

BEYOND MOTIVE:
SITUATIONAL INFLUENCES ON STUDENT PERPETRATED SHOOTINGS

by

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This work is dedicated to Noah and Isabel.
“It always seems impossible until it is done.”
-Nelson Mandela

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To all the individuals I have had the opportunity to learn from, thank you. To all of those who have lovingly supported me, thank you. To all those who helped me keep moving forward, thank you.

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Due to the reactive nature of school policies surrounding school shootings, such as the increased implementation of various security measures, it is important to understand whether these new approaches make a meaningful difference in school safety. Based in situational crime prevention techniques and guided by the theoretical basis found in routine activity theory, this paper will explore the potential effects that various situational security measures may have on the decision of school shooters, by examining how security measures affected outcomes of student-perpetrated school shootings. Of particular interest is whether the presence of these security measures impact the time and location of shooting incidents. Using data on K-12 school shootings in the United States from 2000-2016, this paper will extend the current literature by looking beyond the utility of security measures on campus crime and violence and narrow the focus to their effect on school shootings.

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CHAPTER 1

INTRODUCTION

Lethal violence in schools is rare. When instances of school-associated homicides and suicides of school-age children are examined, there is approximately one student homicide or suicide at a school for every 1.9 million students enrolled (Zhang, 2018). Though statistically rare, these events commonly lead to public outcry for increased use of high security procedures on campuses. School campuses should be safe spaces where students have a healthy environment in which to learn. Thus, it is reasonable that parents, school officials, and the community seek to regain a sense of security and safety after a school shooting event, whether homicide or suicide. One of the most well-known school shootings is the 1999 shooting at Columbine High School in Littleton, Colorado, which captured worldwide media attention and prompted parents, school officials, and policymakers throughout the country to call for security changes on school campuses (Madfis, 2016). In response to this event and the ensuing public outcry, one survey of Texas school administrators found that over 80 percent of Texas middle and high schools changed their school security policies (Snell, Bailey, Carona, & Mebane, 2002). Considering the responsive reaction to school shootings, it is important to understand the impact of security measures used at schools and to evaluate the effectiveness of such security measures in order to help school officials and policymakers best protect students and school campuses.

Implementing security measures without fully understanding their impact can result in ineffective preventative policies and unintended consequences. Examining security measures in detail at schools where shootings have occurred, along with the resulting outcomes, can provide a wealth of information on the efficacy of such measures. One way to do this is by moving away

from a perspective that focuses on the individual *actor* in a school shooting and focuses instead on the *setting*. Shifting the focus in this way can provide an important perspective on the efficacy of security measures. Situational crime prevention techniques and routine activities theory offer a unique perspective that allow this.

Situational crime prevention (SCP) focuses on the management, design, or manipulation of an environment, raising the risk or difficulty of committing a crime with the ability to focus on highly specific forms of crime (Clarke, 1997). Outside of school settings, situational crime prevention has covered a wide range of crimes, from motor vehicle theft to retail theft, graffiti, drunkenness, and violent crime (Clarke, 2010). In schools, situational crime prevention strategies include various forms, but those that receive the most attention are visible security measures and access control measures (Addington, 2009, Zhang, 2018). Visible security measures tend to include the hiring of personnel such as School Resource Officers (SROs) and security guards, the use of metal detectors, and security cameras or closed circuit television (CCTV). Visible security measures tend to be the more expensive strategy (Musu-Gillette, Zhang & Oudekerk, 2018). Access control strategies can include locked doors, fencing, and required use of identification badges. Although this paper will not explore legal responses, it is important to note that legal remedies such as universal background checks and gun-free zones are also often used to help prevent shootings (Kleck, 2009). Each security effort, whether programmatic or legal, is aimed at different protective strategies, from blocking outside threats to preventing dangerous acts by insiders within the school.

Indeed, students who attack their own campuses present a special challenge to a school's security procedures. These students, by nature of their daily attendance at a given school,

become familiar with security efforts present on their campus and have an advantage in understanding how to thwart such efforts. Routine activity theory, or the focus on the circumstances surrounding the criminal act, can help explain how current students find the “opportunity” to commit a school shooting. Routine activity theory posits that three elements must be minimally present for a criminal act to occur: a likely offender, a suitable target and the absence of a capable guardian against the crime (Cohen & Felson, 1979). Guided by the theoretical basis found in routine activity theory, a spatial and temporal understanding of crime in a place, and using data on K-12 school shootings in the United States from 2000-2016, this paper will explore the impact various situational security measures have on the decision making of current students who perpetrate such acts at their own school. Of particular interest is whether the presence of these security measures impact the time and location of shooting incidents. This paper will extend the current literature by looking beyond the utility of security measures on campus crime and violence and narrow the focus to their effect on school shootings.

CHAPTER 2

LITERATURE REVIEW

Overview

Academic researchers, especially in criminology, have become increasingly more interested in understanding school shootings both from a qualitative and quantitative approach (e.g., Addington, 2009; Langman, 2009; Agnich, 2013; Wallace, 2015; Gerard et al, 2016; Lankford, 2016; Baird, Roelke & Zeifman, 2017; Livingston, Rossheim & Hall, 2018). Even though school shootings remain a statistically rare event and schools remain safe places for students (Crawford & Burns, 2015; Wike & Fraser, 2009), the increase in the body of research on shootings is noticeable. Commonly, research examines the individual and individual-level factors that could explain these events (Langman, 2009; Rocque, 2012; Agnich, 2013; Gerard et al., 2016; Lankford, 2016; Farr, 2017). The most researched group of school shooters are those labeled as “mass” school shooters. According to the F.B.I’s Behavioral Analysis Unit, mass murder is defined as four or more murders that occur during a single incident (Morton, 2005). The most prominent findings for mass school shooters are their gender and race: school shooters tend to be male and white (Harding, Fox & Mehta, 2002; de Apodaca et al., 2012; Agnich, 2015; Gerard et al., 2016; Lankford, 2016). Additionally, studies have found that these mass school shooters commonly exhibit symptoms of depression (Newman, 2004; Langman, 2009; Verlinden et al., 2000; Gerard et al., 2016), may have experienced rejection, whether by their peers or due to a romantic breakup, and have poor relationships with peers (O’Toole, 2000; Vossekuil, Reddy, Fein, Borum & Modzeleski, 2001; Wike & Fraser, 2009; Agnich, 2015). The available evidence suggests that mass shootings are the minority of school-associated violent deaths but they receive

the most attention (e.g., Kleck, 2009; Agnich, 2015; Zhang, 2018). The exploration of individual-level factors, such as those of a mass school shooter, is important; but with actors in rare events, patterns useful for prevention may not be evident. Understanding school shootings in context of the *event* instead of the *individual* may offer a more meaningful way to address and respond to such incidents.

Theoretical Overview

To understand school shootings in context of the event, theoretical connections need to be explored. Although the field of criminology has a host of theoretical perspectives focused on individual criminal behavior that may be helpful in understanding the *motives* of school shooters, it is important to additionally take into consideration how *places*, such as schools, can promote or fail to prevent illegal acts. Situational crime prevention is one possible perspective to help explore how interactions between people and the environment could influence individuals to engage in a violent act such as a school shooting.

Situational crime prevention (SCP) is a method of crime prevention that focuses on thwarting or hindering the opportunities for a crime to take place. The focus of SCP does not lay in a desire to change the individual by changing an offender's motivation but rather by reducing opportunities for the situational components of criminal events. As Smith and Clarke (2010) explain, SCP seeks to alter proximal causes of crime (the situation), which may be more amenable to change, rather than distal causes (the individual). Situational crime prevention is concerned with *how* offenders commit crimes, not *why* perpetrators offend. The focus is on identifying possible intervention points and then implementing strategies to prevent the crime.

The concept of situational crime prevention is of British origins, stimulated by the results of work by the Home Office Research Unit on correctional treatments undertaken in the 1960s and 1970s (Smith & Clarke, 2010). This concept soon influenced the United States through Oscar Newman's work on "defensible space" (Newman, 1972) and C. Ray Jeffery's work on "crime prevention through environmental design" (Jeffery, 1971). Although there are several overviews of situational crime prevention, Ron Clarke, having published over three decades on the topic, is one of the strongest contributors to the idea. Situational crime prevention methods were originally constructed with two groups of measures that would: (a) make it physically harder to commit crime; and, (b) manipulate the costs and benefits of committing a crime, as well as the material conditions (Hough, Clarke & Mayhew, 1980). Originally, the first group included techniques on: (1) target hardening; (2) target removal; and, (3) removing the means of crime. The second group included: (4) reducing the pay-off; (5) formal surveillance; (6) natural surveillance; (7) surveillance by employees; and, (8) environmental management. Several iterations have been developed over time, with a range of twelve (Clarke, 1992) to sixteen techniques involved in the process (Clarke & Homel, 1997).

Currently there are five general strategies laid out in twenty-five techniques (Wortley, 2001, Cornish & Clarke, 2003). Among these techniques are the inclusion of "hard" interventions, which desire to make it impossible or more difficult for the crime to be committed, and "soft" interventions, which desire to reduce situational prompts or cues that require an increase in a person's motivation to commit a crime (Cornish & Clarke, 2003). As Clarke (2010) points out, the fact that the classifications of techniques have seen so much change is "evidence of the vitality of the situational approach and, indeed, these re-classifications help further to

stimulate its development by calling attention to new forms of opportunity reduction” (p.15). This falls in line with an important facet of situational crime prevention: measures must be tailored to highly specific categories of crime (Clarke, 1992).

For situational crime prevention to return the highest benefits, it is imperative to define the problem presented by a specific crime in order to reveal which situational factors facilitate that crime (Korsell, Freilich & Newman, 2018). After the specific situational factor is defined, it is necessary to intervene with a technique that will make the crime impossible or at least very difficult to commit. The initial application of SCP was to prevent motor vehicle theft. Automakers attempted several modifications of vehicles, such as devices for protecting the ignition switch and different shaped door handles, only to find car theft still rising (Clarke, 2010). Through the use of SCP, identification of an intervention point (ability to steer and thus, drive away the car) was made and a strategy (steering column lock) was employed to intervene and prevent the vehicle theft. The use of steering column locks, a deterrent device adaptable to all vehicle types, was found to be a successful intervention cross-culturally in Germany, England, and the United States to prevent car theft (Clarke, 2010). Since this initial application, situational crime prevention has been widely used and found success with reductions in prostitution, retail theft, graffiti, drunkenness, and violent and property crime (Clarke, 2010). It has also been applied recently to organized crime (Korsell, Freilich & Newman, 2018), terrorist assassinations (Mandala & Freilich, 2018), and child sexual abuse (Guerzoni, 2018).

As situational crime prevention techniques have been implemented in expanding areas of crime, critical study of such techniques has also expanded. In these studies, SCP techniques have received empirical support demonstrating effectiveness in crime reduction (e.g., Welsh &

Farrington, 2004; Clarke, 2010, Smith & Clark, 2012). Most applications of situational crime prevention have been in public spaces (e.g., retail spaces, parking garages) but, although rarely explored, research does offer support for the use of situational crime prevention techniques in the context of schools (O'Neill & McGloin, 2007). Cheurprakobkit and Bartsch (2005) found that one particular situational crime prevention technique, the use of metal detectors, was associated with lower crime rates while O'Neill and McGloin (2007) found that use of a locked door, a situational crime prevention technique to block access to a place, had lower incidences of property crime. Alternatively, Schreck, Miller and Gibson (2003), found that the presence of security guards, or an employee that would limit crime opportunities, was not an effective technique in lowering theft and victimization in schools. The exploration of the use of situational crime prevention in schools is worthy of future exploration.

It is worth noting that the strongest criticism of any SCP technique is the critique that there is the possibility of the displacement, or relocation of the crime as a result of the intervention. A street lighting program is but one example where the addition of a street light in one area of town could possibly shift crime to areas nearby without street lights (Clarke, 2010). Displacement can take many forms, including: (1) temporal, where offenders change the time during which they commit the crime; (2) spatial, where offenders switch from targets in one location to targets in another location; (3) target, where offenders change from one type of target to another type of target; (4) tactical, where offenders alter the methods used to carry out a crime; (5) offense, where offenders switch from one form of crime to another; and, (6) offender where new offenders replace old offenders who have been removed or who have desisted from crime (Cornish & Clarke, 1986; Guerette & Bowers, 2009; Reppetto, 1976). The most commonly

recognized form of displacement is displacement in terms of a shift in place or spatial displacement (Eck, 1993). Regardless of the form, displacement is thought of as a negative consequence of crime prevention efforts (Guerette & Bowers, 2009). In terms of school shootings, for example, the use/presence of metal detectors might influence a perpetrator in terms of choice of location a shooting might occur. The blocked access to the inside the school might only cause the perpetrator to choose to carry out the shooting outside of the school building (spatial displacement) instead of inside of the building, directly impacting the number of injuries, law enforcement response efforts, and the lethality of the event.

Situational crime prevention efforts can also have positive peripheral outcomes. One such outcome is the diffusion of benefits, in this case crime reduction, to the areas close to the crime-prevention intervention effort, even when this area is not targeted by the intervention itself (Clark & Weisburd, 1994). An example of diffusion is the introduction of CCTV to a university parking lot in order to curb motor vehicle theft but finding that other parking lots on campus not using CCTV experienced similar reductions in crime (Clarke, 2010). Often called the “bonus” or “halo” effect (Guerette & Bowers, 2009), previous literature supports the likelihood of the diffusion (of benefits) of crime rather than the displacement of crime (Weisburd et al., 2006).

There are several studies that have fleshed out the support for the likelihood of a diffusion of benefits rather than displacement with situation crime techniques. Eck (1993) analyzed 33 studies on situational crime prevention techniques and found 91 percent of the reviewed cases had little or no displacement of crime location. Hesseling (1994), in an analysis of 55 studies, found that 40 percent experienced no displacement, with 6 percent reporting a diffusion of benefits. In one of the larger meta-analyses, Guerette and Bowers (2009) examined

102 studies with 574 different types of displacement and found that temporal displacement was the most commonly observed (36 percent of interventions), followed by spatial displacement (23 percent of interventions). Diffusion of benefit was observed in 27 percent of the 574 observations. Similarly, a systematic review of hotspot policing efforts by Braga and colleagues (2014) explains that out of 13 focused police efforts, 9 tests revealed diffusion effects while four reported displacement effects. Overall, research supports diffusion, or the benefits of crime intervention moving into surrounding areas, and not displacement, or pushing of crime into other areas.

Another potential criticism is the temptation to see SCP as atheoretical. However, it is important to discuss that situational crime prevention is not atheoretical, but, rather is a method rooted in criminological theory: rational choice, an individual-level theory, and routine activity theory, a situational-based theory. Rational choice theory explains that one can change a criminal outcome by changing the person while routine activity theory explains that one can change a criminal outcome by changing the situation. Rational choice posits that individuals are rational in their decision making, weighing the costs and benefits of their actions (Clarke & Cornish, 1985; Cornish & Clarke, 1987). Rational choice theory does not attempt to explain the motivation of a crime act but rather assumes that some people will always commit crime if given the opportunity. Although an important contribution, both to the underpinnings of situational crime prevention and to the field of criminology, this paper will focus on routine activity theory and understanding the event in terms of the place rather than the actor. School shootings are rare events and focusing on the place might provide new insights that have previously been neglected in the examination of the offender. Additionally, as discussed above, examination of the place

could offer valuable observations concerning patterns that make a school shooting more or less likely to occur on a school campus.

Routine activities theory explores spatial-temporal ideas based on the importance of where and when a crime takes. Considerable attention has been paid to the importance of place and crime since as early as the first half of the nineteenth century, with Quetelet's (1842) analysis of crime across regions. During the late 19thth and early 20thth century, the Chicago School of Criminology furthered the importance of place through the study of Chicago neighborhoods' spatial patterns of crime (Burgess, 1925; Shaw & McKay, 1942). Hawley (1950) expanded the study of place from an emphasis on spatial analysis to one that included temporal analysis. These spatial-temporal ideas help form the basis of the routine activity theory.

Routine activity theory posits that offenders typically commit their crimes in bounded areas that are consistent with their regular routines and do not, contrary to common wisdom, wander around randomly looking for criminal opportunities (Eck & Weisburd, 1995). According to Cohen and Felson (1979), routine activity theory has three components that must be minimally present for a criminal act to occur: 1) a motivated offender, or one who plans to commit a crime; 2) a suitable target, or a potential victim; and 3) the absence of a capable guardian, or those who might prevent victimization. These three elements do not concentrate on the characteristics or motives of offenders, but rather the circumstances surrounding the criminal act. Cohen and Felson (1979) emphasize that the lack of any one of these three components is normally sufficient to prevent a criminal act.

For example, in their study, Cohen and Felson (1979) demonstrate how the changes from the modernization of post-World War II allowed for more opportunities to commit crime and that

crime rates may be explained in terms of changes of availability of targets (empty homes) and absences of guardians (home owners away at work). The theoretical approach of routine activities has been used for micro-level explanations in analysis of specific locations found within the larger social environment (Eck & Weisburd, 1995). Micro-level analysis has included places such as areas next to automatic teller machines (ATMs), strip shopping centers, subway stations, and schools (Spelman, 1995; Pratt & Cullen, 2005).

The routine activities approach has expanded to focus on the control of criminal opportunities through both the regulation of actors and settings with three components: handlers; managers; and, guardians. Felson (1986) explains that the handler, or one who could potentially control an offender through supervision or monitoring, can take many forms. A parent who makes sure a child gets home on time, a school principal who sends kids back to class, and a stranger who questions a group of boys' activities at a mall are all examples of handlers, or those who help supervise potential offenders. Eck (1995) explains that managers are those who control places through monitoring. A nosy neighbor, building manager, or a janitor are all examples of managers, or those who help discourage crime by monitoring a specific place. Guardians are aimed at the suitable target component of routine activity theory (Cohen & Felson, 1979). Examples of guardians are bystanders preventing shoplifting, a store clerk who monitors items, and oneself by monitoring their belongings. According to routine activity theory, when handlers, managers and guardians are present, crimes will be discouraged. The concept of handlers, managers, and guardians constitute the underpinnings of several situational crime prevention techniques.

Situational Crime Prevention Techniques used in Schools

This paper will discuss two categories of situational crime prevention techniques most commonly used in schools. One of the most prevalent types of situational crime prevention used at schools (Zhang, 2018) is the use of what previous school shooting literature has called “visible security measures” (Addington, 2009; Tanner-Smith & Fisher, 2016). Visible security measures, in line with situational crime prevention techniques, to increase risk of detection through surveillance by the physical presence of a device (e.g., metal detectors or closed-circuit television (CCTV)) or security personnel (e.g., school resource officers (SROs) and security guards) (Zhang, 2018). Access control is the second category of situational crime prevention most commonly used in schools. These efforts attempt to block or limit offenders’ access to a space. Access control measures include the use of locked doors and gated exteriors. Both measures desire to block access to a place, in this case the inside of the school or other school property. The following sections will outline different types of visible security and access control measures as well as their current empirical support.

Visible Security Measures: SROs, Security Guards, CCTVs and Metal Detectors

One type of visible security measure that has received recent media attention is School Resource Officers (SROs). According to the U.S. Department of Education (Zhang, 2018), SROs are sworn law enforcement officers assigned to a school, or group of schools, with the intention to promote a safe learning environment for all students, staff, and community members. Under the situational crime prevention premise, SROs should provide more or better guardianship to increase the likelihood of detection. Depending upon budget and municipality SROs may or may

not serve in a full-time capacity. The SRO has had an evolving role at schools. Originally placed in schools in the United States in the 1950s to reduce gun-related incidences, their presence in schools in the 1960s and 1970s evolved to help address racial tensions (Ryan, Katsiyannis & Counts, 2018). A decade later, SROs were used as drug-related deterrence. Then in the wake of notable school shootings, such as Columbine and Sandy Hook, they were used to address safety issues hoping to prevent school shootings. According to the 2012 report by the National Association of School Resource Officers (NASRO), SROs current role is threefold: (1) to ensure a safe and secure campus, (2) to educate students about law-related topics, and (3) to mentor students by being counselors and role models. The SROs role can differ by location but they typically dress in traditional police uniform and carry a firearm (Ryan, Katsiyannis & Counts, 2018; Zhang, 2018).

The SRO has also been used in an increasing number of schools. In 1975, only 1% of schools reported use of police in schools (National Institute of Education, 1978). During the 2015-2016 school year, 48% of public schools reported the use of SROs with higher prevalence in secondary schools than primary schools (Musu-Gillette, Zhang & Oudekerk, 2018). The increased use of SROs is in part related to the availability of federal funds. Post-Columbine, \$60 million in funds was pledged by then-President Clinton to help hire SROs, while the Department of Justice also awarded \$747.5 million to fund and train SROs in public schools (Addington, 2009). It is therefore not surprising that SROs constitute one of the most commonly used strategies used to protect schools.

As for empirical support for SROs, key stakeholders demonstrate general support for SROs (Chrusciel et al., 2015), but many question their impact because of the increased detection

and increased criminalization that can happen on campuses as a result of having a SROs present (Hirschfield, 2008; Theriot, 2009; Swartz et al., 2016; Ryan, Katsiyannis & Counts, 2018). There is a dearth of information on the effectiveness of SROs in reducing crime in schools. One study that evaluated the effectiveness of the SROs (N=18) in a southern city in the United States found that SROs had a positive impact on school violence and school disciplinary problems. Both intermediate offenses (e.g., fighting, larceny, possession and/use of tobacco) and major offenses (e.g., use or sale of drugs, burglary of school property, possession of firearms or weapons) in high schools and middle schools decreased from 3,267 in 1995 to 2,710 in 1996 after an SRO was permanently assigned to schools (Johnson, 1999). Additionally, there was an overall decline in school suspensions. A slightly more recent study of Brownsville, Texas students' perceptions (N=230) of SROs' impact on school safety found that 69 percent agreed that SROs do a good job of keeping school safe (Brown, 2006). Brown's findings are in contrast to other findings that SROs did not have any effect on both students' safety perceptions or delinquency (Jackson, 2002; Tillyer, Fisher & Wilcox, 2010). Regarding school shootings, Swartz and colleagues (2016) explain that SROs operate in more of a reactive rather than preventative capacity, unable to prevent violent acts by nature of being limited to only one place at one time.

The use of security guards is another form of visible security measures that are commonly used in schools. Security guards operate similarly to SROs, acting as a form of surveillance, hoping to increase the likelihood of detection. Security guards, like SROs allow for the division of labor in schools so that teachers are responsible for students' mind and security guards are responsible for their bodies. According to the School Crime Supplement to the National Crime Victimization Survey, in 2015-2016, 20 percent of schools reported the presence

of security guards, a smaller used security personnel option when compared to SROs. This number has remained relatively consistent over the past decade with 19 percent in 2005-2006.

There is less empirical research on school security guards compared to that on SROs. Brown (2006) also evaluated student perception on security guards and found that 71 percent of student agree that security officers do a good job of keeping school safe, a higher percentage than SROs. Regarding effectiveness of reducing crime in schools, Jennings, Khey, Maskalay and Donner (2011) using the 2006 School Survey on Crime and Safety, found that security guards in schools are significantly related to a school having a high incidence of crime. Burrow and Apel (2008) had similar findings indicating that security guards are positively and significantly associated specifically with higher larceny risks. Of note when discussing security guards and school shootings, armed security guards were present at Columbine but did not prevent the shooting (Addington, 2009).

Another form of visible security measures is the use of security cameras or CCTV. CCTV, in line with situational crime prevention techniques, offer formal surveillance to the targeted area, increasing the likelihood of detection. According to Ratcliffe (2006), the primary aim of CCTV is to influence an offender to refrain from crime by triggering a perceptual mechanism. In schools, CCTV is often used in public spaces such as hallways, gyms, and lunchrooms to gather evidence in instances of delinquency (Fisher, Higgins & Homer, 2018). The use of CCTV in schools is on the rise. In the 1999-2000 school year, 19% of public schools used security cameras and by the 2015-2016 school year, 81% of public schools reported using security cameras (Musu-Gillette, Zhang & Oudekerk, 2018).

In a recent systematic review of CCTV use in various crime settings (N=80), the results show that CCTV was associated with a modest and significant reduction in crime (Piza, Welsh, Farrington & Thomas, 2019). Despite their wide use on school campuses, literature on CCTV in schools is meager. Some studies have found improved perceptions of safety with the use of security cameras (Brown, 2006, Heinen et al., 2007; van Rompay, Vonk & Fransen, 2009) while another recent study suggests that security cameras are unrelated to improving school crime or reducing social disturbances in schools (Fisher, Higgins & Homer, 2018). Rocque (2012) points out that security cameras were present and operational on the Columbine campus when the attacks occurred. The cameras filmed the two shooters in action but the shooters were not deterred by the presence of CCTV.

Metal detectors are the fourth and final visible security measure examined here. Metal detectors, in line with situational crime prevention, increase the risk of detection through weapon detection. In 2015, approximately 12 percent of students in the United States reported metal detectors in their schools. Metal detectors are the least common of the visible security measures that are examined here (Zhang, 2018).

Several studies examine whether metal detectors are perceived as an effective security measure. In a study conducted by Time & Payne (2008), where school officials from the Commonwealth of Virginia were interviewed about their opinions on effective security strategies, metal detectors were viewed as one of the least useful strategies towards preventing violence in schools. A similar study of interviews with law enforcement executives and school principals in South Carolina found low support for use of metal detectors as an effective school safety strategy (Chrusciel, Wolfe, Hansen, Rojek, & Kaminski, 2015). Students, however,

disagree with this point. In a study that asked students (N=230) in Brownsville, Texas about their perceptions of metal detectors, almost half (49%) felt that they were an effective measure to reduce weapon possession and crime (Brown, 2006).

Regarding metal detectors' impact on crime, Ginsberg and Loffredo (1993) in a comparison study of schools with and without metal detectors found that students in schools with metal detectors were half as likely to carry a weapon than those in school without metal detectors. Johnson (2000) also found metal detectors to be useful in reducing weapon carrying. Another study that examined the relationship between security measures and the incidence of general violence in schools found that general violence (e.g., fights, threats of assault without a weapon) was significantly lower in schools that had metal detectors but no significant impact was made on reducing serious violence (e.g., rape, robbery, aggravate assault) (Jennings, Khey, Maskaly, & Donner, 2011).

Other factors should be considered when evaluating metal detectors as preventative for mass school shootings. In Columbine, for example, the perpetrators began their shooting outside of the school, as has been the case in other mass shooting incidents including Westside Middle School in Jonesboro, Arkansas. As Kleck (2009) explains, "metal detectors may have some utility for deterring routine daily carrying of weapons into school buildings, but they are not relevant to premeditated acts of mass gun violence."

Overall, many forms of visible security measures have been implemented with the desire to protect schools through increasing the likelihood of detection. Individually and collectively, each measure has mixed support in their ability to prevent school crime and delinquency (Tanner-Smith et al., 2018). Several scholars have suggested that such security measures may

have negative effects on students, including increased fear of victimization (Tillyer, et al., 2011) and decreased feelings of safety (Jackson, 2002; Schreck & Miller, 2003, Bachman, Randolph & Brown, 2011). With regards to security for school shootings, they may serve only as a minor inconvenience to those who are determined to attack (Fox & DeLateur, 2014; Rocque, 2012).

Access Control Measures: Locked Door and Fences

Access control is another type of situational crime prevention that schools use to protect their campuses by attempting to block or limit offenders' access to a space. Access control has been defined as informal or formal barriers to entry, presumably into a building but also into a larger space (Connell, 2019). In regards to schools, access control typically relates to locking or monitoring doors and the presence of external barriers such as fences. These strategies seek to monitor and allow access to only those who have a legitimate purpose on a school campus (National Clearinghouse for Educational Facilities, 2008). According to situational crime prevention, these efforts desire to block or limit offender actions or movement to the outside of the building or school yard.

Due to the relative ease of implementing these strategies at schools, it has been one of the most common responses of school security, more regularly used during school hours and in main buildings than in other school-controlled situations, such as during extracurricular activities (Fox & DeLateur, 2014). In the 2015-2016 school year, an overwhelming 94 percent of public schools reported using access control procedures. Although access control measures are widely used in schools, they can take many forms. Most commonly, access control focuses on entry into the building, with locked or monitored doors, or grounds with monitored gates. This paper will focus

on these two access control measures: locked door building security and grounds access control through fencing and/or monitored gates.

The 2017 Indicators of School Crime and Safety (Zhang, 2018) showed that between 1999 and 2015 there was an increased use of locked entrances/exit doors during the school day, with an increase from 38 to 78 percent. The presence of gates around external grounds was not covered in the recent Indicators of School Crime and Safety report but Fox and DeLateur (2014) report that 46 percent of US campuses use them. Even with such wide use of both locked doors and gated grounds, there is little research about the impact of access controls on campus security. In a 2011 study of 954 U.S. high schools, Jennings and colleagues (2011) found that access control measures had no significant effect on violent or serious violent crime. Fisher, Higgins and Homer (2018) also found that access control measures did not decrease drug use, weapon carrying, or fights on school campuses. Conversely, Crawford and Burns (2015) found that access control measures were associated with lower incidence of threatened weapon attacks. Jonson (2017) points out that, anecdotally at least, access control measures have been easily bypassed by the population of shooters who were enrolled students. These perpetrators have the necessary identification to enter the school and likely the knowledge on how to avoid any obstacles due to access control strategies. It is important to understand how these and other heavily used security measures impact school shootings.

The current study will examine the influence that security measures have on temporal and spatial decisions of school shooters. Several hypotheses will be explored attempting to understand if the presence of the security measures discussed above, in light of their theoretical understanding, impact a sample of school shootings. While it is not possible with these data to

infer offender decision making, this approach is a starting point into understanding how these security measures may affect how a student-perpetrated school shooting incident unfolds.

Understanding the relationship between the presence of various security measures and the time of day and location of the shooting may be helpful in evaluating the efficacy of presently used security measures and, furthermore, may provide meaningful insight on new security measures, or new methods of implementing security measures, that would positively affect a shooter's decisions.

CHAPTER 3

METHODOLOGY

Hypotheses

This research examines the relationship between the presence of various security measures and the time of day and location of the shooting. The following are the hypotheses for this study:

H₁: Access control measures and place: Access control measures will increase the likelihood that student perpetrated school shootings will occur outside of the school building.

Concerning *H₁*, according to SCP, the assumption is that access control measures, or the presence of locked doors and an external gate, will block access and make it more difficult to commit a criminal act. Therefore, the assumption is that access control measures will correspond with a spatial change in school shootings and that shooters would choose a space on school property that does not have blocked access (i.e., outside of the school building).

H₂: Visible security measures and time: Visible security measures will increase the likelihood that school shootings will occur outside of school hours.

According to SCP, visible security measures such as a metal detector, increase the risk of detection. *H₂* is testing the assumption that, since visible security measures increase the risk of detection, students will want to choose a time of day where the risk is lower (i.e. before or after school).

H₃: *Combined and location*: Combined security measures (the combination of visible security and access control measures, or *more security*) will increase the likelihood that a shooting will occur outside of the school building (i.e. parking lots) but still on school property.

The assumption with H₃ is that current students are aware of the security measures employed on their own school campus. According to SCP, visible security measures increase the risk of detection and access control measures block perpetrator access. Thus, in line with theoretical assumptions detailed previously, students would use the awareness of the security on their campus and choose a location that provides a better opportunity, or a location with less detection and more access.

H₄: *Combined and time of day*: Combined security measures (the combination of visible security and access control measures, or *more security*) will increase the likelihood that a shooting will occur outside of school hours (i.e. before or after school).

The assumption with H₄ is similar to that in H₂; current students are aware of the security measures employed on their own school campus. In line with theoretical assumptions, students would want to choose a time of day with more opportunity for a shooting. Since places inside of the school are more regularly guarded, a time outside of school hours would provide more opportunity.

The above four hypotheses will be tested with and without incidents that are considered, according to the FBI qualifications, as a mass shooting, or a shooting that includes four or more murders that occur during a single incident (Morton, 2008). Although previous literature does not examine different populations of school shooters, it may be helpful for this study to use

models that include the entire population of students who shoot on their own campus (N=191) but additionally a model that does not include mass shootings (n=2) to better add to our understanding of whether these events (Langman, 2009) affect the analysis. There are reasonable assumptions to be made that mass shooters may be highly motivated and thus immune.

Data

The data utilized in this study are from the United States (US) School Shooting Database (SSDB). This database, funded by the National Institute of Justice, is the collaborative work of three universities: The University of Texas at Dallas, John Jay College, and Michigan State University, along with partners at the University of Maryland at College Park and Seattle University. The SSDB is an open-source relational database that includes all publicly known shootings that resulted in at least one injury that occurred on K-12 school grounds between January 1, 1990 and December 31, 2016. Publicly known shootings are those that have been reported about in the news media and/or other publicly available sources that have been verified with official records. This database is unique in that it provides access to over 460 variables on each school shooting. The SSDB includes data over several units of analysis: the incident, the perpetrator, the victim, and the school where the attack occurred. The SSDB is also unique in that variables were operationalized and data were collected in order to better test two major theoretical traditions from criminology. First, Sampson and Laub's (1993) developmental/life course social control perspective was used to help create measurements at the individual offender (and victim) level. Sampson and Laub (1993) stress the importance of "turning points," or a certain event, experience, or awareness that result in changes in direction of a pathway or trajectory over the life time. This means that the SSDB includes such variables as the

perpetrator's employment, military status, or educational attainment history. The second criminological perspective used to guide the creation of the SSDB, which is more relevant to this current study, is rational choice theory and situational crime prevention perspectives. As explained in the previous chapter, interactions between people and the environment could impact individuals to engage in or disengage from a criminal act. Thus, the SSDB includes many school level variables, such as security measures present at the time of the shooting that may have influenced an individual's decision when and where to perpetuate a school shooting.

The compilation of the SSDB was an iterative process. First, a strict inclusion criteria was defined: an event had to occur on a school campus or at a school sponsored event (such as a sporting event or bus route), and this event had to include the firing of a firearm resulting in at least one injury (this includes events where the perpetrator is the only identified victim, such as suicides). Once event inclusion was confirmed, data were then collected on each of the 460 variables. To both confirm the inclusion of the event and subsequent data collection, open source materials were used, drawing especially on court documents and newspaper accounts. Protocol for open source data collection included simultaneously searching 26 search engines, including but not limited to, Lexis-Nexis periodicals, Lexis-Nexis Legal, Proquest, Newspapers.com, News Library, Infotrac, Google Scholar, Google U.S. Government, Federation of American Scientists, Open Source Center (FBIS), and National Center for Education Statistics (NCES). Sources such as Lexis-Nexis Legal ensured inclusion of written court decisions for cases that went to trial and resulted in conviction. Both indictments and appellate decisions contain summaries of the incidents and rich information about those involved. The NCES was particularly useful in providing data on security measures present at school shooting events, such as SROs, locked

door systems, metal detectors, and CCTV. The use of open source methods has increased in the last decade and has withstood peer-review scrutiny (Chermak, Freilich, Parkin & Lynch, 2012; Freilich, Chermak, Belli, Gruenewald & Parkin, 2014)

The use of public information in the SSDB research process is more transparent and creates fewer ethical and privacy issues. Prior to the commencement of both data collection and this study, Institutional Review Board approval was received. Approval of protocols was received from all universities involved in the process and additionally approved by the National Institute of Justice. After all data were collected on each event, a review was conducted by another individual within the same university for accuracy and completeness. After initial reviews, the data were then reviewed by a team member at another university. This process of review increased reliability, helping ensure the accuracy of both the inclusion of a case and the data collected therefrom.

The current study uses seven years of the data. The data include the entire population of school shootings that occurred between 2010-2016 perpetrated by a student at their own school campus. This timeframe was chosen for two reasons. First, in order to eliminate potential cohort effects, the timeframe after the Columbine High School shooting (April 20, 1999) was selected. In the aftermath of the Columbine shooting, many security measures were changed or implemented nationwide (Madfis, 2016). By selecting a timeframe after, there would be more consistency from the influence of Columbine. Additionally, the 2000-2016 years have markedly more open-source information than the previous years. This is likely due to growth of overall internet content, from archived media sources to online resources like state court records. The

sample size for the sub-sample used in this study is 191, sufficient for the kind of statistical analysis employed.

The current study will investigate how the presence of various security measures employed impact outcomes in school shooting incidents. Schools are typically more guarded during the school day and inside the school building (Zhang, 2018). In light of routine activity theory and SCP, the presence of visible security measures and access control measures during these times and places should make it more difficult to carry out a school shooting and thus less likely to occur during the day and inside of a school. Since all schools in the sample had a school shooting, outcomes will be evaluated in terms of the location and time of day, attempting to understand if security measures affect outcomes. While it is not possible with these data to infer offender decision making, this approach opens a window into understanding how these security measures may affect how a student-perpetrated school shooting incident unfolds. Perpetrators may make decisions based on the presence or absence of security measures or based on their ability to get access into certain parts of the school property. Visible security measures, as outlined in the literature review, will include SROs, metal detectors, CCTV and security guards. Access control measures will include locked doors and external gates.

Variables

All variables used in this study were transformed into dichotomous variables, where no=0 and yes=1. The following section will explain the dependent, independent, and control variables employed in this study.

Dependent Variables

There are two dependent variables, or outcome variables, in this study: time and location.

Time: The time of the incident was taken from information available in open data sources such as newspaper articles and police reports. From there, the incident was coded both as the actual time of the shooting and also as a categorical variable falling into one of the following four categories: before school, during school, after school and over the weekend/no scheduled school session. To help insure accuracy of the time categorical variable, available sources, such as district websites, were then used to confirm the start time and end time of each school. For analysis, the categorical time variable is recoded to a dichotomous measure indicating “outside school hours” as “1” or times before, after school, and over the weekend/no scheduled school session and “during school hours” as “0” for any time during the school day. The majority of incidents, 58% (N=109), occur during school hours, while 42% (N=80) occur outside of school hours (before school=37, after school=41 and weekend/no schedule=2).

Location: The incident location, or where the shooting occurred, was taken from available open sources such as local newspaper articles and police reports. Location was originally coded as a specific location in and around the school: office, classroom, hallway, gym, locker room, lunchroom, library, bathroom, yard/outside, field house, stadium, parking lot, school bus, and related event. For the purposes of analysis, location is dichotomized to “inside” (0) for locations that are inside the school walls (i.e. hallway, classroom, etc.) or “outside” (1) for locations that are not in the school building or otherwise enclosed school property (i.e. parking lot, yard/outside). The majority of incidents, 60% (N=102), occur inside the school building, mainly in the classroom (N=28) and hallways (N=30).

Table 1: Summary of Dependent Variables

DV		Frequency	Percent	Total
Location	Outside	69	40	171
	Inside	102	60	
Time of Day				189
	Before/After	78	42	
	During	109	58	

Independent Variables

I examine three independent, or predictor, variables in this study: visible security measures, access control measures, and combined security measures. All three independent variables are indices, or a compound measure that aggregates multiple variables, as explained below.

Visible security measures: In accordance with the literature review, this study will include the following variables in the index for visible security measures: SROs, security guards, CCTV and metal detectors. According to SCP, SROs, security guards, CCTV, and metal detectors are intended to help increase the risk for a potential offender in a given situation. The variables in the visible security measures index were commonly extracted from school district websites and national reports such as the NCES. For example, school handbooks, available at the district or school level, are one source often utilized. These handbooks will often have a section outlining security procedures administered and will explain the presence of, for example, personnel such as security guards. For analysis, all of these variables were coded dichotomously, as “yes, present” (1) if there was available evidence to support the presence of the measure

during the academic year in which the school shooting occurred and “no” (0) if there was no available evidence to suggest their presence.

The disaggregated information on visible security measures is in Table 2 and is as follows: 25% (n=47) of schools had an SRO present during the academic school year of the attack, 25% (n=46) had security guards present during the academic school year of the attack, 21% (n=39) had CCTV present on the campus during the academic school year of the attack, and 13% (n=25) had metal detectors present on the campus during the academic school year of the attack. The data do not distinguish if metal detectors are stand alone systems or are handheld wand-like metal detectors. The presence of a metal detectors is reflective of either type of metal detector in during the academic year of the shooting.

Table 2: Visible Security Measures Disaggregated

Visible Security Measures	Frequency	Percent
SRO	47	25
Security guards	46	25
CCTV	39	21
Metal detectors	25	13
Total	191	100

Below, Table 3 reflects the index of visible security measures demonstrating that out of the 191 schools in the sample, most did not employ any kind of security measure. A small minority of schools (10%) utilized the entire range of visible security measures. Fifty-three percent of schools had no visible security measures during the academic year of the attack, whereas 23% had one measure, 14% had two measures, and 10% used all three measures.

Access control measures: Guided by the previous literature, the index for access control includes two measures: locked door security, and the presence of a fence or wall surrounding the school.

Table 3: Visible Security Measures Index

Visible Security Measures	Frequency	Percent
0	101	53
1	43	23
2	27	14
3	20	10
Total	191	100

In accordance with SCP, these measures require an increase of effort by a potential offender, thus making it more difficult to commit a crime. These variables were taken primarily from school related documents and websites such as district websites and the NCES.

Additionally, when possible, a Google image from the year of the attack was examined to confirm the presence of an external fence or wall. For analysis, both locked door security and external fence/wall were coded “yes, present” (1) if the available evidence suggested they were present during the academic year in which the school shooting occurred, and “no” (0) if there was no evidence to suggest their presence. Out of the 191 cases, fences/walls were present at 39% of school doors (n=70) while locked doors were present in only 18% (n=34) of schools.

Table 4 reflects the index of access control measures, or the combined measure of both locked door security and the presence of an external gate/fence. Evident from Table 4, the index of access control measures, 52% of schools did not have any access control measure present during the school year of the shooting occurred. Additionally, 42% had only one access control measure and 6% had both.

Table 4: Access Control Measures Index

Access Control Measures	Frequency	Percent
0	99	52
1	80	42
2	12	6
Total	191	100

Combined security measures: The last independent variable is the index of all the visible security measures (detailed above) and all the access control measures (also detailed above). This means the combined security measure is the index of SROs, security guards, CCTV, metal detectors, locked door security and the presence of an external fence/wall. Table 5 represents the index of all six variables. This measure is used in Models 3 and 4.

Table 5: Combined Security Measures Index

Combined Security Measures	Frequency	Percent
0	63	33
1	63	33
2	21	11
3	24	13
4	18	9
5	1	<1
6	1	<1
Total	191	100

Table 5 demonstrates that 33% of schools had no security measure at all present during the academic year of the school shooting, 33% had one measure, 11% had two measures, 13% had three measures, 9% had four measures, and fewer than 1% had five and six measures. It appears from this sample, schools where a current student shot a firearm at their own school that it is more common to have fewer measures or no measures utilized.

Control Variables

Several control variables are employed in order to help assess the relationship between the independent variables and dependent variables. This is necessary because control variables help prevent the confounding of the relationship between the independent variable and dependent variable. To reduce this possible effect, several additional variables are included.

Urban: In order to control for community level factors that are beyond the scope of this research, census measures for urbanicity were included in the original database. This variable was recoded to show whether or not the school in question was in an urban location. The new urban variable indicates “yes” (1) for school shootings that occurred in metro counties with a population over 50,000 and “no” (0) for shootings that occur in other areas. It is necessary to control for urbanicity because urban locations in the US may potentially have a greater presence of security measures due to issues in the surrounding neighborhoods of schools (Addington, 2009). School shootings by current students in urban locations occurred in only 6% (n=12) of school in this sample (n=191). The overwhelming majority, 96% (n=179), of shootings occurred in locations other urban locations.

High School: Additionally, this study uses school type as a control. School type was originally coded as pre-k, kindergarten, elementary school, grade school (grades 1-6), junior high (grades 6-8), high school, vocational school and other. School type was acquired through various district and school level sources such as the NCES. Due to the likelihood that high schools have more security measures (Zhang, 2018), the school variable is recoded as dichotomous “high school” (1) or “not high school” (0). Seventy four percent (n=137) of schools in this study were

high schools. Vocational schools, even though they may act as an alternative to a local high school, were not represented in this sample (n=0) and therefore irrelevant to this analysis.

Gang membership: The variable “gang membership” is used as a control in this study. To confirm gang membership, available newspaper articles and police reports were used to determine if the perpetrator was involved in a group of delinquent peers or an actual organized gang. If the perpetrator was involved with an organized gang, when available, the gang name was recorded as a string variable. Gang memberships was originally coded as: no; yes, delinquent peers; yes, organized gang/criminal organization; and missing. For the purposes of this study, gang membership is recoded as dichotomous to “yes” (1) as any recognition of gang membership or “no” (0) with no known gang membership. The use of gang membership as a control follows the assumption that gang membership impacts an individual’s gun carrying inclinations (Tigri et al., 2012). Gang membership was confirmed in 13% (n=24) of cases in this sample.

Suicides: Although previous literature on school shootings has not distinguished different types school shootings, it is apparent that, although security should potentially act as a deterrent for all types of shootings, suicides may be qualitatively different situations. As such, it is important to control for this sub-set of the sample, especially in terms of looking ahead to prevention approaches. Suicides are recoded as dichotomous as “yes” (1), for situations where only the perpetrator was killed or injured and no evidence of wishing to harm others was present. When evidence suggested otherwise, this variable is coded as “no” (0). Newspaper accounts and court documents were the main sources for this information. In this study 20% (n=32) of the cases are categorized as suicides.

Descriptive Statistics

In order to better understand the breakdown of the data, descriptive statistics of all variables were computed and are represented in Table 6.

Table 6: Descriptive Statistics

Variable	n	Mean	Std. Dev.	Min	Max
Dependent					
Time of Day	189	0.58	0.50	0	1
Location	171	0.60	0.50	0	1
Independent					
Visible Security Index	191	0.82	1.03	0	3
Access Control Index	191	0.55	0.61	0	2
Combined Index	191	1.36	1.37	0	6
Visible Security Measures					
SRO	186	0.25	0.44	0	1
Security Guard	183	0.25	0.44	0	1
CCTV	186	0.21	0.41	0	1
Metal Detectors	187	0.13	0.34	0	1
Access Control Measures					
Locked Doors	184	0.19	0.39	0	1
External Fence	185	0.38	0.49	0	1
Control					
High School	185	0.74	0.44	0	1
Urban	191	0.06	0.24	0	1
Gang Membership	187	0.13	0.34	0	1
Public School	180	0.96	0.21	0	1
Suicides	191	0.37	0.48	0	1
n=191					

Analytical Strategy

In order to understand if various security measures impact the outcome of a shooting occurring during school, regression analyses are employed. The current study uses logistic regression, which is one of the most commonly used analytical methods in the field of

criminology research (Weisburd & Britt, 2014). Logistic regression estimates the probability of an outcome and requires dependent variables to be dichotomous, or variables that are divided into two categories such as “yes” and “no.” Logistic regression uses the logic of a curve, or s-shape, rather than the straight line found in other regression models like ordinary least squares regression. This s-shape is due to the fact that predictions are constrained to values bounded between 0 and 1 (Weisburd & Britt, 2014). Logistic regression is a type of maximum likelihood estimator which operates by maximizing the probability of getting the observed results given the fitted regression coefficients (Walker & Madden, 2013). In this study, the odds ratio is used as a measure of effect size. The odds ratio is well suited for this type of data due to its straightforward and meaningful interpretation with greater than 1.0 increasing the likelihood of a shooting occurring inside of the school building and an odds ratio with less than 1.0 indicating the odds decreasing the likelihood of a shooting occurring inside of the building.

As previously mentioned, this study includes the entire population of school shootings where a current student perpetrates the shooting from 2010 to 2016 timeframe. Employing statistical analysis with a whole population, rather than a portion of one, impacts the need to do tests of significant. This paper though, will use the theoretical background, previously discussed, to guide inclusion of variables in logistic regression models employed.

In order to test the previously described hypotheses, several multivariate models will be presented to better shed light on the predicted probability of the two outcomes: time of day of a shooting and location of the shooting. These models will be used to examine the relationship between the presence of various security measures and the time of day and location of the

shooting. Examining the relationship between security measures and the time of day and location of the shooting can give insight as to the impact security measures have on school shootings.

CHAPTER 4

ANALYSIS AND RESULTS

The aim of this study is to understand if various security measures impact the outcome of a shooting occurring during school or during the school day. To understand this, several logistic regression models were utilized. Model 1 is attempting to understand the impact of access control measures on the location of a shooting, Model 2 the impact of visible security measures on the outcome of time of day, and Models 3 and 4 are additive models analyzing the impact of combined security measures (both visible and access control measures) on both the location and time of day a shooting occurred. This chapter will present the descriptive information on variables used in the models as well as the logistic regression results for each model.

Correlation

The below Pearson's correlation matrix reveals how the independent, dependent, and control variables are correlated with each other and to determine if there were statistically significant relationships between the variables (Walker & Madden, 2013). This is presented in order to get a bird's eye view of the possible relationships in this data set. Overall, the variables in this study operate in the expected directions and are presented in Table 7.

Time of day, the first outcome variable, has a positive and significant relationship with two variables: location of the shooting ($r=0.36$, $p\leq 0.01$) and visible security measures ($r=0.18$, $p\leq 0.05$). The variable location, the second outcome variable, has a positive and significant relationship with two variables: combined security measures ($r=0.26$, $p\leq 0.01$) and visible security measures ($r=0.28$, $p\leq 0.01$).

The variable, combined security measures, has a high correlation with visible security measures ($r=0.80$, $p\leq 0.01$) and access control measures ($r=0.50$, $p\leq 0.01$); this is as expected due to the fact that combined security measures are the combination of access control measures and visible security measures. The ombudsman measure is not included in any models with the two disaggregated measures and therefore will not present a collinearity problem for the analyses. Combined security also has a positive and significant relationship with perpetrator gang membership ($r=0.24$, $p\leq 0.01$) and being a high school ($r=0.19$, $p\leq 0.01$).

One of the independent variables utilized in this, visible security measures, in addition to having a positive and significant relationship with time of day and location (mentioned above), has a positive and significant relationship with perpetrator gang membership ($r=0.23$, $p\leq 0.01$) and being a high school ($r=0.21$, $p\leq 0.01$). Access control measures, another independent variable, has a positive and significant relationship with perpetrator gang membership ($r=0.15$, $p\leq 0.05$).

Urban, one of the control variables, has a negative but significant relationship with being a high school ($r=-0.14$, $p\leq 0.05$). Suicide, another control variable, also has a significant but negative relationship with perpetrator gang membership ($r=-0.22$, $p\leq 0.01$) while public school, yet another control variable, has a positive and significant relationship with time of day ($r=0.17$, $p\leq 0.05$). Again, the correlation coefficient between variables in this study operates as expected.

Table 7: Pearson's Correlation Matrix

Variables	Time of Day	Location	Combined Security Measures	Visible Security Measures	Access Control Measures	Urban	Gang Membership	High School	Public School	Suicide
Time of day	1.00									
Location	0.36**	1.00								
Combined Security Measures	0.11	0.26**	1.00							
Visible Security Measures	0.18*	0.29**	0.80**	1.00						
Access Control Measures	-0.02	0.08	0.50**	0.02	1.00					
Urban	-0.08	-0.01	-0.01	-0.04	0.02	1.00				
Gang Membership	0.01	-0.12	0.24**	0.23**	0.15*	-0.04	1.00			
High School	0.05	-0.07	0.19**	0.21**	0.04	-0.14*	0.12	1.00		
Public School	0.09	-0.09	-0.11	-0.03	-0.03	0.06	-0.01	0.17*	1.00	
Suicide	-0.04	0.07	-0.10	-0.04	-0.09	0.17	-0.22**	0.14	0.09	1.00

* $p \leq .05$ ** $p \leq .01$

Logistic Regression Results

In order to evaluate the previously explained hypotheses in this study, four models are presented. After each of the four models are discussed, further analyses examine whether the addition of the mass shooting cases substantively affects the findings. Implications are discussed.

H₁: Access control measures and place

H₁ is testing whether access control measures will increase the likelihood that student perpetrated school shootings will occur outside of the school building. In this model, inside the school is represented as 1 and outside of the school (but still on school grounds) is 0. The findings for H₁ are reported in Model 1 in Table 8.

Table 8: Model 1: Logistic Regression Predicting Location with Access Control Measures

Location	B	SE	z	P> z	Odds Ratio	95% Conf. Interval	
						Lower	Upper
Access Control Measures	0.826	0.327	2.52	0.012	0.438	0.231	0.832
Urban area	-0.331	0.681	-0.49	0.627	1.392	0.366	5.287
Gang membership	-0.403	0.513	-0.78	0.433	1.496	0.547	4.090
High School	-0.438	0.432	-1.01	0.311	1.550	0.644	3.617
Public School	-0.886	1.196	-0.74	0.459	2.425	0.233	25.284
Suicide	0.596	0.497	1.20	0.230	0.551	0.208	1.459
Constant	0.961	1.225	0.78	0.433	0.382	0.035	4.218
Number of observations	132						
LR chi2(6)	9.56						
Prob > chi2	0.1443						
Pseudo R2	0.0528						

In Model 1, the probability of obtaining χ^2 is 0.1443. This is the p-value which is compared to a critical value of 0.05 or 0.01 to determine if the overall model is statistically significant (Walker & Madden, 2013). Although it is preferable to have a $\chi^2 < 0.05$ and could

explain that the current model does not have relevant explanatory power, the higher χ^2 in this model might be due to the smaller sample size utilized in this analysis. The pseudo R^2 in this model is 0.0528. Although this is a low pseudo R^2 , Osborne (2015) explains many drawbacks in pseudo R^2 estimates and thus are reported for the purposes of transparency but are not the best statistic by which to make bold statements about the results.

In Model 1, regarding the main independent variable access control, we see for every unit increase in access control, the odds of a shooting occurring outside of the school is 0.438. Access control measures (OR=0.438, 95% CI: 0.231, 0.8318) reduce the likelihood that a shooting will occur outside of the school by 56% when compared to inside of the school. Additionally, we find that a suicide death (OR=0.551, 95% CI: 0.208, 1.459) also decreases the likelihood of a shooting occurring outside of the school. Urban areas (OR=1.392, 95% CI: 0.366, 5.288), gang membership (OR=1.496, 95% CI: 0.547, 4.090), high schools (OR=1.550, 95% CI: 0.644, 3.617), and public schools (OR=2.426, 95% CI: 0.233, 25.284) all increase the likelihood of a shooting occurring outside of school. All of the variables in Model 1 operate in the theoretically expected ways.

H₂: Visible security measures and time

H₂ is testing whether visible security measures will increase the likelihood that student perpetrated school shootings will occur outside of the school hours (i.e., before or after school). In this model, during school is represented as 0 and outside of the school hours (i.e., before and after school) is 1. In Model 2, the probability of obtaining χ^2 is 0.5989. Regarding the main independent variable, visible security, we see for every unit increase in visible security, the odds of a shooting occurring outside of the school is 0.798. Visible security measures

Table 9: Model 2: Logistic Regression Predicting Time of Day with Visible Security Measures

Time of Day	B	SE	z	P> z	Odds Ratio	95% Conf. Interval	
						Lower	Upper
Visible Security Measures	0.226	0.183	1.23	0.217	0.798	0.558	1.142
Urban area	-1.010	0.678	-1.49	0.136	2.744	0.727	10.361
Gang membership	0.199	0.521	0.38	0.702	0.820	0.295	2.273
High School	-0.357	0.418	-0.85	0.393	1.429	0.630	3.242
Public School	0.521	1.039	0.51	0.613	0.592	0.077	4.537
Suicide	0.109	0.456	0.24	0.811	0.897	0.367	2.192
Constant	-0.121	1.075	-0.11	0.910	1.129	0.137	9.292
Number of observations	140						
LR chi2(6)	4.58						
Prob > chi2	0.5989						
Pseudo R2	0.0239						

Visible security measures (OR=0.798, 95% CI: 0.558, 1.142) reduce the likelihood that a shooting will occur outside of the school. Confidence intervals are valuable in smaller samples, such as this study, because they can demonstrate the level of confidence in the odds ratio (Osbourne, 2015). In this study confidence intervals helps confirm support for the results: urban areas (OR=2.744, 95% CI: 0.727, 10.361) and taking place at high schools (OR=1.429, 95% CI: 0.630, 3.242) increase likelihood of shootings occurring outside of school hours and perpetrator gang membership (OR=0.820, 95% CI: 0.295, 2.273), public schools (OR=0.592, 95% CI: 0.077, 4.537) and a suicide death (OR=0.897, 95% CI: 0.367, 2.192) all decrease the likelihood that shootings occur outside of school hours.

H3: Location and Combined Security Measures

Table 10 represents H3, the hypothesis testing that more security measures (the additive effect of both visible security measures and access control measures) will increase the likelihood that a shooting will occur outside of the school building (i.e. parking lots) but still on school

property based on the outcome location. In this model, inside the school is coded as 0 and outside of the school (but still on school grounds) is 1.

Table 10: Model 3: Logistic Regression Predicting Location and Combined Security Measures

Location	B	SE	z	P> z	Odds Ratio	95% Conf. Interval	
						Lower	Upper
Combined Security Measures	0.641	0.167	3.85	0.000	0.527	0.380	0.730
Urban area	-0.420	0.719	-0.58	0.559	1.522	0.372	6.233
Gang membership	-0.916	0.572	-1.60	0.109	2.499	0.815	7.661
High School	-0.771	0.450	-1.71	0.087	2.162	0.815	5.224
Public School	0.436	1.329	-0.33	0.743	1.546	0.144	10.933
Suicide	0.620	0.515	1.20	0.229	0.538	0.196	1.476
Constant	0.443	1.352	0.33	0.743	0.642	0.045	9.084
Number of observations	132						
LR chi2(6)	20.65						
Prob > chi2	0.0021						
Pseudo R2	0.1141						

In Model 3, the probability of obtaining χ^2 is 0.0021. The main independent variable, combined security measures, or the additive effect of visible security and access control measures, has an odds ratio of 0.527. Combined security measures (OR=0.527, 95% CI: 0.380, 0.730) reduce the likelihood of a shooting occurring outside the school building by 36%. A suicide death (OR=0.620, 95% CI: 0.196, 1.476) also decreases the likelihood of a shooting occurring outside of the school. There are several variables that operate in the predicted manner, increase the likelihood of a shooting occurring outside of school: urban area (OR=1.522, 95% CI: 0.372, 6.233), perpetrator gang membership (OR=2.499, 95% CI: 0.815, 7.661), taking place at a high school (OR=2.162, 95% CI: 0.815, 5.224), and being public school (OR=1.546, 95% CI: 0.144, 10.933).

H4: Time of Day and Combined Security Measures

The expectation in H₄ is that more security (the additive effect of both visible security measures and access control measures) in schools will increase the likelihood that a shooting will occur outside of school hours (i.e. before or after school). In this model, during school is represented as 1 and outside of the school hours (i.e., before and after school) is 0.

In Model 4, the probability of obtaining χ^2 is 0.5746. Similar to Model 2, there is evidence that more security (or the additive effect of visible security measures and access control measures) (OR=0.178, 95% CI: 0.641, 1.093), perpetrator gang membership (OR=0.213, 95% CI: 0.294, 2.220), being a public school (OR=0.615, 95% CI: 0.068, 4.322), and suicides (OR=0.168, 95% CI: 0.344, 2.079) all decrease the likelihood of a shooting occurring outside of the school day. Urban areas (OR=2.896, 95% CI: 0.762, 11.002) and being a high school (OR=0.479, 95% CI: 0.645, 3.388) all increase the likelihood of a shooting occurring outside of school hours.

Additional models

When the two cases of mass shootings were dropped and all four models were run again, there were no substantive changes to the results. This step was taken to explore the possibility that mass shootings may operate differently. However, the small number of student perpetrated mass shootings in this sample would make it difficult to come to any meaningful conclusions. Therefore, the difference between student perpetrated mass shootings and other shootings remains an empirical question that will have to be examined using other means. Additionally, all four models were estimated with the Firth method, a possible method for

Table 11: Model 4: Logistic Regression Predicting Time of Day and Combined Security Measures

Time of Day	B	SE	z	P> z	Odds Ratio	95% Conf. Interval	
						Lower	Upper
Combined Security Measures	0.178	0.136	1.30	0.192	0.837	0.641	1.093
Urban area	-1.063	0.681	-1.56	0.118	2.896	0.762	11.002
Gang membership	0.213	0.515	0.41	0.680	0.808	0.294	2.220
High School	-0.391	0.423	-0.92	0.355	1.479	0.645	3.388
Public School	0.615	1.061	0.58	0.562	0.541	0.068	4.322
Suicide	0.168	0.459	0.37	0.715	0.845	0.344	2.079
Constant	-0.248	1.105	-0.22	0.822	1.282	0.147	11.171
Number of observations	140						
LR chi2(6)	4.76						
Prob > chi2	0.5746						
Pseudo R2	0.0249						

analyzing rare events with logistic regression. Heinze and Schemper (2002) explain in their comparison study utilizing the Firth method, that the Firth method when used on smaller samples can help overcome the problem of “inestimable” maximum likelihood estimates. The Firth method though, did not impact the outcomes in any substantial or significant way in this study.

In sum, all four of the hypotheses have been rejected. H₁ hypothesized that access control would impact the location, increasing the likelihood that a shooting would occur outside of the building. The results though showed an increase in likelihood of a shooting occurring inside of the building. H₂ assumed that visible security measures would impact the time of day, increasing the likelihood that a shooting would occur not during the school day. The results for demonstrated an increase in likelihood that shootings would occur during the day. H₃ is also rejected presenting, with a combination of security measures (the additive effect of visible security measures and access control measures), an increase in the likelihood of a shooting occurring inside of the school rather than outside. H₄ had similar results as H₂ on time of day. A

combination of security measures (the additive effect of visible security measures and access control measures) increase the likelihood of a shooting occurring during the school day rather than after or before school.

Although many of the findings were not statistically significant, this study included the entire universe of school shootings over the designated time period. This means that there was no sampling error and very little measurement error but fault could be found with missing data (which will be explained in the next chapter). Given what we know about other types of rare homicide, the findings, or rejection of all four hypotheses, is not surprising. Each case can differ dramatically from the next in such a way that finding patterns may be difficult. Regardless, there are still important themes to be drawn from these findings. They are explored in the next chapter.

CHAPTER 5

DISCUSSION

In considering the research question, “do security measures impact the time of day and location of a school shooting?”, it appears that these measures do not impact outcomes as expected. It is worth pointing out that in regard to the reduction of victimization on school campuses due to the presence of security measures, studies show, at best, mixed support (Tanner-Smith et al., 2018) and often call attention to the possible negative effects on students, such as decreased feelings of safety (Jackson, 2002; Schreck & Miller, 2003, Bachman, Randolph & Brown, 2011). It is important to remember that this study is one of the first examinations of school security in relation to school shootings and as such, these results offer a stepping off point for future research and not a definitive answer to the question. Additionally, the lack of support for security measures is not a criticism of SCP techniques but rather a call for better understanding of the nuances involved in this type of analysis. As this area of research grows, so will opportunities for refinement of the measurement and operationalization of variables.

Concerning SCP, it is important to remember that measures should be tailored to highly specific categories of crime. Clarke (2010) explains, “distinctions must be made, not between broad categories such as burglary and robbery, but rather between the different kinds of offenses falling under each of these categories” (p. 4). Clarke (2010), is clear that the proper use of SCP techniques requires the blockage of opportunities in highly specific ways. This needs to apply to SCP techniques used in schools. More tailored, highly specified security approaches are warranted. For example, metal detectors, which typically operate as a weapon detection system

in schools, might be too broadly applied if trying both capture weapons possessed by gang members and weapons used for school shootings. The fact that permanent metal detectors and wand metal detectors are generally employed for different purposes suggests the need for more nuanced understanding of the actual implementation of these security measures, not just their presence or absence, for better understanding school safety. Future research also needs to consider the fact that there are many typologies of school shootings (mass shootings, suicides, etc.) in order to present solutions for more meaningful tailored approaches. Understanding underlying motives and goals of the different scenarios in which a student brings a weapon on campus, for example, can help tailor security approaches in more effective ways.

Another important consideration in light of these results is that school shooters might operate outside of the theoretical perspective offered in this paper. SCP is rooted in both rational choice theory and routine activity theory. Under these theoretical understandings, the actor is assumed to be rational and the manipulation of the environment is assumed to impact the opportunity to encourage or discourage a criminal act. As previously pointed out in this paper, security measures, such as metal detectors may have some utility for deterring routine daily carrying of weapons into school buildings, but could be irrelevant to premeditated acts of mass gun violence (Kleck, 2009). It is possible that an individual-based theoretical understanding that takes into consideration the highly-motivated offender (Langman, 2009) could a better fit for understanding these rare events.

There are several limitations to this study. The first is that several school security measures are underreported and difficult to obtain within the open-source protocol. It is possible that a qualitative case study approach would serve towards better understanding school security

measures. This study captures the presence of the security measure during the academic year of the attack; a measure that examines the presence of security on the day of the attack would be the next step in better understanding how security measures affect decision making paradigms. Furthermore, qualitative studies should evaluate the location of the shooting in terms of the distance from various security measures to get even more robust understanding of the security utilized. Similarly, evaluation of accurate use of security measures present, rather than just the presence of security measures, would give more meaningful insight.

Another limitation of this study is the subjectivity in some variables used. For example, the security measures in this study were operationalized as the evidence of the presence of a security measure or no evidence of its presence. Coders could have missed evidence and inaccurately coded. Additionally, it is possible in some cases that security measures are so well established in a school that they are omitted from reporting. For example, the recent NCVS School Supplement states that 94 percent of public schools utilize access control procedures. The sample in this study had only 38% with external fencing and 19% with locked door security. This suggests a disconnect between actual practice and reported practice. Due to limits with historical data, it may be difficult to reconcile this limitation with the current dataset but future research could contact schools for more detailed security measure usage. Addressing the limitations outlined above would allow for future improvements on measurement of school security as it relates to school shootings.

There is widespread support among policy makers, school administrators, parents, and the community in understanding which security measures in school campuses are worth the cost and what alternative methods may be more effective (Derzon & Wilson, 1999). School security

is an under researched area with many questions left to be asked; our understanding of the most effective practices to reduce and prevent serious violence is still young. This study should be a tool for future research on what can be learned on how security measures impact decision making of school shooters. Future studies should consider a case study and mixed methods approach to continuing the study of these rare events. Events, which though rare, have a significant impact on schools and their communities

In further studies, it is important to still consider the perspective of how place can contribute to school shootings. The SCP perspective which seeks to alter proximal causes of crime (the situation), may still be more amenable to change, rather than distal causes (the individual). Finding ways to identify intervention points by examining the time and location of school shootings in relation to available security measures offers meaningful potential of crime prevention, not only with respect to school shootings, but to other crimes as well. Refining the application of SCP methods and narrowing its focus has proven to be very successful in the past and can continue to offer success in ever widening areas of crime.

REFERENCES

- Addington, L. (2009). Cops and cameras: Public school security as a policy response to columbine. *The American Behavioral Scientist*, 52(10) 1426.
doi:10.1177/0002764209332556
- Agnich, L. (2015). A comparative analysis of attempted and completed school-based mass murder attacks. *American Journal of Criminal Justice*, 40(1), 1–22.
<https://doi.org/10.1007/s12103-014-9239-5>
- Bachman, R., Randolph, A., Brown, B., Zeldin, S., Wilson, D., & Collura, J. (2011). Predicting perceptions of fear at school and going to and from school for African American and white students: The effects of school security measures. *Youth & Society*, 43(2), 705–726.
<https://doi.org/10.1177/0044118X10366674>
- Baird, A., Roellke, E., & Zeifman, D. (2017). Alone and adrift: The association between mass school shootings, school size, and student support. *The Social Science Journal*, 54(3), 261–270. <https://doi.org/10.1016/j.soscij.2017.01.009>
- Braga, A. A., Papachristos, A. V., & Hureau, D. M. (2014). The effects of hot spots policing on crime: An updated systematic review and meta-analysis. *Justice quarterly*, 31(4), 633-663.
- Brown, B. (2006). Controlling crime and delinquency in the schools: An exploratory study of student perceptions of school security measures. *Journal of School Violence*, 4(4), 105-125.
- Burgess, E.W. (1925). Can neighborhood work have a scientific basis. *The city*, 142-155.
- Burrow, J. D., & Apel, R. (2008). Youth behavior, school structure, and student risk of victimization. *Justice Quarterly*, 25(2), 349-380.
- Chermark, S.M., Freilich, J.D, Parkin, W., & Lynch, J.P. (2012). American terrorism and extremist crime data sources and selectivity bias: An investigation focusing on homicide events committed by far-right extremists. *Journal of Qualitative Criminology*, 28(1), 191-218.
- Cheurprakobkit, S., & Bartsch, R. (2005). Security measures on school crime in Texas middle and high schools. *Educational Research*, 47(2), 235–250.
<https://doi.org/10.1080/00131880500104366>

- Chrusciel, M. M., Wolfe, S., Hansen, J. A., Rojek, J. J., & Kaminski, R. (2015). Law enforcement executive and principal perspectives on school safety measures. *Policing: An International Journal of Police Strategies & Management*, 38(1), 24-39. doi:10.1108/PIJPSM-11-2014-0115.
- Clarke, R.V. (Ed.) (1992) *Situational crime prevention: Successful case studies*. Albany, NY: Harrow and Heston.
- Clarke, R.V. (1997) Problem-oriented policing and the potential contribution of criminology. Report to the National Institute of Justice. Grant #95IJCX0021
- Clarke, R.V. (Ed.) (2010). *Situational crime prevention*. Boulder, CO: Lynne Rienner Publisher, Inc.
- Clarke, R.V. & Cornish, D.B. (1985). Modeling offenders' decisions: A framework for research and policy. In *Crime and Justice: An annual review of research*, vol. 6, edited by M. Tonry & N. Morris. Chicago: University of Chicago Press.
- Clarke, R.V., & Homel, R. (1997). A revised classification of situational crime prevention techniques. In *Crime Prevention at a Crossroads*, edited by Steven P. Lab. Highland Heights, KY: Academy of Criminal Justice Sciences and Anderson.
- Clarke, R.V., & Weisburd, D. (1994). Diffusion of crime control benefits: Observations on the reverse of displacement. *Crime Prevention Studies*, vol 2, ed. Ronald V. Clarke. Monsey, NY: Criminal Justice Press.
- Cohen, L.E. & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, (44), 588-608.
- Connell, N.M. (2019). Increasing safety in schools through physical space: CPTED and schools. Paper. Report to National Institute of Justice. Comprehensive School Safety Initiative. 2016-231.
- Cornish, D., & Clarke, R. (1986). Situational prevention, displacement of crime and rational choice theory. *Situational crime prevention: From theory into practice*, 1-16.
- Cornish, D., & Clarke, R. (1987). Understanding crime displacement: an application of rational choice theory. *Criminology*, 25, 933-947.
- Cornish, D., & Clarke, R. (2003). Opportunities, precipitators and criminal decisions: A reply to Wortley's critique of situational crime prevention. In *Theory for practice in situational prevention*, edited by M. Smith, & D. Cornish. Vol. 16 of Crime Prevention Studies. Cullompton, UK: Criminal Justice Press and Willan.

- Crawford, C., & Burns, R. (2015). Preventing school violence: assessing armed guardians, school policy, and context. *Policing: An International Journal of Police Strategies & Management*, 38(4), 631-647. doi:10.1108/PIJPSM-01-2015-0002.
- de Apodaca, F., Brighton, L., Perkins, A., Jackson, K., & Steege, J. (2012). Characteristics of schools in which fatal shootings occur. *Psychological Reports*, 110(2), 363-377. <https://doi.org/10.2466/13.16.PR0.110.2.363-377>
- Department of Health and Human Services & Center for Disease Control and Prevention. *Youth Risk Behavior Surveillance—United States, 2005*. *MMWR*. 2006;55(S-5): 6-7.
- Derzon, J. H., & Wilson, S. J. (1999, November). An empirical review of school-based programs to reduce violence. In *Annual meeting of the American Society of Criminology*.
- Eck, J. E. (1993, September). The threat of crime displacement. In *Criminal Justice Abstracts* (Vol. 25, No. 3, pp. 527-546).
- Eck, J.E. (1995). Examining routine activity theory: A review of two books. *Justice Quarterly*, 12, 783-797.
- Eck, J.E. & Weisburd, D. (1995). Crime places in crime theory. In *J.E.Eck & D. Weisburd (Eds.), Crime places (Crime Prevention Studies)*, 4, 1-33. Monsey, NY: Willow Tree Press
- Farr, K. (2018). Adolescent rampage school shootings: Responses to failing masculinity performances by already-troubled boys. *Gender Issues*, 35(2), 73-97. <https://doi.org/10.1007/s12147-017-9203-z>
- Felson, M. (1986). Linking criminal choices, routine activities, informal control, and criminal outcomes. In *The Reasoning Criminal, (Ed.)*, D.B. Cornish & R.V. Clarke. New York: Springer-Verlag.
- Felson, M. (1987). Routine activities and crime prevention in the developing metropolis. *Criminology*, 25(4), 911-932.
- Felson, M. (1995). Those who discourage crime. *Crime and place*, 4, 53-66.
- Fisher, B. W., Higgins, E. M., & Homer, E. M. (2019). School crime and punishment and the implementation of security cameras: Findings from a national longitudinal study. *Justice Quarterly*, 1-25.
- Fox, J. A., & DeLateur, M. J. (2014). Mass shootings in America: Moving beyond Newtown. *Homicide studies*, 18(1), 125-145.

- Freilich, J.D., Chermak, S.M., Belli, R., Gruenewald, J. & Parkin, W.S. (2014). Introducing the United States extremist crime database (ECDB). *Terrorism and Political Violence* 26(2): 372-384.
- Gerard, F., Whitfield, K., Porter, L., & Browne, K. (2016). Offender and offence characteristics of school shooting incidents. *Journal of Investigative Psychology and Offender Profiling*, 13(1), 22–38. <https://doi.org/10.1002/jip.1439>
- Gilmore, P., & Glatthorn, A. (1982). Children in and out of school *Ethnography and Education. Language and Ethnography Series, Volume 2. Colloquium on Ethnography and Education* (Philadelphia, PA, 1978) . Washington, D.C: Distributed by ERIC Clearinghouse.
- Ginsberg, C., & Loffredo, L. (1993). Violence-related attitudes and behaviors of high school students—New York City 1992. *Journal of School Health* 63, 438-440.
- Guerette, R. T., & Bowers, K. J. (2009). Assessing the extent of crime displacement and diffusion of benefits: A review of situational crime prevention evaluations. *Criminology*, 47(4), 1331-1368.
- Guerzoni, M. (2018). A situational crime prevention analysis of Anglican clergy's child protective practices. *Child Abuse & Neglect*, 77, 85–98. <https://doi.org/10.1016/j.chiabu.2017.12.016>
- Harding, D., Fox, C., & Metha, J. (2002). Studying rare events through qualitative environment: Part I. Results from the school health policies and programs study 2006. *Journal of School Health*, 77(8), 522-543.
- Hawley, A.H. (1950). *Human ecology: A theory of community structure*. New York, NY: Ronald Press.
- Heinen, E., Webb-Dempsey, J., Moore, L., McClellan, C., & Friebe, C. (2007). Safety matters: How one district addressed safety concerns. *Journal of school violence*, 6(3), 113-130.
- Heinze, G., & Schemper, M. (2002). A solution to the problem of separation in logistic regression. *Statistics in medicine*, 21(16), 2409-2419.
- Hesseling, R. (1994). Displacement: A review of the empirical literature. In *Crime Prevention Studies*, vol. 3, ed. R.V. Clarke. Monsey, NY: Criminal Justice Press.
- Hirschfield, P. J. (2008). Preparing for prison? The criminalization of school discipline in the USA. *Theoretical Criminology*, 12(1), 79-101.

- Holland, K. M., Hall, J.E., Wang, J., Gaylor, E.M., Johnson, L.L., Shelby, D. & Simon, T. (2019). Characteristics of school-associated youth homicides—United States, 1994-2018. *Center for Disease Control and Prevention: Morbidity and Mortality Weekly Report*, 68, 53-60.
- Hough, J.M., Clarke, R.V.G., & Mayhew, P. (1980). Introduction. *In designing out crime*, edited by R.V.G. Clarke and P. Mayhew. London: Her Majesty's Stationery Office. Improving School Access Control. (2008). Washington, D.C: Distributed by ERIC Clearinghouse.
- Jackson, A. (2002). Police-school resource officers' and students' perception of the police and offending. *Policing: An International Journal of Police Strategies & Management*, 25(3), 631–650. <https://doi.org/10.1108/13639510210437078>
- Jeffery, C. Ray. 1971. *Crime Prevention Through Environmental Design*. Beverly Hills, CA: Sage.
- Jennings, W. G., Khey, D. N., Maskaly, J., & Donner, C. M. (2011). Evaluating the relationship between law enforcement and school security measures and violent crime in schools. *Journal of Police Crisis Negotiations*, 11(2), 109-124. doi:10.1080/15332586.2011.581511
- Johnson, R.S. (2000). Metal detector searches: An effective means to help keep weapons out of schools. *Journal of Law & Education*, 29, 197-203.
- Jonson, C. L. (2017). Preventing school shootings: The effectiveness of safety measures. *Victims & Offenders*, 12(6), 956-973.
- Kleck, G. (2009). Mass shootings in schools: The worst possible case for gun control. *The American Behavioral Scientist*, 52(10), 1447. doi:10.1177/0002764209332557
- Korsell, L., Freilich, J. & Newmann, G. (2018). Regulating organized crime. *The annals of the American Academy of Political and Science*, 679(1), 158–177. <https://doi.org/10.1177/0002716218782654>
- Langman, P. (2009) Rampage school shooters: A typology. *Aggression and Violent Behavior*, 14(1), 79-86. <https://doi.org/10.1016/j.avb.2008.10.003>
- Lankford, A. (2016). Fame-seeking rampage shooters: Initial findings and empirical predictions. *Aggression and Violent Behavior*, 27, 122–129. <https://doi.org/10.1016/j.avb.2016.02.002>

- Livingston, M., Rossheim, M., & Hall, K. (2019). A Descriptive analysis of school and school shooter characteristics and the severity of school shootings in the United States, 1999–2018. *Journal of Adolescent Health, 64*(6), 797–799.
<https://doi.org/10.1016/j.jadohealth.2018.12.006>
- Mandala, M., & Freilich, J. (2018). Disrupting terrorist assassinations through situational crime prevention. *Crime & Delinquency, 64*(12), 1515–1537.
<https://doi.org/10.1177/0011128717718488>
- Madfis, E. (2016). “It’s better to overreact”: School officials’ fear and perceived risk of rampage attacks and the criminalization of American public schools. *Critical Criminology, 24*(1), 39–55. <https://doi.org/10.1007/s10612-015-9297-0>
- Morton, R. (2005). *Serial murder: multi-disciplinary perspectives for investigators*. Washington, D.C: Behavioral Analysis Unit-2, National Center for the Analysis of Violent Crime.
- Musu-Gillete, L., Zhang, A., Wang, K., Kemp, J., Diliberti, M., & Oudekerk, B. A. (2018). *Indicators of school crime and safety: 2017*. Washington, DC.: National Center for Education Statistics, U.S. Department of Education, and Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice.
- Mytton, J. A., DiGuseppi, C., Gough, D. A., Taylor, R. S., & Logan, S. (2002). School-based violence prevention programs: systematic review of secondary prevention trials. *Archives of pediatrics & adolescent medicine, 156*(8), 752-762.
- Na, C., & Gottfredson, D. C. (2013). Police officers in schools: Effects on school crime and the processing of offending behaviors. *Justice Quarterly, 30*(4), 619-650.
- Newman, K. (2004). *Rampage: The social roots of school shootings*. NY: Basic Books.
- Newman, O. (1972). *Defensible space; crime prevention through urban design*. New York: Macmillan.
- O’Neill, L., & Mcgloin, J. (2007). Considering the efficacy of situational crime prevention in schools. *Journal of Criminal Justice, 35*(5), 511–523.
<https://doi.org/10.1016/j.jcrimjus.2007.07.004>
- Osborne, J. (2015). *Best Practices in Logistic Regression*. Thousand Oaks, CA: Sage Publications.
- O’Toole, M. (2000). *The school shooter: A threat assessment perspective*. Quantico, VA: FBI National Center for the Analysis of Violent Crime.

- Park-Higgerson, H. K., Perumean-Chaney, S. E., Bartolucci, A. A., Grimley, D. M., & Singh, K. P. (2008). The evaluation of school-based violence prevention programs: A meta-analysis. *Journal of School Health*, 78(9), 465-479.
- Quetelet, A., & Knox, R. (1842). A treatise on man and the development of his faculties. Edinburgh: W. and R. Chambers.
- Ratcliff, J. (2006). *Video surveillance of public places (Problem-oriented guides for police. Response guide series. Guide No. 4)*. Washington, DC: U.S. Department of Justice Office of Community Oriented Policing Services. Center for Problem-Oriented Policing.
- Repetto, T. A. (1976). Crime prevention and the displacement phenomenon. *Crime & Delinquency*, 22(2), 166-177.
- Rocque, M. (2012). Exploring school rampage shootings: Research, theory, and policy. *The Social Science Journal*, 49(3), 304-313. doi:10.1016/j.soscij.2011.11.001
- Ryan, J., Katsiyannis, A., Counts, J., & Shelnut, J. (2018). The growing concerns regarding school resource officers. *Intervention in School and Clinic*, 53(3), 188–192. <https://doi.org/10.1177/1053451217702108>
- Schreck, C. J., & Miller, J. M. (2003). Sources of fear of crime at school. *Journal of School Violence*, 2(4), 57-79. doi:10.1300/J202v02n04_04
- Shaw, C.R. & McKay, H.D. (1942). Juvenile delinquency and urban areas.
- Smith, M. & Clarke, R. (2012). Situational crime prevention: classifying techniques using “good enough” theory. In *The Oxford Handbook of Crime Prevention* (pp.291-315). New York, NY: Oxford University Press.
- Snell, C., Bailey, C., Carona, A., & Mebane, D. (2002). School crime policy changes: The impact of recent highly-publicized school crimes. *American Journal of Criminal Justice*, 26(2), 269-285. doi:10.1007/BF02887831
- Swartz, K., Osborne, D. L., Dawson-Edwards, C., & Higgins, G. E. (2016). Policing schools: Examining the impact of place management activities on school violence. *American Journal of Criminal Justice*, 41(3), 465-483.
- Tanner-Smith, E., Fisher, B., Addington, L., & Gardella, J. (2018). Adding security, but subtracting safety? Exploring schools’ use of multiple visible security measures. *American Journal of Criminal Justice*, 43(1), 102-119. doi:10.1007/s12103-017-9409-3
- Theriot, M. (2009). School resource officers and the criminalization of student behavior. *Journal of Criminal Justice*, 37(3), 280–287. <https://doi.org/10.1016/j.jcrimjus.2009.04.008>

- Tigri, H. B., Reid, S., Turner, M. G., & Devinney, J. M. (2016). Investigating the relationship between gang membership and carrying a firearm: Results from a national sample. *American Journal of Criminal Justice : AJCJ*, *41*(2), 168-184. doi:<http://dx.doi.org.libproxy.utdallas.edu/10.1007/s12103-015-9297-3>
- Tillyer, M. S., Fisher, B. S., & Wilcox, P. (2011). The effects of school crime prevention on students' violent victimization, risk perception, and fear of crime: A multilevel opportunity perspective. *Justice Quarterly*, *28*(2), 249-278. doi:10.1080/07418825.2010.493526
- Time, V., & Payne, B. K. (2008). School violence prevention measures: School officials' attitudes about various strategies. *Journal of Criminal Justice*, *36*(4), 301-306. doi:10.1016/j.jcrimjus.2008.06.001
- Trump, K. (2012). NASRO School Resource Officer Report: To protect and educate, 2012 *Report on the Annual National Survey of School-Based Police Officers*. Washington, D.C: Distributed by ERIC Clearinghouse.
- Van Rompay, T. J., Vonk, D. J., & Fransen, M. L. (2009). The eye of the camera: Effects of security cameras on prosocial behavior. *Environment and Behavior*, *41*(1), 60-74.
- Verlinden, S., Hersen, M., & Thomas, J. (2000). Risk factors in school shootings. *Clinical psychology review*, *20*(1), 3-56.
- Vossekuil, B., Reddy, M., Fein., Borum, R., & Modzeleski, W. (2001). *The final report and findings of the safe school initiative*. Washington DC: United States Secret Service and U.S. Department of Education.
- Wallace, L. (2015). Responding to violence with guns: Mass shootings and gun acquisition. *The Social Science Journal*, *52*(2), 156–167. <https://doi.org/10.1016/j.soscij.2015.03.002>
- Weisburd, D., Wyckoff, L. A., Ready, J., Eck, J. E., Hinkle, J. C., & Gajewski, F. (2006). Does crime just move around the corner? A controlled study of spatial displacement and diffusion of crime control benefits. *Criminology*, *44*(3), 549-592.
- Welsh, B., & Farrington, D. (2004). Surveillance for crime prevention in public space: Results and policy choices in Britain and America. *Criminology & Public Policy*, *3*(3), 497–526. <https://doi.org/10.1111/j.1745-9133.2004.tb00058.x>
- Wike, T. L., & Fraser, M. W. (2009). School shootings: Making sense of the senseless. *Aggression and Violent Behavior*, *14*(3), 162-169. doi:10.1016/j.avb.2009.01.005

Wortley, R. (2002). *Situational prison control: crime prevention in correctional institutions*. Cambridge, UK: Cambridge University Press.

Zhang, A. (2018). Indicators of School Crime and Safety : 2017. NCES 2018-036/NCJ 251413.

BIOGRAPHICAL SKETCH

Sarah Patton Gammell was born in Dallas, Texas. After completing her schoolwork at Paschal High School in Fort Worth, Sarah entered Texas A&M University in College Station, Texas. She received a Bachelor of Arts with a major in speech communication from Texas A&M in August 1999. During the following fifteen years, she was employed by a non-profit, living for several years in Lisbon, Portugal. In May 2016, she received a Master of Science in criminal justice and criminology from Texas Christian University in Fort Worth, Texas. In August of 2016, she entered the criminology graduate program at The University of Texas at Dallas.

CURRICULUM VITAE

EDUCATION

- PhD** The University of Texas at Dallas, Criminology **Expected August 2019**
- MS** Texas Christian University, Criminal Justice and Criminology **May 2016**
- BA** Texas A&M University, Speech Communications **August 1999**
Minored in Business Administration

PROFESSIONAL EXPERIENCE

- 2016 – 2019 **The University of Texas at Dallas**
Research Assistant/Project Manager
Understanding the Causes of School Violence Using Open Source Data
Funding Organization: National Institute of Justice, Comprehensive School Safety Initiative
- 2016 – 2019 **The University of Texas at Dallas**
Teaching Assistant
Criminology Department
School of Economic, Political and Policy Sciences
- 1999 – 2016 **Young Life International**
Regional Developer: responsible for program development and funding

HONORS AND AWARDS

- 2016 **Texas Christian University Excellence in Research Honor**
Award given to the graduate student who exemplifies excellence in research.
- 2014 **Texas Juvenile Justice Department**
Outstanding Mentor/Volunteer—Willoughby House Juvenile Correctional Facility