat (Garrett, 2007; Giduck, 2008). Law enforcement agencies have trained extensively on rapid response of law enforcement officers in a building to neutralize active shooters. Despite this training, there are still cases such as the 2009 Binghamton, New York, shooting in which officers waited outside for 40 minutes before making entry (Clark, 2014). During this delay at Binghamton, multiple victims died waiting for care (Clark, 2014).

There are two overarching tactical priorities for law enforcement at active shooter events (Federal Emergency Management Agency [FEMA], 2014). The Federal Emergency Management Agency (2014), states, “While the main priority for active shooter response efforts is minimizing the number of casualties, an equally pressing priority is getting emergency medical care to victims of the shooting in a timely manner" (pg. 1). Law enforcement must aggressively stop the threat with whatever level of force necessary, and then immediately work to ensure medical assistance is provided to the victims (FEMA, 2014a). The most important law enforcement response is to confront the perpetrator(s) aggressively with more focused and intense violence than that which is displayed by the perpetrator(s) (Hawkins, 2009).

Despite the rapid response by enforcement to active shooter events, there are still a high number of people shot before law enforcement arrives (WSFC & OTFC, 2014). The five highest victim count active shooter events from 2000 to 2013 occurred despite law enforcement arriving on scene in less than three minutes from the first 911 call (WSFC & OTFC, 2014). The Washington State Fusion Center and Oregon Titan Fusion Center (2014) stated, "Clearly, fast and effective police response comprises only part of the answer to limiting damage done during these attacks" (pg. 7).

Fire Department Response at Active Shooter Events

Fire department personnel frequently provide medical care and rescue of civilians from a multitude of dangerous situations (Goodwin, 2013). Fire department personnel often operate in dangerous environments, such as building collapses, building fires, technical rescues, and hazardous material spills. All of these situations can cause serious injury or death to firefighters. Despite the risk, firefighters recognize the danger and continue to operate at these risky events to save lives. Active shooter events are just another example of high-risk events, to which fire personnel need to respond (Goodwin, 2013).

In 2013, the International Association of Fire Chiefs (IAFC) conducted a nationwide study to determine if fire departments had an active shooter protocol and if fire departments were actively working to develop such a protocol (Goodwin, 2013). The IAFC found that 75% of fire departments do not have an active shooter response protocol (Goodwin, 2013). Of those fire departments that do not have a protocol, 44% of fire departments stated they were either developing a plan or considering a plan (Goodwin, 2013).

Multiple fire service organizations have recognized the need for fire service involvement at active shooter events (FDNY, 2012; Fletcher, 2010). The overwhelming consensus in the fire service is that firefighters need to enter active shooter scenes rapidly to provide care, even if the perpetrator is not neutralized (International Association of Fire Chiefs, 2013; Moore-Merrell, 2013; National Fallen Firefighters Foundation, 2013; Roberts, 2013). However, the majority of fire departments are not prepared for these types of events. Most fire departments lack active shooter response protocols, training, and equipment. Failure to implement integrated active shooter response plans can result in numerous lives lost (Fletcher, 2010).

For the majority of fire departments, the response to an active shooter event require fire personnel to stage several blocks away and await law enforcement to completely secure the scene before responding into the event (Brookhyser, 2014; Goodwin, 2013; Iselin & Smith, 2009). The Arlington (Virginia) Fire Department was one of the first fire departments in the United States to develop a comprehensive integrated police/fire/EMS response plan to active shooter attacks (Iselin & Smith, 2009). The Arlington Fire Department began this process in 2009. Prior to 2009, the Arlington Fire Department found that victims would frequently wait anywhere from 90 minutes to 2.5 hours to receive care at active shooter drills (Iselin & Smith, 2009). The Arlington Fire Department created the Rescue Task Force (RTF) concept, an integrated team of firefighter/paramedics and law enforcement officers (Iselin & Smith, 2009). These Rescue Task Force teams would enter in behind law enforcement contact teams to quickly provide care and evacuate injured victims.

The Arlington Fire Department conducted multiple active shooter drills to test the Rescue Task Force concept. The Arlington Fire Department first conducted the drill using traditional response that had fire and EMS personnel stage and wait for law enforcement to declare the scene save (Iselin & Smith, 2009). The drill had 44 victims inside a building that required care and extraction. Employment of the traditional *stage and wait* response model resulted in the first victim accessed 90 minutes after the drill started and 2.5 hours to treat and evacuate all victims. The Arlington Fire Department conducted the drills again using the Rescue Task Force model. Four Rescue Task Forces treated and evacuated all 44 victims within 30 minutes of entering the building (Iselin & Smith, 2009). The Arlington Fire Department found that the implementation of the Rescue Task Force provided a model that will significantly reduce the time-to-treatment and time-to-extraction of victims at active shooter events (Iselin & Smith, 2009). Frazzano and Synder (2013) stated, "The Rescue Task Force model is a highly desirable, multidisciplinary response model for other jurisdictions to study and adopt" (pg. 5).

The purpose of the Rescue Task Force is to operate in the warm zone treating victims and rapidly removing the victims to the cold zone where there is no threat from hostile engagement (Meoli & Rathburn, 2014). The Rescue Task Forces will quickly access victims in the warm zone and extract the victims to the cold zone (Meoli & Rathburn, 2014). Figure 1 shows the concept of the hot zone, warm zone, and cold zone. The first Rescue Task Force will enter in behind the law enforcement contact team to treat and extract the victims (Meoli & Rathburn, 2014). As additional fire and EMS providers arrive, they will form up with law enforcement to create additional Rescue Task Forces (Meoli & Rathburn, 2014).

Figure 1

Sample Hot Zone, Warm Zone, and Cold Zone Operations at Active Shooter Events

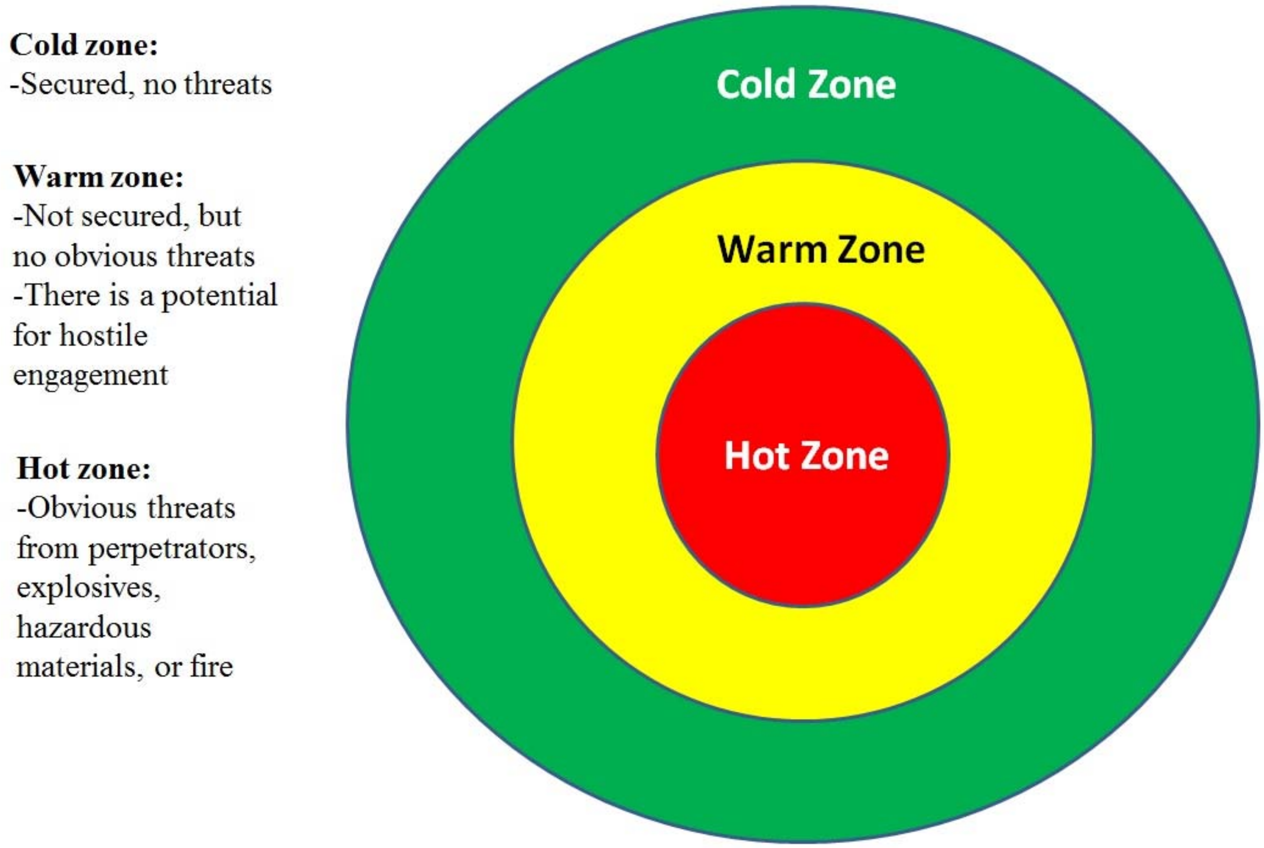


Figure 2

Hot Zone Description at Active Shooter Events

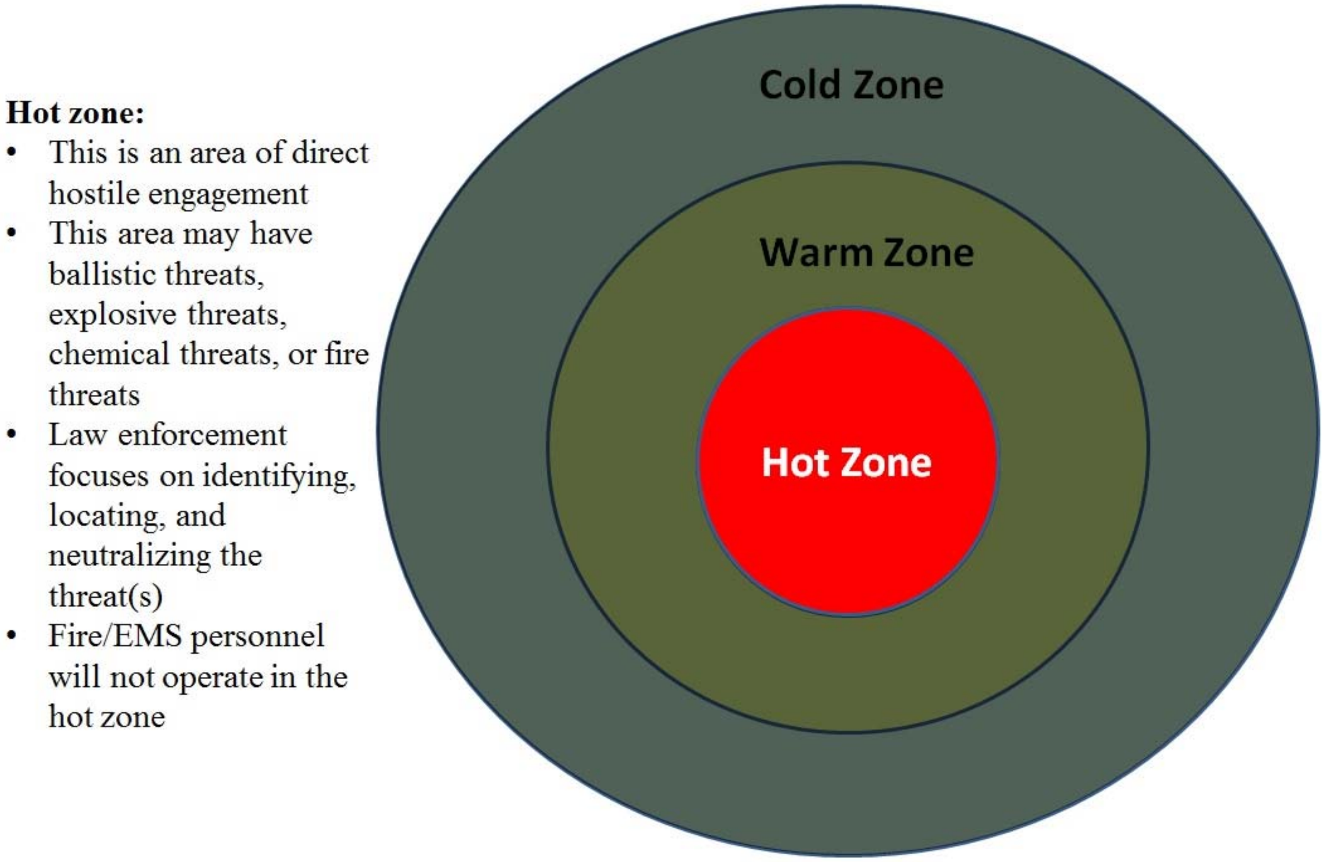


Figure 3

Warm Zone Description at Active Shooter Events

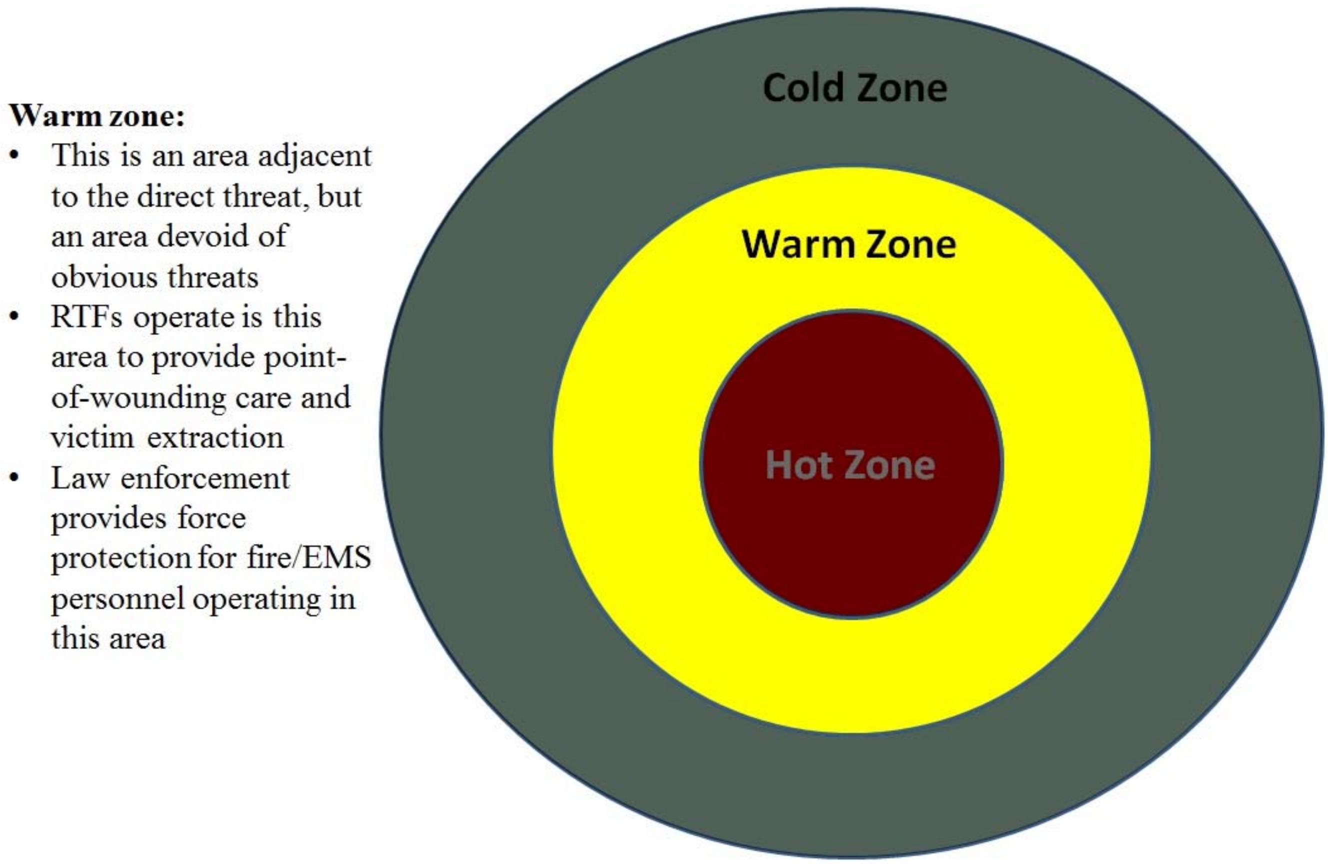
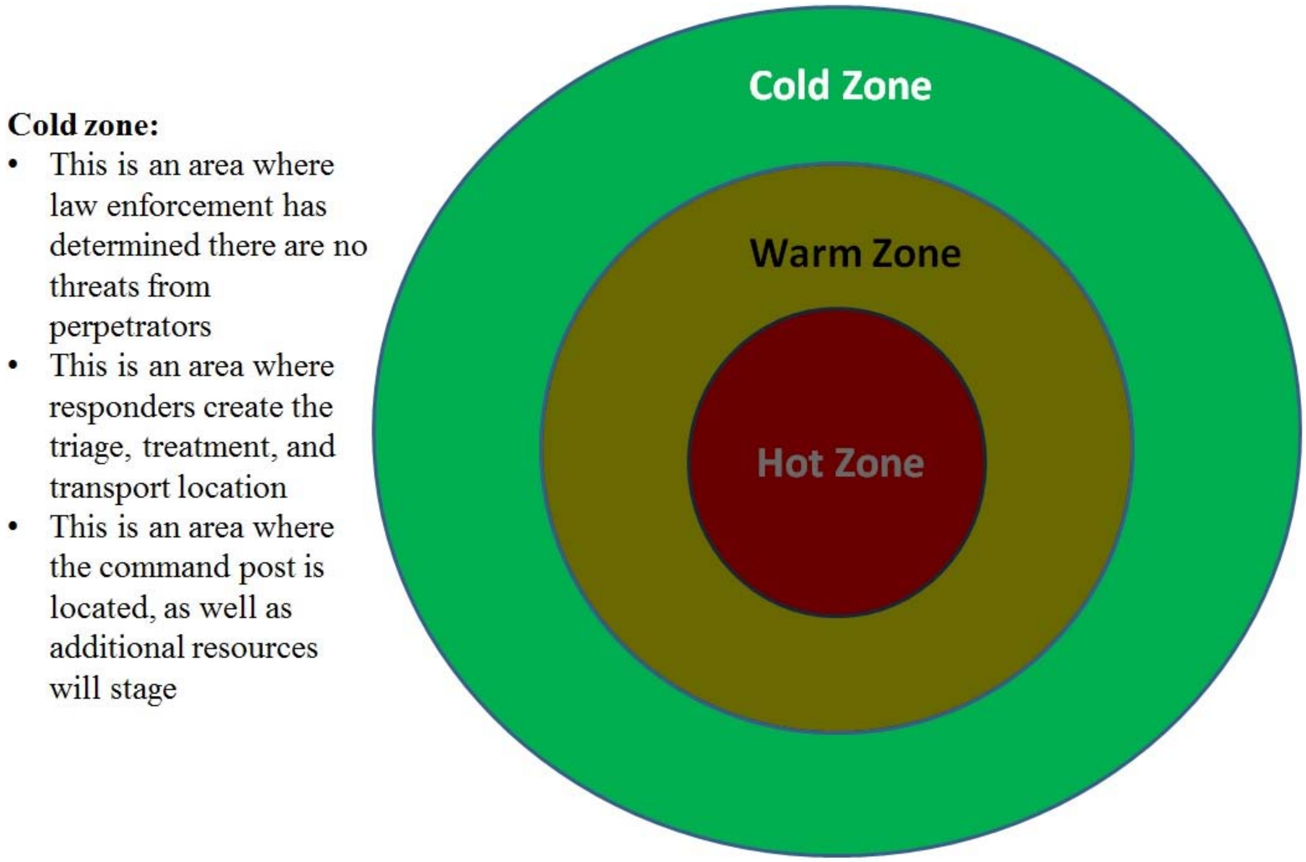


Figure 4

Cold Zone Description at Active Shooter Events



Prior to 2013, the Los Angeles County Fire Department (LACoFD) did not have an active shooter response protocol (Brookhyser, 2014). The LACoFD would stage and wait for law enforcement before making entry into the scene. Brookhyser is a battalion chief with the LACoFD, and he found that fire personnel would often wait on the perimeter hours while law enforcement secured the scene. Brookhyser found that injured people were frequently at these scenes and waited hours for medical care while law enforcement secured the scene. The LACoFD researched Los Angeles-area law enforcement protocols and found that nearly all protocols specifically excluded fire and EMS personnel from operating at hostile events

(Brookhyser, 2014). The LACoFD found that integration of a joint public safety active shooter response plan required guidelines for personnel training, tactical medical certifications for personnel, deployment of tactical medical personnel at high-threat events, and guidelines for integrated response with law enforcement (Brookhyser, 2014).

The New York City Fire Department (FDNY) has determined that mass shooting terrorist events are very manpower intensive (FDNY, 2012). Attacks such as the 2008 Mumbai terror attacks involve multiple assailants simultaneously attacking different locations in a city (Palmeri, 2014). These types of complex, coordinated attacks require fire department personnel to receive advanced training so that personnel can successfully perform at these events. Most fire department personnel will operate under direct law enforcement protection (FDNY, 2012). In 2014, the Department of Homeland Security granted the FDNY $560 million to train and prepare for attacks involving multiple perpetrators against the city (Palmeri, 2014). The FDNY has recognized that there is a high likelihood for these types of attacks against cities in the United States (Palmeri, 2014).

Fire departments with integrated active shooter response protocols have identified several training issues. Two common themes in training include tactical medicine training and operating with tactical awareness in potentially hostile environments with law enforcement protection (Fletcher, 2010; Flynt, 2012; Giduck, 2008). Other studies demonstrate that fire departments must have extensive planning, preparation, and training prior to responding to active shooter events to optimize success and survivability at the event (United States Fire Administration [USFA], 2013).

Multiple fire service organizations state that fire departments must implement active shooter protocols and train fire department personnel on active shooter response (International

Association of Fire Chiefs [IAFC], 2013; Moore-Merrell, 2013; National Fallen Firefighters Foundation [NFFF], 2013; Roberts, 2013). In January of 2013, the National Fallen Firefighters Foundation released a report of 16 life-safety initiatives that were critical to fire department operations in the United States (NFFF, 2013). Life Safety Initiative Number 12 states, "National protocols for response to violent incidents should be developed and championed" (NFFF, 2013, pg. 1).

On June 17, 2013, the International Association of Fire Fighters (IAFF), the largest union representing career firefighters, released a position statement that was sent to all 750,000 union members. The IAFF position statement said, "In light of recent events and the nationwide initiative, the IAFF Executive Board felt it prudent to release position statements in regard to the expected changes in response paradigms and standard operating procedures for fire departments responding to active shooter events" (Moore-Merrell, 2013, pg. 1). The IAFF further stated, "Use the Rescue Task Force concept for on scene response" (Moore-Merrell, 2013, pg. 1). The IAFF has joined several other large fire service organizations to recommend that all fire departments have active shooter response protocols and utilize the Rescue Task Force concept for active shooter operations.

On October 10, 2013, the International Association of Fire Chiefs (IAFC) released a position statement on active shooter response (International Association of Fire Chiefs [IAFC], 2013). The IAFC is one of the world's largest organizations representing fire department command staff personnel. The IAFC made four significant recommendations, including (1) every fire department must have an active shooter response protocol, (2) fire departments and law enforcement must train together, (3) fire departments need to utilize the Rescue Task Force model; and, (4) fire personnel must have training in Tactical Emergency Casualty Care (IAFC, 2013).

Emergency Medical Response to Active Shooter Events

The only certain feature that does not change at active shooter events is the *mass casualty* medical component (Institute of Management and Administration [IOMA], 2009). Several studies have identified three major medical response deficiencies at active shooter events (IOMA, 2009). The first deficiency identified is the lack of medical equipment available to first responders (IOMA, 2009). The second deficiency identified is the lack of rapid response by medical personnel to the injured (IOMA, 2009). The last major deficiency identified is the lack of fire and EMS preparation and training for active shooter events (IOMA, 2009).

The average number of people shot at active shooter events is five (Heightman, 2014). However, several active shooter events in the United States have had many more victims. Table 2 shows the top 10 deadliest active shooter events in United States history and the number of dead and injured at each of the events. Events outside of the United States have had victims doubling the number seen at United States active shooter events (Spreekillers, 2014). It is important to note that while Table 2 lists the top 10 deadliest active shooter events, the eleventh event is very notable. At the Aurora Theater shooting, there were 12 dead, and 70 injured requiring ambulance transport (Tri-Data Corporation, 2014). In total, there were more than 100 injured victims, many of whom transported themselves to nearby hospitals (Tri-Data Corporation, 2014).

Table 2

Ten Deadliest Active Shooter Events in United States' History[a]

Location	**Date**	**Dead**	**Injured**
Blacksburg, Virginia[b]	04/16/2007	32	18
Newtown, Connecticut[c]	12/14/2012	26	02
Killeen, Texas[d]	10/16/1991	23	24
San Diego, California[e]	07/18/1984	21	19
Austin, Texas[f]	08/01/1966	15	32
Edmund, Oklahoma[g]	08/20/1986	14	06
Fort Hood, Texas[h]	11/05/2009	12	31
Binghamton, New York[i]	04/03/2009	13	04
Camden, New Jersey[j]	09/06/1949	13	03
Wilkes-Barre, Pennsylvania[k]	09/25/1982	13	01

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[a] Deaths of perpetrators have not been included in the number of people killed.
[b] CNN Library (2014-Apr 6). Virginia Tech shooting fast facts. *Cable News Network.* Retrieved from www.cnn.com
[c] Johnson, M.A. & Bratu, B. (2012-Dec 17). Police: Second person injured in Connecticut school shooting survived. *NCB News.* Retrieved from www.nbcnews.com.
[d] Kelly, R.L. (2010-Mar). *EMS revisited: October 1991 Luby's shooting.* EMS World. Retrieved from www.emsworld.com.
[e] Bosh, S. (2014-Jul 18). Survivors recount San Ysidro McDonald's massacre after 30 years. *KUSI San Diego News.* Retrieved from www.kusi.com.
[f] Hlavaty, C. (2013-Aug 1). 47 years later, Whitman's tower shooting still a haunting memory for Texans. *The Chronicle.* Retrieved from www.chron.com.
[g] Lamar, J.V. (2001-Jun 24). "Crazy Pat's" revenge. *Time Magazine.* Retrieved from www.time.com.
[h] Staff. (2009-Nov 5). Gunman kills 12, wounds 31 at Fort Hood. *NBC News.* Retrieved from www.nbcnews.com.
[i] McFadden, R.D. (2009-Apr 3). 13 shot dead during a class on citizenship. *The New York Times.* Retrieved from www.nytimes.com.
[j] Goldstein, R. (2009-Oct 9). Howard Unruh, 88 dies: Killed 13 of his neighbors in Camden in 1949. *The New York Times.* Retrieved from www.nytimes.com.
[k] Robbins, W. (1982-Sep 27). Wilkes-Barre killings: Racial pressures cited. *The New York Times.* Retrieved from www.nytimes.com.

Many physicians agree that responders can save more victims at active shooter events (Goodwin, 2013). Several notable active shooter events have occurred where victims died waiting for medical care (Adams, 2013; Cullen, 2009; Flynt, 2012). Adams reviewed seven major active shooter events to determine if rapid medical intervention by medical personnel would affect victim mortality. Adams found that when medical personnel do not rapidly enter the scene, victim survivability is approximately 37%. Adams found that when medical personnel rapidly enter an active shooter event and provide care, victim survivability is approximately 70%.

Exsanguinating hemorrhage is the most common preventable cause of death after trauma (Gruen, R.L., Brohi, K., Schreiber, M., Balogh, Z.J., Pitt, V., Narayan, M. & Maier, R.V., 2012). Exsanguinating hemorrhage is responsible for one-third of the six million trauma deaths each year in the United States (Gruen, et al., 2012). Approximately half of the trauma deaths occur before the victim reaches the hospital (Gruen, et al., 2012). Immediate compression of external wounds by first responders or a paramedic can substantially reduce volume loss and the harmful consequences associated with blood loss (Gruen, et al., 2012).

The majority of the recommendations for emergency medical care at active shooter events come from medicine learned in combat on the battlefield. There exist several commonalities between combat medicine and civilian care in hostile environments (Callaway, et al., 2011). In addition, much of the research for penetrating trauma treatment was derived from combat (Cain, 2008). Because of the similarities in care during combat and hostile events, it is important to review the literature on combat trauma and combat medicine.

Numerous scholars and researchers have studied medical care to determine optimal treatment of trauma victims before they reach definitive care at a hospital (Cain, 2008; Callaway, et al., 2011). There are three primary causes of preventable death in penetrating trauma victims (Cain, 2008). These causes in order of prevalence include gross hemorrhage, airway obstruction, and breathing failure from damage to the chest cavity (Cain, 2008).

Research from the United States Army Institute of Surgical Research found that morbidity and mortality decreases significantly when basic medical care is provided at the far-forward point in combat (Cain, 2008; Champion, et al., 2003). This basic medical care consists of treatments that correct the three most preventable causes of combat trauma deaths. The United States Department of Defense created the Tactical Combat Casualty Care (TCCC) course to teach soldiers how to treat preventable causes of battlefield deaths.

Standard civilian prehospital emergency medical care fails to address the treatment of trauma victims in high-threat environments (Champion, et al., 2003). Researchers at the Uniformed Services University of the Health Science in Bethesda, Maryland, found six primary differences between combat trauma and standard civilian trauma- such as that seen with car accidents and other non-hostile trauma (Champion, et al., 2003). These six differences include, (1) the high energy and high lethality of the wounds, (2) multiple wound causes, (3) high prevalence of penetrating injury, (4) the persistent threat of engagement or reengagement by enemy forces, (5) austere, resource-constrained environment; and, (6) delayed access to definitive care (Champion, et al., 2003). Champion and colleagues found that that approximately 10% of those who died from exsanguinating truncal hemorrhage died within 10 minutes of injury and died from injuries that could have been successfully surgically repaired if basic medical treatment had been immediately available at the time of injury. These different characteristics of combat trauma require unique training for civilian emergency medical personnel.

Eastridge and colleagues (2012) with United States Army Institute of Surgical Research conducted a review of 4,596 battlefield casualties from 2001-2011 to delineate fatalities between non-survivable and potentially survivable. The authors found that during this time, approximately 25% of battlefield deaths were potentially survivable (Eastridge, et al., 2012). Approximately 75% of all battlefield deaths occur from penetrating trauma from gunshot wounds or fragmenting explosives (Eastridge, et al., 2012). Of the casualties that die in combat, 90% die before they reach a hospital (Eastridge, et al., 2012).

Approximately 67% of casualties with severe ballistic wounds will die within 30 minutes; with at least half dying from uncontrolled blood loss (Strawder, 2006; Flynt, 2012). Eastridge and colleagues (2012) found that 35% of deaths were instantaneous, 52% of deaths occurred in minutes to hours, and 12% of deaths occurred when victims reached the hospital. Of the deaths deemed potentially survivable, 91% were the result of exsanguinating hemorrhage, and 9% were the result of airway compromise (Eastridge, et al., 2012). Of the hemorrhage deaths, 67% occurred in the victim's truncal area, 19% occurred in the victim's extremity junctions, and 14% occurred in extremities. Previous studies have demonstrated a profound survival advantage for casualties in whom tourniquets were applied early and effectively on the battlefield (Kragh, J.F., Walters, T.J., Baer, D.G., Fox, C.J., Wade, C.E., Salinas, J. & Holcomb, J.B., 2008; Kragh, J.F., Walters, T.J., Baer, D.G., Wade, C.E., Salinas, J. & Holcomb, J.B., 2009; Kragh, J.F., Littrel, M.L., Jones, J.A., Walters, T.J., Baer, D.G., Wade, C.E. & Holcomb, J.B., 2011).

Low-velocity firearms are weapons that fire a projectile at less than 600 meters per second (Lichte, Oberbeck, Binnebosel, Wildenauer, Pape & Kobbe, 2010). Handguns and shotguns are examples of low-velocity firearms. High-velocity firearms are weapons that fire a projective greater than 600 meters per second (Lichte, et al., 2010). Examples of high-velocity firearms include carbine or "assault-style" weapons and hunting rifles. Lichte and colleague (2010) found that injuries sustained from high energy weapons often result in severe soft tissue damage that requires multiple surgeries. Approximately 6-42% of gunshot wound victims will have simultaneous injuries to the thorax and the abdomen (Lichte, et al., 2010). Of those victims with simultaneous thorax and abdominal injuries, approximately 36% will have serious injuries to the lungs or diaphragm (Lichte, et al.). The increasing prevalence of carbine weapons at active shooter events shows the high potential for serious gunshot wounds. The research by Dillion (2013) demonstrates the use of carbine weapons at active shooter attacks has increased significantly in the last four years.

The 2003-2011 war in Iraq had the lowest killed-in-action rate of any protracted conflict in United States history (Gerhardt, R. T., De Lorenzo, R. A., Oliver, J., Holcomb, J. B. & Pfaff, J. A., 2009). The two leading causes of preventable battlefield death were extremity hemorrhage and airway obstruction (Gerhardt, et al., 2009). None of the injured casualties died from extremity hemorrhage or airway obstruction after a medical professional began treating the victim (Gerhardt, et al., 2009). Civilian first responders can duplicate this extraordinary statistic at active shooter events with proper training and equipment.

At the 2007 Virginia Tech shooting, 25 of the 26 victims were triaged by EMS personnel at the scene (Kaplowitz, et al., 2007). At the Virginia Tech shooting, there was a mortality of 3.8% for victims who were alive when a medical provider initiated victim care (Kaplowitz, et al., 2007). The Virginia Tech Review Panel (2007) credited the rapid response by EMS personnel for saving multiple victims' lives. Several of the victims had extremely life-threatening injuries, including femoral arterial lacerations and gunshot wounds to the chest (Virginia Tech Review Panel, 2007).

At the 2008 Fort Hood shooting, soldiers immediately provided lifesaving care using torn strips of uniform and diapers (Rielage, 2009). If a Fort Hood shooting victim was alive upon arrival at the hospital, they survived the event (Shepherd, Gerdes & Nipper, 2011). This is a remarkable statistic as several of the Fort Hood victims had very critical gunshot wounds, including gunshot wounds to the face, gunshot wounds to the spine, and gunshot wounds to the torso (Shepherd, et al., 2011). The immediate lifesaving care of the soldiers that day saved several injured victims' lives (Shepherd, et al., 2011).

The Committee for Tactical Emergency Casualty Care (C-TECC) is a civilian-based committee that frequently examines the TCCC standards and modifies the standards for applicability to civilian victim care in the United States (Callaway, et al., 2011). The C-TECC group created the Tactical Emergency Casualty Care (TECC) guidelines which have become the standard for prehospital civilian trauma care in high-threat environments (Callaway, et al., 2011). Creation of the TECC guidelines began with the examination of TCCC standards established by the United States Department of Defense as well as civilian first responder practices in the United States. The C-TECC group then studied military and civilian care as well as a data analysis of military and civilian tactical morbidity and mortality rates (Callaway, et al., 2011). The C-TECC group determined that civilian prehospital medical providers can implement military combat medical care at high-threat environments (Callaway, et al., 2011). The C-TECC group also established a standard set of guidelines for civilian prehospital providers to follow in high-threat environments (Callaway, et al., 2011).

The TCCC guidelines are so successful in preventing combat deaths that TCCC training is now required for all military personnel deploying to combat (Callaway, et al., 2011). Research from the United States Department of Defense, Defense Health Board found that no reported incidents of preventable battlefield deaths occurred in Iraq and Afghanistan with Special Forces units trained in TCCC (Callaway, et al., 2011). In 2009, the Defense Health Board found that the American forces killed-in-action rates fell from 9% to 2-3% when all soldiers received TCCC training (Smith & Callaway, 2014). The TCCC guidelines are also nationally recommended for fire and EMS providers in the United States (IAFC, 2013; Jacobs, 2014).

Civilian tactical care in high-threat environments differs from standard civilian prehospital emergency victim care (Callaway, et al., 2011). Conventional prehospital medical care instructs medical personnel not to enter a scene unless the scene is safe from all hazards (Callaway, et al., 2011). However, civilian prehospital medical providers now operate more frequently in unsecured high threat environments.

Emergency medical personnel frequently lack tactical training and attempt to wrongfully utilize civilian medical care procedures at tactical situations (Giduck, 2008). All fire and EMS personnel must have tactical training to operate in potentially hostile environments (Giduck, 2008). Specific tactical medical training includes triage, forward casualty collection points, and tactical medical care (Fletcher, 2010). Civilian medical personnel need to learn from the battlefield military medical care and implement this care to increase civilian penetrating trauma survivability in the United States (Cain, 2008).

One of the most important prehospital medical treatments for trauma victims is the rapid transport of the victim to the hospital with surgical intervention capabilities (Jacobs, 2014). Numerous research studies have found that time from injury to surgical intervention is a significant independent factor in mortality for trauma victims (Crandall, et al., 2013; Zafar, et al., 2014). The American College of Surgeons recommends a scene time of no more than 20 minutes when a victim has suffered serious trauma (Zafar, et al., 2014). Many emergency medicine experts recommend a scene time of less than 10 minutes when a victim has moderate to major traumatic injuries (Calland, 2005; Cooke, 1999).

Additional studies in EMS response have found increased survivability of victims when EMS response times are reduced (Blackwell & Kaufman, 2002; Pons, P.T., Haukoos, J.S., Bludworth, W., Cribley, T. & Markovchick, V.J., 2005). Two studies conducted with large EMS services in the United States found that all-cause victim mortality for critical victims is 7.1% when response times to the scene are greater than eight minutes (Blackwell, et al., 2002; Pons, et al., 2005). When response times are less than 07 minutes and 59 seconds, victim mortality is 6.4% (Blackwell, et al., 2002; Pons, et al., 2005). These two studies demonstrate that the rapid response to a victim can reduce mortality.

Crandall and colleagues (2013) conducted a similar study to determine if a delay in transport of trauma victims to the hospital can affect mortality. Crandall and colleagues examined the Illinois State Trauma Registry from years 1999-2009 and reviewed victims with gunshot wounds transported by ambulances to Chicago trauma centers. The study found that victims who were shot less than five miles from a trauma center had an average transport time of 10.3 minutes, whereas victims shot more than five miles from a trauma center had an average transport time of 16.6 minutes (Crandall, et al., 2013). The study found that the mortality increased 26% for victims shot more than five miles from a trauma (Crandall, et al., 2013). An interesting aggregate of this study shows that the mortality increased 26% for gunshot victims when transport time increased by six minutes.

Another study conducted by the United States Army Surgical Research Center further underscores the necessity for rapid care when treating trauma victims (Kragh, et al., 2011). Kragh and colleagues examined victim outcomes for 499 soldiers who had a tourniquet applied to stop life-threatening hemorrhage. The study found that survival for victims was quite dismal if shock had already set in before application of the tourniquet (Kragh, et al., 2011). In this group the mortality was 82% (Kragh, et al., 2011). Survival is quite good if responders place the tourniquet before shock sets in (Kragh, et al., 2011). There was a mortality of only 10% for the group that had tourniquets placed before shock (Kragh, et al., 2011). This research demonstrates the time criticality of quickly stopping gross hemorrhage before shock sets in.

Tien and colleagues (2008) examined 134 combat trauma victims treated at a multinational medical unit at Kandahar Airfield Base from February 7, 2006 to May 30, 2006. The authors found that no victims arrived at the hospital with uncontrolled arterial bleeding (Tien, H. C., Jung, V., Rizoli, S. B., Acharya, S. V. & MacDonald, J. C., 2008). Tien and colleagues attribute this to TCCC training, and appropriate TCCC medical interventions utilized prior to the victims arriving at the hospital. Tien and colleagues found that TCCC-trained personnel performed appropriate treatments in the field that absolutely saved the lives of trauma victims.

Medical care at active shooter events centers on recognizing life-threatening bleeding, stopping the hemorrhage, and rapidly transporting victims to a hospital with surgical capabilities (Fabbri, 2014). All other treatment given must have clear indications and the benefit of the treatment weighed against the delays in transporting the victim to the hospital (Jacobs, 2014). Numerous other studies demonstrate that optimal prehospital care for trauma victims requires medics to stop major bleeding, maintain a simple airway, and rapidly transport the victim to a hospital (Smith & Conn, 2009).

The Virginia Tech Review Panel (2007) found that EMS personnel’s greatest challenge comes from handling the logistics of the mass casualty event. At the Virginia Tech shooting, EMS providers were overwhelmed with a large number of casualties and EMS providers had great difficulty with coordinating victim transportation to multiple hospitals (Virginia Tech Review Panel, 2007). In addition, EMS command personnel had difficulty coordinating the response of 14 EMS agencies that responded with 27 ambulances and more than 120 EMS personnel (Virginia Tech Review Panel, 2007).

Medical care at active shooter events can appear daunting; however, numerous research articles confirm that victims require a very basic level of medical care (Cain, 2008; Callaway, et al., 2011; Champion, et al., 2003, Fabbri, 2014; Gerhardt, et al., 2009; Jacobs, 2014; Kaplowitz, et al., 2007; Kragh, et al., 2008; Kragh, et al., 2009; Kragh, et al., 2011; Rielage, 2009; Shepherd, et al., 2011; Smith & Conn, 2009). Medical providers need to concentrate on recognizing life-threatening hemorrhage, stopping the hemorrhage, and then rapidly transporting victims to hospitals with surgical capabilities (Cain, 2008; Callaway, et al., 2011; Champion, et al., 2003, Fabbri, 2014; Gerhardt, et al., 2009; Jacobs, 2014; Kaplowitz, et al., 2007; Kragh, et al., 2008; Kragh, et al., 2009; Kragh, et al., 2011; Rielage, 2009; Shepherd, et al., 2011; Smith & Conn, 2009). In addition, EMS command staff personnel will face numerous logistical challenges in managing a mass casualty event with the potential of numerous critically injured victims (IOMA, 2009; Tri-Data Corporation, 2014; Virginia Tech Review Panel, 2007).

Joint Public Safety Response at Active Shooter Events

In October of 2008, the Department of Homeland Security published a handbook for active shooter response. The handbook stated, “The first officers to arrive to the scene will not stop to help injured persons. Expect rescue teams comprised of additional officers and emergency medical personnel to follow the initial officers. These rescue teams will treat and remove an injured person” (DHS, 2008a, pg. 5). The Department of Homeland Security pushed this expectation out nationwide; however, very few fire departments and EMS agencies worked to comply with the expectation of an integrated response with law enforcement.

The shootings at Sandy Hook Elementary School in Newtown, Connecticut, provided the catalyst for an increased focus on medical capabilities at active shooter events (Heightman, 2014). The subsequent shootings at the Los Angeles International Airport and the Aurora, Colorado Century 17 Theaters put even more emphasis on medical response to active shooter events (Lopez & Welsh, 2013; Tri-Data Corporation, 2014). Reed Smith is the medical director of the Arlington, Virginia Fire Department and an expert in active shooter response. Dr. Smith stated, “The only reason EMS hasn’t changed their response is because no one has demanded it. The police were faulted at Columbine, but EMS wasn’t. However, you are now hearing more and more discourse on the EMS response, particularly involving Aurora” (Goodwin, 2013, pg. 10).

Police, fire, and EMS personnel must all train jointly on active shooter response (Clark, 2014; FEMA, 2014a; Heightman, 2014; Maryland Governor’s Office of Homeland Security, Maryland Institute for Emergency Medical Services System, Maryland Department of the State Police, Maryland Active Assailant Interdisciplinary Work Group [State of Maryland], 2014). Police, fire, and EMS must learn to utilize a unified command system at the event to ensure a coordinated response (FEMA, 2014b). Dr. William Fabbri, the Medical Director for the Federal Bureau of Investigation stated that police, fire, and EMS personnel must work in a coordinated response to rapidly access, treat, and remove victims at active shooter events (Fabbri, 2014). Active shooter events can happen in any community regardless of size, so all jurisdictions must plan and prepare for these events (Fabbri, 2014). Coordinated active shooter response by police, fire, and EMS are complex (Fabbri, 2014). Because of the complexity of active shooter events, the responses prevent a cookie-cutter approach (Fabbri, 2014). Public safety providers need to tailor an active shooter response plan to the resources of the community (Fabbri, 2014).

Dr. Lenworth Jacobs is a physician at Hartford Hospital and a founding member of the Hartford Consensus, a group of the nation's leading trauma physicians who made recommendations for active shooter medical care (Jacobs, 2014). Dr. Jacobs stated, "It is no longer acceptable for fire department and EMS personnel to stage and wait for casualties to be brought out by law enforcement" (pg. 477). Fire and EMS personnel must receive proper training and appropriate equipment to provide care at these events (Jacobs, 2014). Dr. Jacobs and the Hartford Consensus group have made it clear that the national standard of care is for an integrated police, fire, and EMS response to active shooter events (Jacobs, 2014).

A joint police/fire/EMS response to active shooter events requires training and specific response protocols. The introduction of non-tactical emergency responders can pose a significant tactical complication for law enforcement officers who are attempting to neutralize an active shooter threat (Flynt, 2012). The majority of fire and EMS personnel lack training to operate tactically in unsecured active shooter events (Flynt, 2012).

In 2003, President George W. Bush passed Homeland Security President Directive (HSPD) Number Five, entitled *Management of Domestic Incidents* (Federal Emergency Management Agency [FEMA], 2008). This presidential directive requires all local, state, and federal response agencies to utilize the National Incident Management System (NIMS) at emergency event (FEMA, 2008). The National Incident Management System is a systematic and organized approach for all responders to use when responding to an emergency, regardless of the size of the event (FEMA, 2008). The National Incident Management System requires responders to utilize the Incident Command System (ICS); a system consisting of organizational processes, terminology, and standard requirements for managing emergency scenes (FEMA, 2008).

Despite the federal presidential directive, multiple active shooter event after-action-reports have found frequent failures to establish a unified command structure (Columbine Review Commission, 2001; Tri-Data Corporation, 2014; Virginia Tech Review Panel, 2007). The failure to create a unified command structure has frequently resulted in significant delays in accessing victims, and unnecessary lives lost (Columbine Review Commission, 2001; Tri-Data Corporation, 2014).

In September, 2013, the United States Fire Administration published a position paper for all United States fire and EMS agencies. This position paper recognized that active shooter events are increasing in the United States and that all fire and EMS agencies must create policies to address these events (USFA, 2013). The United States Fire Administration position paper states,

> It is essential that police, fire, and EMS agencies put policies in place before active shooter events happen to ensure coordinated and integrated planning, preparation, response, treatment, and care. Extraordinary efforts on the part of local fire/EMS and direct pre-planned coordination with law enforcement is required during the response to active shooter events to affect rescues, save lives, and enable operations with mitigated risk to personnel. (pg. 3).

Responders can also use the active shooter Rescue Task Force model for other mass violence events, such as a bombing. At the 2013 Boston Marathon bombing, responders were faced with a mass casualty situation in a fluid and dynamic threat environment (Kue & Kearny, 2014). Although the bombing was not an active shooter event, many of the same issues were present. The responders were faced with a scene that was not totally secured by law enforcement, the potential for additional hostile engagement, multiple locations of injured victims, and victims literally bleeding to death in front of the responders (Kue & Kearny, 2014). The response priorities were very similar to that of an active shooter; (1) stop life-threatening bleeding, (2) move the victims out of the hostile area; and, (3) rapidly transport the injured to hospitals with surgical capabilities (Kue & Kearny, 2014).

Chapter 3: Research Method

Active shooter events have continued to increase in the last decade (Blair & Schweit, 2014; DHS & FBI, 2012; Dillon, 2013; Dumitriu, 2013; Madfis, 2014). The number of people injured and killed continues to increase at each event. A review of 100 active shooter events in the United States found that there is an average kill/serious injury occurring every 15 seconds after the shooting begins until the shooter is neutralized or gets tired of killing (Peppers, 2010; PERF, 2014). Many active shooter perpetrators have demonstrated a strong desire to make their attack even deadlier than previous active shooter events (Cullen, 2009; Fast, 2009: Sinai, 2013; Slayton, 2014). Multiple active shooter perpetrators have demonstrated extensive pre-attack planning and research (Cullen, 2009; Fast, 2009: Sinai, 2013; Slayton, 2014). These facts show that active shooter events continue to have a serious likelihood of a high number of victims.

Public safety officials continue to focus on responsive methods to active shooter attacks. In the past two years, government agencies and active shooter researchers have placed an increasing emphasis on the importance of rapidly accessing victims at active shooter events (Fabbri, 2014; Goodwin, 2013; Williams, 2013). Retrospective analysis of multiple active shooter events demonstrates that victims are dying inside while waiting for care (Goodwin, 2013, Jacobs, 2013).

Traditional fire department and EMS response to potentially violent incident requires fire and EMS personnel to remain blocks away until the scene is declared safe by law enforcement (Morrissey, 2011). Once the scene is declared safe, fire and EMS personnel move in to provide care, and transport the injured. This model offers the highest amount of protection for unarmed fire and EMS personnel, but the lowest chance of survival for the injured.

Data from active shooter events and large-scale drills demonstrated that use of the *stage and wait* model results in EMS care delays of one to two hours, if not longer (Goodwin, 2013; Iselin & Smith, 2009). At Columbine, medical responders did not make entry into the building until the scene was declared safe by law enforcement. Responders did not reach some of the victims at Columbine until three hours and 20 minutes after the event started, and the last injured victim was not removed from the building until four hours and 30 minutes after the attack started (Mell & Sztaknkrycer, 2005). At the 2009 Fort Hood shooting it took two hours to evacuate and transport 32 victims to area hospitals (Shepherd, Gerdes & Nipper, 2011). At the 2009 American Civic Association shooting in Binghamton, New York, medical personnel did not reach the first victim until 60 minutes after the event started, and it took three hours to remove two injured victims from the one-story building (Adams, 2013; Clark 2014).

At the 2012 Aurora Theater shooting, dispatchers did not tell medical providers the locations of victims for 17 minutes, and 27 of the victims were transported in police cars because medical providers were not accessing the victims, (Tri-Data, 2014). At the Los Angeles International Airport shooting in 2013, it took 33 minutes to provide medical care to a gravely injured airport security officer who was located less than 20 feet inside of the terminal (Associated Press, 2013). Another critically injured shooting victim at LAX airport had to use his own sweatshirt to make a tourniquet because medical providers would not enter the airport (Dillon, 2013).

The research conducted by Reed and Iselin (2009) at numerous other active shooter events found that care is delayed by more than an hour and in some cases, victims did not receive care for several hours. The goal of a new active shooter response plan is find a method by which the time to first provide care and the time to evacuate the injured are significantly less than the current average of an hour or more. Incidents continue to demonstrate that when medical providers wait for law enforcement to give an *all clear*, care is provided in hours, not minutes.

Half of the victims at an active shooter event will have moderate to severe gunshot wounds (Kaplowitz, et al., 2007; Linkous & Carter, 2009). Shooting victims frequently suffer critical wounds that require emergent treatment (FEMA, 2014a). Research conducted on ballistic injury shows that half of all deaths that occur from ballistic injury in combat occur in the first 60 minutes after the injury (Strawder, 2006). Combining the research from Kaplowitz and colleagues, Linkous and Carter, with Strawder's research demonstrates the high potential for mortality at active shooter events.

A new public safety model is required to save as many lives as possible at active shooter events (Frazzano & Snyder, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). This new model aggressively incorporates fire and EMS personnel into potentially hostile areas to treat and extract the wounded (Fabbri, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). These fire and EMS personnel operate under the protection of law enforcement in areas without obvious perpetrator threats but still with the potential of encountering hostile actions. Creation of these protocols is very difficult and complex because of the nature of the events, a lack of general consensus on the type of training needed for responders, different opinions on the optimal response protocol, and a lack of formal research on integrated response protocols.

The public expectation for responders is that every police, fire, and EMS agency is prepared to respond to active shooter events. Frazzano and Snyder (2014) stated, "The high-profile lethality of mass casualty violence events has raised the public's expectations that first responders will be poised to rapidly and skillfully protect victims from these events" (pg. 1).

Because of the repeat occurrence of active shooter events, the public expects that emergency responders will not be taken by surprise when these events occur, regardless of the size of the community.

This mixed methods descriptive case study utilized both quantitative and qualitative research. The purpose of this study was to analyze the testing of the unified police/fire/EMS active shooter response protocol in Charlotte, North Carolina, and the lessons learned from the testing of the protocol. The primary focus of current active shooter exercises primarily is law enforcement response and not the immediate care of the injured. This research examined the rapid integration of medical providers with law enforcement officers.

There has been very limited formal published research that explores the efficacy of a unified police/fire/EMS active shooter response plan. The creation of the Charlotte, North Carolina, response plan was an 18-month-long process that began in 2013 and involved multiple active shooter subject matter experts. This process was one of the largest joint active shooter response plan initiatives in the United States. The researcher analyzed the results of protocol implementation in which Charlotte Fire Department conducted 32 large-scale active shooter exercises to test the new protocol. The scripted scenario for the exercises was based on previous real active shooter events and designed to simulate realistic problems encountered by public safety responders. In addition, the scripted scenarios maintained consistency at each of the exercises. The recorded data came from archived data collected by the Charlotte Fire Department Training Academy staff during the exercises and observations submitted by the five lead instructors who led the large-scale exercises.

Public safety administrators can use the detailed information gathered from this case study to design a similar active shooter response protocol for the areas they serve. In addition, the research will provide public safety policy makers data to determine if protocol development and implementation will affect victim outcome at active shooter events. Last, the research provides the members of CAST a candid evaluation of the effectiveness of the protocol.

The researcher analyzed the data obtained during the large-scale exercises to examine two critical benchmarks, including (1) time from dispatch to first treatment for each victim and (2) time from dispatch to extraction from the building for each victim. The purpose of the quantitative data analysis was to determine if the victims were treated in less than 15 minutes from responder dispatch and evacuated from the building in less than 30 minutes from responder dispatch. Both of these timeframes represent high levels of survivability for gunshot victims if accomplished (Cain, 2008; Champion, et al., 2003; Crandall, et al., 2013; Eastridge, et al., 2012; Flynt, 2012; Smith & Callaway, 2014). The researcher then analyzed the multiple observations made by the lead instructors during the drills to establish trends, patterns, and recommendations for improvement.

This study examined the lessons learned from the testing of the new Charlotte, North Carolina joint public safety active shooter response model. Prior to creating this model, the three primary public safety response agencies in Charlotte (Charlotte Fire Department, CMPD, and MEDIC) did not have an integrated active shooter response protocol. The Charlotte-Mecklenburg Active Shooter CAST understood that active shooter events were increasing and that a response protocol was necessary to ensure public safety.

Several high profile active shooter events occurred nationwide prior to the formation of the CAST. The catalyst for creating the CAST was the Sandy Hook Elementary School shooting in Newtown, Connecticut. Members of the CAST were aware the public perception was that emergency responders are prepared and able to respond efficiently to active shooter events to minimize loss of life (Frazzano & Snyder, 2014). Members of the CAST were also aware that data demonstrated that victims were dying needlessly at active shooter events because of the delay in receiving medical care (Adams, 2013; Cullen, 2009; Flynt, 2012; Goodwin, 2013). Although Charlotte, North Carolina, has not had a significant active shooter event, the members of the CAST all recognized the high probability of an active shooter event in the community.

In 2000, CMPD began training all police officers in the department on active shooter response. For the next 13 years, CMPD was the only public safety agency in Charlotte that had trained all agency responders in active shooter response. Fire Chief Jon Hannan with the Charlotte Fire Department and Police Chief Rodney Monroe with CMPD recognized a need to train all emergency responders in active shooter response. Chiefs Hannan and Monroe convened the CAST comprised of active shooter experts to coordinate the creation of a unified response protocol and the subsequent training of nearly 4,000 responders in Charlotte. Prior to the CAST convening in 2012, there had not been such a large public safety integrated active shooter training initiative in one jurisdiction in the United States.

The quantitative research questions determined the effectiveness of the Charlotte public safety response models at active shooter events and lessons learned from the testing of the protocol. The quantitative research allowed the researcher to examine the results of the 32 large-scale exercises and determine if the responders met the goals established by the CAST. In additional, the quantitative research provided a benchmark of the Charlotte results against previously published integrated active shooter response times.

This study answered the following four quantitative research questions below with each question's hypotheses listed:

Q1. What effect does the new integrated public safety active shooter response model have on time to treatment when compared to previously published research of non-integrated active shooter response?

$H1_0$: The new public safety active shooter response plan has no significant effect on time to treatment when compared to previously published research of non-integrated active shooter response.

$H1_a$: The new public safety active shooter response plan decreases time to treatment when compared to previously published research of non-integrated active shooter response.

$H1_b$: The new public safety active shooter response plan increases time to treatment when compared to previously published research of non-integrated active shooter response.

Q2. What effect does the new integrated public safety active shooter plan have on the time to victim extraction compared to previously published research of non-integrated active shooter response?

$H2_0$: The new public safety active shooter response plan has no significant effect on to victim extraction when compared to previously published research of non-integrated active shooter response.

$H2_a$: The new public safety active shooter response plan decreases time to victim extraction when compared to previously published research of non-integrated active shooter response.

$H2_b$: The new public safety active shooter response plan increases time to victim extraction when compared to previously published research of non-integrated active shooter response.

Q3. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving treatment within the target goal of 15 minutes from dispatch of the call?

$H3_0$: Implementation of the new active shooter response protocol failed to result in all victims receiving initial treatment within 15 minutes of dispatch from the call.

$H3_a$: Implementation of the new active shooter response protocol resulted in all victims receiving initial treatment within 15 minutes of dispatch from the call.

Q4. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving extraction from the building within the target goal of 30 minutes from dispatch of the call?

$H4_0$: Implementation of the new active shooter response protocol failed to result in extraction of all victims from the building within 30 minutes of the call dispatch.

$H4_a$: Implementation of the new active shooter response protocol resulted in the extraction of all victims from the building within 30 minutes of the call dispatch.

The researcher then examined qualitative data created when the lead instructors for the 32 large-scale drills documented lessons learned following the drills. The five lead instructors created several pages of observations that they made during the drills. The instructors recorded both positive observations and negative observations. The researcher correlated the lessons learned with the quantitative data to determine methods to increase the effectiveness of this integrated response protocol.

In qualitative research, hypotheses are not tested (Ritchie & Lewis, 2003). Rather, hypotheses emerge from the research and findings (Ritchie & Lewis, 2003). The following questions guided the qualitative portion of the research:

Q1. Did responders demonstrate inappropriate response tactics during the exercises?

Q2. Where there any observed tactics that resulted in delays for either victim treatment or extraction?

Q3. Did responders encounter issues with communication or incident command?

The researcher also examined the led instructors' observations to determine which themes and patterns occurred most frequently during the exercises.

This descriptive case study utilized a mixed methods design with both quantitative and qualitative research. A case study is an appropriate research method because the research focuses on the study of a significant event (Schram, 2006). Mixed methods research allows the research to examine both quantitative and qualitative data providing stronger research.

Research Methods and Design(s)

Scientific research methods outline a process by which a researcher can answer the study's research questions. The purpose of this study was to determine the effectiveness of the protocol implementation. The CAST's self-imposed goal was for responders to access every victim and provide initial treatment within 15 minutes of dispatch of the call and then evacuate every victim from the building within 30 minutes of the call. The CAST established these goals based on data that demonstrated the highest survivability for victims with major ballistic injuries.

Second, this study also examined qualitative data to determine themes and patterns from the observations recorded by the lead instructors. Because this case study examined archived data, the study was a non-experimental case study (Cantrell, 2011; Schram, 2006). The study was different from an experimental design because there was no control of the independent variables and no random assignment of participants (Cantrell, 2011).

Mixed methods research combines both qualitative and quantitative research methods (Creswell, 2009). Mixed method research uses different collection and analysis methods to research a single paradigm. The focus of quantitative research is numbers and hard objective data. The researcher can use quantitative research if qualitative research cannot meet the research objective (Zikmund, Babin, Carr, & Griffin, 2010). Quantitative research provides measureable results; whereas qualitative research provides results left to interpretation (Anderson, 2006). Mixed method research provides stronger research than a study where the research uses either quantitative or qualitative research independently.

Mixed method research offers four distinct benefits, including (a) verification purposes, (b) estimating possible errors in the data measurement, (c) facilitate monitoring of data collection; and, (d) probing a data set to determine the meaning (Johnson, Onwuegbuzie, & Turner, 2007). Johnson and colleagues stated that mixed methods can help to discover and handle threats of validity, as well as ensuring good scientific validity by enhancing the validity of methods and research findings. Mixed methods typically have a qualitative or quantitative core component that directs the basic assumption with a qualitative or quantitative supplementary component (Johnson et al., 2007).

Mixed method research allows application of different approaches throughout the research (Buber, Gadner, & Richards, 2004). Mixed method research employs statistical and interpretive research analysis. This analysis aids in providing a better view of the research. Mixed methods research is both a logical and an intuitive research methodology. Variables and data sometimes do not offer clear explanations, and thus the numeric analysis could be better explained through descriptive quantitative analysis (Buber et al., 2004).

Quantitative research condenses data, reduces the number of variables, and comes from precise measurements, whereas qualitative research enhances data, addresses themes and generalizations, and comes from documents and transcripts. Quantitative and qualitative research overlap, but the most striking difference appears in data analysis. Quantitative analysis occurs by using statistics and qualitative analysis to extract themes and generalizations. These themes and generalizations can present the data in a coherent and understandable presentation.

The quantitative portion of the research examines the archived records captured by the Charlotte Fire Department Training Academy staff that shows the time to treatment and time of victim extraction from the 32 large-scale active shooter exercises. The researcher explored the target goals established by the CAST and created hypotheses as to why these goals were or were not met. Quantitative data is appropriate when observations include the numerical representation when explaining a particular phenomenon and observations (Babbie, 2010).

The qualitative portion of the research examined the observations made by the Charlotte Fire Department Training Academy staff during the large-scale exercises. The staff made numerous observations throughout the large-scale drills. Many of these observations include suggestions for ways that the response protocol and procedures can be modified to increase the response effectiveness. Although this research could have stopped with the analysis of the quantitative data, it is the researcher's opinion that the most important data collected came from the observations by the exercise instructors. The quantitative data demonstrated the effectiveness of the Charlotte Fire Department protocol implementation. However, the qualitative data provided analysis of critical factors that could be relevant for any jurisdiction looking to implement similar protocols.

The case study method was appropriate for this study, focusing results achieved by a particular group of people working to solve a problem in a confined geographical location (Schram, 2006). A case study was the appropriate research method because the research focuses on the study of a significant event (Schram, 2006). The purpose of the case study was to examine the complexity of a single event and the potential relationship that this event would have at similar future events (Yin, 1994). According to Yin (2003), qualitative case study research allows the researcher the opportunity to answer *how* and *why* questions when the behavior of the participants is not manipulated by the researcher. Yin (2003) recommended the qualitative case study approach when there are relative contextual conditions to the phenomena studied and when the researcher does not clearly understand the boundaries between context and the phenomena.

The Charlotte Fire Department is a fully paid, large, metropolitan fire department protecting approximately 300 square miles (Charlotte Fire Department, 2013). The Charlotte Fire Department is one of the top 15 largest fire departments in the United States. Charlotte is the 16th largest city in the United States with a population of 800,000 people and a metro population of 2.3 million (Bell, 2014; Chesser, 2013). Charlotte is also the ninth fastest growing city in the United States, with the population increasing more than 33% since 2000 and expected to increase 70% in the next decade (Troyer, 2015).

The department staffs 42 fire stations strategically located throughout the city of Charlotte (Charlotte Fire Department, 2013) (See Appendix A: *Charlotte Fire Station Locations*). The Charlotte Fire Department has 1,164 full-time positions, with 1,044 personnel assigned to the Operations Division (Charlotte Fire Department, 2013). The Charlotte Fire Department staffs 41 engine companies, 15 ladder companies, two heavy rescue companies, and six aircraft firefighting vehicles from the fire stations located in the city (Charlotte Fire Department, 2013). The minimum staffing for all engine and ladder companies is four personnel. The fire department staffs both of the two heavy rescue companies with five personnel. In addition, there are eight battalion chiefs on duty 24 hours a day, responsible for commanding complex emergencies. There are an assortment of other vehicles that fire personnel cross-staff, including five hazardous material response companies, five brush trucks, two dive rescue vehicles, two fire boats, four water tankers, and other specialized rescue vehicles. The Charlotte Fire Department responds to an average of 108,000 emergency calls every year (R. Granger, personal communication, December 11, 2014). The minimum on-duty daily 24-hour staffing for the fire department is 248 personnel (R. Granger, personal communication, December 11, 2014).

The Charlotte Fire Department provides first responder medical care at the Emergency Medical Technician-Basic level. The Charlotte Fire Department does not provide transport capabilities for victims. All advanced life support medical care is provided by MEDIC, the county EMS transport provider. In 2014, MEDIC responded to 118,578 calls for service and transported 93,964 patients (M. Stanford, personal communication April 1, 2015). MEDIC utilizes a dynamic deployment system, commonly known as system status management. The dynamic deployment system determines ambulance staffing and locations based on previous call data. During the day, as many as 50 ambulances may be staffed, but at night the staffing may fall to 20 ambulances (M. Stanford, personal communication April 1, 2015).

The 32 large-scale exercises took place at 701 East Martin Luther King Junior Boulevard in Charlotte, North Carolina. The location for the exercises was the vacant six-story Charlotte-Mecklenburg Schools Education Center located in downtown Charlotte. This building sits on 5.91 acres and is 88,446 square feet (Charlotte-Mecklenburg Schools, n.d.). The Charlotte-Mecklenburg School District gave permission for the Charlotte Fire Department and Charlotte-Mecklenburg Police Department to conduct the active shooter exercises in this facility.

The two exercises used scripted scenarios based on historical active shooter events (see Appendix B and Appendix C). Each scenario was scripted with one perpetrator and 18 victims. The victims were a mixture of mannequins and real actors. Each victim had a card that listed the victim's injuries. The CAST used the same location for the victims and same cards throughout the 32 exercises to maintain consistency.

The Charlotte Fire Department Training Academy assigned training groups in advance for personnel. The personnel then responded on their assigned date and time. All personnel knew in advance that they were coming to active shooter training exercises. Personnel arrived on scene and the lead instructors gave all personnel a quick 10-minute briefing on the rules of the training. Instructors reminded personnel to wait in their apparatus until Fire Communications told each company that they were on scene. This provided an accurate response time configuration for the companies.

To simulate the staggered response of fire apparatus at normal events, the Charlotte Fire Department Communications Division (Fire Alarm) determined actual response times for apparatus responding from their stations to the simulated active shooter locations. In Exercise

One, the location was simulated to be 701 East Martin Luther King Boulevard. This location represented a downtown location in which fire apparatus could normally respond quickly based on the high density of fire stations located nearby. In Exercise Two, the location was simulated to occur at 13860 Ballantyne Corporate Place. This address simulated a location in far Southeast Charlotte, in which fire apparatus would have a longer response time because of the lower density of fire stations in that area.

In Exercise One, the average simulated fire apparatus response time was 3 minutes and 21 seconds (See Table 3). The minimum response time was 2 minutes and 19 seconds, and the maximum apparatus response time was 5 minutes and 24 seconds. The first arriving *battalion chief* had a simulated response time of 2 minutes and 19 seconds, and the second arriving battalion chief had a simulated response time of 5 minutes and 24 seconds.

Table 3

Scenario One Apparatus Response Time from the Station to the Simulated Location

Engine 1	2m 19s
Ladder 1	2m 19s
Battalion 1	2m 19s
Engine 2	2m 58s
Ladder 2	2m 58s
Engine 4	2m 58s
Engine 6	3m 35s
Rescue 10	5m 24s
Battalion 3	5m 24s
Average	3m 21s
Standard Deviation	1m 10s
Sample Size	9
Confidence Coefficient	1.96
Margin of Error	2m 12s
Upper Bound	5m 34s
Lower Bound	1m 9s
Maximum	5m 24s
Minimum	2m 19s
Range	3m 5s

In Exercise Two, the average simulated fire apparatus response time was 8 minutes and 11 seconds (See Table 4). The minimum fire apparatus response time was 4 minutes and 41 seconds. The maximum fire apparatus response time was 17 minutes and 29 seconds. The first arriving battalion chief had a simulated response time of 9 minutes and 45 seconds. The second arriving battalion chief had a simulated response time of 10 minutes and 15 seconds.

Table 4

Scenario Two Apparatus Response Time from the Station to the Simulated Location

Engine 32	4m 41s
Ladder 32	4m 41s
Engine 24	5m 32s
Ladder 24	5m 32s
Engine 9	6m 3s
Engine 20	9m 45s
Battalion 5	9m 45s
Battalion 7	10m 9s
Rescue 3	17m 48s
Average	8m 11s
Standard Deviation	3m 55s
Sample Size	9
Confidence Coefficient	1.96
Margin of Error	5m 20s
Upper Bound	13m 31s
Lower Bound	2m 50s
Maximum	17m 48s
Minimum	4m 41s
Range	12m 48s

During the exercises, the instructors did not provide coaching or response instructions for personnel. Instead, the instructors documented observations and allowed the personnel to respond to the exercise scenario. This provided the instructors with a candid evaluation of the effectiveness of the protocol and observations of how personnel would most likely perform during actual events.

The Charlotte Fire Department Training Academy staff performed all of the data collection at the exercises. At each exercise, there were a minimum of four lead instructors and four Charlotte Fire Training Academy personnel supervising the exercises. As responders encountered each victim, training staff recorded the time on a spreadsheet. As responders removed each victim from the building, training staff again recorded the time on a spreadsheet.

Population

This research analyzed previously collected archived data from the Charlotte Fire Department Training Academy staff. The population utilized by the Charlotte Fire Department consisted of all 1,044 firefighters assigned to the Operations Division. All participants were full-time employees of the Charlotte Fire Department and were required by the Chief of the Fire Department to participate in the drills. The age range of the participants was from 20 years to 65 years. Charlotte Fire Department participants were both male and female. Additional participants were from the Charlotte-Mecklenburg Police Department, Special Weapons and Tactics team. The police department participants were required by the Chief of the Police Department to participate in the drills. The age range of the police department participants was 25 years to 50 years of age (E. Peterson, personal communication December 2, 2014).

Prior to participating in the large-scale active shooter exercises, each member of the fire department attended four hours of lecture training on active shooter events and implementation of the Rescue Task Force model. This training was provided by the Charlotte Fire Department Training Academy staff and took place from September through December of 2013. Participants also viewed an online educational model on the new active shooter response protocol and had to successfully pass an online test.

Sample

The sample population for this research consisted of fire and law enforcement responders from Charlotte, North Carolina. The study was limited to responders from the Charlotte Fire Department Operations Division and participatory responders from the CMPD SWAT team.

Because all personnel from the Charlotte Fire Department Operations Division participated in the training, this training provided a cross-sectional method of design where people of different age were studied at one point in time (Babbie, 2010).

The sample of participants for this study was a purposive sample. A researcher utilizes purposive sampling when investing a particular phenomenon with an identified group of participants (Patton, 2002). The researcher chose the Charlotte Fire Department because the Charlotte Fire Department was the only large fire department in North Carolina creating and implementing a joint public safety active shooter response protocol. In addition, the Charlotte Fire Department had the resources to conduct 32 large-scale exercises; resources that nearly all fire departments in North Carolina do not have. The researcher also chose the Charlotte Fire Department because the Charlotte Fire Department Training Academy staff already collected and archived the data. There was no other archived data similar to this available in North Carolina or in the United States.

Because this study utilizes archived data, no participant consent form was necessary. The Charlotte Fire Department provided a letter authorizing the researcher to examine the data collected from the exercises and publish conclusions from the research. The Charlotte Fire Department stripped all identifying data of personnel and fire apparatus assignments from the data before giving it to the researcher. Removing the identifying data ensures complete individual anonymity in the research. In addition, the Charlotte Fire Department provided the researcher the recorded observations from the lead instructors for analysis and to make conclusions.

Materials/Instruments

In the large-scale active shooter exercises, the Charlotte Fire Department gathered the time data from the participants. All members of the Training Academy staff decided before the large-scale exercises that the staff would collect data on response effectiveness during the drill. The training staff gathered several data points, with a primary emphasis placed on time to initial treatment of the victims and time to extraction of the victims from the crisis site. Data was collected on 578 victim encounters during the 32 exercises.

Prior to the start of the drill, members of the CAST carefully scripted the active shooter exercises (Appendix B and Appendix C). The two scenarios both replicate characteristics of a *basic* active shooter event (Oregon TITAN Fusion Center, 2013). A basic active shooter event involves a single perpetrator, armed with a handgun, attempting to kill or killing in one location (Oregon TITAN Fusion Center, 2013). In both scenarios, the perpetrator died of a self-inflicted gunshot wound at 7 minutes and 15 seconds into the event. This information was relayed to the responders during the drill by the 911 dispatchers participating in the exercise.

The two scenarios used actual response times simulating responding apparatus coming from the stations. The Charlotte Fire Department Communications Center (Fire Alarm) supplied the CAST with the response times. One minute was added into the response times to simulate turnout of personnel to the vehicles after receiving the dispatch. Scenario One used an address located in downtown Charlotte (see Appendix D). This area of the city has multiple resources because of the population density. The majority of all responding apparatus would come from stations located in a five square mile radius. In Scenario Two, the CAST selected a location in far south Charlotte (see Appendix E). The CAST selected this location because of the delay in response apparatus because of fewer fire stations in that part of the city. Some apparatus responded from fire stations located more than 12 miles away.

At the exercises, participating fire personnel had to wait at their apparatus until the simulated dispatch and response time expired. A Charlotte Fire Department training officer ensured that personnel waited to simulate the arrival on the scene until their dispatch and response time expired. The purpose of the simulated dispatch and response time was to prevent an unrealistic dump of resources on the scene at the start of the simulated exercise.

The Charlotte Fire Department lead instructors provided instructions to all participants prior to the start of the exercises. Fifteen participants were randomly selected by the Charlotte Fire Department to act as victims in each scenario. A separate radio channel was used just for the victims to talk with the Training Staff proctor. All participants used radios assigned to them by the Charlotte Fire Department. The Charlotte Fire Department Training Academy staff instructed each participant to use their fire department radio to notify a Training Academy proctor at three times during the exercise: (1) time of first contact by fire department personnel providing point-of-wounding care, (2) time that fire department responders began removing the victim from the building, and (3) time that the victim was outside of the building in the Triage location. The Training Staff proctor then notated these times in a master record book.

Charlotte Fire Department Training Academy staff placed all victim participants in designated locations prior to the start of the drill. The CAST previously established the victim locations in the exercise master plan which coincided with the event information given to the responders. Although the locations of the victims changed between Exercise One and Two, all training simulations used the same victim locations for the two exercises to maintain consistency.

Charlotte Fire Department staff conducted Scenario One a total of 17 times and Scenario Two 15 times. There were two days in which training staff could not complete the second scenario. In the first case, the Charlotte-Mecklenburg Police Department SWAT team was activated on an emergency response shortly after completing the first scenario. The SWAT team then remained on the callout for the duration of the day, thus training staff could not run Exercise Two. At the second case, Charlotte Fire Department personnel were required to terminate the training after the first exercise because of a winter storm and increased call volume in the city necessitating the availability of all emergency responders.

The Charlotte Fire Department Training Academy staff collected all of the quantitative data into a master spreadsheet. This spreadsheet list the date and times of the exercises as well as the data collected during the exercises. The Charlotte Fire Department provided the researcher with this raw data spreadsheet for analysis.

At the beginning of the planning for the exercises, all instructors and the Charlotte Fire Department Training Academy staff planned to have analysis conducted of the efficacy of the exercises upon completion of the training. The data was originally collected to determine the effectiveness of the active shooter protocol implementation. The Charlotte Fire Department collected the data but did not have the time or resources to provide a scholarly analysis of the data. Without the researcher’s support, the Charlotte Fire Department would not have utilized the results of the data collection. The Charlotte Fire Department requested that the researcher provide an analysis of the efficacy of the drills and the subsequent observations made by the instructors. Prior to the start of the exercises, all instructors and training staff members received notification by the Charlotte Fire Department Training Academy staff that the observations would be used at a later date in a complex analysis of the drills.

At the completion of the 32 exercises, the Charlotte Fire Department requested the lead instructors and the participating members of the Charlotte Fire Department Training Academy staff to document observations made during the exercises. The purpose of this documentation was to provide an opportunity for analysis at a later date. The instructors were told to list any observations that could provide insight into ways that the Charlotte Fire Department could improve the response protocol. The eight pages of observations were divided into (1) fire response considerations, (2) law enforcement response considerations, (3) command and control considerations, and (4) recommendations for future training. It is important to note that the researcher elected not to use approximately half of the observations, as this information directly affects tactical operation response to active shooter events. This information is considered *Law Enforcement Sensitive*, and is not appropriate for open source publication.

The purpose of this research was to analyze the observations to find themes and correlations to the results of the quantitative data. Quantitative data is important, in that the data provides a numerical representation of the effectiveness of the new protocol. However, the qualitative research is critical in understanding the experiences and observations of the lead instructors explained in their words without reduction to a statistical representation. The analysis of the participants' archived responses provided an opportunity to analyze the responses without influence from the researcher. The observations allowed the participants to provide authentic feedback on their experience and observations during the exercises.

Operational Definition of Variables

There are two primary constructs examined in the quantitative portion of this research. The first is the time taken by fire responders to initially access the victims, and the second is the time taken by fire responders to extract the victims from the buildings. Previous researchers have shown that it takes an average of 60 to 120 minutes to perform these two functions at active shooter events (Goodwin, 2013; Iselin & Smith, 2009). The research conducted by Goodwin, Iselin, and Smith is the control group against which this researcher measured efficacy of the new protocol.

Time to access the victims after dispatch of the call. The first construct is analysis of the time that it took responders to access and give initial simulated (voice) treatment for the 18 victims in each of the two scenarios during the course of 32 evolutions. The only exception to the voice treatment was responders applied a CAT-2 training tourniquet (North American Rescue) to victims with simulated massive extremity hemorrhage. The Charlotte Fire Department issued all apparatus CAT-2 tourniquets to use for victims with gross extremity hemorrhage. The Charlotte Fire Department Training Staff wanted providers to practice using this equipment at the scenarios.

These response times were measured in minutes and seconds, with the time started at the dispatch of the scenario. The time ended when the first fire department responder made initial access to the victim and provide voice treatment of the victim. A central timekeeper recorded all times as reported by the victims. The researcher analyzed these recorded times for the following data benchmarks: (1) mean time to access each victim, (2) frequency that each victim was accessed within the 15 minute goal imposed by the Charlotte Fire Department; and, (3) graphic analysis of the total time to access and treat each victim.

Time to extract the victims from the building after dispatch of the call. The second construct is the analysis of the time that it took responders to extract the 18 victims in each of the two scenarios during the course of 32 evolutions. These response times were measured in minutes and seconds, with the time started at the dispatch of the scenario. The time ended when the responders removed the victim from the building and delivered the victim to the established triage location outside of the building. A central timekeeper recorded all times as reported by the victims. The researcher analyzed these recorded times for the following data benchmarks: (1) mean time to remove each victim, (2) frequency that each victim was extracted within the 30 minute goal imposed by the Charlotte Fire Department; and, (3) graphic analysis of the total time to extract each victim.

The Charlotte Fire Department provided all engine, ladder, and heavy rescue companies with commercial victim extraction equipment. The Charlotte Fire Department trained all operations members on this equipment during the classroom portion of the active shooter training. The Charlotte Fire Department issued each company two XS-1™ drag straps (North American Rescue) and two Emergency Evacuation Litters™ (North American Rescue). The ladder companies and rescue companies were each issued a Sked™ litter (Skedco). All companies were allowed to use these tactical evacuation devices during the scenarios.

During all of the exercises, instructors did not allow personnel to utilize the two elevators in the building. The instructors did this for two reasons. First, law enforcement typically secures the elevator and stops the elevator from use to prevent perpetrator movement in the building. Second, the instructors wanted to see the responders manually move victims in the building utilizing different extraction devices.

Data Collection, Processing, and Analysis

This research examined archived data that the Charlotte Fire Department previously recorded. The quantitative data was provided to the researcher in raw form in a spreadsheet. There were 17 spreadsheets from Exercise One and 15 spreadsheets from Exercise Two. Each of the spreadsheets listed the victims in numerical order from 1 to 18. Next to each victim, the time was recorded when firefighters first accessed the victim and provided simulated care and the time when the victim was removed from the building. In addition, multiple victims had times recorded when responders moved the victim from their initial injury location to a *casualty collection point*, and then moved again outside of the building to the formal triage location.

Analysis of this data was conducted to determine the average time for initial treatment for each victim and the average time for extraction for each victim from the building. The researcher then matched these averages against the goals established by the CAST prior and previous document averages to determine if the objectives were met. Analysis of the qualitative data occurred to search for themes in the instructors' observations. The instructor's made observations unique to these exercises; however, the instructors also made observations that demonstrate common themes seen in documented active shooter events. The researcher then compared the instructor observations with the quantitative data to determine methods by which responders can reduce the time to treat and time to evacuate in future exercises and actual events.

Assumptions

The researcher made certain assumptions in this research. Babbie (2010) found that there are limitations and assumptions in all legitimate scientific research. This case study research involved three basic assumptions. The first assumption is that the fire personnel understood the concepts of the Rescue Task Force model that the Charlotte Fire Department Training Academy staff taught all personnel. The second assumption is that the quantitative data collected by the Charlotte Fire Department was recorded correctly during the exercises. The final assumption is that the lead instructors and training staff provided candid, forthright observations of the drills.

Limitations

There were minimal limitations in this study; however, as with most research efforts, there were potential limitations. This study examined archived data, thus the researcher was limited to make generalizations based on the data provided. In addition, some of the data was incomplete. In the large-scale exercises, victims radioed the scenario proctor their times when they were first treated by fire personnel and then when they were evacuated by fire personnel. During the scenario, fire personnel would often discover multiple victims in close proximity to each other. The discovery of multiple victims created a large amount of radio traffic, as victims radioed the scenario timekeeper their times.

In several cases, logical assumptions can be made regarding time to first treatment. The researcher makes this logical assumption when victims were located immediately adjacent to each other within obvious view of each other and one victim reported contact by fire personnel but the other did not. The logical assumption is that both victims received point of wounding care at the same time. This assumption is not carried forward to victim extraction. It is not a logical assumption to assume that responders removed both victims from the building at the same time. Responders prioritized removal of victims from the building based on the victim's simulated injuries.

One limitation of this exercise was the sole use of CMPD SWAT officers as force protection officers for the Rescue Task Forces. The CAST only used participants from the CMPD SWAT team because at the time of the large-scale exercises, the Patrol Division of CMPD had not received any training in the Rescue Task Force model. In addition, the decision was made by the CAST to use only CMPD SWAT officers to demonstrate the correct method of Rescue Task Force protection. The concern was that there would be an inconsistency of quality of officers during the 32 exercises, with some police officers conducting inappropriate Rescue Task Force operations. In addition, the CAST determined that SWAT personnel provided the best cadre of personnel with which to provide evaluation of the new model during the exercises. The researcher is very aware that SWAT personnel typically are highest trained unit of police officers, many with extensive training in active shooter response. If the researcher conducted the same large-scale exercises with patrol officers, the time to initial victim treatment and time to victim extraction may have significant increases. This is an area that warrants further research.

Another limitation of this research was the law enforcement sensitive nature of the active shooter response protocols. The focus of this research was to provide responders with research to improve the effectiveness of response to active shooter events. The researcher is acutely aware that previous active shooter perpetrators have extensively studied other attacks to make their attack even deadlier (Brunt, 2012; Cullen, 2009; Fast, 2009; FBI, 2013b; Kass, 2009; Nichols, 2010; Phillips, 2007; Sinai, 2013; State of Connecticut Division of Criminal Justice, 2012; United States Fire Administration, 2008). The researcher ensured that no tactical operation information was included in this paper. In addition, the researcher sent this manuscript over to the CAST for review prior to publication to ensure that no law enforcement sensitive information was inadvertently placed in this publication.

The greatest limitation of this research is the inability to simulate variables and response conditions that occur at real active shooter events. Although the creators designed this training to emulate an active shooter event, there is simply no substitute to the stressors that are inherent to real active shooter events. These stressors include the threat of potential serious injury or death to responders; the potential for multiple fatalities, including children; responders' personal relationships to the victims; potential for explosive devices; fire; smoke; and other variables that can severely tax responders' mental and physical abilities.

Delimitations

This study is delimited in scope to include only responders from the Charlotte Fire Department and police officers from the CMPD SWAT team. Another limitation of this study was the limited number of CMPD police officers available during each exercise. Each exercise utilized 10 police officers. These officers assumed the role of Rescue Task Force protection. All exercise participants were instructed before the scenario that there was a simulated cadre of officers responding into the building and going direct to the threat. Instructors advised the exercise participants that the CMPD police officers available represented the next wave of officers who would escort the Rescue Task Forces.

Another limitation to this study is the size of the Charlotte Fire Department and the resources available in the nation's 16th largest city. The Charlotte Fire Department's active shooter response policy dictates that a minimum of 32 firefighters and two chief officers will respond to a reported active shooter event. These 32 large-scale exercises utilized this same number of personnel. In North Carolina, there are approximately 1,300 fire departments with 75% of these departments served by volunteers (D. Clouston, personal communication on December 5, 2014). This number is also reflected nationwide, where 71% of all fire departments are served by volunteers (United States Fire Administration [USFA], 2015). Many of these departments lack the ability to provide a significant number of personnel quickly to serious events, such as an active shooter event. Smaller fire departments may have difficulty accomplishing the results achieved by the Charlotte Fire Department during these exercises.

Ethical Assurances

The Collaborative Institutional Training Initiative (CITI) is a project with the University of Miami that provides internet-based training programs in human research subject protections (Collaborative Institutional Training Initiative [CITI], 2014). The researcher completed CITI's course entitled, "Basic Course in the Protection of Human Research Subjects". This course provided training on legal and moral protections that are afforded to any human that participates in research or testing.

In addition, the researcher obtained permission from the Northcentral University (NCU) Institutional Review Board (IRB) prior to conducting any research. This permission process included completion and submission of the IRB application, followed by approval of the NCU IRB. No research occurred prior to IRB approval. In addition, the Charlotte Fire Department issued the researcher a permission letter authorizing the researcher to examine the data and make conclusions from the data (see Appendix F). The Charlotte Fire Department stripped any personal identifiers from all of the archived data given to the researcher. Because this research examined archived data collected by a government agency, an exempted review status was approved by IRB (see Appendix G).

While the researcher anticipated no ethical concerns during the research, the researcher was fully aware that if any concerns did arise, he was ethically obligated to immediately respond according to the guidelines established by the American Psychological Association ([APA], 2010) Ethics Code; the Committee on Science, Engineering, and Public Policy's ([CSEEP], 2009) *On Being a Scientist*, and the standards of professional conduct established by Northcentral University (2014). Integrity and ethical considerations are minimal, as this research examined archived data. An important consideration was maintaining the anonymity of the participants to allow for genuine responses. The researcher ensured all removal of the names of the instructors who provided feedback on the scenarios in the research. The removal of the instructors' names minimized any potential consequences of involvement in this research. Great consideration was given to minimizing or negating any potential consequences for the participants.

Researchers must recognize potential biases that they may possess. The most potential ethical concern in this research was the researcher's involvement during the creation and administration of the 32 large-scale exercises. The researcher is a member of the CAST and one of the people responsible for ensuring creation and application of the protocol. The researcher, as well as the CAST understood at the onset of the development of this protocol that no protocol template existed. The researcher and the CAST clearly understood that this protocol would require refinement as the CAST learned lessons from the multiple large-scale exercises. The researcher recognizes that there may be an appearance of bias desiring to prove success with the protocol implementation. However, the true success comes from understanding lessons learned during the exercises and developing methods to continue to reduce the time to initial treatment of victims and the time to evacuate victims from the building. Defining success for these drills is valuable only to the Charlotte Fire Department. Understanding lessons learned is valuable to all public safety agencies.

Summary

Active shooter events continue to increase, and these events have an increasing number of victims (Blair & Schweit, 2014; DHS & FBI, 2012; Dillon, 2013; Dumitriu, 2013; Madfis, 2014). Retrospective analysis of multiple active shooter events demonstrates that victims are dying inside while waiting for care (Goodwin, 2013, Jacobs, 2013). Numerous public safety organizations have stated that a new response model is required in order to save the most number of victims at these events (Fabbri, 2014; Frazzano & Snyder, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013). The use of the Rescue Task Force is a model recommended by many public safety experts (Fabbri, 2014; Iselin & Smith, 2009; Kue & Kearney, 2014; Roberts, 2013).

There has been very limited formal published research that explores the efficacy of a unified police/fire/EMS active shooter response plan. The creation of the Charlotte, North Carolina response plan was an 18-month-long process that began in 2013 and involved multiple active shooter subject matter experts. This process was one of the largest joint active shooter response plan initiatives in the United States. The research analyzed the results of protocol implementation in which Charlotte Fire Department conducted 32 large-scale active shooter exercises to test the new protocol. The scripted scenario for the exercises was based on previous real active shooter events and designed to simulate realistic problems encountered by public safety responders. In addition, the scripted scenarios maintained consistency at each of the exercises. The recorded data came from archived data collected by the Charlotte Fire Department Training Academy staff during the exercises and observations submitted by the instructors who led the large-scale exercises.

This research was a descriptive case study utilizing mixed methods research. This research examined the results obtained when the Charlotte Fire Department conducted 32 large-scale active shooter exercises utilizing the new Rescue Task Force model for active shooter response. The quantitative analysis of this research examined the success of the new model when responders conducted the full-scale active shooter exercises. The CAST established a self-imposed goal that all victims would receive initial care with 15 minutes of the dispatch of the call and that responders would extract all victims from the building within 30 minutes of dispatch. These treatment and extraction goals provide the victims with the highest chance of survivability while maintaining reasonable expectations of responders (Kaplowitz, et al., 2007; Linkous & Carter, 2009; Strawder, 2006). The quantitative data analysis answered four research questions analyzing the effectiveness of the new protocol and the effectiveness of the Charlotte responders at the 32 large-scale exercises.

The qualitative research examined the observations created by the five lead instructors compiled following the exercises. The researcher examined the observations to determine common themes and patterns. The researcher then correlated the observations with the results of the quantitative data analysis to determine methods by which responders can reduce the time to treat and time to extract the victims.

Chapter 4: Findings

The purpose of this descriptive case study was to examine the results obtained when the Charlotte Fire Department conducted 32 large-scale exercises utilizing the new, integrated Rescue Task Force model for active shooter response. To begin this section, the researcher examined the quantitative part of the data. The following four quantitative research questions guided this part of the study:

Q1. Will an integrated public safety active shooter response model decrease the time for point-of-wounding care when compared to previously published research of non-integrated active shooter response?

Q2. Will an integrated public safety active shooter plan decrease the time to victim extraction compared to previously published research of non-integrated active shooter response?

Q3. Did the implementation of the new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving point-of-wounding care within the target goal of 15 minutes from dispatch of the call?

Q4. Did the implementation of the new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving extraction from the building within the target goal of 30 minutes from dispatch of the call?

Quantitative Results

Preliminary screening. Before any analyses began, the data provided by the Charlotte Fire Department was screened for missing data. In several cases, training staff missed times for victim first care and victim extraction (see Table 5). This missed data occurred because of one of three reasons, (1) victims forgot to radio the scenario proctor when they were treated or moved, (2) victims were unable to broadcast on the radio to the scenario proctor because of other people broadcasting on the radio, or (3) the scenario proctor missed the radio transmission and failed to record the time on the spreadsheet. However, as demonstrated in Table 5, training staff captured 284 of 306 times of point-of-wounding care in Scenario One, for a 93% data capture rate. Table 5 also shows that training staff captured 267 of 306 extraction times in Scenario One for an 87% data capture rate. Table 6 shows that in Scenario Two, training staff captured 254 of 270 times for point-of-wounding care, for a 94% data capture rate. Table 6 also shows that training staff captured 234 of 270 extraction times in Scenario Two, for an 87% data capture rate. Although some data was incomplete, the data that the scenario proctor recorded provided a significant number by which the researcher could draw conclusions.

Table 5

Scenario One Percentage of Captured Point-of-Wounding Care and Extraction Data by Victim for 17 Exercises

Victim #	Time to First Treatment	Time to First Treatment Capture %	Time to Extraction	Time to Extraction Capture %
1	16	94%	16	94%
2	15	88%	14	82%
3	15	88%	14	82%
4	14	82%	13	76%
5	17	100%	15	83%
6	17	100%	15 (1 DOA)	100%
7	15	88%	15	94%
8	15	88%	14	82%
9	17	100%	4 (13 DOA)	100%
10	15	88%	12	71%
11	16	94%	16	94%
12	17	100%	14	82%
13	17	100%	15	94%
14	14	82%	17 DOA	100%
15	16	94%	2 (14 DOA)	94%
16	15	88%	13	76%
17	16	94%	13	76%
18	17	100%	17 (DOA)	100%
TOTAL:	**284/306**	**92.8%**	**267/306**	**87.3%**

Table 6

Scenario Two Percentage of Captured Point-of-Wounding Care and Extraction Data by Victim for 15 Exercises

Victim #	Time to First Treatment	Time to First Treatment Capture %	Time to Extraction	Time to Extraction Capture %
1	15	100%	12	80%
2	13	87%	6 (11 DOA)	100%
3	15	100%	12	80%
4	15	100%	14	93%
5	14	93%	13	87%
6	14	93%	13	87%
7	15	100%	11	73%
8	14	93%	11	73%
9	15	100%	13	87%
10	15	100%	13 (2 DOA)	100%
11	13	87%	11	73%
12	14	93%	14	94%
13	14	93%	11	73%
14	14	93%	15 DOA	100%
15	14	93%	15 DOA	100%
16	14	93%	12 (1 DOA)	87%
17	14	93%	11	73%
18	15	100%	15 DOA	100%
TOTAL:	**257/270**	**95%**	**234/270**	**87%**

Quantitative Research Question One. What effect does the new integrated public safety active shooter response model have on point-of-wounding care time when compared to previously published research of non-integrated active shooter response?

Traditional fire department and EMS response to potentially violent incidents require fire and EMS personnel to wait blocks away until the scene is declared safe by law enforcement (Morrissey, 2011). Data from active shooter events and large-scale drills demonstrated that use of this model results in medical care delays of one to two hours, if not longer (Goodwin, 2013; Iselin & Smith, 2009). The Arlington, Virginia Fire Department found that victims would frequently wait anywhere from 90 minutes to 2.5 hours to receive care at active shooter drills when responders used this model (Iselin & Smith, 2009). Using the data collected from Goodwin, Iselin, and Smith, the researcher determined that the national average point-of-wounding time was a minimum of 60 minutes from first dispatch of emergency response personnel. It is against this time that the researcher benchmarked effectiveness of the 32 active shooter exercises.

Prior to the start of the exercises, the CAST established an internal target to provide point-of-wounding care to all victims within 15 minutes from the first dispatch. No national established benchmark or best practice timeframe existed for ideal point-of-wounding care. However, data from combat casualties demonstrate the highest survivability for victims occurs when care is provided almost immediately at the time of injury (Cain, 2008; Champion, Bellamy, Roberts & Leppaniemi, 2003; Crandall, et al., 2013; Eastridge, et al., 2012; Flynt, 2012; Smith & Callaway, 2014).

In Scenario One, the collected times for point-of-wounding care for all victims was compiled into an Excel spreadsheet for analysis. The sample size was 264 documented victim encounters. The mean time for point-of-wounding care for all victims was 18 minutes and 56 seconds. The standard deviation was 10 minutes and 40 seconds. A 95% confidence coefficient was utilized to determine a margin of error of 1 minute and 17 seconds. The maximum time for point-of-wounding care was 51 minutes and 35 seconds. The minimum time for point-of-wounding care was 2 minutes and 2 seconds. Table 7 provides a comprehensive analysis of each victim, including the following point-of-wounding times: mean time, standard deviation, margin of error, upper bound, lower bound, maximum, minimum, and range. Table 8 provides the victim's location in the building. Table 9 provides the victim's simulated injuries.

Table 7

Scenario One Time for Point-of-Wounding Care from Start of Scenario (Confidence Coefficient of 1.96)

	Average	Standard Deviation	Sample Size	Margin of Error	Upper Bound	Lower Bound	Maximum	Minimum	Range
Victim 1	05m 58s	09m 02s	16	02m 29s	08m 27s	03m 33s	22m 04s	02m 17s	19m 47s
Victim 2	17m 47s	12m 47s	15	06m 29s	24m 16s	11m 17s	45m 30s	05m 47s	39m 43s
Victim 3	18m 00s	12m 41s	15	06m 25s	24m 26s	11m 35s	45m 30s	06m 22s	39m 08s
Victim 4	11m 43s	02m 58s	14	01m 33s	13m 16s	10m 10s	17m 27s	06m 06s	11m 21s
Victim 5	19m 11s	07m 35s	17	03m 36s	22m 46s	15m 35s	44m 57s	09m 04s	35m 21s
Victim 6	21m 03s	09m 24s	17	04m 41s	25m 43s	16m 22s	40m 33s	09m 38s	30m 55s
Victim 7	19m 42s	07m 37s	15	03m 51s	23m 34s	15m 51s	40m 40s	09m 46s	30m 54s
Victim 8	17m 47s	04m 58s	15	02m 01s	20m 18s	15m 16s	30m 20s	09m 43s	20m 37s
Victim 9	19m 29s	11m 05s	17	05m 16s	24m 45s	14m 13s	51m 35s	09m 45s	41m 52s
Victim 10	11m 01s	05m 38s	15	02m 51s	13m 51s	08m 10s	27m 32s	05m 25s	22m 07s
Victim 11	28m 43s	09m 13s	16	04m 31s	33m 14s	24m 11s	40m 31s	09m 58s	30m 33s
Victim 12	20m 41s	07m 37s	17	03m 37s	21m 57s	14m 43s	37m 50s	08m 51s	28m 59m
Victim 13	18m 14s	07m 33s	17	03m 35s	21m 49s	14m 38s	37m 20s	08m 51s	28m 29s
Victim 14	09m 47s	06m 07s	14	03m 13s	13m 00s	06m 53s	27m 20s	04m 06s	23m 14s
Victim 15	29m 02s	09m 55s	16	04m 52s	33m 54s	24m 11s	42m 00s	05m 17s	36m 43s
Victim 16	30m 35s	06m 12s	15	03m 08s	33m 43s	27m 27s	40m 41s	16m 05s	24m 36s
Victim 17	15m 13s	06m 38s	16	03m 38s	18m 28s	11m 59s	29m 30s	08m 03s	21m 27s
Victim 18	27m 37s	08m 04s	17	03m 50s	31m 24s	23m 44s	41m 50s	09m 54s	31m 56s

Table 8

Scenario One Victim Location in the Building

Victim #	Victim Location
1	Staggers out of front door and collapses when the first fire company arrives
2	Second floor library
3	Second floor library
4	First floor Room #124
5	Stairwell #2 between the second and third floor
6	Jean-Jameu Michelle's Office (second floor, Room #228)
7	Second floor Room #230
8	Second floor Room #224
9	Second floor hallway outside of Room #226
10	First floor, front lobby men's bathroom
11	Fourth floor Room #414
12	Basement in the computer server room
13	Basement in the computer server room
14	First floor lobby
15	Fourth floor File Storage Room
16	Fourth floor Room #416
17	First floor lobby (rear foyer)
18	Fourth floor hallway outside of Room #400

Table 9

Scenario One Victim Injuries

Victim #	Victim Injuries
1	Gunshot wound to the left femur, minor bleeding controlled with direct pressure. Patient is conscious, alert, and oriented. Patient is unable to walk anymore. Patient is in obvious pain.
2	Gunshot wound to the buttocks. Bleeding is controlled and is minor.
3	Chest pain and difficulty breathing. Patient states a history of angina. States her pain is 7 on a 1/10. States she does not have her nitroglycerin with her.
4	Gunshot wound to the right arm with heavy bleeding. Gunshot wound to the right hand with minor bleeding. Patient is conscious, but not alert and not oriented. Patient answers questions with unintelligible words.
5	Gunshot wound to the chest. Weak carotid pulses present (radial and femoral absent). Skin is cool and clammy. Patient is unresponsive.
6	Gunshot wound to the back from a shotgun. Weak carotid pulses present (radial and femoral absent). Skin is cool and clammy. Patient is unresponsive with significant labored respirations.
7	Gunshot wound to the abdomen and pelvis from shotgun. Uncontrolled bleeding from the pelvis, requiring constant direct pressure.
8	Gunshot wound to the right arm and stomach. Uncontrolled hemorrhage from the right arm. Patient is starting to have difficulty breathing.
9	Gunshot wound to the head. Weak carotid pulses present. Skin is cool and clammy. Patient is unresponsive.
10	Gunshot wound to right ankle, bleeding is controlled.
11	Uninjured wheelchair-bound patient needing evacuation.
12	Fracture right ankle running down the stairs. Obvious fracture to the ankle and possible right knee dislocation.
13	Gunshot wound to the right foot and gunshot wound to the left tibia.
14	Large gunshot wound with entrance to the face and exit from the back of the head. No pulses and no respirations. Grey matter showing from the back of the head.
15	Four gunshot wounds to the chest and abdomen. No pulses and no respirations.
16	Asthma attack.
17	Gunshot wound to the left knee, minor bleeding noted.
18	Single gunshot wound to the left temple with exit out the right temple. Grey matter visible. No pulse and no respirations.

In Scenario Two, the collected times for point-of-wounding care for all victims was compiled into an Excel spreadsheet for analysis. The sample size was 257 documented victim encounters. The mean time for point-of-wounding care for all victims was 21 minutes and 43 seconds. The standard deviation was 8 minutes and 40 seconds. A 95% confidence coefficient was utilized to determine a margin of error of 1 minute and 4 seconds. The maximum time for point-of-wounding care was 50 minutes and 00 seconds. The minimum time for point-of-wounding care was 3 minutes and 49 seconds. Table 10 provides a comprehensive analysis of each victim, including the following point-of-wounding times: mean time, standard deviation, margin of error, upper bound, lower bound, maximum, minimum, and range. Table 11 provides the victim's location in the building. Table 12 provides the victim's simulated injuries.

Table 10

Scenario Two Time for Point-of-Wounding Care from Start of Scenario (Confidence Coefficient of 1.96)

	Average	Standard Deviation	Sample Size	Margin of Error	Upper Bound	Lower Bound	Maximum	Minimum	Range
Victim 1	16m 05s	03m 53s	15	01m 58s	18m 04s	14m 08s	22m 16s	09m 38s	12m 38s
Victim 2	16m 49s	04m 09s	13	02m 16s	19m 04s	14m 33s	23m 45s	11m 25s	12m 20s
Victim 3	18m 51s	05m 52s	15	02m 58s	21m 50s	15m 53s	34m 17s	11m 10s	23m 07s
Victim 4	21m 48s	05m 12s	15	02m 38s	24m 26s	19m 10s	32m 17s	12m 16s	19m 51s
Victim 5	21m 40s	07m 08s	14	03m 44s	25m 25s	17m 56s	38m 39s	09m 35s	29m 04s
Victim 6	21m 42s	05m 37s	14	02m 56s	24m 39s	18m 46s	32m 18s	12m 33s	19m 45s
Victim 7	19m 07s	04m 54s	15	02m 29s	21m 35s	16m 38s	30m 16s	10m 50s	19m 26s
Victim 8	19m 43s	05m 17s	14	02m 46s	22m 28s	16m 56s	32m 24s	13m 30s	18m 54s
Victim 9	18m 32s	05m 44s	15	02m 55s	21m 27s	15m 38s	31m 55s	09m 59s	21m 56s
Victim 10	15m 44s	06m 24s	15	03m 14s	18m 58s	12m 30s	30m 00s	06m 11s	23m 49s
Victim 11	31m 45s	10m 02s	13	05m 27s	37m 12s	26m 18s	51m 00s	11m 29s	39m 31s
Victim 12	26m 14s	09m 49s	14	05m 08s	31m 23s	21m 06s	39m 33s	03m 49s	35m 44s
Victim 13	26m 11s	09m 59s	14	05m 14s	31m 08s	20m 57s	40m 01s	03m 49s	36m 12s
Victim 14	14m 36s	08m 29s	14	04m 26s	19m 02s	10m 10s	40m 18s	07m 19s	32m 59s
Victim 15	19m 46s	07m 53s	14	04m 08s	23m 54s	15m 38s	39m 51s	11m 16s	28m 35s
Victim 16	28m 37s	08m 53s	14	04m 40s	33m 16s	23m 57s	46m 17s	10m 08s	36m 09s
Victim 17	28m 30s	09m 11s	14	04m 49s	33m 19s	23m 41s	45m 20s	12m 28s	32m 52s
Victim 18	26m 45s	06m 46s	14	03m 32s	30m 17s	23m 13s	40m 41s	12m 57s	27m 73s

Table 11

Scenario Two Victim Location in the Building

Victim #	**Victim Location**
1	Third floor Room #322
2	Third floor Room #322
3	Third floor Room #322
4	Third floor Room #311
5	Stairwell #2 on the third floor landing
6	Third floor Room #311
7	Third floor between Room #311 and Room #322
8	Second floor mechanical equipment room near stairwell
9	Second floor mechanical equipment room near stairwell
10	Outside parking lot, rear entrance near Marshall Park
11	Fourth floor Room 404-A
12	Fourth floor Room 400-B
13	Fourth floor Room 400-D
14	First floor main lobby
15	Third floor Room 322
16	Fourth floor Room 400
17	Fourth floor Women's Bathroom
18	Fourth floor hallway outside of Room 400

Table 12

Scenario Two Victim Injuries

1	Gunshot wound to left thigh and pelvis. Heavy bleeding from the left thigh. Moderate bleeding from the pelvis.
2	Gunshot wound to throat. Faint carotid pulse. Agonal respirations. Blood and secretions in the mouth. Patient is unresponsive.
3	Gunshot wound to the left ankle and right knee. Bleeding is minor and is controlled.
4	Gunshot wound to the right arm with heavy bleeding. Gunshot wound to the right hand with minor bleeding. Patient is conscious, but not alert and not oriented. Patient answers questions with unintelligible words.
5	Gunshot wound to the chest. Weak carotid pulses present (radial and femoral absent). Skin is cool and clammy. Patient is unresponsive.
6	Gunshot wound to the left hand, left arm, and right leg. Bleeding is minor and is controlled.
7	Gunshot wound to the abdomen from a shotgun. Weak radial pulses present. Skin is cool and clammy. Patient is very anxious and agitated.
8	Gunshot wound to the right arm and stomach. Uncontrolled hemorrhage from the right arm. Patient is starting to have difficulty breathing.
9	Gunshot wound to the left leg and gunshot wound to the abdomen (pistol wounds). Bleeding is controlled.
10	Gunshot wound to right ankle, bleeding is controlled.
11	Gunshot wound to left knee and right foot. Bleeding is minor.
12	Patient states she was shoved down to the floor by the gunman. She states he struck her in the chest with his pistol but did not shoot her. She states now she is having difficulty breathing.
13	Gunshot wound to the right foot and gunshot wound to the left tibia. Bleeding is minor.
14	Gunshot wound to the face. No pulses. No respirations. Gray matter showing from the back of the head.
15	Four gunshot wounds to the chest and abdomen. No pulses and no respirations.
16	Gunshot wound to the left arm, chest, left leg, and right arm. Major bleeding from all three extremities. Faint carotid pulse. Patient is unconscious and unresponsive.
17	Gunshot wound to left femur, heavy bleeding.
18	Single gunshot wound to the left temple. Gray matter visible. No palpable pulse and no respirations.

The research question's null hypothesis was rejected and the alternative hypothesis was accepted. The new integrated RTF model clearly demonstrated a reduction in the point-of wounding care time from the dispatch of the first fire apparatus. The responders all provided an average point-of-wounding care time far less than previously published times of 60 minutes or more for initial care. Of 264 recorded victim encounters, there were none that exceeded 60 minutes for point-of-wounding care. It is important to note that these victim encounters occurred in a building that is six stories in height and 88,446 square feet partitioned into hundreds of offices.

In addition, responders were not provided with completely accurate information on victim locations. Appendix B shows the *injects* that 911 dispatchers provided the responders. In several cases, responders were told inaccurate locations of victims to simulate the inaccurate information that 911 callers frequently provide during real events. In Scenario Two, dispatchers provided responders with even less specific locations of the victims, requiring responders to search actively and find the victims in the building (See Appendix C).

Quantitative Research Question Two. What effect does the new integrated public safety active shooter plan have on the time to victim extraction compared to previously published research of non-integrated active shooter response?

Currently, no national established benchmark or best practice timeframe exists for ideal extraction times. However, one of the most important treatments that responders can provide to trauma victims is rapid transport of the patient to a hospital with surgical capabilities (Blackwell, et al., 2002; Calland, 2005, Cooke, 1999, Crandall, et al, 2013; Jacobs, 2014; Pons, et al., 2005; Zafar, et al., 2014). Research conducted by Iselin and Smith (2009) found that utilization of the traditional stage and wait response resulted in victim extractions exceeding two and a half hours.

Prior to the start of the exercises, the CAST established an internal target to provide extraction of all victims within 30 minutes from the first dispatch.

In Scenario One, the collected times for extraction for all victims was compiled into an Excel spreadsheet for analysis. The sample size was 204 documented victim encounters. The mean time for extraction of all victims was 24 minutes and 5 seconds. The standard deviation was 11 minutes and 52 seconds. A 95% confidence coefficient was utilized to determine a margin of error of 1 minute and 38 seconds. The maximum time for extraction was 54 minutes and 52 seconds. The minimum time for extraction was 2 minutes and 52 seconds. Table 13 provides a comprehensive analysis of each victim, including the following extraction times: mean time, standard deviation, margin of error, upper bound, lower bound, maximum, minimum, and range. Refer to Table 8 for the victim's location in the building.

Table 13

Scenario One Time for Victim Extraction from Start of Scenario (Confidence Coefficient of 1.96)

	Average	Standard Deviation	Sample Size	Margin of Error	Upper Bound	Lower Bound	Maximum	Minimum	Range
Victim 1	09m 04s	06m 29s	16	03m 11s	12m 14s	05m 53s	22m 55s	02m 52s	20m 03s
Victim 2	23m 17s	12m 33s	14	06m 34s	29m 51s	16m 42s	49m 00s	10m 45s	38m 15s
Victim 3	23m 56s	12m 50s	14	06m 43s	30m 40s	17m 13s	49m 00s	10m 45s	38m 15s
Victim 4	15m 35s	03m 08s	13	01m 42s	17m 17s	13m 53s	21m 30s	09m 23s	12m 07s
Victim 5	26m 11s	07m 27s	14	03m 54s	30m 05s	22m 17s	46m 10s	09m 56s	36m 14s
Victim 6	27m 35s	10m 05s	14	05m 17s	32m 53s	22m 19s	48m 06s	15m 03s	33m 03s
Victim 7	26m 02s	08m 10s	15	04m 08s	30m 10s	21m 55s	43m 47s	14m 51s	28m 56s
Victim 8	23m 52s	06m 50s	14	03m 35s	27m 26s	20m 17s	37m 00s	13m 45s	23m 15s
Victim 9	32m 45s	14m 43s	5	12m 53s	45m 19s	19m 32s	54m 52s	18m 30s	36m 22s
Victim 10	32m 45s	14m 43s	5	12m 53s	45m 19s	19m 32s	54m 52s	18m 30s	36m 22s
Victim 11	36m 35s	10m 12s	16	5m 00s	41m 35s	31m 35s	51m 07s	15m 09s	35m 58s
Victim 12	25m 50s	07m 56s	14	04m 10s	30m 00s	21m 41s	43m 25s	12m 52s	30m 33s
Victim 13	23m 34s	08m 07s	15	04m 07s	27m 40s	19m 27s	43m 20s	09m 37s	33m 43s
Victim 14	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA
Victim 15	41m 15s	04m 55s	2	06m 49s	48m 04s	34m 26s	46m 10s	36m 20s	09m 50s
Victim 16	36m 53s	07m 06s	13	03m 52s	40m 45s	33m 01s	50m 03s	28m 00s	22m 03s
Victim 17	21m 05s	10m 02s	13	05m 27s	26m 30s	15m 38s	49m 50s	11m 27s	38m 23s
Victim 18	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA

In Scenario Two, the collected times for extraction for all victims was compiled into an Excel spreadsheet for analysis. The sample size was 177 documented victim encounters. The mean time for extraction of all victims was 29 minutes and 25 seconds. The standard deviation was 10 minutes and 06 seconds. A 95% confidence coefficient was utilized to determine a margin of error of 1 minute and 30 seconds. The maximum time for extraction was 62 minutes and 30 seconds. The minimum time for extraction was 8 minutes and 20 seconds. Table 14 provides a comprehensive analysis of each victim, including the following extraction times: mean time, standard deviation, margin of error, upper bound, lower bound, maximum, minimum, and range. Refer to Table 11 for the victim's location in the building.

Table 14

Scenario Two Time for Victim Extraction from Start of Scenario (Confidence Coefficient of 1.96)

	Average	Standard Deviation	Sample Size	Margin of Error	Upper Bound	Lower Bound	Maximum	Minimum	Range
Victim 1	27m 13s	08m 04s	12	04m 34s	31m 47s	22m 39s	46m 28s	15m 10s	31m 18s
Victim 2	30m 37s	09m 18s	6	07m 26s	38m 04s	23m 10s	46m 28s	23m 10s	26m 05s
Victim 3	30m 19s	09m 48s	12	05m 33s	35m 52s	24m 46s	49m 58s	14m 15s	35m 43s
Victim 4	28m 02s	07m 19s	14	03m 50s	31m 52s	24m 13s	40m 45s	16m 18s	24m 27s
Victim 5	28m 46s	08m 19s	13	04m 31s	33m 17s	24m 14s	46m 30s	14m 00s	32m 30s
Victim 6	28m 25s	08m 00s	13	04m 21s	32m 46s	24m 04s	40m 17s	16m 18s	23m 59s
Victim 7	26m 38s	05m 59s	11	03m 32s	30m 10s	23m 07s	35m 45s	16m 18s	19m 27s
Victim 8	29m 21s	10m 41s	11	06m 19s	35m 40s	23m 02s	60m 00s	21m 00s	39m 00s
Victim 9	25m 16s	06m 31s	13	03m 32s	28m 49s	21m 44s	37m 00s	16m 00s	21m 00s
Victim 10	18m 37s	08m 16s	13	04m 50s	23m 06s	14m 07s	37m 28s	08m 20s	29m 08s
Victim 11	38m 47s	09m 26s	11	05m 35s	44m 22s	33m 13s	59m 00s	20m 44s	38m 16s
Victim 12	31m 13s	10m 21s	14	05m 25s	36m 38s	25m 48s	44m 34s	14m 30s	30m 03s
Victim 13	34m 15s	13m 41s	11	08m 05s	42m 20s	26m 10s	62m 30s	14m 30s	48m 00s
Victim 14	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA
Victim 15	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA
Victim 16	33m 29s	10m 01s	12	05m 40s	39m 10s	27m 50s	56m 20s	16m 14s	40m 06s
Victim 17	33m 28s	09m 05s	11	05m 22s	38m 50s	28m 06s	55m 00s	19m 54s	35m 06s
Victim 18	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA	DOA

The research question's null hypothesis was rejected and the alternative hypothesis was accepted. The responders all provided an average extraction time far less than previously published times of 60 minutes or more. In addition, the responders provided an average extraction time less than the self-imposed CAST target goal of 30 minutes. Of 474 recorded victim encounters, only one victim extraction exceeded 60 minutes (see Table 15). Victim 13 in Scenario Two had an extraction time of 62 minutes and 30 seconds. It is important to note that these victim encounters occurred in a building that is six stories in height and 88,446 square feet partitioned into hundreds of offices. In addition, the instructors did not allow the responders to utilize the two elevators in the building for any responder or victim movement.

Table 15

Scenario One and Two Victim Extraction Times from First Dispatch to Victim Delivery in Triage Outside of the Building

Average	29m 24s
Standard Deviation	11m 24s
Sample Size	474
Confidence Coefficient	1.96
Margin of Error	1m 21s
Upper Bound	30m 46s
Lower Bound	28m 4s
Max	62m 30s
Min	2m 52s
Range	59m 38s

Quantitative Research Question Three. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving point-of-wounding care within the target goal of 15 minutes from dispatch of the call?

The research question's alternative hypothesis was rejected and the null hypothesis was accepted. After analysis of the data from Exercise One, the CAST target of 15 minutes for point-of-wounding care was not achieved. The average time from first 911 dispatch to point-of-wounding care was 18 minutes and 56 seconds. Only two of the victims in Exercise One (Victim 1 and Victim 14) had an average point-of-wounding time that was less than 15 minutes from first 911 dispatch.

After analysis of the data from Exercise Two, the CAST target of point-of-wounding care within 15 minutes was not achieved. The average time from first 911 dispatch to point-of-wounding care was 21 minutes and 43 seconds. Only two of the victims in Exercise Two

(Victim 1 and Victim 10) had an average point-of-wounding time that was less than 15 minutes from first 911 dispatch.

The average response time of the apparatus and personnel in Exercise One was 3 minutes and 21 seconds (see previous Table 3). When the response time is subtracted, the responders provided point-of-wounding care to all Exercise One victims with an average of 15 minutes and 35 seconds. This provides a target that almost meets the internal goal that was established by the CAST prior to running the exercises with the subtraction of response time.

The average response time of the apparatus and personnel in Exercise Two was 8 minutes and 11 seconds (See previous Table 4). When the response time is subtracted, the responders provided point-of-wounding care to all Exercise Two victims with an average of 13 minutes and 32 seconds. This provides a target that is better than the internal goal established by the CAST prior to running the exercises.

Quantitative Research Question Four. Did the implementation of new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving extraction from the building within the target goal of 30 minutes from dispatch of the call?

The research question's alternative hypothesis was rejected and the null hypothesis was accepted. After analysis of the data from Exercise One, the mean time for extraction of all victims was 24 minutes and 5 seconds. This average was better than the internal goal established by the CAST prior to running the exercises. However, multiple victims had an extraction time that exceeded 30 minutes. Four of the victims in Exercise One (Victim 9, Victim 11, Victim 15, and Victim 16) had an average extraction time that was more than 30 minutes from first 911 dispatch. Responders did not extract Victims 14 or Victims 18. Responders declared both of these victims deceased on scene based on their simulated injuries. Responders elected to extract Victim 15 in only two of the scenarios. In 15 of the scenarios, responders declared Victim 15 deceased on scene based on the victim's simulated injuries.

After analysis of the data from Exercise Two, the mean time for extraction of all victims was 29 minutes and 25 seconds. This average was better than the internal goal of 30 minutes established by the CAST prior to running the exercises. Again, multiple victims had an extraction time that exceeded 30 minutes. Seven of the victims in Exercise Two (Victim 2, Victim 3, Victim 11, Victim 12, Victim 13, Victim 16, and Victim 17) had an average extraction time that was more than 30 minutes from first 911 dispatch. Responders did not extract Victims 14, Victims 15, or Victims 18. Responders declared these three victims deceased on scene based on their simulated injuries.

The average response time of the apparatus and personnel in Exercise One was 3 minutes and 21 seconds (see Table 3). When the response time is subtracted, the responders provided extraction for all Exercise One victims with an average of 20 minutes and 44 seconds once responders arrived on scene. This time is significantly better than previously published data of extraction time ranging from 60 minutes to three hours.

The average response time of the apparatus and personnel in Exercise Two was 8 minutes and 11 seconds (see Table 4). When the response time is subtracted, the responders provided extraction for all Exercise Two victims with an average of 21 minutes and 17 seconds. This average was better than the internal goal established by the CAST prior to running the exercises.

During the examination of the data, the researcher discovered that moving victims into a casualty collection point (CCP) resulted in a delay in removing the victim from the building. The researcher and David Neubert, M.D. coined the termed *TACEVAC inertia* (short for tactical evacuation inertia). Casualty collection points are a location where victims are located in one place. In this context, the CAST limited the term CCP to mean a location inside the crisis site (building).

There are three ways that a CCP is created. First, the perpetrator creates a CCP by injuring multiple victims in one location. Second, victims come together in one location for safety, basic care, or in an attempt to devise a plan to escape the situation. Last, responders create a CCP when they move victims into a specific area for the purpose of triage, treatment, or extraction. The theory of TACEVAC inertia is that a victim in extraction motion has inertia driving the victim outside of the building to waiting ambulances. When the victim is moved to a CCP, the inertia stops, forward progress stops, and now additional resources are necessary to extract the victim.

Although the purpose of this study was not to examine the effect of casualty collection points on delaying patient extraction, the researcher discovered that the scenario proctors recorded the TACEVAC inertia times with 40 victims. The time started with the responders extracting the victim and moving the victim to a CCP. The time then started again when the victim was moved from the CCP to the formal triage location outside of the building. During Exercise One, victims were moved to a CCP a total of 16 times. The average time a victim spent in the CCP was 2 minutes and 9 seconds. The longest amount of time that a victim remained in a CCP was 9 minutes and 45 seconds. During Exercise Two, victims were moved to a CCP a total of 24 times. The average time the victim spent in the CCP was 4 minutes and 14 seconds. The longest amount of time that a victim remained in a CCP was 6 minutes and 58 seconds. The average amount of time that a victim was in a CCP during both exercises was 3 minutes and 23 seconds.

It is important to note that providers did not administer any patient care at the CCPs. The providers established the CCPs for the sole purpose of placing the victims in one location while awaiting additional personnel to remove the victims from the building. When providers administer medical care in the CCP, the delay in extraction can become significant. Every treatment procedure administered by EMS providers on scenes of penetrating trauma victims adds an average of 1 minute and 36 second delay to scene times (Seamon, et al., 2012).

When medical providers administer advanced care in the CCP, the time to extraction can increase significantly. Prehospital intravenous line access can be particularly difficult in trauma victims, with documented prehospital times for establishing a patent intravenous line ranging from 8 to 12 minutes (Smith & Conn, 2009). The average prehospital intravenous line attempt increases scene time an average of 5 minutes and 4 seconds (Carr, B.G., Brachet, T. David, G., Dusei, R. & Branas C.C., 2008). Performing endotracheal intubation increases prehospital scene times an average of 2 minutes and 36 seconds (Carr, et al., 2008).

The CAST deliberately limited the care provided inside the warm zone to basic hemorrhage control following the guidelines established by the Hartford Consensus and the Committee for Emergency Casualty Care (Jacobs, 2014; Callaway, et al., 2011). The Charlotte Fire Department Training Staff provided responders with training CAT-2 tourniquets (North American Rescue) to use to provide this treatment to victims with simulated gross extremity hemorrhage. Sampalis and colleagues (1999) determined that every additional minute of on-scene time for penetrating trauma victims increased mortality five percent. Limiting the care provided inside the warm zone allowed providers to minimize the victim's time inside of the building and maximize victim survivability. In addition, numerous peer-reviewed research articles have demonstrated that prehospital advanced life support care for trauma victims has increased morbidity and mortality for the victims (Cotton, B.A., Jerome, R., Collier, B.R., Khetarpal, S., Holevar, M., Tucker, B., Kurek, S., Mowery, N.T., Shah, K., Brombery, W., Gunter, O.L. & Riordan, W.P., 2009; Dalton, 1995; Eckstein, Chan, Schneir & Palmer, 2000; Gruen, et al., 2012; Huβmann, B., Lefering, R., Taeger, G., Waydhas, C., Ruchholtz, S. & Lendemans, S., 2011; Kalish, B.T., Efron, D.T., Haider, A.H. & Stevens, K.A., 2011; Lieberman, Mulder & Sampalis, 2000; Murad, Larsen & Husum, 2012; Seamon, M.J., Doane, S.M., Gaughan, J.P., Kulp, H., D'Andera, A.P., Pathak, A.S., Santora, T.A., Goldberg, A.J., & Wydro, G.C., 2013; Smith & Conn, 2009; and Zafar, et al., 2014).

Qualitative Results.

Following the conclusion of the 32 large-scale exercises, the five lead instructors wrote observations that each made while conducting the exercises. The instructors were allowed to write anything that they observed that could aid in refining the protocol and integrated response operations. Instructors provided feedback that was both positive and negative. The following questions guided the qualitative portion of the research:

Q1. Did responders demonstrate inappropriate response tactics during the exercises?

Q2. Where there any observed tactics that resulted in delays for either victim treatment or extraction?

Q3. Did responders encounter issues with communication or incident command?

Demographics. The five instructors have a wide range of public safety experience. All participants are males. One instructor has been a sworn police officer for 29 years, with the majority of his career assigned to the Special Weapons and Tactics team. Another instructor has 24 years' fire service experience currently serving at the rank of fire captain, 20 years' experience as a paramedic, and six years' experience as a police officer assigned to a Special Weapons and Tactics team. Another instructor has 29 years' experience in the fire service, currently serves as a battalion fire chief, and conducted post-graduate research on fire service active shooter response. Another instructor has 24 years' experience in the fire service, currently serves as a fire captain, and has extensive experience in technical rescue operations. The last instructor has nine years' experience in the fire service, serves as a firefighter in Special Operations, and had 20 years' experience in a United States Army special warfare unit. All personnel had extensive training and education on active shooter events and integrated response prior to their involvement with the exercises.

The Charlotte Fire Department provided the researcher with the instructor observations. The researcher stripped personal identifiers from the five lead instructors. The researcher identified comments from the instructors by the designators Instructor 1, Instructor 2, Instructor 3, Instructor 4, and Instructor 5. These designators have no correlation with the order of the instructor descriptions given in the previous paragraph. The researcher examined the observations to find themes and patterns that could reduce time to treat and evacuate the victims. The details of the instructors' comments follow along with both expected and unexpected findings. The researcher identified eight distinct themes in the instructor comments that affected the time to treat and remove the victims. The themes all answered the qualitative research questions. Each of the themes is correlated with the appropriate research question. In addition, each theme is identified and explained below.

Qualitative Research Question One. Did responders demonstrate inappropriate response tactics during the exercises?

Theme 1- Law Enforcement Force Protection for the RTF.

Several of the instructors noted issues with the law enforcement force protection provided for the Rescue Task Forces (RTF). Instructor 1 noted, "The two law enforcement officers providing protection for the RTFs would often clear several rooms forward of the RTF. This left the RTF exposed with no protection behind the officers." Instructor 1 also noted "The law enforcement officers providing force protection often wanted to work independent of the RTF." Instructor 4 noted a similar observation, "The RTFs should remain as a single element with law enforcement. The RTF should only seek cover when unintentionally placed in a direct threat area."

The two officers were conducting rooming clearing in front of the RTF. This was done so that the RTF could move forward in the building in their search for victims. Police officers are always taught to clear rooms with a minimum of two officers. A minimum of two officers provides a high level of protection for the officers as they clear the room. However, two officer room-clearing became problematic when the officers with the RTF cleared rooms ahead of the RTF. The two officers would leave the RTF unprotected as the officers cleared the rooms. Depending on the size of the room that required clearing, the officers would leave the RTF unprotected for several minutes at a time. Leaving the RTF unprotected can become very problematic when the location of the perpetrator is unknown in the building.

Because of the potential for leaving the RTF without protection, some departments require a minimum of four police officers to protect the RTF (Fletcher, 2010). This allows for two officers to clear rooms ahead of the RTF while leaving two officers to guard the RTF in case of hostile engagement. The CAST evaluated this model and initially determined that two officers would provide sufficient force protection for the RTF. However, after observing the scenarios, the CAST may need to reevaluate the number of law enforcement officers assigned to the RTF. If three officers were assigned to the RTF, at least one officer would always physically stay with the RTF to provide force protection at all times.

This phenomenon was unexpected by the instructors. The instructors thought that the RTF force protection would maintain a tight security perimeter around the RTF. Instead, the instructors noted that the law enforcement force protection would often move several rooms forward of the RTF, clearing the rooms. This phenomenon might be a result that the instructor used SWAT operators as the force protection. If the instructors used standard patrol officers, the officers might not have aggressively moved forward from the RTF to clear rooms. This phenomenon warrants further research.

Theme 2- Freelancing of RTFs.

Instructor 1 noted that firefighters would tend to freelance and conduct searches for victims on their own, after their law enforcement force protection told them to stay secured in a room. This occurred numerous times, and most often was the result of firefighters searching adjoining rooms in an attempt to quickly find victims. Instructor 1 and Instructor 4 both observed firefighters aggressively trying to search for victims, often independent of law enforcement force protection.

The freelancing was not expected by the instructors; however, this phenomenon is common in the fire service. The firefighters all wanted to quickly find the victims and were willing to take some risks to quickly locate the victims. This freelancing may be attributed to the difference between the training environment and a real event. If the RTF feared a hostile threat, the RTF may not have strayed far from protection. Further research is warranted to determine if this freelancing is the result of wanting to aggressively locate victims, or because the training occurred in a zero threat environment.

Qualitative Research Question Two. Where there any observed tactics that resulted in delays for either victim treatment or extraction?

Theme 3- Marking the Deceased.

Several instructors noted that responders would repeatedly check deceased victims. In both scenarios, a dead victim was placed in the lobby inside the front entrance. In every scenario, responders would immediately see the victim, check the victim's injuries, declare the victim dead, and then move on. However, the deceased victim was never marked to indicate that responders had already checked the victim and declared the victim deceased. As subsequent responders entered into the building they would check the victim's injuries, declare the victim dead, and then move on into the building. The instructors noted that the deceased victim in the lobby was checked an average of six to seven times by responders as each new RTF entered the building.

This same phenomenon was observed at the Virginia Tech shootings. At Virginia Tech, responders checked and rechecked the dead several times, not knowing that responders had already checked the deceased victim (Tri-Data, 2009). Part of the confusion resulted from the lack of any type of identification markers on the victims, such as triage tags (Tri-Data, 2009). In addition, Erin Sheehan one of the students at Virginia Tech, lay down next to several dead victims and pretended to be dead to survive the attack (Fantz & Meserve, 2007). Because of the potential for several living victims playing dead, responders continued to check and recheck the dead victims.

Public safety agencies in the United States have a variety of different methods by which to mark the deceased victims at mass casualty events. These methods include the use of triage tags, chemical lights, victim positioning, surveyor's tape, and permanent marker written notations on the victim. There is no standard method in the United States for marking deceased victims at mass casualty events.

The instructors were aware of this phenomenon prior to the exercises. However, the instructors did not expect to see this happen as many times as it did during the exercises. Almost every exercise demonstrated the RTFs checking and rechecking the deceased victims multiple times.

Theme 4- RTF Size.

One several occasions firefighters tried to make a large RTF. Instructor 1 noted, "Some of the fire crews combined to have 12 firefighters and two law enforcement officers. This large group was completely dysfunctional and unable to move without adequate force protection." The large RTF size not only makes it difficult for law enforcement to provide protection, but the large RTF is unable to move effectively within the building. In one scenario, an RTF with eight firefighters and two law enforcement officers accessed one stairwell. The RTF quickly clogged up the stairwell and made it difficult for other RTFs evacuating victims to use the stairwell. The large RTF also became strung out in the stairwell between several floors, making force protection almost impossible for the two law enforcement officers assigned to the RTF.

During the scenarios, the instructors noted that the best non-law enforcement component of the RTF was three to four firefighters. Three to four firefighters provided an adequate number of personnel to remove simulated unconscious victims down stairs. In addition, three to four firefighters provided adequate resources to begin initial treatment when the RTF encountered multiple victims.

Prior to starting the exercises, the lead instructors were unsure of the optimal RTF size. Different researchers have opined what they believe is the optimal RTF size. Several authors state that the optimal RTF size is two medical providers with four law enforcement officers providing force protection (Enchanted Circle EMS Association, 2013; Meoli & Rathburn 2014). However, during the exercises the instructors noted that two medical providers lacked the physical ability to extract some of the larger victims, especially when the victims required movement down several flights of stairs.

The instructors also noted that four law enforcement officers provided some unique challenges for RTF operations. First, many jurisdictions would have difficulty providing four law enforcement officers for each RTF. As mentioned previously 98% of active shooter events occurred in jurisdictions served by a police force of 100 officers or less (Schweit, 2013). Second, when the RTF had more than three law enforcement officers, the officers want to morph the RTF into a contact team. This phenomenon is believed to be the result of the amount of firepower that four officers have and that most officers are taught to form four-person contact teams. In addition, it is difficult for four street patrol officers to come together and effectively determine who is in charge of the force protection element.

Theme 5- Searching for Victims.

Several instructors noted that the RTFs had difficulty knowing where victim searches had occurred in the building. An example was when the incident commander would send the RTF the third floor to search for victims. The RTF would search several offices and then locate a victim. The RTF would then extract that victim down the stairwell and outside. The incident commander would then send a new RTF to resume the search on the third floor. The new RTF would then start the search over on the third floor, again searching offices that were previously searched. This resulted in a significant delay in searching for victims.

In multiple exercises, the fire department incident commander wanted to lead a thorough search for victims in the buildings. The fire department incident commanders need to recognize that the search of the building is a task that law enforcement needs to lead, not the fire department. The fire incident commanders are used to performing searches for victims at structural fires. At structural fires, firefighters perform a *primary search* and a *secondary search*. The primary search is a rapid search conducted to locate victims in obvious places. Firefighters typically conduct a primary search in heavy smoke and fire conditions. The secondary search is a thorough, comprehensive search to ensure that there are no victims. Firefighters typically conduct the secondary search once the majority of the fire is controlled and smoke removal is in process.

This theme was not anticipated; however this is not a surprising find. Firefighters focus on ensuring that all viable victims quickly receive rescue from hazardous environments. The hazardous environment includes fire, building collapses, explosions, hazardous material events and more. A hostile perpetrator event is not much different than the routine hazardous environments that firefighters frequently encounter every day.

Qualitative Research Question Three. Did responders encounter issues with communication or incident command?

Theme 6- Rapid Creation of a Unified Incident Command.

Instructors 1, 2, and 4 all noted that incident operations went much more smoothly and quickly when the fire officer in charge and the law enforcement office in charge created a unified command post. Instructor 4 noted, “It is critical to establish joint command as soon as possible. In the two scenarios where this did not occur, there was a much less organized operation and it took longer to remove the casualties.” In the first couple of scenarios, the instructors noted that the fire battalion chiefs remained in a separate command post from law enforcement. In these scenarios, it took almost twice as long for fire department personnel to join up with law enforcement to create RTFs.

Instructor 1 noted, “If fire incident command fails to quickly unify with the law enforcement, the incident commander will only have half of the picture.” In Scenario Two, there was an inject given by the dispatcher that there was a sniper on the roof. The law enforcement incident commander was able to immediately address this and dispel that the reported sniper was simply a maintenance man on the roof.

This theme was expected in the exercises. Multiple after-action-reports from active shooter events note that the rapid establishment of a unified incident command is imperative to achieving the best possible outcomes (FEMA, 2014b; Tri-Data Corporation, 2014). These exercises stressed the importance of the rapid integration of both law enforcement and fire department personnel at the command post.

Theme 7- Communications with the RTF Firefighters and the RTF Force Protection.

Prior to the exercises, instructors identified common law enforcement terminology that may provide confusion with fire department responders. Instructors covered these terms in the classroom training provided to the responders before the exercises. However, the five-month delay between the classroom lecture and the exercises may have led to firefighters forgetting the meaning of some of the terms. Following the exercises, the instructors noted two terms that seemed to cause the most confusion with the fire responders.

Instructors 1, 2, and 4 all noted that the fire responders all expressed confusion when law enforcement would announce that a room was *clear*. The firefighters did not know if this meant that the room was clear from a threat, clear of victims, or both. Instructor 1 noted, “The fire companies did not feel comfortable taking the word of the law enforcement officer that a room was clear of victims. The fire companies expressed the desire to go in behind and conduct a thorough search of the room.” In several of the exercises, the firefighters stopped the law enforcement force protection and asked for clarification on what clear meant. Once the firefighters understood that the officers used the term clear to mean there was both no threat and no victims, the RTF operations went much more smoothly.

The term *hold* also confused fire responders when law enforcement officers would tell the RTF to hold in place. When officers use the term hold, they are instructing other members to stop moving and remain in place. Ideally, the firefighters would move behind protective cover when instructed to hold. Even when instructed to hold, the members of the RTF would continue to move around. Part of this may be attributed to the difference between the training environment and a real event. Further research is warranted to determine if this failure to hold and find cover is the result of lack of knowledge, or because the training occurred in a zero-threat environment.

Theme 8- Radio Communications.

Multiple instructors made observations regarding radio communications during the exercises. Several instructors noted that the incident commanders were overwhelmed with information and radio traffic. Not only did the incident commanders have to handle radio traffic from the dispatcher, but the commanders also had to handle an overwhelming volume of radio traffic from the RTFs.

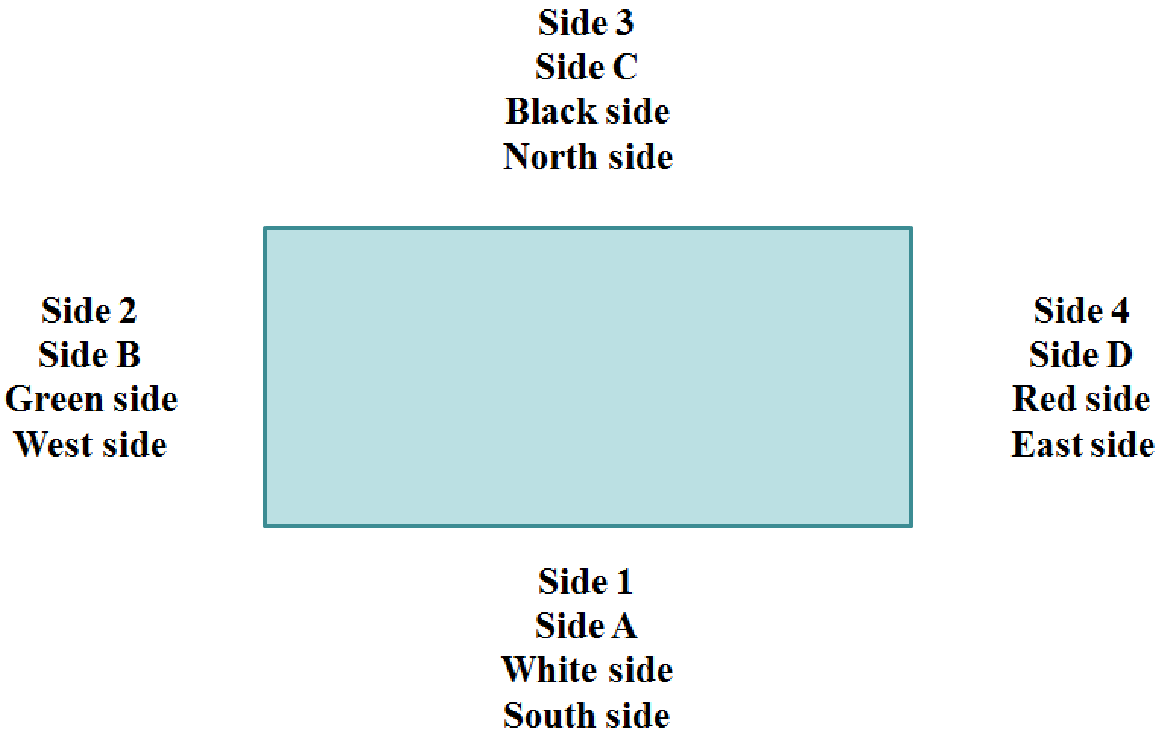
The fire officer on the first arriving fire apparatus would establish fire department command operations at the scene following the guidelines established by the National Incident Management System (Department of Homeland Security, 2008). The first fire officer would immediately locate the commanding police officer and have a face-to-face conversation to establish an operational game plan. During this conversation, several instructors observed multiple fire officers ignoring radio transmissions from the dispatchers. This was the result of an overload of communications on the initial arriving incident commanders. These incident commanders missed multiple important radio transmissions during this time, including victim locations.

All instructors noted the importance of the incident commanders having aides to help track information at the command post. This information included radio transmissions from dispatch, radio transmission from responders on scene, victim locations, suspect locations, information from the fire alarm panel, and more. During the scenarios, the incident commanders would often grab two or three extra firefighters to work as aides or scribes at the command post to help track information and unit assignments.

One of the instructors noted that responders had confusion regarding the descriptions of the building. Dispatch called the floors using plain text (e.g. “A victim is on the fourth floor”). Fire personnel used the term Division Four to note the fourth floor. Law enforcement used the term “division” to represent a side of the building. Other responders described the sides of the building using North, South, East, or West, or a combination of two. To add to the confusion, federal law enforcement agencies use colors to describe the sides of the buildings (see Figure 5). The lack of common terminology added to confusion regarding the location of victims, RTFs, law enforcement officers, and suspects.

Figure 5

Building Side Descriptions



All of the instructors, as well as the majority of the students attending the training noted that the volume of radio traffic was overwhelming. In many of the scenarios, responders could not broadcast important messages on the radio for five minutes or more because of the unceasing volume of communication tying up the radio. Two of the instructors noted that it was critical for the incident commander to move radio traffic from the 911 dispatcher to a radio channel separate from operations. This would allow the 911 communicator to have direct contact with the incident commander on one channel, and the incident commander to have direct contact with the responders on another channel.

This phenomenon was expected by the instructors. The instructors all told the students that volume of radio traffic they experienced was just a fraction of what they can expect during an actual event. Nearly all after-action reports from active shooter events have demonstrated that communications are an issue at active shooter events (Tri-Data Corporation, 2014).

Summary

Chapter 4 presented the results of the data qualitative and quantitative data collected from the 32 large-scale exercises. The quantitative data indicated that the new integrated response plan gave victims point-of-wounding care and evacuations times that were much better than previous published times for these two benchmarks. In addition, the quantitative data demonstrated that the responders partially met the self-imposed target goals established by the CAST. In both scenarios, the responders were unable to provide an average point-of-wounding care time less than 15 minutes from scenario start. However, in both scenarios the responders were able to provide an average victim extraction of less than 30 minutes from scenario start.

The qualitative research was divided into eight separate themes and correlated with the corresponding qualitative research question. These themes consisted of observations from the five lead instructors. Each of the observations provided information that affects the time to point-of-wounding care and victim extraction. The instructors anticipated some of themes prior to the start of the exercises. However, the instructors did not expect some of the themes that they observed.

Based on the frequency of the documented lead instructor comments, the three most significant themes involved integration of force protection for firefighters, communication, and command/control. Each of these themes demonstrated issues encountered by the firefighters, police officers, and incident commanders. The CAST as well as public safety leaders can review these themes to determine if policy or procedure revision is required to address each theme.

Chapter 5: Implications, Recommendations, and Conclusions

Active shooter events are currently one of the most complex problems facing law enforcement and other public safety agencies (Clark, 2014). Responders face several issues at active shooter events, including the potential for multiple heavily armed perpetrators, multiple victims, fire-as-a-weapon, explosives, barricades, and hazardous material releases (Cullen, 2009; Fast, 2009: FEMA, 2013; Mell & Sztaknkrycer, 2005; Nichols, 2010; Sinai, 2013; Slayton, 2014; Tri-Data Corporation, 2014). Three of the most important priorities for responders include rapid neutralization of the perpetrator(s), point-of-wounding care for the victims, and rapid extraction of the victims to waiting ambulances.

This study focused on the integration of fire department personnel with law enforcement at active shooter events in Charlotte, North Carolina. Prior to 2012, the Charlotte Fire Department and Charlotte-Mecklenburg Police Department did not have an integrated response plan for active shooter events. However, members of both departments recognized that victims continue to die needlessly at active shooter events because of delays in medical care (Adams, 2013; Cullen, 2009; Flynt, 2012; Goodwin, 2013).

The purpose of this descriptive case study was to examine the effectiveness of the protocol implementation when responders used this protocol at 32 large-scale active shooter exercises. In addition, the researcher examined the observations made by the lead instructors to find themes that can increase the effectiveness of the protocol and reduce victim treatment/extractions times. The information provided in this research is intended to aid members of the CAST with refining the protocol and provide other public safety leaders information on the effectiveness of the RTF protocol.

The method of data collection provided some research limitations. The scenario proctor missed several point-of-wounding care and extraction times for victims during the exercises. Despite missing times, the researcher still had a large number of collected data by which to draw conclusions.

The large-scale exercises also provided several limitations. First and foremost, an active shooter exercise can never completely simulate the stressors that are inherent to a real incident. These stressors include the threat of serious injury or death to responders from gunfire, explosives, fire, or other deadly threats; a large number of dead or severely injured victims, including the potential for a large number of dead children; personal relationships with the victims; and the chaos and confusion inherent in large-scale hostile events with an unknown number and location of perpetrators.

It is critical to note that the new RTF model has yet to be tested an actual active shooter event. However, simulations such as the large-scale exercises conducted in Charlotte, can help to provide a baseline for the effectiveness when compared other exercises that utilized the traditional stage-and-wait model (Goodwin, 2009). Previous published data from active shooter exercises demonstrated that the stage-and-wait model results in victim care ranging from 60 minutes to 2.5 hours. The exercises in Charlotte demonstrated that the RTF model resulted in victim care and extraction that were significantly less than the stage-and-wait model.

Another significant limitation to the design of these large-scale exercises was the utilization of CMPD SWAT officers to provide the simulated law enforcement force protection for the RTFs. As previously mentioned, instructors made this decision to ensure consistency between the exercises and allow firefighters to see the law enforcement officers demonstrate proper tactics. If the researcher conducted the same large-scale exercises with non-SWAT patrol officers, the time to point-of-wounding care and victim extraction may increase significantly. However, the researcher also believes that patrol officers may provide closer coverage of the RTF and not aggressively push forward of the RTF to clear rooms. The SWAT officers were very aggressive in their searches, sometimes leaving the RTF several rooms behind with no protection while they searched ahead of the RTF. This aggressive searching in front of the RTF is an area that warrants further research to see if patrol officers demonstrate the same type of aggressive search behavior.

The researcher addressed ethical considerations prior to starting the research. The researcher obtained permission from the Northcentral Institutional Review Board prior to conducting any research. This study utilized archived data collected by a government agency. The Charlotte Fire Department had stripped all personal identifiers before the data was given to the researcher.

The area with the most potential ethical concern in this research was the researcher's involvement in the creation and administration of the 32 large-scale exercises. The researcher is a member of the CAST and one of the people responsible for ensuring creation and application of the protocol. The researcher recognized that there might be an appearance of bias desiring to prove success with the protocol implementation. However, true success comes from understanding lessons learned during the exercises and developing methods to continue to reduce the time to point-of-wounding care for victims and the time to evacuate victims from the building. Defining success for these Charlotte exercises is valuable only to the Charlotte Fire Department. Understanding lessons learned is valuable to all public safety agencies. Although this training and the subsequent exercises proved successful in Charlotte, there exist several areas for improvement of the protocol.

Implications

Quantitative research.

Research Question One. Will an integrated public safety active shooter response model decrease the time to point-of-wounding care when compared to previously published research of non-integrated active shooter response?

The integrated RTF model demonstrated that responders can provide point-of-wounding care much quicker than the previously published national average of 60 minutes (Iselin & Smith, 2009). The RTF model provided a successful model by which firefighters could quickly integrate with law enforcement officers to provide care in an area where a potential hostile threat exists. The alternative option to stage and wait for law enforcement to clear the structure would result in a potential high mortality for victims inside the structure.

Prior to putting fire department members through the large-scale exercises, all members received four hours of classroom training provide by members of the CAST. This training provided the firefighters with an essential foundation by which they could utilize the RTF model. The training included the history of active shooters, statistical data from numerous events demonstrating the short duration of hostile actions by the perpetrator, overview of the new fire department tactical order for active shooter response, explanation of the RTF model, required RTF equipment, law enforcement priorities, and tactical medical care guidelines. It is highly recommended that all agencies provide responders with a solid overview of the previous topics prior to attempting exercises utilizing the RTF model. The classroom training provides responders with the knowledge to understand law enforcement responsibilities and to effectively employ RTF tactics.

In addition, the active shooter response must be a complement to normal operations provided by fire department and law enforcement officers. For optimal success, the active shooter response plan should not utilize different terminology, equipment, communications, or tactics that are far removed from standard response procedures. Although active shooter events are increasing, these events are still statistically rare considering the vast number of towns and cities in the United States. Numerous large-scale emergencies in the United States demonstrated the responders typically reverted to normal operations to manage these events. It is very difficult for responders to utilize tactics, techniques, and procedures appropriately during *Black Swan* events. If agency leaders create a response procedure significantly different from normal operations, personnel will most likely fail to utilize these procedures during stressful events, such as an active shooter incident.

The 32 large-scale exercises in Charlotte, North Carolina, demonstrated that the average time for point-of-wounding care for all victims in Scenario One was 18 minutes and 56 seconds after dispatch of the first fire apparatus. In Scenario Two, responders provided an average point-of-wounding care time of 21 minutes and 43 seconds. These averages both represent times that are almost 66% better than the previous published national average of 60 minutes (Iselin & Smith, 2009). However, in Scenario One, the maximum time for point-of-wounding care was 51 minutes and 35 seconds, and in Scenario Two, the maximum time for point-of-wounding care was 50 minutes and 00 seconds. While some statisticians may be quick to dismiss outliers, it is incumbent upon researchers to explore the rationale for why outliers occur. The exploration of these outliers warrants further research to determine why these victims had such a delay in point-of-wounding care.

Very few active shooters events in the United States have occurred in buildings taller than three floors. In the Charlotte exercises, the responders utilized a building that was six stories tall and more than 88,000 square feet. In addition, the building provided an intricate maze of interconnected offices that responders had to search. The scripted scenarios also purposely did not give the location of all victims to the responders, requiring the responders to search the entire building. The building height and layout provided significant challenges by which responders had to overcome.

Scenario One and Scenario Two both utilized 18 victims. The average number of victims at an active shooter event is five (Heightman, 2014). However, the CAST wanted to prepare responders for the rare active shooter events with multiple victims. The CAST decided to utilize 18 victims, as this provided a victim count that represented some of the highest victim active shooter events in United States history (refer to Table 2). In addition, the CAST included the three victims with non-survivable injuries. The average number of people killed in a mass killing event is 4.92 (Hilal, et al., 2014). The CAST wanted to ensure that some of the victims represent the likely occurrence of deceased victims.

Research Question Two. Will an integrated public safety active shooter plan decrease the time to victim extraction compared to previously published research of non-integrated active shooter response?

The integrated RTF model clearly demonstrated extraction times far below the national average of 2.5 hours (Iselin & Smith, 2009). The average time for extraction for both exercises was 29 minutes and 24 seconds. The average time for extraction in Scenario One was 24 minutes and 5 seconds. The average time for extraction in Scenario Two was 29 minutes and 25 seconds. Out of 474 victim extractions, only one victim extraction exceeded 60 minutes (refer to

Table 15). The average extraction time of 29 minutes and 24 seconds for both exercises was better than the self-imposed goal established by the CAST that victim extractions would occur in 30 minutes or less.

In all exercises, fire department personnel paired up with law enforcement officers and made entry into the building within 10 minutes of fire department arrival. The lead instructors all noted that the sooner fire and law enforcement commanders established a unified command; the sooner the RTFs entered the building. Several published research papers and after-action reports have noted the same theme (Columbine Review Commission, 2001; Fabbri, 2014; Tri-Data Corporation, 2014).

The Charlotte Fire Department issued every fire company two XS-1™ victim drag straps (North American Rescue) and two Emergency Evacuation Litters™ (North American Rescue). The ladder companies and rescue companies were each issued a Sked™ litter (Skedco). All companies used these victim evacuation devices during the scenarios. The instructors noted that the responders preferred using the Emergency Evacuation Litters in lieu of the XS-1 and Sked. The Emergency Evacuation Litter allowed two responders to place a victim on the soft litter and quickly carry the victim out of the building. In addition, the Emergency Evacuation Litter was the easiest device to use in the stairwells, especially around corners on the landings and when the stairwells became crowded with responders. The responders elected not to use the XS-1 drag straps in the majority of the scenarios. Responders found it quicker to carry victims out instead of dragging them with a drag strap.

Most responders expressed dissatisfaction with the Sked inside of the building. Responders found that the Sked required the most amount of time of the issued tactical extraction equipment to deploy adequately. In addition, the responders had significant difficulty using the Sked in the stairwells, mainly turning corners on the landings. The Sked may be most useful when a victim needs to be lowered out of windows above the ground floor. Of the issued equipment in Charlotte, the Sked is the optimal extraction device for a vertical rescue.

Numerous equipment manufacturers sell tactical evacuation equipment. These exercises demonstrated that the disposable or nylon soft litters provided the best means for victim extraction. In addition, personnel also found other means by which to extract victims. Some responders used rolling office chairs, some manually carried victims, and others used materials located inside of the building to make a hasty litter. Part of the success of the rapid extraction times is the result of the responders receiving training on tactical extraction prior to the exercises.

Research Question Three. Did the implementation of the new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving point-of-wounding care within the target goal of 15 minutes from dispatch of the call?

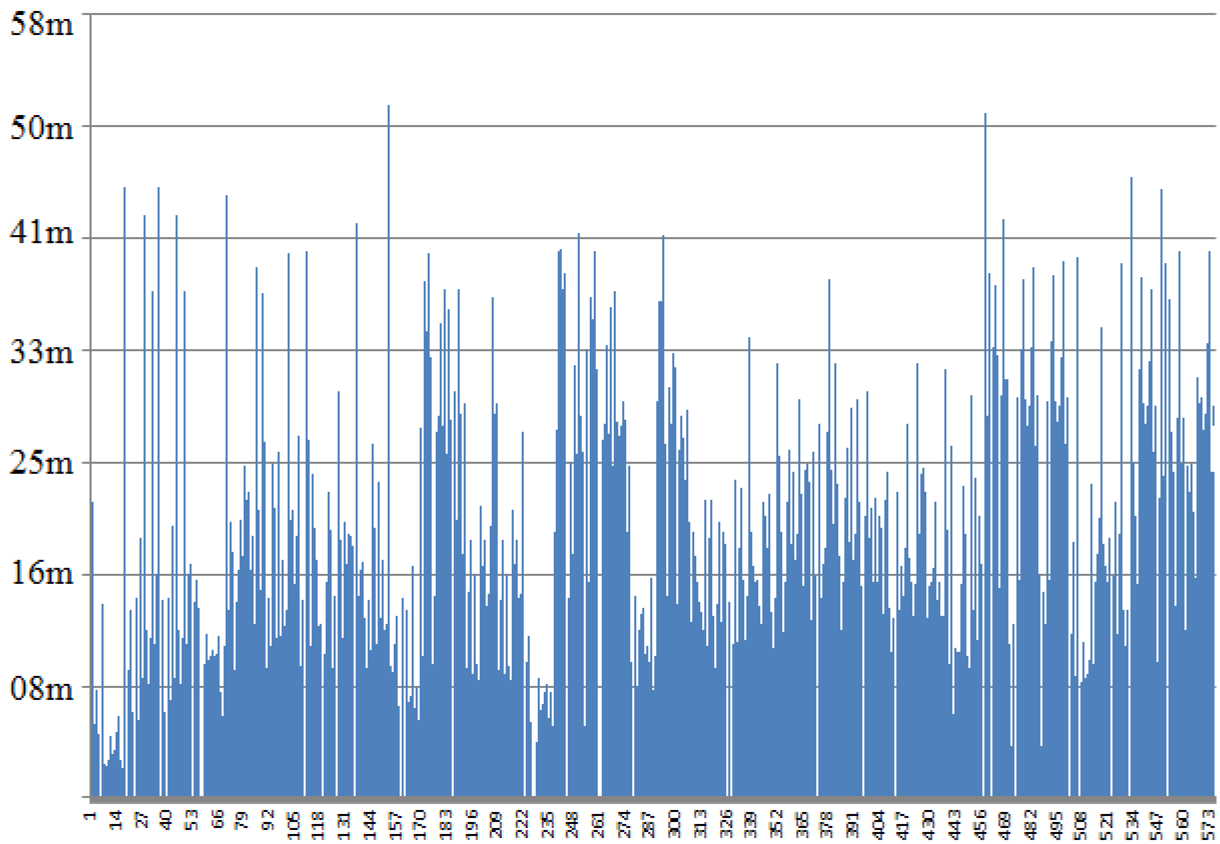
The data demonstrated that responders did not meet an average point-of-wounding time within the target 15 minutes from dispatch of the call. The CAST created this target goal based on two objectives. First was the plethora of data that demonstrated that rapid point-of-wounding care is essential to improving survivability. Second, the CAST wanted to emphasize to the responders the importance of rapid integration with law enforcement and entry into the warm zone.

The target goal to provide point-of-wounding care within 15 minutes of dispatch is an aggressive goal that appears difficult for responders to achieve. In Scenario One, the average apparatus response time was 3 minutes and 21 seconds (refer to Table 3). In Scenario Two, the average response time was 8 minutes and 11 seconds (refer to Table 4). These response times make two critical assumptions. First, the incident occurs in an area served by fire apparatus staffed by trained personnel 24 hours a day. Second, the closest apparatus are available to respond to the incident and are not committed on other incidents in the area. If the incident occurs in an area served by a volunteer fire department, the response time is expected to be much greater. Likewise, if the closest apparatus are on other emergencies, there will be a delay as apparatus further away respond.

The data demonstrated that responders provided point-of-wounding care an average of 18 minutes and 56 seconds for the victims in Scenario One, and 21 minutes and 43 seconds for victims in Scenario Two. It is important to correlate the Scenario One point-of-wounding time in Table 7 with the victim's simulated injuries listed in Table 9. Victims 4, 5, 6, 7, 8, and 9 all had critical injuries that required immediate care, mainly hemorrhage control. These victims all have average point-of-wounding time ranging from 11 minutes and 43 seconds to 21 minutes and 3 seconds (See Figure 6). It is difficult to determine if these victims would have lived with their simulated injuries long enough to allow responders to treat their injuries so that the victims could have survived.

Figure 6

Point-of-Wounding Time for All Victims



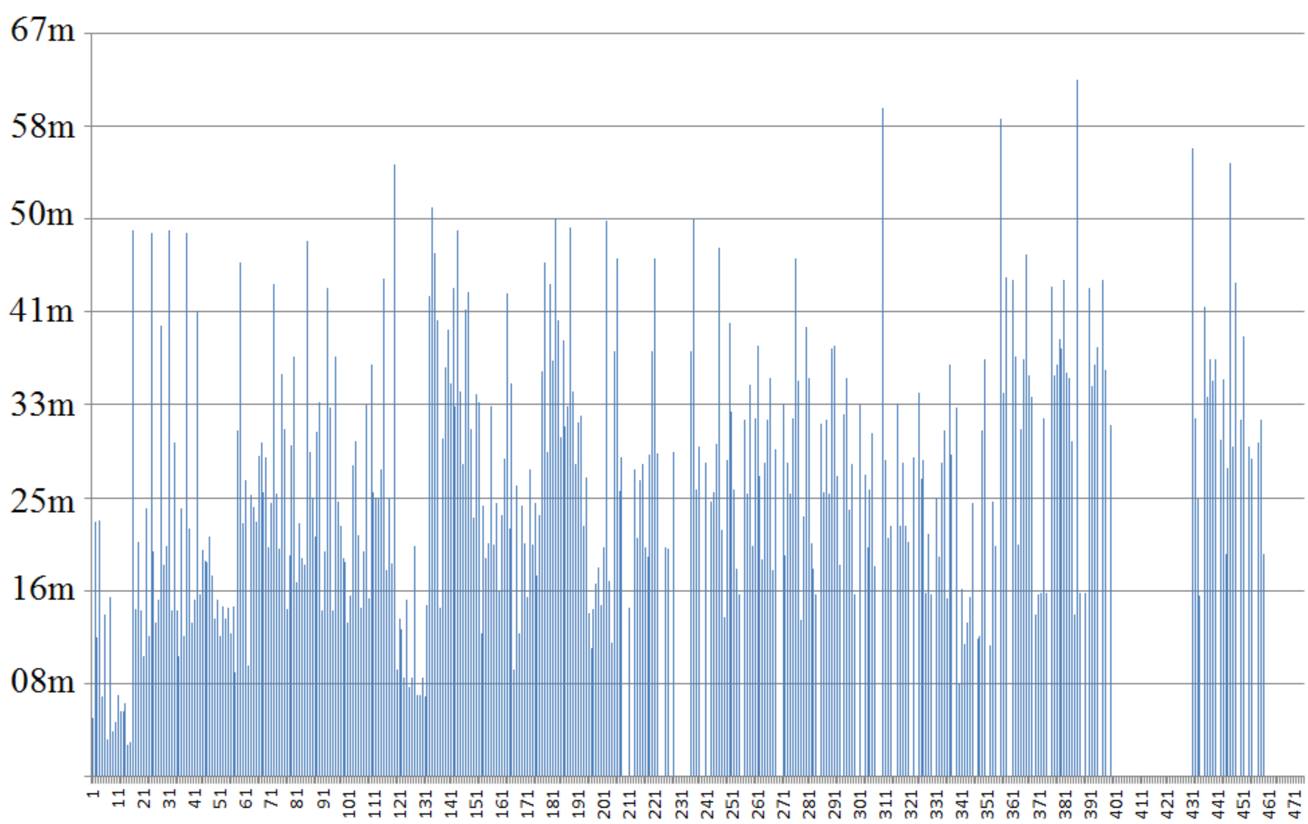
Likewise, it is important to correlate the Scenario Two point-of-wounding time in Table 10 with the victim's simulated injuries in Table 12. Victims 1, 2, 4, 5, 7, 8, 16, and 17 all had critical injuries that required immediate care, mainly control of gross hemorrhage. These victims all had average point-of-wounding times ranging from 16 minutes and 5 seconds to 28 minutes and 37 seconds. It is difficult to determine if these victims would have lived with their simulated injuries long enough to allow responders to treat their injuries so that the victims could have survived.

Research Question Four. Did the implementation of the new active shooter response plan result in all victims in the Charlotte Fire Department active shooter exercises receiving extraction from the building within the target goal of 30 minutes from dispatch of the call?

The research data demonstrated that the new active shooter response plan provided an average extraction time of 24 minutes and 5 seconds in Scenario One, and 29 minutes and 25 seconds in Scenario Two. It is important to note that these times are an average and that multiple victims had extraction times that exceeded the target 30 minutes. Figure 7 shows the average extractions for all 474 victims.

Figure 7

Extraction Times for All Victims



The RTF model clearly demonstrated that extraction times in these exercises are much quicker than previously documented times of two and a half hours or more (Iselin & Smith, 2009). It is of interest to note that once apparatus times were subtracted from the extraction time in Scenario One and Scenario Two, responders were 2 minutes and 2 seconds faster on average removing the victims in the second scenario. Although the location of the victims was different, the scenarios were scripted very similarly. It is the opinion of the researcher that additional scenarios would further decrease the victim extraction time as responders become more comfortable with the RTF concept. These two scenarios demonstrate the responders can improve tactical evacuation time just through repeat exposures to scenarios.

Recommendations

Qualitative research.

Qualitative Research Question One. Did responders demonstrate inappropriate response tactics during the exercises?

Theme 1- Law Enforcement Force Protection for the RTF.

The optimal number of force protection law enforcement officers for an RTF remains hotly debated among public safety leaders throughout the country. In resource-rich cities, public safety leaders prefer a minimum of three or four law enforcement officers for each RTF. This provides the ultimate level of 360-degree protection for the RTF. In addition, three or four officers allows two officers to move forward of the team and clear rooms. This still allows for one or two officer to remain with the RTF as protection.

However, many jurisdictions in the United States do not have the benefit of a large police force. As previously mentioned, 98% of all active shooter events in the United States occurred in jurisdictions served by a police department with 100 or fewer officers (Schweit, 2013).

Because of the limitation of police officers nationwide, policymakers should not establish a minimum number of law enforcement officers required for RTF force protection. In some cases, a single officer may be the only security option available. If this is the case, incident commanders should not hesitate to utilize the RTF concept. The optimal number of law enforcement force protection is most likely a recommendation that situations will dictate, not policy. If a plethora of officers are available to protect RTFs, then three officers should deploy with the RTF. The lack of three officers or even two officers should not be a determining factor in not deploying an RTF. A single police officer can provide a degree of force protection for an RTF. The risk associated with limited force protection for the RTF is far outweighed by the life-saving benefit the RTF can provide to critically injured victims.

In Charlotte, a large number of police officers are working the streets at any given time. The CAST may need to look at the option of placing three law enforcements officers as force protection for the RTF. This would allow two officers to clear rooms, while one officer remains to protect the RTF. The use of three or four officers for force protection depends on the number of available officers.

Theme 2- Freelancing of RTFs.

Fire personnel have a long history of freelancing on fire ground operations (Coleman, 2007). Freelancing occurs when personnel perform actions that are independent of the instructions given by commanding officers (Coleman, 2007). When fire personnel freelance, several potential problems emerge. First, incident commanders lose accountability of personnel (Corbett, 2009). Second, freelancing results in personnel failing to complete assigned tasks, or duplicating tasks that other responders have already completed (Viscuso, 2013). Last, freelancing often results in firefighters placing themselves at additional risk. Retrospective research on firefighter fatalities found that firefighter freelancing is a significant cause of fatalities during firefighting operations (Klaene, 2016).

Several of the lead instructors noted that RTFs would conduct searches on their own, even after their force protection officers told the RTF to stay secured in a room. This freelancing most frequently occurred when firefighters would check interconnecting offices attached to the room in which they were located. Firefighters knew that victims were located throughout the building and wanted to quickly locate the victims. Firefighters would often go look in closets or adjoining rooms that had not been searched by law enforcement officers.

Another obvious reason for the freelancing was that firefighters knew that this was training and that no hostile threat existed. If firefighters believed that an actual hostile threat was possibly present, the researcher believes that firefighters would be much less eager to freelance away from their force protection. However, some firefighters may still be as aggressive, especially if the potential victims involve small children. In these cases, the law enforcement force protection needs to work to ensure that the RTF stays together and that personnel do not stray from the protection of the officers.

It is incumbent upon public safety leaders to express the importance of not freelancing on any operation, but in particular events of mass violence where hostile perpetrators may exist. Policy must address the issue of freelancing and require that all personnel working at active shooter events pay special attention to avoid freelancing. This freelancing can occur purposefully or inadvertently with misunderstood communication and a lack of clear direction from the incident commanders.

Qualitative Research Question Two. Where there any observed tactics that resulted in delays for either victim treatment or extraction?

Theme 3- Marking the Deceased.

The CAST needs to address this theme internally with a protocol. Checking and rechecking the deceased is typically not problematic when there are few victims. In cases with few victims, rechecking the deceased can help to confirm that the victim is indeed nonviable. However, the practice of rechecking the deceased is problematic when this slows down care to other victims. The instructors noted that responders frequently rechecked deceased victims eight to nine times during the exercises. This practice directly delayed point-of-wounding care for other victims in the building.

There exists a variety of different methods by which responders can mark a victim as deceased. These methods include chemical lights, writing “dead” on the victim’s forehead with permanent marker, victim body positioning, surveyor’s tape, and triage tags. Each of the aforementioned techniques has advantages and disadvantages. Chemical lights are highly visible; however, responders may not have chemical lights, the chemical lights may be kicked or moved, or the responders do not have enough chemical lights for the number of deceased victims. Writing on the victim’s forehead can be quick and effective; however, this is often considered poor taste when family members need to identify the victim’s body. Several agencies utilize victim body positioning to indicate a deceased victim. This positioning involves rolling the victim onto their stomach and crossing their arms and their legs. In addition, some agencies roll a victim onto their left side in a recumbent position to indicate a deceased patient. Although victim positioning does not require additional equipment, the position of the victim may also create questions. Using the left side recumbent position, responders much ensure that no other victims happened to place themselves in this position, leading to a false assumption that responders have already declared the victim deceased.

Surveyor's tape and triage tag provide a quick resource to mark deceased victims. Although these options appear to be quite logical, research conducted at active shooter events and other disasters demonstrate that responders rarely use triage tags or other triage marking devices (Tri-Data Corporation, 2014; Virginia Tech Review Panel, 2007). Responders typically do not use triage tags in mass disasters for two reasons. First, the responders are not familiar with the triage tag, as these items are rarely used during in their career (Tri-Data Corporation, 2014). Second, the responders are often overwhelmed with a large number of critically injured victims and do not have time to place triage tags while performing numerous life-saving treatments. At the Aurora Theater shooting, responders faced more than 100 injured victims, with 70 requiring ambulance transport (Tri-Data Corporation, 2014).

Policy makers need to establish a clear policy on the identification of deceased victims at mass casualty events. Failure to identify deceased victims frequently results in unnecessary checking and rechecking of the victim. This unnecessary action has a direct effect on delaying point-of-wounding care to other victims.

Theme 4- RTF Size.

Multiple authors have opined the optimal RTF size, with several stating that the ideal size is two medical providers with four law enforcement officers (Enchanted Circle EMS Association, 2013; Meoli & Rathburn 2014). The issue of the optimal number of law enforcement officers was addressed earlier in this paper. The lead instructors observed RTF sizes ranging from two medical providers to more than ten medical providers in a single RTF.

RTFs with more than four medical providers quickly became dysfunctional because of the large size of the RTF and the inability of the two law enforcement officers to provide adequate protection for the large RTF. Likewise, an RTF with only two medical providers frequently encountered difficulty moving a large victim significant distances, including traversing stairs. The instructors noted that the optimal RTF size consisted of three to four medical providers. These providers were able to move effectively one large patient a long distance, or move two smaller victims at once. In addition, the three to four medical providers immediately provided multiple simultaneous treatments when the RTF located multiple victims in one place. Limiting the size of the RTF to three or four medical providers also allowed the law enforcement officers to provide sufficient force protection for the RTF.

Theme 5- Searching for Victims.

In these exercises, fire and law enforcement personnel faced a complex task of searching a six-story building with a maze of interconnected offices. Many of these offices did not have labels identifying the office number. Responders had to quickly figure out the layout of the building and often had to find one office that was correctly labeled and then work from there to identify other nearby offices with potential victims.

Incident commanders divided the search for victims into two categories. First, responders went to areas of known victim locations. Responders established known victim locations based on information provided through the injects given by the 911 dispatcher as well as information provided by the simulated victims on scene. Second, responders searched the building for unreported victims or victims with a very non-specific location given, such as “the third floor”. The searches for unknown victims took much longer, as responders slowly checked room by room.

During the slow search for unknown victims, a RTF would sometimes encounter a victim. In many cases, the RTF would extract the victim and the incident commander would send in a new RTF to continue the search for additional victims. The instructors frequently observed that the new RTF would search rooms again that the first RTF had already searched. This occurred because of a lack of communication between the RTFs. This double searching of rooms delayed finding victims in many scenarios.

In other cases, the RTF would locate a victim and then extract the victim back to a waiting RTF. The original RTF would then resume the search where they last left. This operation proved to be very successful and reduced the amount of time it took to locate victims. The original RTF knew where they had already searched and were able to immediately resume searching new rooms. When resources permit, it is recommended that one RTF provide the majority of searching in an area and extract victims to other incoming RTFs. These handoffs can occur in areas such as stairwells, lobbies, or other recognizable location inside the building.

Qualitative Research Question Three. Did responders encounter issues with communication or incident command?

Theme 6- Rapid Creation of a Unified Incident Command.

Rapid creation of a unified incident command is essential to rapidly accessing and removing victims at active shooter events (Columbine Review Commission, 2001; Fabbri, 2014; FEMA, 2014b; Tri-Data Corporation, 2014). Several of the lead instructors noted that the 32 exercises went much better when a police and fire created a unified incident command quickly into the event. In the majority of the exercises, the first arriving fire captain found the police officer in charge and created a hasty unified command post, typically right in front of the entrance to the building. Once the first battalion chief arrived on the scene, the command post was usually located farther away from the building. In the majority of exercises, the fire battalion chief and law enforcement officer in charge collocated in the battalion chief's fire command vehicle.

Collocation of the police and fire commanders was essential to effective command and control. In one exercise, the fire battalion chief elected to run the operation independent of law enforcement. In this case, the fire battalion chief instructed fire companies to pair up with two law enforcement officers and make entry into the building. This exercise did not run as smoothly as the other exercises where the fire and police commander collocated. Instead of the fire battalion chief talking face-to-face with the law enforcement incident commander, communications between the two passed through several intermediaries. In this case, the law enforcement officers providing force protection notified the captain in the RTF, who in turn notified the fire battalion chief. In several cases, the battalion chief missed important communication.

Within the unified command post, the police officer in charge directed law enforcement operations, while the fire battalion chief directed victim rescue operations. The law enforcement commander focused on locating and neutralizing the threat, while the fire battalion chief focused on treating and removing victims. The fire battalion chiefs understood that the law enforcement commander had ultimate authority on operations; however, the law enforcement commander knew that the fire battalion chief was better suited to coordinate rescue operations of victims. Both the law enforcement and fire commanders worked in cooperation with each other.

Theme 7- Communications with the RTF Firefighters and the RTF Force Protection.

Several of the instructors noted confusion with verbal communications between the RTF firefighters and the RTF police officer force protection. Prior to the start of the exercises, the fire department trained all fire personnel on common terminology that firefighters may hear from law enforcement. Some of the terms included *hold, clear,* and *cover*. Instructors taught firefighters to remain in place when they were told to hold. Firefighters were taught that clear means the space searched is secured from threats.

The term *cover* has two different meaning depending on the context. If an officer is requesting cover, the officer is requesting other officers to provide lethal coverage towards the threat because the first officer is unable to direct attention towards the threat. This can occur when an officer is reloading, has a weapon malfunction, or placing a subject in custody. Cover can also mean to seek a secure place that provides ballistic protection from a threat. If the RTF force protection tells the firefighters to take cover, the firefighters need to immediately find a location that can stop ballistic threats, such as behind a large vehicle or in a room with reinforced concrete or brick construction.

The most confusing term for responders was the meaning of *clear*. It is important for both law enforcement and fire personnel to have a standard definition for the term. In all cases, law enforcement used the term to mean that the area searched was free from both hostile threats and victims. However, the firefighters did not know that law enforcement meant that there were no threats and no victims. An easy remedy for this is to train police officers to declare an area clear and declare no victims (if none exist). This helps to prevent confusion regarding the meaning of the word.

As communities look to create an integrated active shooter response plan, public safety leaders must identify terms that may provide confusion for responders. Terms vary based on geography and individual agencies. In Charlotte, several agency-specific terms have the potential for creating confusion with other agencies. Charlotte Fire Department uses the term *filling the box* to mean that dispatch is assigning additional fire apparatus to an emergency based on predesignated response protocols. Fire personnel are very familiar with this term and use it every day when requesting additional resources. However, personnel with Charlotte-Mecklenburg Police Department are not familiar with the term and have no idea what filling the box means. The CAST identified several other agency-specific terms that could create possible confusion during an interagency response.

Responders can easily prevent confusion with agency-specific terms by utilizing plain language terminology when operating at joint agency emergency events. The Federal Emergency Management Association addressed this issue in 2006, stating, “It is important that responders and incident managers use common terminology. There simply is little or no room for misunderstanding in an emergency situation” (FEMA, 2006, pg. 1). All agencies should adopt a plain text policy during multiagency responses. The CAST should further work to identify potential confusing terms and educate the other agencies as to the meaning of these terms. In addition, the CAST needs to ensure that all agencies understand the importance of using plain language communication during active shooter events and other interagency events.

Theme 8- Radio Communications.

Almost every incident commander at the 32 exercises commented that the volume of radio communication was overwhelming and often resulted in missed communication. This missed communication included messages from dispatch to the incident commanders and messages from responders to the incident commanders. In addition, most of the responders stated frustration about the inability to broadcast transmissions on the radio because other units were talking. In one scenario, a fire captain in charge of an RTF had to wait more than five minutes to broadcast an urgent message on the radio.

The instructors readily anticipated problems with radio communication. This problem is not inherent to these exercises, but has also been problematic at numerous real active shooter events (Tri-Data Corporation, 2014). In addition, the scenarios provided in these exercises far underestimates the actual volume of radio traffic that responders can expect at actual events. At the 2007 Virginia Tech shooting, three dispatchers at the campus 911 center handled more than 2,000 emergency calls (Larson, 2008). At the 2012 Aurora Theater shooting, 13 dispatchers handled more than 6,000 emergency calls (Tri-Data Corporation, 2014). At the 2013 Garden State Mall shooting in Paramus, New Jersey, four on-duty dispatchers handled 1,000 911 calls in the first 45 minutes of the event (Ehrenberg, K., personal communication February 23, 2015).

It was impossible for the CAST instructors to simulate thousands of 911 calls and the subsequent volume of information inflow/outflow from the 911 center to the responders in the scenarios. The scripted scenarios represent a small fraction of the anticipated volume of information that 911 dispatchers will have to pass along to responders on the scene. Even with the small volume of radio traffic, incident commanders and responders still found the volume to be overwhelming.

Incident commanders will have trouble minimizing the volume of radio traffic; however, commanders can implement several steps that will make communications less overwhelming. In some jurisdictions, responding police, fire, and EMS agencies all switch to a common radio frequency when operating together on calls. In an active shooter event, the researcher discourages this practice. The primary reason for not having a common radio frequency is because of the sheer volume of anticipated radio traffic that each agency will have as they accomplish their agency specific incident objectives.

Law enforcement officers must operate on a frequency where radio discipline is paramount, with typically only the officers going direct to threat talking on the radio for the initial first minutes in the event. This affords those officers closest to the threat priority air time on the radio. This also allows officers close to the threat to broadcast pertinent tactical information back to responding officers. Likewise, fire and EMS personnel will have similar priorities that each agency must broadcast to other incoming fire apparatus and ambulances. These priorities include fire suppression operations, hazardous material mitigation, and victim treatment/extraction/transport.

Despite the researcher's recommendation against a common operating channel, responders may elect to monitor the radio channel of other agencies. This can provide an increased situational awareness of the event. However, many jurisdictions will lack available personnel to adequately monitor additional radio channels. In addition, this practice may cause personnel to operate on the wrong radio frequency and miss important radio traffic on their primary frequency.

The optimal solution for maintaining separate radio frequencies requires police, fire, and EMS commander to operate together in a unified command post. This ensures that each discipline receives the same information and that all agencies operate together with a common goal and purpose. The unified command post also allows each agency to ensure their tactical objectives are accomplished in coordination with the other agencies' tactical objectives. As previously stated, the sooner police, fire, and EMS establish a unified command post, the faster each agency will accomplish their agency-specific incident objectives.

Incident commanders should also consider designating one radio channel for communications only between the incident commander and the 911 center. This ideally should occur very early into the incident. This allows the incident commander to have a direct, uninterrupted line of communication with the dispatch center and places the operational radio traffic on a separate radio channel. To effectively implement this, incident commanders should ideally have an aide assisting in the command post. Typically, this aide will monitor the radio traffic from the 911 center, allowing the incident commanders to focus on the operational radio channel.

In the 32 large exercises, almost every incident commander designated at least one aide to assist in the command post. In many cases, the second arriving battalion chief became the aide in the command post, while in other cases the incident command designated a firefighter or captain to operate as an aide. In the exercises with a command aide, the incident commanders expressed that it was of great benefit to have the aide assisting early into the operations to reduce the workload on the incident commander.

In many fire departments, ancillary fire personnel may fill the role of command aide. These ancillary fire personnel can include fire inspectors, arson investigators, logistical support personnel, training officers, and other non-operation fire personnel. This allows the incident commander to maximize the use of operational personnel to affect rescues, treat victims, and mitigate other potential hazards.

Implications and Recommendations for Leadership

Active shooter events are extremely complex public safety emergencies (Clark, 2014). These events often incorporate numerous challenges, including armed perpetrators intent on mass homicide, explosive devices, fires, chemical munitions, barricades, and multiple critically injured or dead victims (Cullen, 2009; Fast, 2009: FEMA, 2013; Mell & Sztaknkrycer, 2005; Nichols, 2010; Sinai, 2013; Slayton, 2014; Tri-Data Corporation, 2014). Every published active shooter event after action report lists multiple areas for leadership improvement (Tri-Data, 2009; Tri-Data, 2014).

The greatest challenge for public safety leaders is recognition that an active shooter event can happen in any jurisdiction, regardless of size or resource capability. Public safety leadership must make plans to respond to an active shooter event in their community. Although active shooter events are low frequency, the event can have catastrophic results. Active shooter events frequently garner international attention, placing the responding agencies on the international microscope for everyone to evaluate and critique the response to the event. Peter Cox with the London Fire Brigade stated, "We have far too great a reputational risk to not be scene doing something at active shooter events" (Cox, 2015).

Interagency cooperation, planning, and training are some of the greatest hurdles that public safety leaders must overcome. Active shooter events are not simply a law enforcement event. Fire service personnel and emergency medical service personnel all have equal responsibilities and priorities to accomplish at these events. Public safety leaders must collectively work together to create a unified active shooter response plan that aggressively incorporates point-of-wounding care for victims and rapid extraction of victims to awaiting ambulances. It is incumbent upon public safety leaders to cooperatively identify each agency's priorities at these events, and determine ways that agencies can work synergistically with each other to accomplish mission objectives.

An integrated active shooter plan requires much more than just a theorized plan on paper. To be effective, public safety agencies must train together on the integrated response plan. The 32 large-scale exercises in Charlotte demonstrated the importance of allowing responders the opportunity to practice the integrated response model with law enforcement in simulated active shooter events. Through the use of exercises, public safety leaders will have the opportunity to identify problems that may occur during response to an actual active shooter event.

Public safety leadership should also test the effectiveness of the exercises by documenting the time from dispatch to initial point-of-wounding care, and the time from dispatch to victim extraction from the building. The documentation of times allows for leadership to analyze and assess the data to determine the effectiveness of the response. The analysis of data can provide public safety leaders with the opportunity to improve on the protocol and benchmark their success with other published active shooter response research.

Conclusions

This research provides public safety leaders with the rigors of legitimate scientific inquiry as demonstrated in this study. While many have opined to the effectiveness of the RTF response model, there exists almost no published scientific evidence of the testing of this concept. This research provided two meaningful purposes. First, the CAST has a comprehensive analysis of the results of the 32 large-scale exercises. Second, public safety leaders everywhere can benefit from the lessons learned from these exercises.

Most importantly, this research allows the lives of those lost at active shooter events to not be in vain. The memory of every victim is honored in this research, as public safety leaders everywhere look to prevent future deaths at active shooter events. In particular, this research honors the lives of Lauren Townsend and Victoria Soto. Lauren Townsend lost her life on April 19, 1999 as a student at Columbine High School. Victoria Soto lost her life on December 14, 2012 as a teacher at Sandy Hook Elementary School. If just one life is saved from this research, the reward is beyond measure.

The catalyst for this study came from a lack of published research on the efficacy of the RTF model. The Charlotte Fire Department and Charlotte-Mecklenburg Police Department developed an integrated active shooter response plan that aggressively incorporated fire personnel at active shooter events to treat and extract victims to waiting ambulances. Not only did both departments train personnel on this new protocol, but scenario proctors captured data on the results of the new protocol at 32 large-scale exercises. The quantitative part of the data collection provided an unbiased examination of the new protocol. The qualitative part of the data collection examined the instructors' observations and identified eight common themes seen during the 32 exercises. Combined, the quantitative and qualitative data provided a descriptive analysis of the RTF protocol. The RTF model holds significant promise to decrease the time to treat and extract victims at active shooter events.

The completion of this study is a beginning and not an end to integrated active shooter response research. What worked in Charlotte may very well not work in other jurisdictions. Coordinated active shooter response by police, fire, and EMS are complex (Fabbri, 2014). Because of the complexity of active shooter events, the responses prevent a cookie-cutter approach (Fabbri, 2014). Public safety providers need to tailor an active shooter response plan to the resources of the community (Fabbri, 2014). A standard response template does not exist for active shooter response. Each community must analyze the capabilities of their personnel and resources to create an ideal active shooter response plan.

It is the researcher's hope that this study will help to generate discussion in many communities regarding the aggressive deployment of medical personnel into active shooter events. The data overwhelming demonstrates that rapid medical care will save the lives of penetrating trauma victims. The lessons learned from these exercises will hopefully help other communities as they create protocols and procedures for their jurisdiction.

This research also generated additional topics that require further scholastic exploration. The first topic is the effect on point-of-wounding time and extraction time when SWAT officers provide the force protection, compared to standard patrol officers. This research used SWAT officers for standardization of response during all 32 exercises. However, in an actual event, patrol officers will provide the vast majority of RTF force protection. At a future time, the researcher would like to run these same scenarios utilizing patrol officers to examine the difference in times.

A second topic that the researcher would like to explore further is the concept of TACEVAC inertia. Further research is needed to examine the potential delays in the warm zone that slow the time for victim extraction to waiting ambulances. These delays include the use of casualty collection points and providing unnecessary medical treatments.

The completion of this study marks a significant milestone in the researcher's personal, professional, and academic endeavors. This study provided a capstone of more than 4,000 hours of personal research on active shooter perpetrators and active shooter events. The researcher was able to combine 23 years' experience in the fire service, 20 years' experience as a paramedic, and six years' experience as a police officer to effectively analyze a holistic public safety view of integrated active shooter response. In addition, the researcher was able to combine the experience of personally training more than 40,000 public safety responders on active shooter response and the feedback obtained through those educational opportunities.

In conclusion, the researcher focuses back on the quote from Dawn Anna, regarding her expectation as a parent for active shooter event responders: "Either go in there and do something, or take off your uniform and find another job" (Bradley, 2001 [television interview]). Every responder should take this admonishment to heart and introspectively review their commitment to aggressively place themselves between harm's way and innocent victims. It is vital that responders take the time to plan and prepare for active shooter events. As Abraham Lincoln said, "I will study and prepare myself, for someday my chance will come" (Aganaba, 2012).

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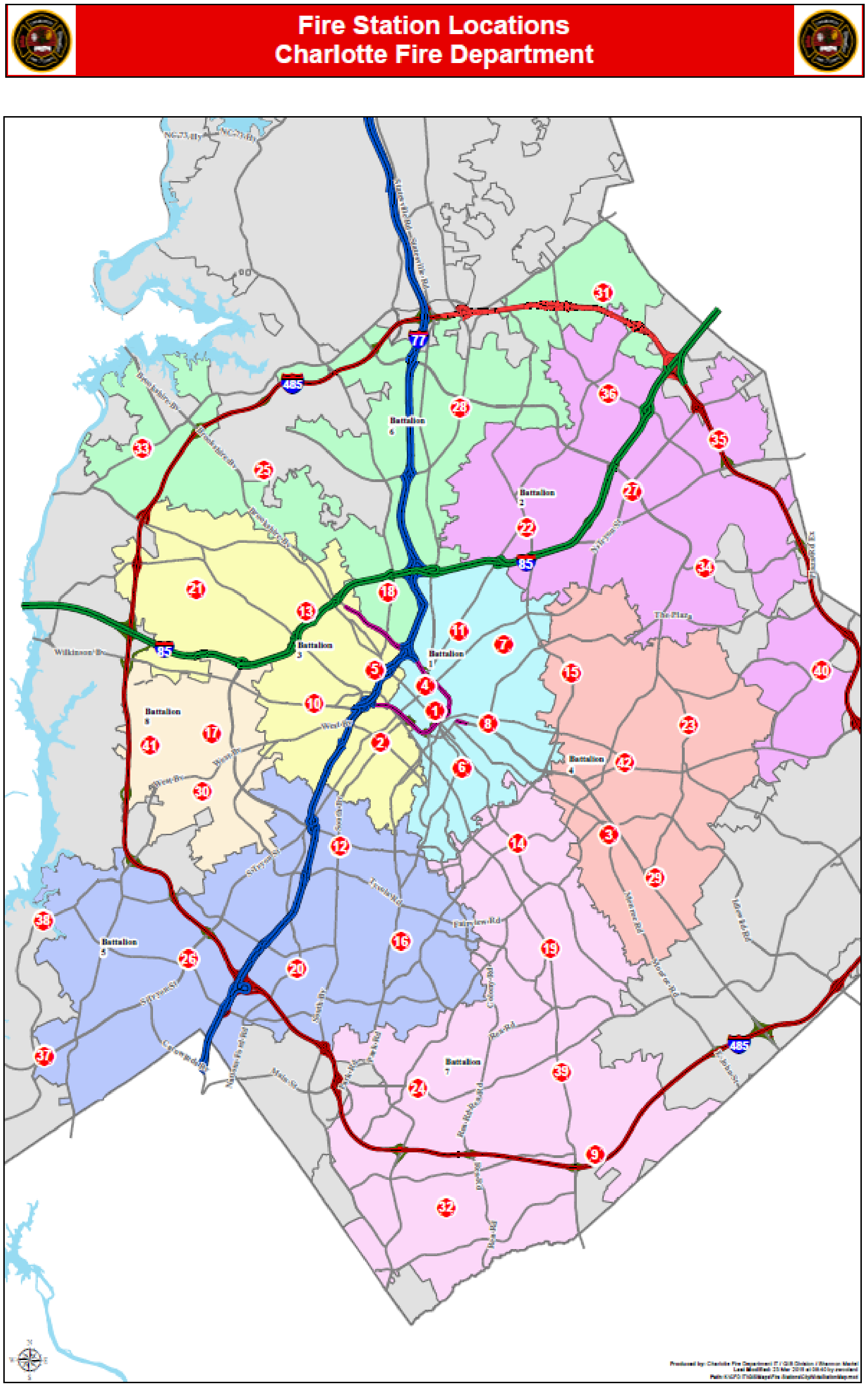
Appendix A:

Charlotte Fire Station Locations



Appendix B:

Active Shooter Scenario #1

Charlotte Fire Department Communications (Alarm) has run the response times for companies to this location. These response times are listed below and will be kept true to form in this scenario. Note that one minute will be added in the scenario to each of the times below to simulate turnout time for the companies.

Response times from quarters to 701 E. Martin Luther King Boulevard:

Engine 1, Ladder 1, Battalion 1 = 1:19 min
Engine 2, Ladder 2 = 1:58 min
Engine 4 = 1:59 min
Engine 6 = 3:11 min
Rescue 10, Battalion 3 = 4:24 min
Haz Mat 1 = 7:00 min

Scenario #1:

Time:	**Inject:**	**Notes:**
0 minutes	ALARM dispatches Engine 1 for an unknown medical at 701 E. Martin Luther King Boulevard at the Queen City Office Building	
00:30	ALARM advises Engine 1 that MEDIC states possibly two shot in the parking lot at this location. ALARM states that MEDIC advises to “stage”, the assailant is still on scene.	ALARM is not going to upgrade this automatically.
00:45	ALARM advises reports of multiple people shot inside a commercial building, upgrading this to AVI.	
01:00	AVI dispatch: Engine 2, Engine 4, Engine 6, Ladder 1, Ladder 2, Battalion 1, Battalion 3, Rescue 10, Haz-Mat 1 (note, both Rescue and Haz-Mat will be coming from the TA for purposes of manpower restrictions in this scenario)	
01:30	ALARM advises all companies that CMPD is doing an	

	"Active Shooter" response. ALARM also advises MEDIC is sending an MCI response.	
01:45	ALARM advises reports of victims on the second and third floor. ALARM states there may be as many as six victims.	
02:00	ALARM advises that CMPD is stating the shooter is on the third floor.	
02:15	ALARM advises fire pull station activations on the second and third floor.	
02:19	Engine 1 arrives on scene.	
02:30	ALARM advises reports of at least three shot on the second floor, and possibly three or four shot on the third floor.	
03:00	Victim #1 comes out of the front entrance and collapses.	Victim #1 located outside main entrance of building. Priority 2 victim. This victim is advising that there are multiple people shot in the building.
03:15	ALARM advises third pull station activation from the fourth floor.	
03:19	Ladder 1 and Battalion 1 on scene	
03:30	CMPD is on scene advising they have 10 officers currently in the building going direct-to-threat (simulated officers). CMPD advised there are still shots being fired on upper floors.	
03:45	ALARM advises that MEDIC states possible victims on the third floor. Two are located in the library. One is shot and one is having chest pains.	Victim #2 and Victim #3 located on second floor library. Both are Priority 2 victims.
03:58	Engine 2 and Ladder 2 are on scene	
03:59	Engine 4 is on scene	
04:15	ALARM states that MEDIC is advising there is one shot in the female bathroom on the first floor. Victim is bleeding severely from a GSW to the arm.	Victim #4, located in first floor women's bathroom. Priority 1 victim.
05:11	Engine 6 is on scene	
05:30	CMPD advises the first floor is clear of any obvious threat. Contact team is moving to the second floor. CMPD advises they can hear gunshot from the third or fourth floor.	
05:45	CMPD is advising there might a second perpetrator in the building. Possibly on the third floor.	There is no second perpetrator.
05:45	ALARM advises four shot on the second floor near the Assistant Superintendent's office	
06:00	Two CMPD officers are available to form an RTF.	Two CMPD officers needed
06:00	CMPD advises one shot in the stairwell between the second floor and third floor.	Victim #5, located in the stairwell between the first and second floors. Note: there are

		two stairwells and they are labeled Stairwell #1 and #2. This victim will be located in Stairwell #2 (the furthest stairwell from the front entrance.) Priority 1 victim.
06:24	Rescue 10 and Battalion 3 are on scene	
06:45	CMPD advises they are on the third floor and the gunfire has stopped. They have to slow down their direct-to-threat search and search room-to-room.	
07:00	ALARM advises they are talking calls for a possible second gunman on the third floor.	There is no second perpetrator.
07:15	ALARM advises that CMPD is stating a 911 caller has said the perpetrator has possibly killed himself on the fourth floor in the Assistant Superintendent's office	
07:30	CMPD advises that the second floor is clear of any obvious threats. CMPD is advising there are multiple victims down on the second floor.	These are victims #2, #3, #6, #7, #8, and #9
08:45	CMPD states they have the possible perpetrator on the fourth floor. He appears deceased with a self-inflicted gunshot wound to the head. CMPD is requesting medical personnel to come and confirm that the victim is deceased.	Victim #18
09:00	Haz-Mat 1 is on scene (if participating in the training)	
09:30	CMPD is requesting a fire company to control the elevators and recall them to the first floor.	
10:30	CMPD advises they have located a victim on the first floor men's bathroom.	Victim 10 first floor men's bathroom. Priority 3. This victim advises responders that two other victims ran to the basement (Victim #12 and Victim #13). Both of these are Priority 3 victims.
11:00	ALARM advises there is an uninjured wheelchair bound victim on the fourth floor. The victim is in room #414. Victim states they heard gunfire two rooms over.	Victim #11 fourth floor Room #414. Uninjured handicapped victim hiding.
11:30	ALARM advises MEDIC is stating there are possibly four victims in a conference room on the second or third floor. This is a second-hand report from an employee's husband calling from a remote location.	There are no victims in the conference room.
12:30	ALARM advises that CMPD has said they were unable to locate a second gunman on the second floor. They are now conducting a room-to-room search on all floors.	
13:30	Two CMPD officers are available to form an RTF	Two CMPD officers needed
14:00	CMPD states there are victims in the Payroll Processing Office on the third floor.	Victim #15 deceased dummy in fourth floor payroll office. Victim #16 fourth floor payroll office Priority 3.

16:00	ALARM advises that CMPD is receiving reports of another gunman on the third floor in the conference room.	There is no gunman.
18:00	ALARM advises a caller states her daughter works in the building and has an office on the 3rd floor. The mother has not heard from the daughter and wants someone to check the office. The mother fears her daughter is dead.	There is no victim.
20:00	CMPD advises the second floor is all clear.	
30:00	CMPD advises the third floor is all clear.	
45:00	CMPD advised the fourth floor is all clear.	

Appendix C:

Active Shooter Scenario #2

Charlotte Fire Department Communications (Alarm) has run the response times for companies to this location. These response times are listed below and will be kept true to form in this scenario. Note that one minute will be added to each of the times below to simulate turnout time for the companies.

Response times from quarters to 13860 Ballantyne Corporate Place:

Engine 32 and Ladder 32 = 3 min 41 seconds
Engine 24 and Ladder 24 = 4 min 32 seconds
Engine 9 = 6 min 03 seconds
Engine 20 and Battalion 5 = 8 min 45 seconds
Battalion 7 = 09 min 09 seconds
Rescue 3 = 16 min 29 seconds
Hazmat 1 = 20 min 53 seconds

Scenario #1:

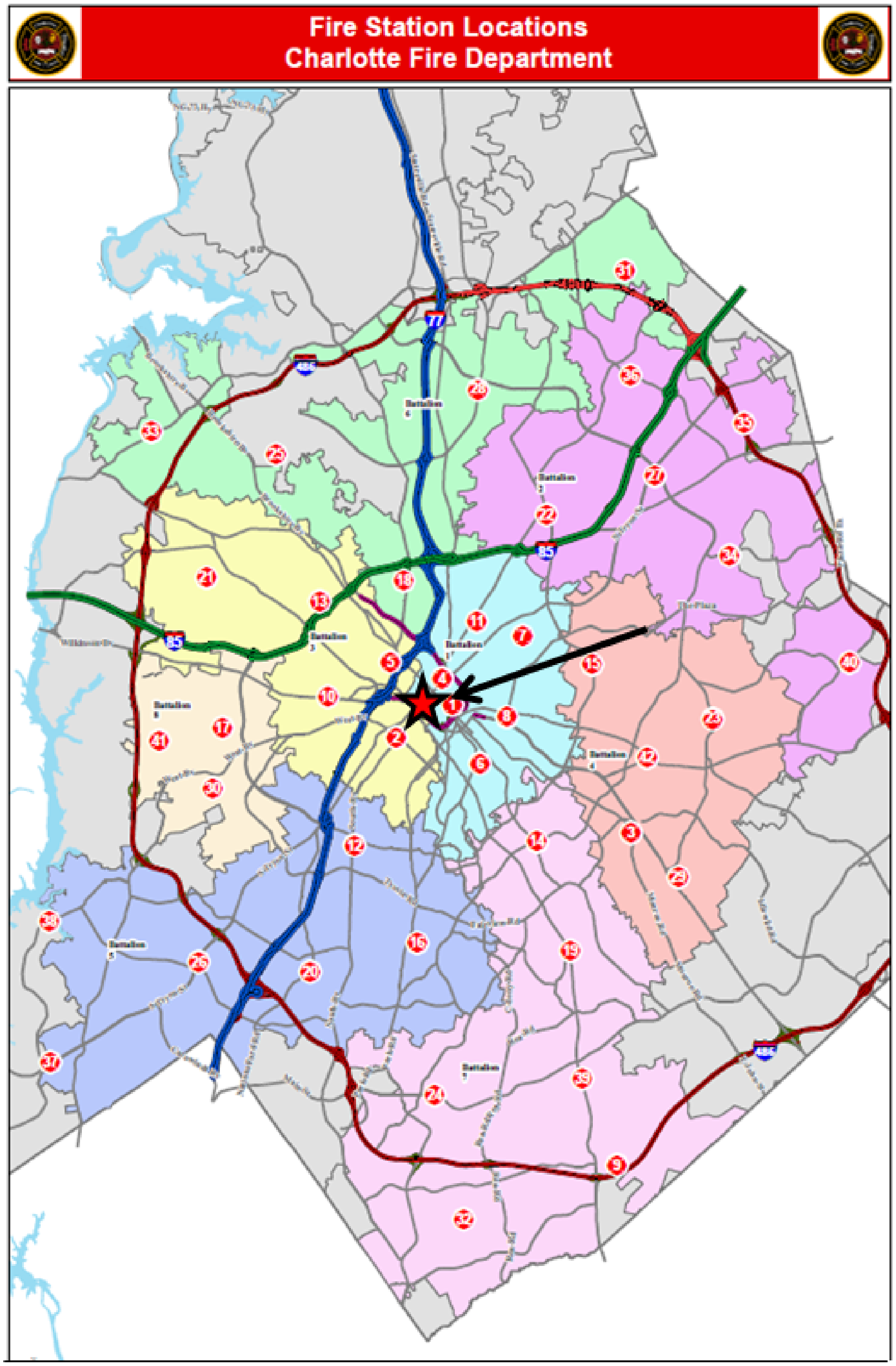
Time:	**Inject:**	**Notes:**
0 minutes	ALARM dispatches Engine 32, Ladder 32, and Battalion 5 for a reported fire alarm at 13860 Ballantyne Corporate Place	
00:30	ALARM advises units enroute that this is for a pull station activation in the lobby of the Ballantyne Corporate Building.	
01:00	ALARM advises units enoute that MEDIC is reporting one shot in the 13000 block of Ballantyne Corporate Place and that Engine 24 is being dispatched to that call.	
01:30	ALARM advises Battalion 5 that there is now a second shooting reported at 13860 Ballantyne Corporate Place and to “use caution”. ALARM advises they will be adding Ladder 24 to the call.	
02:00	ALARM advises that per MEDIC, there is an “active shooter” in the building at 13860 Ballantyne Corporate Place and there are several people shot. The caller states the gunman is still onscene. ALARM advises they are going to be filling out the AVI box.	
02:20	AVI dispatch: Engine 9, Engine 20, Battalion 7, Rescue	Haz-Mat 1 is coming because

	3, Haz-Mat 1	the 32s are on the initial call.
02:40	ALARM advises all companies that CMPD is doing an "Active Shooter" response. ALARM also advises MEDIC is sending an MCI response.	
02:50	ALARM advises reports of multiple gunshot victims on the third and fourth floors. MEDIC is advising they are victims in the Payroll Office in room #322 and Room #311.	
03:10	ALARM advises that callers are stating they are two shooters in the building. One is dressed in a black trench coat; the other is dressed in black coveralls. Both are reported to be armed with at least two pistols and a shotgun. One might have an assault-style weapon as well.	
03:15	ALARM advises third pull station activation from the fourth floor.	
04:15	ALARM advises a 911 caller from 13000 Ballantyne Corporate Center states that there is a gunman on the roof of the building at 13860 Ballantyne Corporate Center	When asked, CMPD will advise that CMPD air support states this is a maintenance man on the roof.
04:41	Engine 32 and Ladder 32 are on scene.	
05:00	ALARM states that MEDIC is advising that there is one victim with a gunshot wound in the rear parking lot.	
05:45	ALARM advises there is a 911 open line from the fourth floor Purchasing Clerks Office and that gunfire can be heard along with screaming.	
05:45	ALARM advises four shot on the fourth floor near Room #400	
06:32	Engine 24 is on scene	
07:02	Ladder 24 is on scene	
07:15	ALARM advises that CMPD is stating a 911 caller has said the perpetrator has possibly killed himself on the fourth floor in the Assistant Superintendent's office	
09:32	Engine 9 is on scene	
10:09	Engine 39 and Battalion 7 are on scene	
11:30	ALARM advises MEDIC is stating there are possibly three victims who ran to the basement. This is a second-hand report from an employee who already fled the building.	
12:09	Battalion 7 is on scene	
12:30	ALARM advises that CMPD has said they were unable to locate a second gunman on any floor. They are now conducting a room-to-room search on all floors.	
18:00	ALARM advises there are possibly three victims located in the mechanical room on the third floor. Caller states he saw several of employees running in there to hide.	

19:29	Rescue 3 is on scene	
20:00	CMPD advises the second floor is all clear.	
23:53	Haz-Mat 1 is on scene	
30:00	CMPD advises the third floor is all clear.	
45:00	CMPD advised the fourth floor is all clear.	

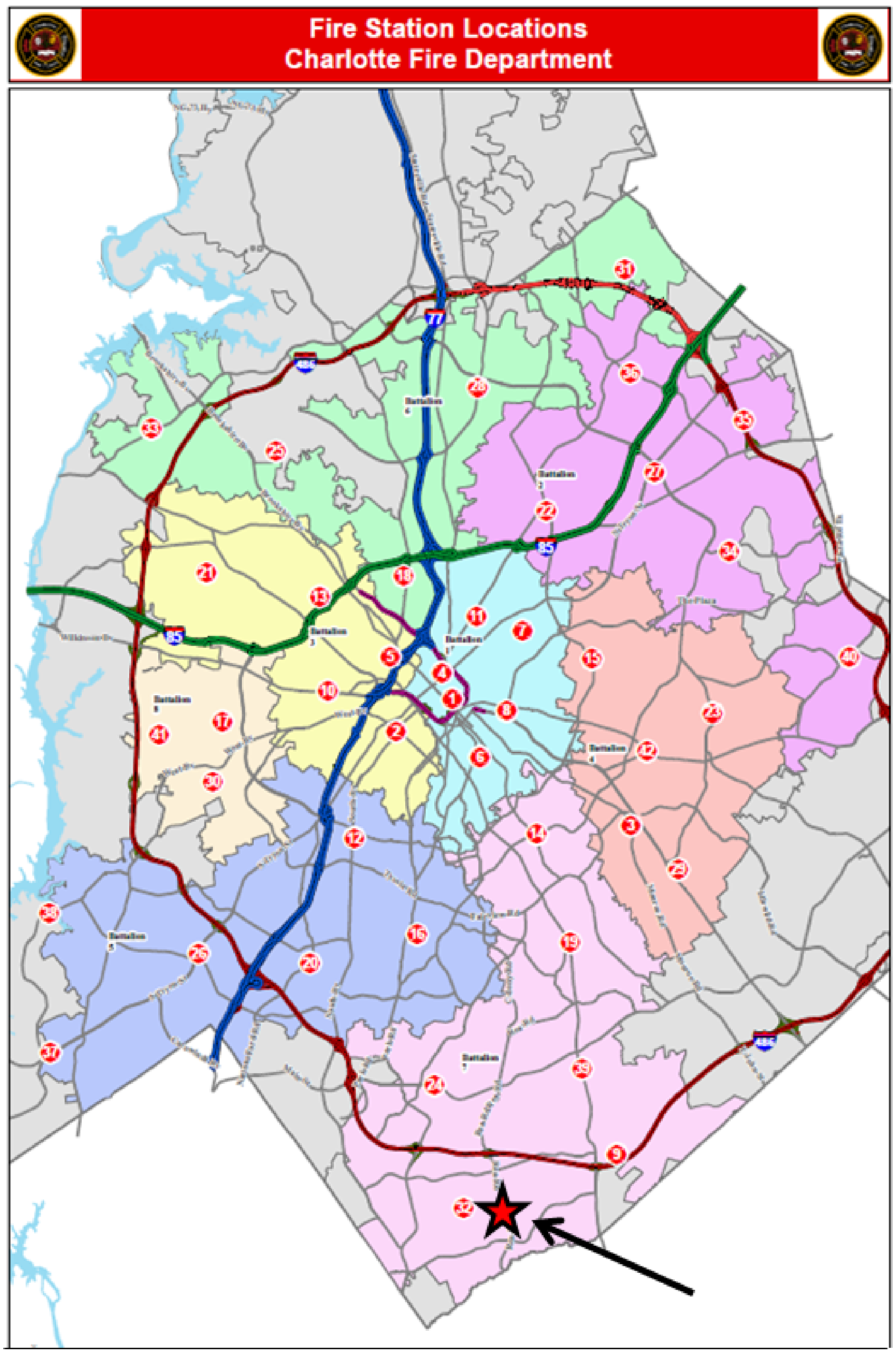
Appendix D:

Active Shooter Scenario One Location in Relation to Charlotte Fire Stations



Appendix E:

Active Shooter Scenario Two Location in Relation to Charlotte Fire Stations



Appendix F:

Charlotte Fire Department Permission Letter for Data Use and Research

Charlotte Fire Department

Battalion Chief K.P. Davis
1st Battalion, C Division
221 N. Myers St.
Charlotte N.C.

To: Whom It May Concern

Date: February 1, 2015

From: K.P. Davis
Battalion Chief

Re: Permission to Use Data Collected from Active Violence Drills

The Charlotte Fire Department required all 1,100 fire department personnel assigned to the Operations Division to participate in active shooter training exercises from February 2014 to June 2014. During those exercises, the Charlotte Fire Department Training Academy personnel collected data, including time to first treatment of simulated victims and time to victim removal from the building. Additional data included observations and comments from the five primary instructors involved with coordinating the exercises. Data collection was provided by the Charlotte Fire Department Training Academy staff utilizing predetermined benchmark criteria and data collection methods. All collected data was specifically stripped of any personal identifiers. The research data that Michael "Mike" Clumpner will use does not identify any individual within the Charlotte Fire Department.

The Charlotte Fire Department is now providing Mike Clumpner with all of the data collected during these active shooter exercises. Mike Clumpner is then responsible for analyzing the data to interpret results and determine trends in the data. The data analysis and interpretation performed by Mike Clumpner will help the Charlotte Fire Department and other agencies in creating and modifying active shooter response policies and training.

We fully understand that Mike Clumpner will be using the data collection and analysis for his doctoral dissertation research at Northcentral University. We understand that Mike Clumpner is writing his doctoral dissertation on joint public safety response to active shooter events. We understand that the Charlotte Fire Department conducted the active shooter training exercises and will provide the exercise data and exercise observations to Mike Clumpner for analysis and interpretation. We understand that Mike Clumpner's research will discuss the steps taken to develop an active shooter response plan in Charlotte, North Carolina, steps taken to train and test personnel on the new response plan, and the lessons learned from the exercises. We understand that Mike Clumpner's research will discuss the results of the active shooter exercises we conducted in Charlotte.

Should you have any questions, please feel free to contact me at the numbers or e-mail address below.

Regards,

Kent Davis
Battalion Chief Kent Davis
kpdavis@charlottenc.gov
Fire Station #1
221 N. Myers Street
Charlotte, NC 28202
(704) 336-2150 – Fire Station
(980) 213-8914 – Cell

Appendix G:

Northcentral University IRB Approval Letter

Date: 3/19/2015

From: The Institutional Review Board (IRB)

Student Name: Mike Clumpner

Study Title: *Analysis of Records that Represent an Active Shooter Response Model Using 33 Large-Scale Exercises*

Review Level: Exempt

Approval Date: 3/19/2015
Continuing Review Due Date: 9/19/2015
Expiration Date: 3/19/2016

Dear Mike Clumpner:

Congratulations, on behalf of Northcentral's Institutional Review Board (IRB); we are writing you to inform you that your study has been approved. Please be aware that you must be enrolled in an active dissertation course with NCU in order to collect data.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved IRB to your study such as changes to the recruitment, sampling procedures, research procedures, consent/assent forms and any other study documents, regardless of how minor the proposed changes might be. This will result in a modification of your IRB application and you will be responsible for a resubmission of the IRB application via your chair.
2. This project requires continuing review every **6 months.**

3. Continuing review is required as long as you are in data collection or analysis of your data. Failure to receive approval for a continuing review application before the expiration date means that all work with research participants and/or their data must end on the expiration date of this approval. There is no grace period. You are responsible for submission of this information via your chair.
4. You must use the approved consent form (if applicable).
5. If there are any unanticipated problems or complaints from participants during your data collection you must notify the NCU IRB within 24 hours of the data collection or problem. Please contact IRB@ncu.edu.
6. Monitoring of the consent process or data collection and analysis may occur. The IRB will notify you if your study will be audited.

Congratulations from the NCU IRB on achieving this milestone. Best wishes as you conduct your research!

Respectfully,

Northcentral University Institutional Review Board
Email: irb@ncu.edu