Falling Down: The Influence Of Traffic Patterns And Availability Of Emergency Medical Service Personnel On The Lethality Of Violent Encounters

2006

Nicholas Libby
University of Central Florida

FALLING DOWN: THE INFLUENCE OF TRAFFIC PATTERNS AND AVAILABILITY OF EMERGENCY MEDICAL SERVICE PERSONNEL ON THE LETHALITY OF VIOLENT ENCOUNTERS

by

NICHOLAS LIBBY
B.S. University of Central Florida, 2004

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Arts
in the Department of Sociology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Summer Term
2006

ABSTRACT

This study investigates the impact of traffic patterns and the availability of emergency medical services on the lethality of violent interpersonal encounters. Key situational and contextual factors are controlled using the criminal events perspective. Data were taken from the 2002 National Incident-Based Reporting System of the FBI, as well as from fire/rescue and EMS services of Memphis, TN, Cincinnati, OH, and Richmond, VA. Additive models of logistic regression analysis revealed that fire/rescue availability, firearm use, incidents arising out of arguments, outdoor locations, and victim gender are the most consistent predictors of whether or not a violent incident will result in a homicide.

ACKNOWLEDGMENTS

The author would like to thank Jay Corzine, Elizabeth E. Mustaine, and Anna Campbell Buck of the University of Central Florida, Greg S. Weaver of Auburn University, and John P. Jarvis of the Federal Bureau of Investigation for their assistance with this research.

TABLE OF CONTENTS

LIST OF ACRONYMS vi

CHAPTER ONE: INTRODUCTION 1

CHAPTER TWO: LITERATURE REVIEW 2

The Criminal Events Perspective 2

Traffic Patterns 4

Emergency Response and Medical Resources 4

Additional Lethality Research 7

The Present Study 8

CHAPTER THREE: METHODOLOGY 10

Data 10

Measures 11

Method 15

CHAPTER FOUR: RESULTS 17

CHAPTER FIVE: CONCLUSION 20

APPENDIX: TABLES 27

LIST OF REFERENCES 30

LIST OF ACRONYMS

DOA	Dead on Arrival
EMS	Emergency Medical Service
EMT	Emergency Medical Technician
NIBRS	National Incident-Based Reporting System
FBI	Federal Bureau of Investigation
ORI	Originating Agency Identifier
TTI	Texas Transportation Institute

CHAPTER ONE: INTRODUCTION

Crime has long been a topic of interest to social scientists and the general public. In the past, the bulk of the literature on the topic has usually focused on either the application of abstract theories, many of which are difficult to test empirically, or characteristics of victims and/or offenders. While these dimensions are important considerations when examining criminality, they often ignore significant situational and contextual factors of crime. The criminal events perspective (Sacco & Kennedy, 1996) takes these factors into account, providing a theoretical framework that offers a more focused examination of criminal activity by conceptualizing the criminal event as a complete incident instead of studying offender, victim, and situational elements separately.

Research has consistently shown that the United States has a high rate of homicide compared to other countries. However, according to survey data, the rate of serious assault incidents in the United States tends to be lower than reported rates in many other industrialized nations (Bureau of Justice Statistics, 2004). In response to this phenomenon, an important application of the criminal events perspective is to investigate factors of violent crime that increase the chance of a lethal outcome in violent criminal encounters (Felson & Messner, 1996; Weaver et al., 2004).

The focus of the present research is to examine the effect of traffic factors and the availability of emergency medical service personnel on the chances of a violent interpersonal incident resulting in a fatal outcome. A principal benefit of lethality research is that understanding what makes a violent encounter result in a lethal outcome brings us one step closer to knowing how to prevent and respond to these situations, resulting in a reduced loss of life.

CHAPTER TWO: LITERATURE REVIEW

The Criminal Events Perspective

Prior to the work of Cohen and Felson (1979), discussed below, few studies focused on the multiple dimensions of the criminal encounter. Traditional criminological approaches had focused individually on offender-based and victim-based theories. Wolfgang (1958) was among the first to conduct research on a number of variables involved in violent interpersonal encounters beyond victim and offender characteristics. He included additional analyses on victim-offender relationships, alcohol use, incident location, types of weapons used, and circumstances of the encounter (Wolfgang, 1958). Luckenbill (1977), who continued research on additional factors influencing the outcome of violent encounters, proposed that these encounters are situated transactions occurring within a social occasion. He found that violent encounters consisted of multiple participants – the offender, the victim, and sometimes bystanders. These participants are instrumental in setting the stage for the encounter. Thus, he argued, criminal homicide is not a one-sided event with the victim assuming a passive role. Additionally, he found that violence is often used as a tool to resolve questions of character and sometimes that violence escalates to the point where one of the participants in the encounter is killed (Luckenbill, 1977). However, though these researchers incorporated several situational variables unexplored in previous investigations, neither presented their research in a way to suggest a new theory of criminal encounters.

It is widely recognized that Cohen and Felson's (1979) routine activities theory is the first fully developed theoretical approach to consider a criminal incident as an event, with offenders and victims as participants in that event . Essentially, this theory proposes that, in order for a

crime to occur, a combination of a potential offender, a suitable target, and the lack of a capable guardian must occur at the same place and same time. The criminal event perspective includes more situational and contextual variables that influence the outcome of an interpersonal criminal encounter, such as those analyzed by Wolfgang (1958) and Luckenbill (1977). Analyses of criminal events incorporate the elements of offender, victim, and situation, factoring in the social and interpersonal circumstances of the criminal event before, during, and after its occurrence, as well as the social context of the crime. Essentially, this perspective encompasses all possible factors relevant to the occurrence of the crime (Meier, Kennedy, & Sacco, 2001).

Previous crime research using this perspective has incorporated a variety of situational and contextual variables. An analysis of drug-related homicides found that "homicide events involving friends were nearly 23 times more likely to be drug-motivated events compared to those involving strangers" (Varano et al., 2004: 386). Additionally, lifestyle choices related to involvement in drug use and drug markets increase the risk of victimization (Varano et al., 2004). In an examination of criminality across the life course, Kazemian and LeBlanc (2004) found that patterns of perpetration are more dependent on situational and contextual variables rather than individual predispositions. In other words, criminality is more often situational and unplanned, and the offender engages in crime when the opportunity presents itself. Kleck and McElrath (1991), in a study of the effects of weaponry on interpersonal violence, found that there is a hierarchy of violence, ranging from threat, attack, injury, and finally to death resulting from a fatal injury. The authors also found that weapons tend to have four effects on participants in a violent encounter. These effects are the facilitation of aggression of weaker aggressors towards stronger opponents, the triggering of aggression from the presence of a weapon, inhibiting attack behavior due to the possession of a potentially lethal weapon, and, finally, using

a deadly weapon to terrify the other participant and to coerce compliance (Kleck & McElrath, 1991).

Traffic Patterns

There is little research regarding the effect of traffic patterns on the lethality of violent encounters. Most of the available analyses of transportation data focus on logistical matters of transportation or traffic incidents such as crashes, charges of DUIs, and the like (Bureau of Transportation Statistics, 2006). In addition, some national statistical analyses illustrate the growth of traffic trends. According to the Federal Highway Administration (2003), the national population, number of licensed drivers, and number of registered vehicles have been steadily increasing over the past 40 years. Additionally, the number of workers driving themselves to work have increased over the past two decades, while the number of workers carpooling has decreased (Bureau of Transportation Statistics, 2005). Thus, it is reasonable to assume that vehicular traffic has increased over the years, especially during the daytime when the majority of the population is traveling to or from work or traveling to conduct business at locations only accessible during standard daytime business hours. Given this trend, along with the fact that speedy response by emergency service personnel affects the chances of death from trauma (Doerner & Speir, 1986; Doerner, 1988), traffic patterns should be given more attention when analyzing the lethality of violent encounters.

Emergency Response and Medical Resources

Several other researchers have recognized the potential effects that medical intervention may have on homicide rates. Wolfgang (1958:118) suggested that quick communication with the police after an attack, rapid transportation to a hospital after infliction of serious injury, and

advanced medical technology are major factors that "make it possible for many victims of aggravated assault and other serious offenses against the person to recover from their wounds." Doerner (1983:1-2) also proposes that medical intervention is "the 'missing link' in the question as to whether or not interpersonal violence escalates from a case of aggravated assault to a case of homicide." Additionally, the regional distribution of medical resources impacts criminally-induced lethality rates (Doerner & Speir, 1986). Doerner (1988) also found that emergency medical transportation has a vital role in reducing chances of lethality.

In a longitudinal study of national assault and homicide data, Harris et al. (2002:155) found support for their hypothesis that "advances in emergency medical care have greatly and increasingly reduced the lethality of violent assaults." Analyzing trends of aggravated assault rates and homicide rates in annual Uniform Crime Report data from 1960 to 1999, the authors observed "an almost undisturbed drop in lethality during the 40-year period," with annual drops in the lethality rate ranging from 2.5% to 4.5% (Harris et al., 2002).

In another study of homicide data from Memphis for the years 1935, 1960, and 1985, Giacopassi and colleagues (1992) analyzed percent lethality, which is the ratio of recorded homicide cases to the number of aggravated assaults and homicide cases combined (Doerner & Speir, 1986), and the percent of homicide victims dead on arrival (DOA) at the hospital. The authors found that percent lethality dropped from 11.4% to 3.2%. Additionally, they found that the percentage of DOA victims rose from 52.4% to 74.4%. Harris et al. (2002:133) suggest that this is due to Giacopassi's homicide-only dataset and that the results "suggest an unobserved but increasing proportion of assault victims saved from death who 'reside elsewhere,' that is, in an unobserved aggravated assault dataset."

Emergency medical care goes hand-in-hand with emergency response time when it comes to lethality research. Barlow and Barlow (1988), in an analysis of aggravated assault and homicide cases, found that among patients arriving at a hospital within 20 minutes of their injury only 4% died. Furthermore, among patients arriving more than 20 minutes after receiving the injury, 20% of the cases resulted in a lethal outcome (Barlow & Barlow, 1988). Receiving appropriate aid quickly and effectively in the field where an incident occurs, as opposed to an emergency department, also increases chances of patient survival. Though they did not limit their sample to victims of criminally induced trauma, Arbabi et al. (2004) found that early field intubation is associated with a decreased risk of a lethal outcome in victims of blunt and penetrating trauma.[1]

Though not relating directly to emergency field medicine, Beaman et al. (2000) conducted research on the lethality of firearm-related injuries characterized by intent of injury and the anatomic location of the gunshot wound. The authors found that when the shooter has more control in targeting the weapon, there were higher chances of lethality. Compared to unintentional gunshot wounds, those with intentional self-inflicted wounds were 10 times more likely to die. Victims of assaultive gunshot injuries were three times as likely to die than victims of unintentional gunshot wounds. Not surprisingly, victims suffering a head shot were 3.3 times more likely to die than those shot in other locations (Beaman et al., 2000). Beaman et al. (2000:263) also found that "70% of firearm-related deaths occur at the scene of the injury or before receiving emergency department care," and recommend that to enhance the survival of

[1] Intubation is the insertion of a tube through the mouth and larynx into the trachea for the purpose of providing respiratory support.

persons with these injuries, more investment should be made in improving access to emergency medical and acute care services, as well as firearm safety training.

Unfortunately, there is a lack of available research dealing with police and the potential mediating effects of police on violent encounters, particularly the prevention of a lethal outcome. However, in an analysis of a dual response system of responding to cardiac arrests consisting of standard emergency medical service (EMS) response as well as police equipped with automatic external defibrillators, police often had faster response times than EMS personnel. Additionally, the first responding police, who were equipped to handle these medical emergencies involving cardiac arrest, yielded higher survival rates than traditional EMS deployments (Myerburg et al., 2003). Though not directly related to injuries suffered due to criminally inflicted trauma, this study outlines the importance of fast response by medically trained field personnel as well as the role sufficiently trained police officers can have in saving lives.

Additional Lethality Research

Felson and Messner (1996) found several factors that influence the chances of a lethal outcome in a violent interpersonal encounter. Victims were found to be less likely to be killed in robberies than assaults, presumably because there is less value to the offender in harming a robbery victim. Regarding weaponry, guns and knives tend to significantly increase lethality. Additionally, victims were often killed due to the offender's fear of retaliation from the victim. Black or male victims were more likely to be killed and victim death was more likely when the offender was alone, which the authors reasoned was because the offender's fear of retaliation was greater in those situations. Relational ties and the ability of a victim to identify the offender were also found to increase lethality. The stronger the relational tie between the victim and

offender, the more likely the victim is to be killed, and the risk of lethality was shown to be greatest if the victim is a family member (Felson & Messner, 1996).

In order to examine factors that influence the lethality of violent encounters using the criminal events perspective, Weaver et al. (2004) conducted a study comparing aggravated assaults and homicides, which several researchers argue are essentially aggravated assaults resulting in the death of the victim (i.e. Harris et al., 2002; Weaver et al., 2004). Using data from the National Incident-Based Reporting System (NIBRS), the researchers looked at a multitude of variables, including the victim and offender characteristics of age, sex, and gender, victim-offender relationships, incident circumstances, offense locations, weapons, and time of offense. The authors found many factors that significantly and substantially influenced lethality. Violent encounters occurring during another felony related circumstance were over 12 times more likely to result in a lethal outcome. Potential lethality increased by nearly eight times if the incident occurred in relation to a drug deal. Not surprisingly, encounters involving the use of a firearm were more than 11 times more likely to result in a homicide (Weaver et al., 2004).

The Present Study

The present study is a conceptual and methodological extension of the research conducted by Weaver et al. (2004). The authors reported that an unexpected result of their study was the greater lethality of violent encounters occurring during the daytime. The aim of this research is to determine if traffic congestion factors and the availability of emergency service personnel including emergency medical technicians (EMTs) and fire/rescue personnel affect the chances of a lethal outcome. In the event of injury, hasty response of field medical personnel may prevent serious injuries from becoming lethal. Traffic congestion may impact the ability for emergency service personnel to get from where they are when they receive a call for service to

the location where their presence is needed and/or to transport an assault victim to a hospital. Given the higher volume of traffic present during the daytime, this may provide an explanation for why Weaver et al.'s (2004) finding that daytime incidents were potentially more lethal. Therefore, I hypothesize that (1) violent incidents occurring during rush hours, which are characterized by increased levels of traffic density, will have a higher chance of a lethal outcome and (2) that a higher number of available emergency service personnel will decrease the chances of lethality.

CHAPTER THREE: METHODOLOGY

Data

Two sources of data were used for this research. The first is the merged incident, offender, victim, and administrative files of the 2002 National Incident-Based Reporting System (NIBRS) dataset, which was collected by the Federal Bureau of Investigation (FBI) and obtained from the Interuniversity Consortium for Political and Social Research. Incident reports in NIBRS are assembled voluntarily by law enforcement agencies across the country and compiled by the FBI. This dataset is an incredibly useful resource that provides a substantial amount of information compared to previous Uniform Crime Reports and Supplementary Homicide Reports (Dunn & Zelenock, 1999). Due to the incident reporting format of NIBRS, entries can be linked to corresponding offense, property, victim, offender, and arrestee details, providing comprehensive data about criminal activities that allow for the examination of the effects of demographic and contextual event variables in criminal incidents. In addition to these factors, NIBRS entries can be traced back to the reporting law enforcement jurisdiction using Originating Agency Identifiers (ORIs) that correspond to particular incidents.

For the purpose of this research, ORIs were used to limit the scope of the NIBRS data used to the cities of Cincinnati, OH, Memphis, TN, and Richmond, VA. The data were also limited to include incidents of aggravated assaults and criminal homicide/non-negligent manslaughter. Given the nature of this research, it should be clarified that cases of attempted murder are classified as aggravated assaults (FBI, 2000). Furthermore, only incidents occurring on weekdays were included in the analysis, as traffic is most likely to be congested during peak times, or rush hours, that occur during the week (TTI, 2005). This resulted in a loss of

approximately 32% of the aggravated assault cases and 34% of the murder/non-negligent manslaughter cases.

In addition to NIBRS, availability information was collected from emergency medical service and fire/rescue agencies within each city analyzed. This was necessary to determine how many units of each type of emergency personnel are available during each hour of the day. This is the second source of data. All data was then merged into a single file for analysis purposes.

Measures

The dependent variable in this study is an indicator of whether a violent encounter results in a nonlethal outcome (aggravated assault) or a lethal criminal homicide (murder or non-negligent manslaughter). Incidents of aggravated assault are coded as "0" and incidents of murder/non-negligent manslaughter are coded as "1." As Table 1 (Appendix) shows, there were a total of 3993 aggravated assault cases and 153 cases of murder/non-negligent manslaughter used in this analysis.

Five categories of independent variables will be used in this analysis: traffic patterns, emergency medical service availability, situational and incident factors, victim characteristics, and offender characteristics. The latter three categories will be analyzed in a fashion similar to Weaver et al (2004), with situational and incident factors including weapons used, circumstances of the incident, victim-offender relationship, and location of the incident.

Traffic Patterns

A dummy variable was constructed to indicate incidents occurring during weekday peak travel times, or rush hours. For the purpose of this study, peak travel time periods are estimated as 6:00 a.m. to 9:00 a.m. and 4:00 p.m. to 7:00 p.m. (TTI, 2005). These time periods are

estimated to include nearly 50% of daily vehicle travel during weekdays (TTI, 2005). For this variable, incidents occurring during the specified time periods were coded as "1," with all other incidents coded as "0." Table 1 (Appendix) shows that 3263 incidents occurred during non-rush hours, and 883 of the offenses occurred during the designated rush hour time periods.

Emergency Medical Service Availability

This grouping includes the availability of emergency medical technicians and fire/rescue personnel. Information for this independent variable was gathered directly from the fire/rescue and EMS agencies of the cities used in the study. The average number of medical service vehicles available per 24 hour shift was coded, as most fire/rescue and EMS agencies operate on a 24 hour schedule, but allow for additional units to be on standby should there be a high volume of calls for service.

For qualitative reasons, fire/rescue and EMS agencies were coded separately and analyzed as multiple variables due to the different roles they may play in response to a violent criminal encounter. Fire/rescue personnel referred to in this study all have at least emergency medical technician training while some have training as a paramedic. In addition, vehicles used by fire/rescue personnel to respond to emergencies are properly equipped with life support equipment. They are typically classified as "first responders," whose job it is to get to the scene as quickly as possible and administer emergency aid to stabilize victims. Emergency medical technicians and paramedics assigned to ambulances have similar duties to administer aid and stabilize victims, but they have the added responsibility of transporting the victim to an emergency room or trauma center if necessary. For cities that have a combined fire/rescue and emergency medical service, the number of medical service units will be a count of how many medical transport units the agency has, and the number of fire/rescue units will be a count of how

many fire engines, trucks, and ladders that are equipped to handle medical emergencies as first responders. The counts of how many emergency service vehicles that were available are shown in Table 1 (Appendix). Memphis had 86 fire/rescue vehicles with medical equipment and trained staff, as well as 31 medical transport units available. Richmond had 13 fire/rescue vehicles and 30 medical transport units. Finally, Cincinnati had 39 fire/rescue vehicles and 10 transport units.

Weapons

As with Weaver et al. (2004), the categories for this variable grouping include the use of hands, fists, or feet as a contrast category, as well as firearms, cutting instruments, blunt instruments, motor vehicles, and other/unknown weapons. However, unlike Weaver et al. (2004), the present research separates the firearms into individual category by firearm type in order to determine which type of firearm tends to be most lethal, as Beaman et al. (2000) suggest firearm type may influence the severity of the injury to the victim. Firearm types include handgun, rifle, shotgun, and other/unknown firearm. Dummy variables were constructed for these categories, with each variable coded as "1" if the incident involved the use of these weapons and "0" for the unarmed (hands, fists, or feet) contrast category.

As Table 1 (Appendix) shows, the most prevalent weapons were firearm categories: handguns (1238), rifles (37), shotguns (73), and other firearms (327). Knives and cutting instruments were used in 771 offenses, blunt objects in 215, motor vehicles in 225, and other weapons in 607. The hands, fists, or feet contrast category constituted 653 of the cases.

Victim-Offender Relationship

The categories of this variable include family, acquaintance, stranger, and unknown. A series of dummy variables were coded for these relationships, with each variable coded as "1" if

it involved these relationships and “0” if it did not. Family will be used as the contrast category. Table 1 (Appendix) indicates that most of the victim-offender relationships were that of acquaintance (2243), followed by stranger and unknown at 697 each, and, finally, familial relationships constituted 472 of the incidents.

Circumstances

Identical to Weaver et al. (2004:359), this grouping will include a series of dummy variables created for the circumstances of “arguments, lovers’ quarrels, whether the incident occurred during the course of a transaction involving illegal drugs, or whether the incident transpired as a consequence of other felony-related circumstances.” The variables were coded as “1” if the incident involved these circumstances and “0” if it did not. As Table 1 (Appendix) shows, the most common circumstance by far was argument related, with 2015 of the incidents arising out of arguments. Ninety-six of the incidents occurred during a lover’s quarrel, 66 during other felony related activities, and 24 during the course of a drug transaction.

Location

A series of dummy variables were constructed to handle location characteristics of incidents. Location was broken down into five separate categories: open access, restricted access, outdoor, residence, and other/unknown. Open access is defined as public buildings where anyone has the ability to enter, such as banks, supermarkets, gas stations, etc. Restricted access locations are locations where there is a limited clientele, such as office buildings, government buildings, and jails or prisons. The outdoor category consists of areas of nature (fields, woods, rivers, etc.), as well as man-made outdoor locations (i.e., parking lot, highway, construction sites). The residence category includes homes and apartments. Based on the rationale of Weaver et al.

(2004) that residences are places where external intervention in violent interpersonal encounters is less likely to occur, the residence category will be used as the reference category.

Table 1 (Appendix) shows that the most common location for a violent incident was in a residence (1995). The outdoor classification constituted the second most common location with 1597 incidents. There were 256 incidents in an open access location, 119 in a restricted access location, and 179 in other locations.

Victim and Offender Characteristics

Key demographic variables available in NIBRS for both victims and offenders were used in this analysis. These include age in years, gender ("1" = male, "0" = female), and race ("1" = nonwhite, "0" = white). More information on these variables and the preceding situational and incident-related variables can be found in the NIBRS codebooks (United States Department of Justice, FBI, 2001-2002).

As shown in Table 1 (Appendix), the vast majority of victims were nonwhite. There were 3427 non-white victims compared to 668 white victims. Furthermore, there were 2585 male victims and 1540 female victims. The mean victim age was 30.07 years old.

Similarly, most offenders were nonwhite: 3583 of the incidents involved a nonwhite offender with only 408 incidents involving white offenders. There were 3135 male offenders and 887 female offenders. The mean offender age, at 28.44 years old, is slightly lower than the mean victim age.

Method

Logistic regression models were used to analyze the data because the dependent variable is dichotomous. The first regression model, which is unadjusted, predicted only the effect of an

incident occurring during a peak travel time on the chances of a lethal encounter. In the next model, variables relating to emergency medical service availability were added. Then, groups of control variables were added one at a time. The purpose of this approach was to determine if there are any mediating effects of these variables on the dependent variable. SPSS version 14 was used to conduct these analyses.

CHAPTER FOUR: RESULTS

Table 2 (Appendix A) shows the results of logistic regression models. Odds ratios are reported to show the chances that a violent encounter will result in a homicide. All models, with the exception of the first, which only analyzes effects of rush hour on lethality, are statistically significant ($p < .01$). The final model with all variables included accounts for approximately 15% of the variance in the lethality of violent encounters.

The results indicate that rush hour has no statistically significant effect on lethality (Model 1), even though incidents occurring during peak travel times increase the chances of the encounter to end in death. Increasing the availability of fire/rescue services significantly decreases the chances of lethality from 1% (OR=.99*) to 2% (OR=.98**) (Models 2-5) until victim and offender characteristics are added to the model (Models 6-7). At that point, the fire/rescue availability variable loses significance. Oddly enough, the availability of emergency medical services in the form of ambulances or medical transport significantly increases the chances of lethality by roughly 3% (OR=1.038) when only the rush hour, fire/rescue, and EMS variables are analyzed (Model 2). When the other control variables are entered into the model, the availability of emergency medical transport loses its significance.

Interestingly, the only weapon variables that have a significant effect on lethality compared to being unarmed are that of handgun, rifle, and other/unknown firearm. In the final model (Model 8), handguns increased chances of lethality by nearly three times (OR=2.90**), rifles increased the chances by nearly eight times (OR=7.86**), and the catch-all category of other/unknown firearms increased chances by nearly seven times (OR=6.60**). None of the other weapon variables had a significant effect on lethality, though use of shotguns, knives, blunt instruments, and motor vehicles seem to decrease the chances that the encounter will result in

death, and the other/unknown weapon category increases the chance of lethality. See Table 1 for specific results for weapon variables.

Regarding victim-offender relationship, the only significant indicator of lethality was the unknown category. When controlling for all variables (Model 8), incidents where the relationship was unknown to officials were more than four times as likely to result in a lethal outcome (OR=4.27**). Incidents involving strangers are typically less likely to result in a lethal outcome until victim and offender characteristics are considered, though this is not a statistically significant finding. Violent encounters involving acquaintances appear to be more likely to result in a lethal outcome, but once again, this finding is not significant.

In adding circumstance variables to the regression models, it was found that incidents arising out of arguments were less likely to have a deadly outcome. However, it is interesting to note that arguments are roughly 42% (OR=.63**) less likely to result in a lethal outcome when only the primary independent variables, weapons, and victim-offender relationship are controlled for (Model 3), but this figure drops to a 37% (OR=.63*) less chance when location and victim and offender characteristics are added (Model 8). Additionally, lovers' quarrels are less likely to result in a lethal outcome in all of the models run, though this is not a statistically significant finding. Circumstances involving other felony related activities or drug deals increase the chances of a lethal outcome, but again these figures are not significant.

The only location to have a significant effect on lethality is the outdoor category, and this is always a reduced chance of a lethal outcome compared to a residence location. Incidents are 40% (OR=.60*) less likely to result in death outdoors when all variables but offender characteristics are controlled for (Model 7). When controlling for offender characteristics, the

chances of death are 44% less (OR=.56*) (Model 8). All of the other indicators of location are not statistically significant, but they tend to have a lower chance of lethality.

Victim age characteristics have a slight effect on lethality. When offender characteristics are not controlled (Model 7), chances of a lethal outcome increase by 2% (OR=1.02*) per year of age that the victim is. This statistically significant finding disappears when offender characteristics are introduced into the model, however (Model 8). Victim sex remains significant; males are roughly 7.5% (OR=1.76*) more likely to die than females, even when offender characteristics are analyzed. The variables for victim race are not significant, and neither are any of the offender characteristics.

Given these results, there is no support for my first research hypothesis, which was that incidents occurring during rush hour are more likely to result in a lethal outcome. However, there is some support for my second hypothesis, which was that increased availability of emergency medical service personnel would significantly decrease the chances of a lethal outcome in a violent interpersonal encounter. More detailed discussion of these findings can be found below.

CHAPTER FIVE: DISCUSSION AND CONCLUSION

This research extends the work of Weaver et al. (2004) with some surprising results. The first of which is that rush hour does not adequately explain the higher chances of lethality of violent encounters during the daytime. However, this may be due to simply designating blocks of time to represent rush hour. An analysis of violent encounters occurring during rush hour that are located nearby roadways with high levels of traffic density may yield more significant results. Designating a particular time block as a peak travel time does not necessarily mean the entire city is experiencing traffic delays that would increase the response time of emergency medical service personnel.

The results with regard to the availability of fire/rescue services and emergency medical transport services are also interesting. As stated previously, chances of lethality decrease when availability of fire/rescue services increases. This may indicate that, since these agencies are first responders to incidents where an injury has occurred, emergency medical attention on scene is instrumental in patient survivability. This is consistent with previous research (i.e., Arbabi et al., 2004), though the availability of fire/rescue services loses significance when victim and offender characteristics are introduced into the model. This may indicate that certain characteristics associated with demographic variables of victims and offenders presented in this analysis influence the severity of the trauma that a victim receives, which may reduce the efficacy of emergency medical aid. Unfortunately, these issues are beyond the scope of the present research due to the fact that such detailed data are not available in the NIBRS dataset.

The increased availability of emergency medical transport services slightly increased the chances of a lethal outcome. This finding is difficult to explain without additional analyses. More data, such as distance from incident to EMS station and times for both arriving to the incident

location and transporting the patient to a hospital, are needed in order to determine why these results were found. More analysis should be conducted with some more specific data before developing any hasty conclusions as to why this result was found.

Regarding the categories of control variables that were replicated from the Weaver et al. (2004) study, a number of interesting differences in findings appear. In the weapons category, Weaver et al. (2004) found significant increases in lethality for firearms, knives, and other/unknown weapons. This research found significant increases for only the handguns, rifles, and other/unknown firearm categories. Knives and other/unknown weapons were not significantly related to lethality. Though analysis of firearms was handled differently for this research, the findings for handguns, rifles, and other/unknown firearms do fit with the findings of previous research (Kleck & McElrath, 2001; Weaver et al., 2004). Interestingly, however, shotguns were indicative of a reduced chance of a lethal outcome, though this finding was not significant. This finding and the discrepancies between this study and Weaver et al. (2004) may be due to the fact that this research used three urban metropolitan areas for analysis, while Weaver et al. (2004) used all locations reporting to NIBRS. As previously stated, agencies reporting to NIBRS are predominantly rural. This may mean that there are urban and rural differences in what factors contribute to the chances of a lethal outcome in a violent encounter. One of the reasons that there were not as many weapon types that significantly increased lethality in this study could be the presence of more advanced hospitals and trauma centers and a higher number of on-site emergency medical services available (Doerner & Spier, 1986). Additionally, the NIBRS category for knives includes knives and “other cutting instruments,” which would include axes, hatchets, sickles, and other types of tools that would be more prevalent in a rural setting. It should also be noted that the least frequent types of firearms found

in this study, shotguns and rifles, are not typically considered to be more rural type firearms, which further supports the contention of urban and rural differences presented here.

Another interesting discrepancy between this research and research conducted by Weaver et al. (2004) arises in the category of victim-offender relationship. The previous research indicated that both acquaintance and stranger relationships significantly decreased the chances of a lethal outcome, while the unknown relationship category had no significant effect. This research shows no significant impact of stranger and acquaintance relationships on lethality and a significant increase on the chances of a lethal outcome for the unknown category. Both analyses used the family category as an omitted reference category. Unfortunately, the unknown relationship category means that the relationship between victim and offender is unknown to the agency reporting to NIBRS. In reality, the relationship could be family, stranger, or acquaintance. However, though stranger and acquaintance relationships did not significantly impact lethality, it was shown that, when all variables are considered, strangers and acquaintance relationships were conducive to higher chances of lethality. This discrepancy may also be due to urban and rural differences.

Continuing the trend of differences in the results of this research and previous research on lethality conducted by Weaver et al. (2004), the only circumstance to significantly affect lethality in this study was incidents arising out of arguments, which decreased the chances of a deadly outcome. Weaver et al. (2004) did find similar results with this category, but the remaining categories (felony related, lovers' quarrel, and drug deal) significantly increased the chances of a lethal outcome. Once again, it is possible to attribute this to urban and rural differences in medical care. It is also possible that this may be explained by the programs put forth by urban law enforcement agencies (who typically have more funding available) that focus on reducing

and preventing crime, as well as speedy responses to criminal encounters before they reach an intensity that would be conducive to a lethal outcome. Another interesting finding of this research is that the level of significance achieved by the argument circumstance drops once victim and offender characteristics are brought into the model. Again, as with the availability of fire/rescue services, it seems that these demographic variables have an effect on the other situational and contextual variables used in examining lethality, especially the gender of the victim. This finding also supports previous lethality research (Felson & Messner, 1996).

Regarding location, the only significant finding is a reduced chance of lethality when an incident occurs at an outside location. This may be due to higher visibility of the incident and thus higher chances of someone alerting authorities. Even in more remote outside locations such as highways or parks, the popularity of cellular phones grant many witnesses and onlookers the ability to call for police or paramedics without personal risk. Also, it is important to note that while the category of outside location was the only category to significantly impact lethality, the other categories also show reduced chances of a lethal outcome when compared to the contrast category of home or residence. This indicates that even urban areas must continue to increase efforts in combating domestic violence, as it is often recurrent and escalating, which typically provides enough time for intervention before a fatal outcome is reached (Weaver et al., 2004).

Finally, victim and offender characteristics were analyzed to determine their effects on the chance of a lethal outcome in a violent interpersonal encounter. With all variables but offender characteristics included in the model, both victim age and sex significantly increased lethality. However, when offender characteristics were introduced into the model, victim age influence loses its significance. Victim sex remains significant, with males more likely to be killed in a violent encounter. This finding supports Wolfgang (1958), who hypothesized that

males are more likely to be killed because of the potential threat perceived by the opposing party in the violent encounter.

While this study makes an important contribution to the existing literature, there are a number of limitations. First, there is an obvious urban bias, and the cities of Memphis, Cincinnati, and Richmond are hardly representative of major cities in the United States. Thus, generalizability is limited. Similarly, there may even be differences between the cities used in this study. Unfortunately, in the cases used for this research, dummy variables constructed to test for this were so highly correlated with the fire/rescue and EMS variables that they were thrown out of the regression model. It was impossible to test for differences without ignoring the primary independent variables that this study intended to investigate. Nonetheless, when considering the differences in the number of fire/rescue and EMS units available in the cities used in this analysis, one could assume that different deployment strategies are used. For example, Memphis has 86 fire/rescue units available to provide emergency medical service, while Richmond has an average of 13. This difference could suggest evidence of strategic idiosyncrasies amongst the cities.

In addition, as mentioned previously, there are problems in merely using only peak travel times as a variable to explain traffic patterns. Additionally, availability of emergency personnel as a variable may not adequately describe the phenomenon it was constructed to investigate, which is the deployment of emergency medical resources. Finally, there is some evidence that police intervention may play a role in reducing lethality and preventing serious violent crime such as aggravated assault and homicide (Myerburg et al., 2003; Worrall, 2006). Unfortunately, the necessary data to analyze that effect was not made available for this research.

While the results of this research were not expected based on the findings of previous studies, this analysis suggests new avenues for future research. One of the most interesting discrepancies is the possibility of urban and rural differences on the lethality of violent encounters. Differences in lethality of various weapons, victim-offender relationship, and circumstances were identified when comparing this research to that of Weaver et al. (2004), which used the entire NIBRS dataset. As mentioned previously, the NIBRS dataset has a rural bias. Investigation into these differences could lead to some interesting research.

Another avenue of research would be to elaborate upon the concepts used in this study. A study of a single city would be more effective, assuming one could obtain more specific data on traffic patterns and issues of congestion, such as when and where the most congestion occurs. Furthermore, issues of distance between where an incident occurs and where the nearest emergency medical service station (fire/rescue or EMS) or police patrol unit is and the time required to cross that distance should be examined. Additionally, it would be beneficial to include the distance from the incident location to the nearest hospital and the time it took to travel that as well. To extend the scope even further, one could focus more on hospitals, the presence or absence of trauma centers, and, if present, the levels of trauma centers. As other research indicates, the time it takes to deploy emergency medical services in the field and the time it takes to transport an injured person to a hospital have an effect on the lethality of an encounter (Arbabi et al., 2004), so simply addressing availability of those units may not adequately address this issue. Adding this sort of information to the type of data available in the NIBRS dataset would be useful in future research on lethality.

Finally, as demonstrated by the effects that victim and offender demographic characteristics have on other variables, it would be prudent to incorporate more detail in order to

paint a clearer picture of the backgrounds of victims and offenders beyond their age, sex, and race. Socioeconomic status and qualitative lifestyle information such as frequently traveled places and what type of areas the victim lives in and works at may influence lethality in a number of ways. For example, an area of a city where a victim lives may have higher levels of violent crime and a high availability of firearms, which could contribute to an increase in the likelihood of death in a violent encounter.

Despite the limitations associated with this research, it contributes to the literature in several ways. While there were not many significant findings that were found, it is the first study to replicate the work of Weaver et al. (2004) in order to determine why chances of lethality increases during the daytime. Furthermore, it has added to the body of existing literature regarding the importance of emergency field medical services when analyzing lethality and suggested future avenues of study for developing a more comprehensive understanding of. It has also raised some interesting research questions regarding how victim and offender characteristics influence other variables in lethality research. Finally, it has found possible urban and rural differences in factors that contribute to the lethality of violent encounters.

APPENDIX: TABLES

Table 1. Descriptive Statistics of Dependent and Independent Variables

Variable	N	Variable	N
Dependent Variable		Location Type	
Aggravated Assault	3993	Open Access	256
Murder	153	Restricted Access	119
		Outdoor	1597
Traffic Patterns		Residence	1995
Rush Hour	883	Other Location	179
Non-Rush Hour	3263		
Emergency Services		Victim-Offender Relationship	
Fire/Rescue		Stranger	697
Memphis	86	Acquaintance	2243
Richmond	13	Family	472
Cincinnati	39	Unknown	697
EMS			
Memphis	31	Circumstances	
Richmond	30	Argument	2015
Cincinnati	10	Drug Deal	24
		Felony Related	66
Weapon Types		Lover's Quarrel	96
Unarmed	653		
Handgun	1238	Victim Characteristics	
Rifle	37	White	668
Shotgun	73	Non-White	3427
Other Firearm	327	Male	2585
Knife/Cutting Instrument	771	Female	1540
Blunt Objects	215		
Motor Vehicles	225	Offender Characteristics	
Other Weapons	607	White	408
		Non-White	3583
		Male	3135
		Female	887

	Mean	Min	Max	Std. Dev.
Victim Age	30.07	1	78	11.73
Offender Age	28.44	8	78	10.76

Note: Total N = 4146

Table 2. Additive Models of Logistic Regression Predicting Odds of Lethality

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Rush Hour	1.28	1.31	1.28	1.27	1.25	1.23	1.15	1.16
Availability								
Fire/Rescue		.98**	.98**	.99**	.99*	.99*	.99	1.00
EMS		1.03*	1.01	1.02	1.02	1.02	1.01	1.01
Weapon								
Handgun			4.29**	3.66**	3.34**	3.49**	3.29**	2.90**
Rifle			7.79**	7.11**	6.17**	6.37**	6.78**	7.86**
Shotgun			.98	.82	.79	.80	.85	.80
Other Firearm			10.15**	8.27**	7.17**	7.60**	7.38**	6.60**
Knife			.68	.68	.69	.67	.68	.68
Blunt Instrument			.24	.24	.24	.25	.25	.27
Motor Vehicle			.36	.33	.29	.37	.37	.37
Other			1.75	1.61	1.52	1.53	1.52	1.17
Victim-Offender Relationship								
Stranger				.96	.78	.90	.98	1.37
Acquaintance				1.00	.98	1.05	1.29	1.73
Unknown				2.23*	1.96	2.20*	2.40*	4.27**
Circumstance								
Argument					.58**	.56**	.61*	.63*
Felony Related					1.58	1.50	1.65	1.30
Lovers' Quarrel					.27	.25	.32	.36
Drug Deal					2.72	2.81	1.71	1.67
Location								
Open Access						.57	.58	.61
Restricted Access						.77	.86	.82
Outdoor						.60*	.60*	.56*
Other/Unknown						1.23	.91	.94
Victim Characteristics								
Age							1.02*	1.01
Sex							1.75*	1.76*
Race							.78	1.34
Offender Characteristics								
Age								1.00
Sex								1.86
Race								.48
Constant	.036	.035	.030	.014	.018	.023	.010	.005

Note: Table shows odds ratios; N = 4146; *p < .05, **p < .01

LIST OF REFERENCES

Arbabi, S., Jurkovich, G., Wahl, W., Franklin, G., Hemmila, M., Taheri, P., & Maier, R. (2004). A comparison of prehospital and hospital data in trauma patients. *The Journal of Trauma Injury, Infection, and Critical Care*, 56(5), 1029-1032.

Barlow, H., & Barlow, L. (1988). More on the role of weapons in homicide violence. *Medicine and Law*, 7, 347-358.

Beaman, V., Annest, J., Mercy, J., Kresnow, M., & Pollock, D. (2000). Lethality of firearm-related injuries in the United States population. *Annals of Emergency Medicine*, 35(3), 258-266.

Bureau of Justice Statistics. (2004). Cross-national studies in crime and justice. Retrieved February 8, 2006 from http://www.ojp.usdoj.gov/bjs/pub/pdf/cnscj.pdf

Bureau of Transportation Statistics. (2005). National transportation statistics: Principal means of transportation to work. Retrieved January 28, 2006 from http://www.bts.gov/publications/national_transportation_statistics/2005/html/table_01_38.html

Bureau of Transportation Statistics. (2006). TranStats. Retrieved January 28, 2006 from http://www.transtats.bts.gov

Doerner, W. (1983). Why does Johnny Reb die when shot? The impact of medical resources upon lethality. *Sociological Inquiry*, 53(1), 1-15.

Doerner, W., & Speir, J. (1986). Stitch and sew: The impact of medical resources upon criminally induced lethality. *Criminology*, 24(2), 319-330.

Federal Bureau of Investigation. (2000). Crime in the United States, 1999: Uniform crime reports. Retrieved February 5, 2006 from http://www.fbi.gov/ucr/99cius.htm

Federal Bureau of Investigation. (2002). National Incident-Based Reporting System Codebook. Distributed by the Inter-University Consortium for Political and Social Research. Referenced on January 20, 2006 from http://www.icpsr.umich.edu/cgi-bin/bob/newark?study=4066

Federal Highway Administration. (2003). Licensed drivers, vehicle registrations, and resident population. Retrieved January 28, 2006 from http://www.fhwa.dot.gov/policy/ohim/hs03/htm/dlchrt.htm

Felson, R. & Messner, S. To kill or not to kill? Lethal outcomes in injurious attacks. *Criminology*, 34(4), 519-543.

Giacopassi, D., Sparger, J., & Stein, P. (1992). The effects of emergency medical care on the homicide rate: Some additional evidence. *Journal of Criminal Justice*, 20, 249-259.

Harris, A., Thomas, S., Fisher, G., & Hirsch, D. (2002). Murder and medicine: The lethality of criminal assault 1960-1999. *Homicide Studies*, 6(2), 128-166.

Kazemian, L., & LeBlanc, M. (2004). Exploring patterns of perpetration of crime across the life course: Offense and offender-based viewpoints. *Journal of Contemporary Criminal Justice*, 20(4), 393-415.

Kleck, G. & McElrath, K. (2001). The effects of weaponry on human violence. *Social Forces*, 69(3), 669-692.

Luckenbill, D. (1977). Criminal homicide as a situated transaction. *Social Problems*, 25(2), 176-186.

Meier, R., Kennedy, L., & Sacco, V. (Eds.). (2001). *Advances in Criminological Theory: The process and structure of crime: Criminal events and crime analysis* (Vol. 9). New Brunswick, NJ: Transaction Publishing.

Myerburg, R., Velez, M., Rosenberg, D., Fenster, J., & Castellanos, A. (2003). Automatic external defibrillators for prevention of out-of-hospital sudden death: Effectiveness of the automatic external defibrillator. *Journal of Cardiovascular Electrophysiology*, 14, S108-S116.

Sacco, V., & Kennedy, L. (2002). *The criminal event: Perspectives in space and time*. Belmont, CA: Wadsworth.

Texas Transportation Institute. (2005). Urban mobility study: Appendix B: Methodology for 2004 annual report. Retrieved January 25, 2006 from http://mobility.tamu.edu/ums/report/methodology_appB.pdf

Varano, S., McCluskey, J., Patchin, J., & Bynum, T. (2004). Exploring the drugs-homicide connection. *Journal of Contemporary Criminal Justice*, 20(4), 369-392.

Weaver, G., Wittekind, J., Huff-Corzine, L., Corzine, J., Petee, T., & Jarvis, J. (2004). Violent encounters: A criminal event analysis of lethal and nonlethal outcomes. *Journal of Contemporary Criminal Justice*, 20(4), 348-368.

Wolfgang, M. (1958). *Patterns in criminal homicide.* Philadelphia: University of Pennsylvania Press.

Worrall, J. (2006). Does targeting minor offenses reduce serious crime? A provisional, affirmative answer based on an analysis of county-level data. *Police Quarterly*, 9(1), 47-72.