

ANALYSIS OF THE FACTORS INFLUENCING MULTIPLE USES OF  
CRIME GUNS: AN EXPLORATORY STUDY

By

Samantha Scott

Dr. Rick Dierenfeldt  
U.C. Foundation Assistant Professor  
of Criminal Justice  
(Chair)

Dr. Jared Rosenberger  
Assistant Professor of Sociology  
(Committee Member)

Dr. Courtney Crittenden  
U.C. Foundation Associate Professor  
of Criminal Justice  
(Committee Member)

Dr. Grant Drawve  
Associate Professor of Sociology  
and Criminology  
University of Arkansas  
(Committee Member)

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## ABSTRACT

A broad body of literature has been built around the topic of gun violence in the United States. The characteristics of communities, victims, and offenders have each been used to explain variation in the likelihood and frequency of gun crime. Less attention has been given to the factors associated with multiple uses of crime guns. The current study applies binary logistic regression to crime logs maintained by the police department of a mid-size city in the Southeastern U.S. to examine how neighborhood and initial incident characteristics influence the likelihood that a crime gun will be used in multiple incidents. Gang involvement and time in circulation are found to be positively related to the odds of a crime gun being used in more than one offense, while street culture exerts an inverse influence. Further, street culture was found to condition the impact of offense severity on repeat use.

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## CHAPTER I

### INTRODUCTION

According to the Uniform Crime Report (2021) the homicide rate in the United States has increased 5.1 to 6.5 homicides per 100,000 people from 2019 to 2020 – 77% of which were committed with a firearm. In a further breakdown of these rates, the Pew Research Center illustrated that this is an increase of approximately 30% in murders by firearm (Gramlich, 2022). Indeed, this rise is so profound that many policy makers, health care workers, and criminal justice researchers have begun to treat gun violence as a public health issue (Center for Disease Control, n.d.; Parsons et al., 2018; Resnick et al., 2017; Satcher, 1955). Indeed, rates of gun violence have reached a record high since 1968 (Gramlich, 2022). Therefore, it is imperative that law enforcement, academics, and practitioners renew efforts to address issues of gun violence within the community. The extant literature has explored the characteristics of communities, victims, and offenders to explain variation in both the likelihood and frequency of gun-related crimes (Anderson, 1994, 1999; Burgason et al., 2014; Bursik, 1989; Dierenfeldt et al., 2017). However, considerably less attention has been given to crime guns themselves and the factors that influence their use in multiple offenses. Indeed, the literature has also implied, albeit unintentionally, that each gun crime involves a unique firearm rather than the notion that one gun could be involved in multiple gun crimes. Such an assumption is evident in the measures

previously used in the literature. For example, research surrounding gun crime has employed measures such as gun availability through the percent of suicides by firearm or percent of non-felony homicides (Cook, 1979; Kleck, 2015; Kleck & Patterson, 1993). In other cases, counts of stolen guns have been used as a proxy measure for gun crime (Dierenfeldt et al., 2017). Although such measures have been empirically supported, there has been little to no distinction made between guns used in crimes and those that are not used in crimes. Therefore, this study deviates from the focus of gun crimes towards a focus on crime guns. Specifically, the current study explores neighborhood and initial incident characteristics that influence the likelihood that a crime gun will be used in multiple offenses. Not only are these factors useful towards the advancement of criminological research on crime guns, but they are necessary to consider in the development of gun-related policies.

A broad body of literature has noted the relationship between high levels of neighborhood disadvantage and gun violence (Bushman et al., 2016; Hemenway & Miller, 2013; Lizotte et al., 2000). Furthermore, Anderson's (1994) *Code of the Street* thesis illustrated the development of violent subcultures within structurally disadvantaged neighborhoods. These subcultures have been characterized by increased levels of preemptive and retaliatory violence – particularly violence involving guns (Anderson, 1994, 1999). Within this context, Matsuda and colleagues (2013) have also noted the proliferation of gangs. Given the emphasis on campaigning for respect among gang members and street individuals, the likelihood of disputes becoming violent may be exacerbated and, subsequently, increase the likelihood of gun use (Matsuda et al., 2013). Moreover, the symbolic nature of firearms in street-oriented communities may also increase the likelihood of violence involving firearms (Anderson, 1994, 1999). Little is known, however, about the continued use of crime guns in these social contexts. This gap in the

literature is particularly concerning given that neighborhoods beset by disadvantage and violence have been associated with high levels of legal cynicism (Anderson, 1994, 1999), which in turn, may hinder the likelihood of crime guns being identified and seized by police.

Drawing on the theoretical perspective of Anderson (1994, 1999), this study explores how the entrenchment of street code influences multiple uses of crime guns. The current study also explores the extent to which the use of crime guns in multiple incidents is influenced by characteristics of the original offense—such as gang involvement and offense severity. Finally, this study aims to shed light on the relationship between time in circulation on the likelihood of a crime gun being used in multiple offenses – a factor overlooked in the extant gun literature. To do so, binary logistic regression techniques are applied to data obtained from the National Integrated Ballistic Information Network (NIBIN) lead logs maintained by the police department of a medium sized city in the Southeastern United States, as well as sociodemographic data drawn from the American Community Survey (ACS) 5-year summary files.

## CHAPTER II

### REVIEW OF THE LITERATURE

#### Environmental Perspectives and Crime

At the start of the 20<sup>th</sup> century, theoretical approaches to crime had predominantly focused on individual-level explanations of crime and deviance. However, the rise of the Chicago School represented a shift in focus towards environmental explanations of crime. The works of Park (1925), Burgess (1925), and Park and Burgess (1924) contributed to a reconsideration of crime as a product of the characteristics of places rather than the individual. Burgess (1925), for example, described how the distribution of residential and economic developments contributed to neighborhood-level crime. Specifically, Burgess delineated five zones present in Chicago. First, the innermost zone, or “loop,” consisted of major transportation resources such as railways and/or waterways that maintained the central business district. Zone II, also called the zone in transition, separated the innermost zone from the outer three zones. The zone in transition was of particular interest to Burgess (1925), as this zone was categorized by population heterogeneity, dilapidated housing structures, and consequently, an inability of residents to create and maintain the informal bonds of social control necessary for crime prevention (Burgess, 1925). Finally, Zone III consisted of working-class residential homes, while Zone IV and Zone V were considered wealthier, residential blocks separated from the disadvantage that characterized the inner-city. The distinct characteristics of the zone in

transition compared to those in other zones led Burgess (1925) to conclude that structural and social disruptions typical of this zone resulted in crime.

Expanding on this perspective, Shaw and McKay (1942) theorized that crime, typified by youthful offending, would vary across urban areas depending on physical status, economic status, and population status. First, indicators of physical status were characterized by the distribution of major industrial structures and dilapidated buildings, as well as population fluctuations (e.g., transiency), within areas of interest (Shaw & McKay, 1942). Next, Shaw and McKay (1942) conceptualized economic status as the number of families on governmental assistance, the median cost of rental units, and the number of owned homes in the areas of interest. Finally, population composition was conceptualized as the percentage of Black and foreign-born headed households within the areas of study (Shaw & McKay, 1942). Shaw and McKay's (1942) findings illustrated several key points regarding the effects of disadvantage, residential turnover, and racial heterogeneity. First, Shaw and McKay (1942) discussed that areas characterized by these factors were located near the industrialized center where poor, newly arrived immigrants maintained access to low-skill employment opportunities. These areas allowed immigrants to become accustomed to conventional "American" lifestyles necessary to integrate into mainstream society. As individuals adapted to mainstream norms and became more economically stable, their families were able to relocate to more stabilized areas that maintained lower levels of crime. In turn, as these populations moved out, other groups of poor, heterogeneous groups moved in - creating a cycle of transience (Shaw & McKay, 1942). This process, however, also allowed older, more experienced delinquents who dwelled in the inner city to transmit their criminal tendencies on to newly arrived youth.

Beset by diminished resources necessary for socialization (e.g., schools, businesses), alongside the cultural and lingual barriers between residents, families within these communities lacked the social bonds necessary for keeping order among youth (Shaw & McKay, 1942). In this way, deviant behaviors were easily developed and transmitted from one generation to the next. These findings led Shaw and McKay (1942) to conclude that the cycle of transience allowed neighborhoods, as well as the social processes within them, to reproduce themselves across time (Skogan, 1986; Skogan, 1990) – particularly in areas of disadvantage.

### Social Disorganization Perspective

Although Shaw and McKay's (1942) findings enjoyed early empirical support, their theory was eventually revised in the wake of marked changes to U.S. urban neighborhoods following World War II. By the 1970's, the manufacturing industries that had previously provided inner-city stability left for overseas labor markets, and the U.S. transitioned to a service industry - prompting a class divide (Bursik & Grasmick, 1993). As a result, neighborhoods were no longer stable socio-spatial environments. Instead, they were subject to decay across time.

To address the shifts in neighborhood dynamics, Kornhauser (1978) reformulated social disorganization as a theory of informal social control. Specifically, in eliminating strain and cultural transmission components of the theory, Kornhauser (1978) highlighted the inability for individuals to collectively enforce the social contract, stating that this disparity was a product of the residential instability that characterized high crime neighborhoods. That is, transient populations had little stake in the future of the neighborhood or the informal social controls needed to maintain it (Kornhauser, 1978). These suggestions coalesced with the work of Kasarda and Janowitz (1974), who emphasized friendship networks, ties to formal and informal institutions, and time in residence as contributors to community investment. Such revisions

allowed the theory to maintain its relevance within the everchanging economic climate that characterized the 1970's.

While the works of Kornhauser (1978) and Kasarda and Janowitz (1974) enjoyed widespread support, Sampson and Groves (1989) sought to combine the findings of the impact of informal controls with the works of earlier Chicago School criminologists. Indeed, Sampson and Groves (1989) coined the term “collective efficacy” to formally illustrate the connection between disorganization, community investment, and crime. Their efforts combined measures of disorganization (e.g., strength of communal relationships, participation in local organizations, levels of unsupervised peer groups) with other community-level measures, including socioeconomic standing, ethnic makeup, and residential mobility (Sampson & Groves, 1989). In doing so, Sampson and Groves (1989) found that structural deficits, particularly residential turnover, increased social disorganization and, in turn, levels of crime. Subsequent studies have also suggested that levels of collective efficacy tend to be inversely related to levels of disadvantage and the influence of deviant peers (Maimon & Browning, 2010; Sampson & Graif, 2009; Sampson et al., 1999; Sampson et al., 1997; Steenbeek & Hipp, 2011). In sum, collective efficacy has been a robust predictor of neighborhood violence (Sampson et al., 1997).

Structural disadvantage and the impact of community ties have been key variables in understanding the relationship between environments and crime. However, the works of Bursik (1988; 1984; 1986) and Bursik and Grasmick (1993) offered an alternative breakdown of the effects of social control. Building from the conclusions of Sampson and Groves (1989), Bursik and Grasmick (1993) argued that social control existed at three separate levels, all of which impacted the others. The first, “private,” referred to the relationships with immediate family and friends (e.g., kinship networks). Next, “parochial,” referred to relationships maintained through

involvements in community organizations or places one might visit daily (e.g., school, church). The final level, “public,” referred to relationships with external institutions, particularly those tasked with keeping order in the community (e.g., law enforcement, government). Bursik and Grasmick (1993) asserted that the ways in which these relationships employed informal social control were directly related to neighborhood stability. Moreover, as public controls become strained, the effects of private and parochial controls would begin to weaken (Bursik & Grasmick, 1993).

### Racial Disparities and the Urban Landscape

As previously discussed, the years following World War II saw important structural and social reformations of many urban communities (Bursik, 1988). Spatially, communities began to grow linearly along major transit routes rather than in concentric zones—a change that accompanied a national level shift from manufacturing industries to service industries (Bursik & Grasmick, 1993; Bursik, 1984; Bursik, 1988; Bursik & Webb, 1982; Wilson, 1980, 1987). In turn, successively poorer groups moved into urban centers seeking economic relief. As these populations settled, those with the means to relocate moved outside of the inner city, leaving behind a population characterized by concentrated poverty, low education rates, and high levels of family disruption (Cerda et al., 2010; McCall et al., 2010). Moreover, additional lower-income households replaced those who had mobilized, and thus, further contributed to weakened levels of community investment through residential turnover (Kasarda & Janowitz, 1974; Kornhauser, 1978). In this way, residents experienced extreme difficulty in forming the networks necessary for maintaining order, resulting in heightened levels of violence and crime within urban communities (Bursik & Grasmick, 1993).

It is important to note that these disparities were disproportionately felt by Black individuals. Indeed, the poor, homogenous populations that remained in the inner city were primarily Black individuals - subject to chronic disadvantage and an environment devoid of positive connections with mainstream norms and values (Bursik & Grasmick, 1993; Hipp et al., 2009; Warner & Pierce, 1993; Wilson, 1980, 1987). These disparities were further exacerbated by the community disinvestment of real estate and banking industries (Lacker, 1995). For example, researchers have provided evidence of banking and mortgage lenders failing to provide minority communities with credit opportunities, and instead, directing such opportunities towards White, suburban areas (Lacker, 1995; Metzger, 2000). In light of this disparity, many middle-class Blacks pursued opportunities outside of the urban center, leaving behind an immobile population characterized by extreme poverty, low levels of education, and spatial isolation (Massey & Denton, 1993; Wilson, 1987). Consequently, as public controls began to dwindle, so too did private and parochial controls. Businesses either closed or relocated, leaving a population of economically disenfranchised Black individuals with few ties to one another or the larger community (Bursik & Grasmick, 1993; Bursik, 1989; Immergluck & Smith, 2006; Skogan, 1986; Velez, 2009). In sum, the compounding issues of strain (Shaw & McKay, 1942), decline of informal kinship networks (Kornhauser, 1978; Sampson & Groves, 1989), and waning support from formal institutions (Bursik, 1984) created an environment that fostered high levels of crime and deviance. Further, many segments of these populations developed alternative sets of norms and values that ultimately promoted involvement in preemptive and retaliatory violence (Anderson, 1999; Massey & Denton, 1988; Massey & Denton, 1993).

## The Rise of Subcultural Violence in the Urban Context

A broad body of literature has discussed the development of violent subcultures in the presence of chronic, structural deprivation (Anderson, 1994, 1999; Krivo & Peterson, 2000; Parker & McCall, 1999; Peterson & Krivo, 1993). These subcultures mediate human behavior in situations of survival and conflict resolution (Copes et al., 2013). Following the decline of inner-city black communities, many urban neighborhoods exhibited the characteristics that facilitated subcultural violence. That is, legitimate avenues of gaining status through political, economic, or residential means were largely absent. Moreover, a shared perception that police were not dependable, or only served the White middle- and upper-class, prompted a form of self-help social control that manifested in the form of violence and aggression (Anderson, 1994, 1999; Black, 1983).

Research on the dynamics of urban subcultures has not been neglected. Anderson's (1994, 1999) ethnographic study of poor, African American communities in Philadelphia illustrated the adoption of an alternative set of values and behaviors referred to as the *Code of the Streets*. This code is characterized by preemptive and retaliatory violence, conspicuous displays of wealth, and sexual promiscuity as mechanisms for achieving respect (Anderson, 1994, 1999). Anderson (1994, 1999) identified two distinct adaptations within this context – decent families who make up the majority of residents, and street families who represent the dominant force. Decent families, comprised largely of the working-class, maintain conventional, middle-class values (Anderson, 1994). Parents and children of decent families identify closely with religious, educational, and law-abiding values in their community (Anderson, 1994, 1999). In contrast, street families could be characterized by extreme violence and abuse, drug use, broken homes, and parental incarceration. These individuals reject conventional norms and, instead, seek status

and respect through preemptive or retaliatory violence (Anderson, 1994, 1999). Simply put, street families believe that one's reputation is contingent on their response to adversity – violence is necessary despite the potential consequences (Anderson, 1994, 1999; Hughes & Short Jr, 2005; Stewart & Simons, 2010). Indeed, there are distinct characteristics separating decent and street families. However, Anderson (1994, 1999) described a key similarity among the two groups – the socialization of children into acting in accordance with the code of the streets.

In the event of confrontation, for example, decent adults and children often alter their behavior to blend with those associated with street culture (Anderson, 1994, 1999; Hughes & Short Jr, 2005; Stewart et al., 2006). Like street families, decent families teach their children that engaging in street code behaviors is a means of insulating them from victimization (Anderson, 1994, 1999; Hughes & Short Jr, 2005; Stewart et al., 2006). Although decent families may not subscribe with the values of the code of the streets, they remain familiar with the prescriptive behaviors associated with street culture and act appropriately when situational context demands (Anderson, 1994, 1999).

Street families, on the other hand, tend to transmit and encourage alternative beliefs and behaviors to their children early on, either directly or indirectly (Anderson, 1994, 1999). For example, street parents often feel overwhelmed by their inability to provide – an issue that is exacerbated by drug and alcohol use and parental incarceration (Anderson, 1994, 1999). Children of these parents may have an abusive homelife that normalizes violence and aggression as a means of conflict resolution. Consistent with the assertions of Shaw and McKay (1942), parents may be completely absent, leaving deviant peers and violent role models as primary mentors throughout a child's life. In this vein, children of street families begin to conform to the oppositional culture and pursue the respect they have been taught to value.

In the context of street culture, ‘respect’ is often based on the ability to defend oneself – a theme common to both street and decent families (Anderson, 1994, 1999). Indeed, young males are encouraged to prove their masculinity through sexual conquests and acts of physical violence - often involving guns (Anderson, 1994; Matsueda et al., 2006). Moreover, young girls, similarly influenced by a need for status and respect, often create avenues for violence by learning to fight from male figures or asking men to retaliate on their behalf (Anderson, 1994, 1999). Many children may also find themselves immersed in drug involvement or other illegal means of making money to support their families, or most commonly, to obtain flashy clothing and other items that symbolize wealth (i.e., “juice”) (Anderson, 1994, p. 88). It is through this generational transmission that the code of the streets becomes pervasive by promoting exacerbated levels of violence, victimization, and incarceration within communities of color (Anderson, 1994, 1999).

Finally, Anderson (1994, 1999) explains how violence permeates in the community in response to weakened confidence in formal institutions (e.g., law enforcement). Specifically, Anderson (1994, 1999) discusses how street code adherents tend to perceive the police as illegitimate or discriminatory towards people of color, and thus, handle disputes without the assistance of law enforcement. This is not surprising, however, as individuals who adhere to the street code have been socialized to either engage in retaliatory violence in the event of victimization (Gau & Brunson, 2015; Haas et al., 2014; Jacobs & Wright, 2006; Rosenfeld et al., 2003) or engage in preemptive violence in order to insulate themselves from victimization (McNeeley & Wilcox, 2015a, 2015b; McNeeley & Yuan, 2017; Stewart et al., 2006). Similarly, reporting their victimization, or “snitching,” could put an individual at an increased risk for revictimization (Anderson, 1994, 1999; Baron et al., 2001; Clayman & Skinns, 2012; Kubrin & Weitzer, 2003; Rosenfeld et al., 2003). It is important to note, however, that studies have shown

that a vital aspect of maintaining order in the community revolves around residents reporting victimization, as it directly relates to whether crime is brought to the attention of law enforcement (Bennett & Wiegand, 1994).

Research has also illustrated that the reluctance of reporting victimization may result in an inability of officers to arrest the offender and, in turn, higher levels of violence in the community (Kirk & Papachristos, 2011; Skogan, 1984). In line with Anderson's (1994, 1999) assertions, a lack of reporting among these populations may be attributed to perceptions of procedural injustice (see Fagan, 2008; Goudriaan et al., 2004), perceived unfairness in police performance (Conaway & Lohr, 1994; Zhang et al., 2007), or repeat victimizations (Zaykowski, 2015). In other words, individuals who do not believe that the police are capable of keeping them safe (e.g., code of the street adherents) could be less likely to report and, thus, more likely to engage in violence. In this vein, it is no surprise that roughly half of violent victimizations reported in the National Crime Victimization Survey (NCVS) are unknown to law enforcement (Langton et al., 2012).

The framework described by Anderson (1994, 1999) has garnered widespread support among qualitative and quantitative works (e.g., Brezina et al., 2004; Brookman et al., 2011; Drummond et al., 2011; Jones, 2008; Parker & Reckdenwald, 2008; Stewart et al., 2006; Stewart & Simons, 2010; Taylor et al., 2010). Additionally, the findings presented by Anderson (1994, 1999) closely resemble developments in other areas of the literature. That is, the social dynamic and propensities for violence described in the code of the streets are remarkably similar to those described in studies of gangs (e.g., Matsuda et al., 2013; Mitchell et al., 2017). There are also consistencies within the theoretical realm, as the impact of residential turnover, racial isolation, and the lack of collective efficacy are major contributors to the proliferation of gangs (e.g.,

Bursik & Grasmick, 1993; Kornhauser, 1978), as well as subcultural violence. Therefore, the following sections will further the discussion of social disorganization, street code adherence and gang involvement as they relate to the provocation of violence within inner city neighborhoods.

### Street Culture and Gang Activity

Although Anderson (1994, 1999) does not specifically reference the presence of gangs in the code of the streets thesis, their proscriptions and behaviors are associated with those of street culture (Matsuda et al., 2013). For example, Anderson (1994, 1999) placed particular emphasis on the likelihood of code adherence among adolescent boys. Similarly, the literature has shown that an overwhelming number of street gang participants are known to be teenaged males (Pyrooz, 2014). Moreover, gangs often emerge in the presence of structural and economic deprivation. The frustration associated with the lack or rejection of mainstream opportunities is often mitigated through gang involvement, as members find a sense of “status enhancement” (Cohen, 1955; Huebner et al., 2016, p. 839; Miller & Brunson, 2000) in the same way street individuals follow the code.

More recent works have made connections regarding gang activity and the code of the streets. For example, Matsuda and colleagues (2013) reported that gang members were more likely to participate in violent offending due to their close adherence with Anderson’s (1994, 1999) code of the street framework. Specifically, those who participated in gangs were more inclined to commit acts of violence when campaigning for respect, compared to those who did not participate in gangs. Moreover, gang-involved individuals displayed higher levels of self-centeredness, anger, commitment to negative peers, lack of guilt, quickness-to-anger, low-parental monitoring, and time spent in unstructured environments that promote violence – all of which correlate with the values of subcultural adherence (see Anderson, 1994, 1999; Matsuda et

al., 2013). Perhaps the most robust comparison of these topics, however, has been provided by Mitchell and colleagues (2017) in their evaluation of the similarities and differences between street code, convict code, street gangs, and prison gangs. Similar to Matsuda and colleagues' (2013) approach, Mitchell et al. (2017) compared the themes presented in street culture research with those reported in the gang literature. Differentiating by "belief" (i.e., adhering to the code of the streets or convict code) versus "group" (i.e., participating in a street gang or prison gang), their findings suggest that the norms and values expressed within each of these codes align with the values and beliefs exhibited by gang members (Mitchell et al., 2017).

Thus, the values associated with street culture adherence and gang involvement appear largely analogous. Like the street individuals described by Anderson (1994, 1999), gang members frequently exhibit increased cynicism towards law enforcement (Curry & Decker, 2003) and other formal institutions. Other similarities also exist, as gang involvement and street code adherence promote an involvement with violent peer groups (Anderson, 1994, 1999; Decker & Van Winkle, 1996; Hagedorn & Macon, 1998; Moore, 1991; Thrasher, 1927; Winfree et al., 1994). In line with Shaw and McKay's (1942) concept of cultural attenuation, the literature has suggested that gangs could serve as a primary source for the transmission of violence and delinquency to young populations (Matsuda et al., 2013). Finally, perhaps the most prominent similarity between gang violence and subcultural adherence revolves around campaigning for respect. Those who subscribe to street values tend to engage in public displays of violence to demonstrate toughness, or "nerve," (Anderson, 1994, p. 92, 1999). Likewise, studies have shown that the gang, too, provides and encourages individual or group opportunities to assert pride and honor (Decker, 1996; Melde et al., 2009). It should be stated, however, that in neighborhoods where violence is pervasive, these public disputes are more likely to become violent (Anderson,

1999; Berg et al., 2012; Copes & Hochstetler, 2003; Stewart & Simons, 2010). Indeed, Dierenfeldt et al. (2021) provided evidence that confrontations that occur in public, involve individuals known to one another, and take place in disadvantaged and violent communities are much more likely to involve the use of firearms. Therefore, the following section discusses the nexus between street code adherence, gang involvement, and the likelihood of gun violence in the urban context.

### Gun Crime and Campaigning for Respect

A broad body of literature has argued that there is a significant relationship between social disorganization, street culture, and gun violence (Burgason et al., 2014; Spano & Bolland, 2013; Spano et al., 2012). In particular, research has suggested that violent subcultures nested within disadvantaged neighborhoods further aggravate the likelihood of gun violence (Anderson, 1994, 1999; Kleck & Hogan, 1999). As previously stated, individuals who identify with the code of the streets tend to adhere to an alternative set of behaviors that promote violence and deviancy (e.g., physical disputes, promiscuity, substance use, assault) as an expression of masculinity (Anderson, 1994, 1999). Participation in these acts, however, tends to place these individuals at a greater risk of engaging in gun violence, both as victims and offenders (Copes et al., 2013; Wright & Rossi, 1986). More recent studies have yielded similar findings. Using race-specific measures, Dierenfeldt and colleagues (2021) found that in communities maintaining higher levels of street code entrenchment, Black male offenders displayed a higher likelihood of gun use in aggravated assaults. Moreover, the authors emphasized the strong relationship between community characteristics and gun *access* – a factor often neglected in this area of study (see Dierenfeldt et al., 2017).

Firearms are considered both symbolic and protective among street-oriented populations (Anderson, 1994, 1999; Kubrin, 2005). For example, one may carry a gun as an extension of their identity, as it represents wealth and a readiness to protect themselves and their belongings (Anderson, 1999). One might also carry a firearm as a display of power (Kleck & Hogan, 1999). Further, guns increase the odds of success when carrying out deviant acts involving violence and intimidation (Kleck & Hogan, 1999). A key finding regarding the purpose of guns, however, relates to the need for self-protection (Kleck & Hogan, 1999; Kovandzic et al., 2013; Wright & Rossi, 1986). Indeed, in the event of confrontation, one may be inclined to use a gun to overpower their opponent (Kleck & Hogan, 1999), or defend their own reputation in hopes of preventing future victimization (Anderson, 1999). Criminologists have pointed out, however, that a large portion of individuals who are barred from legitimate ownership of firearms (e.g., felons and/or those with criminal history) are also those who may be at the highest risk of involvement in gun violence (Braga & Cook, 2016).

Findings are less uniform regarding the impact of gun availability on crime (Kleck, 2004, 2015). Still, researchers have described the primary avenues related to gun acquisition and offending. For example, Sheley and Wright (1993) and Wright and Rossi (1986) provided evidence that criminals often used stolen guns when carrying out their offenses. Relatedly, using the number of guns reported stolen in the National Incident Based Reporting System (NIBRS) as a proxy measure of illegal gun availability, Stolzenberg and D'Alessio (2000) concluded that the availability of illicit guns shared a positive relationship with gun crime in South Carolina. In a more recent examination of this relationship, Dierenfeldt et al. (2017) offered further support that illegal firearm availability held a positive relationship with gun violence - particularly in crimes such as robbery, aggravated assaults, and homicides across cities in the United States.

The literature has also illustrated a direct relationship between firearm accessibility and the presence of gangs. Generally, gangs have been found to exacerbate the issue of gun violence within communities (Huebner et al., 2016). Indeed, the literature suggests that gangs maintain strong networks with illicit gun salesmen and traffickers (Cook, Harris, et al., 2015; Cook et al., 2007; Hureau & Braga, 2018). Moreover, gang leaders have been found to distribute, loan, or rent out guns to others within the gang, providing a feasible avenue for obtaining firearms among criminal populations (Cook et al., 2007).

#### Focus on Crime Guns

Research on the factors that pertain to crime guns, while available, is sparse. Given that the research has established gun violence as a public health issue (Parsons et al., 2018; Resnick et al., 2017; Satcher, 1955), the majority of studies have focused on the characteristics that facilitate gun violence instead of the firearms themselves. For example, the literature has established that gun violence is permeated in urban communities characterized by high levels of disadvantage (Bushman et al., 2016; Hemenway & Miller, 2013). Such findings are consistent with the assertions of social disorganization theory, as multiple authors have established the relationship between poor neighborhoods with weakened social controls and increased violence – particularly violence involving guns (Maimon & Browning, 2010; Sampson & Groves, 1989; Shaw & McKay, 1942). Building from the perspective of ‘place’, Burgason et al. (2014) found that disadvantaged communities embedded in Anderson’s (1994, 1999) description of street culture were more likely to experience increased levels of gun violence.

Firearm availability has also been a focus of crime gun research. Indeed, studies have found that access to firearms is positively related to increases in violent crime (Stolzenberg & D'Alessio, 2000), although other studies have yielded the opposite (Lott, 2010) or null effects

(Kleck & Patterson, 1993; Kovandzic et al., 2005). Such availability may be exacerbated by the presence of gangs within the community, specifically in relation to illicit guns (e.g., Cook, Parker, et al., 2015; Huebner et al., 2016).

As mentioned, an important shortcoming in the literature revolves around the examination of crime guns themselves. To date, Wilkinson and Fagan (1996) acknowledged the need for assessing guns as elements of crime commission. Yet, a continued focus of crime gun research has been the symbolism of guns relating to fear, power, death (Wright & Decker, 1997), status (Anderson, 1994, 1999; Harding & Blake, 1989), and the perceived affordances offered by firearms in relation to crime commission (Goldsmith et al., 2020). In sum, gun crime and acquisition appear to be the result of myriad factors, which in turn, necessitates attention to the lifespan and uses of such crime guns. Moreover, given that the literature suggests a significant relationship between social disorganization, street culture, and gun violence (Burgason et al., 2014; Spano & Bolland, 2013; Spano et al., 2012), further examination of the roles of crime guns is necessary at an incidental and contextual level.

### CHAPTER III

#### CURRENT STUDY

The extant literature provides a robust understanding of the impact of structural, cultural, and incident-level characteristics on the frequency and likelihood of gun violence. The focus on ‘gun crime’ has, however, inhibited examination of the importance of ‘crime guns.’ This omission has implications for policy and practice both in terms of gun control and reducing gun victimization. Previous studies have implied, albeit unintentionally, that each gun crime involves a unique firearm when this may not be the case. Indeed, given the symbolic status conferred upon firearms within communities marked by disadvantage and street culture, as well as by gang members, it is possible that they retain their crime guns rather than discard them so that they may be used in future crimes. This study addresses these omissions in the literature through exploration of the extent to which neighborhood and initial incident characteristics influence the likelihood that a crime gun will be used in subsequent offenses.

## CHAPTER IV

### METHODOLOGY

A significant portion of criminal justice research focuses on the frequency and likelihood of gun violence in relation to the characteristics of the community, victim, and the offender. Comparatively little is known about the guns used in these offenses or the factors that influence their repeated use in criminal activity. Exploring these issues may be helpful in developing policies and practices aimed at reducing gun crime. The aforementioned gap in the literature prompted the Primary Question: How do neighborhood and incident characteristics influence the likelihood of a crime gun being used in multiple offenses? To explore these relationships, binary logistic regression is used to simultaneously examine the influence of neighborhood- and incident-level factors on the probability that a crime gun will be used in multiple offenses.

#### Research Questions and Hypotheses

Answering the primary question requires first developing and answering several research questions. Prior works clearly suggest that aggregate levels of disadvantage and violence influence the likelihood of firearm use and victim injury (Burgason et al., 2014; Dierenfeldt et al., 2021). At this time of this writing, however, no study could be located that described the nature of the relation between neighborhood levels of disadvantage and violence and the likelihood that a crime gun would be used in multiple offenses. This omission in the literature prompts Research Question 1 (RQ1): What is the relationship between neighborhood levels of disadvantage and violence and the likelihood that a crime gun will be used in more than one

offense? Based on prior studies of the relationships between community characteristics and violence (Dierenfeldt et al., 2021; Thomas & Drawve, 2018) the following is hypothesized (H1): Neighborhood levels of disadvantage and violence will share a direct, positive association with the likelihood that a crime gun will be used in more than one offense.

The literature has established a clear connection between the presence of gangs within communities and increased levels of gun violence (Huebner et al., 2016). Moreover, there is empirical evidence suggesting that gang leaders tend to loan or rent out guns to others within the gang (Cook et al., 2007). The degree to which gang involvement in gun crimes influences the probability that the firearms used in those crimes will be used in additional offenses remains an empirical question. This prompts Research Question 2 (RQ2): What is the relationship between gang involvement in a gun crime and the likelihood that a crime gun will be used in more than one offense? Based on prior studies of the relationship between gangs and increased levels of gun violence (Huebner et al., 2016), the following is hypothesized (H2): A crime gun will have a higher likelihood of being used in multiple offenses if the original incident was gang-involved.

The work of Tarling and Morris (2010) has suggested that the more serious an offense, the more likely the crime is to be reported. Specifically, the authors indicate that incidents involving a weapon and resulting in victim injury significantly increased the likelihood of the crime being reported (Tarling & Morris, 2010). The impact of these factors on the likelihood that crime guns will be used in future offenses, however, remains unexplored. This prompted Research Question 3 (RQ3): What is the relationship between the original incident involving a homicide or aggravated assault on the likelihood of a crime gun being used in more than one offense?

Serious and violent offenses, such as murders and aggravated assaults using firearms, are more likely to reach the attention of police (Tarling & Morris, 2010). As a consequence, the firearms used to commit such crimes may be less likely to be used again. Indeed, offenders may be eager to create distance between themselves and such crime guns in order to avoid being linked with the associated offenses. Therefore, the following is hypothesized (H3): A crime gun will have a lower likelihood of being used in multiple offenses if the original incident involved a homicide or aggravated assault.

Both Anderson (1994, 1999) and Kleck and Hogan (1999) have suggested that violent subcultures nested within disadvantaged neighborhoods further aggravate the likelihood of gun violence. That is, the emphasis on preemptive and retaliatory violence as well as the symbolic nature of firearms among street-oriented populations are directly related to increased gun violence in areas entrenched in the street code described by Anderson (1994, 1999). Moreover, street culture is more likely to be entrenched in communities marked by disadvantage and violence (Burgason et al., 2014). Prior studies have not considered, however, the degree to which these conditions moderate the relationship between gang involved offenses and the likelihood that guns used in those crimes will be used in additional offenses. This prompted the development of Research Question 4 (RQ4): How do neighborhood levels of disadvantage and violence moderate the relationship between gang involved offenses and the likelihood that guns used in those crimes will be used in additional offenses?

Similarly, extant literature has failed to consider the extent to which the relationship between offense severity and the likelihood that guns used in those offenses are used in additional crimes is moderated by neighborhood levels of disadvantage and violence. This omission prompted the development of Research Question 5 (RQ5): How do neighborhood

levels of disadvantage and violence moderate the relationship between severity of the original gun crime and the likelihood that the gun used in that offense will be used again? As previously mentioned, the presence of gangs tends to exacerbate levels of firearm violence within communities (Huebner et al., 2016). Moreover, Matsuda et al. (2013) and Mitchell et al. (2017) suggested that there are structural and behavioral overlaps between gang adherence and individuals who identify with Anderson's (1994) code of the street. Given that incidents involving gangs may be nested within areas entrenched in subcultural violence (e.g, Matsuda et al., 2013; Mitchell et al., 2017), and guns maintain symbolic importance among such actors (Anderson, 1999; Kleck & Hogan, 1999), the following is hypothesized (H4): The impact of gang-involvement on the likelihood that a crime gun will be used in multiple offenses will be exacerbated by higher levels of neighborhood disadvantage and violence.

For similar reasons, neighborhood levels of disadvantage and violence may condition the impact of offense severity on the likelihood crime guns will be used again. Carrying a firearm and involvement in violence (e.g., physical disputes, assault) have each been associated with status enhancement among street code adherents (Anderson, 1994, 1999). One might carry a firearm to overpower an adversary, essentially increasing the odds of success when carrying out acts of violence (Kleck & Hogan, 1999). However, one might also carry a firearm in order to insulate against victimization. In either case, offenders may be more likely to retain possession of crime guns and use the same weapons repeatedly in communities where street code is entrenched. (H5): The impact of an original incident involving a homicide or aggravated assault on the likelihood that a crime gun will be used in multiple offenses will be conditioned by neighborhood levels of disadvantage and violence.

## Data and Sample

Data used in this study are obtained from the National Integrated Ballistic Information Network (NIBIN) lead logs maintained by the Chattanooga Police Department (CPD). Analysis is restricted to the ‘cleared’ cases associated with crime guns used in offenses between 6/23/2013 and 10/31/2020 (n = 309)<sup>1</sup>. The addresses of the original incidents in which these firearms were used are geocoded to census tracts located within the city of Chattanooga (n = 29)<sup>2</sup>. Relevant sociodemographic data for census tracts were drawn from the 2013-2017 American Community Survey (ACS) 5-year summary file. Finally, homicide rates were calculated using address-level shooting and homicide logs provided by CPD. All research protocols were reviewed and approved by the UTC Institutional Review Board (IRB# 20-171) in connection with a Department of Justice grant award to the Chattanooga Police Department through the Edward Byrne Memorial Justice Assistance Grant Program (2020-DG-BX-0008)<sup>3</sup>.

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<sup>1</sup> This approach presents in obvious limitation in terms of generalizability. The NIBIN lead logs listed 277 crime guns associated with ‘active’ investigations during the same observation period. However, data for these crime guns were missing or incomplete on several key measures.

<sup>2</sup> There are 56 census tracts located in Chattanooga. That all 309 crime guns were used in offenses located in only 29 of these census tracts is indicative of the extent to which gun violence is concentrated in the city of Chattanooga. Indeed, the 309 crime guns examined here are associated with 1,095 gun crimes within the 29 census tracts included in the analyses that follow.

<sup>3</sup> This project was supported by Grant No. 2020-DG-BX-0008 awarded by the Bureau of Justice Assistance. The Bureau of Justice Assistance is a component of the Department of Justice's Office of Justice Programs, which also includes the Bureau of Justice Statistics, the National Institute of Justice, the Office of Juvenile Justice and Delinquency Prevention, the Office for Victims of Crime, and the SMART Office. Points of view or opinions in this document are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Justice.

## Dependent Variable

For the purposes of this study, ‘multiple offenses’ is conceptualized as the use of the same firearm in more than one criminal act against person or property in the city of Chattanooga between 6/23/2013 and 10/31/2020. Thus, the dependent variable is operationalized as a dichotomous indicator of whether a crime gun was used in multiple violent and/or property crimes in the city of Chattanooga between 6/23/2013 and 10/31/2020 according to the cleared cases listed within the CPD NIBIN lead log (1 = yes; 0 = no). The dependent variable represents a nominal-level measurement as it is mutually exclusive and exhaustive.

## Independent Variables

Consistent with the works of Bursik and Grasmick (1993) and Sampson and Groves (1989), concentrated disadvantage is conceptualized as coalescing forms of structural disadvantage. In turn, this concept is operationalized through multiple measures from the 2013-2017 American Community Survey (ACS) 5-year summary file. These include tract-level measurements of the percent of the population living below the federally established poverty threshold, percent of the population that is unemployed, percent of the population that is Black, percent of households headed by a single female with children, percent of the population over the age of 25 that did not earn either a high school diploma or GED, and the percent of households participating in the Supplemental Nutrition Assistance Program (SNAP). Street culture is conceptualized as neighborhood-level support for exaggerated forms of preemptive and retributive violence (Anderson, 1999). Echoing previous research conducted by Burgason et al. (2014) and Dierenfeldt et al. (2021), street culture is operationalized as the 3-year average homicide rate for each census tract. Obliquely rotated factor analysis indicates that neighborhood measures of concentrated disadvantage and violence converge on a unidimensional construct

with an Eigenvalue of 4.581 and factor loadings in excess of .58. Consistent with the works of Burgason et al. (2014) and Dierenfeldt et al. (2021), these measures are retained as a summary index of neighborhood disadvantage and violence constructed as the average of standardized values ( $\alpha = .905$ ). This variable represents an interval-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, and maintains equal intervals between each value.

In line with the works of Shaw and McKay (1942) and Sampson and Groves (1989), ethnic heterogeneity is conceptualized as the residential integration of peoples from diverse cultural traditions and national origins. This concept is operationalized as the percent of the population that is Hispanic and the percent of the population that is foreign-born as documented in the 5-year ACS summary files. Again, factor analysis with an oblique rotation reveals that these measures converge on a single dimension with an Eigenvalue of 1.809 and factors loadings of .951. They are retained as a summary index of ethnic heterogeneity constructed as the average of standardized values ( $\alpha = .893$ ). Thus, this represents an interval-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, and maintains equal intervals between each value.

The literature has clearly demonstrated the importance of residential stability and community investment in the development and maintenance of informal networks of informal social control (e.g., Kasarda & Janowitz, 1974; Kornhauser, 1978; Sampson & Groves, 1989; Sampson et al., 1997). Consistent with prior studies, residential stability is conceptualized as the tendency of neighborhood residents to live in the same homes over time. This concept is operationalized as the percent of residents who lived in the same home for at least 1 year. This variable represents a ratio-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, maintains equal intervals between each value, and has a true zero. Community

investment is conceptualized as the infusion of lending capital into residential neighborhoods. This concept is operationalized as the percent of homes that are owner occupied<sup>4</sup>. Like residential stability, community investment is a ratio-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, maintains equal intervals between each value, and has a true zero. Each measure was calculated based on tract-level data draw from the 2013-2017 ACS 5-year summary files.

Neighborhood-level controls include age structure, income inequality, and total population. Age structure is conceptualized as the proportion of the population that are in their peak offending years. This concept is operationalized as the percent of the population between the ages of 15 and 24. This variable represents a ratio-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, maintains equal intervals between each value, and has a meaningful zero. Income inequality is conceptualized as uneven distribution of income within a population, typified by the concentration of income within a small subset of residents. This measure is operationalized through the use of the Gini Index of income inequality, whereby a value of 0 indicates perfect equality and a value of 1 represents perfect inequality. Like age structure, income inequality is a ratio-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, maintains equal intervals between each value, and has a true zero. Last, total population was conceptualized as the number of neighborhood residents. This concept was operationalized as the total census tract population converted to its natural logarithm. Total population represents a ratio-level measurement, as it is mutually exclusive, exhaustive, can be ranked in order, maintains equal intervals between each value, and has a true zero.

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<sup>4</sup> Measures of home ownership and residential stability are frequently retained in summary indexes. In the present study, however, this measure lacked internal consistency ( $\alpha = .352$ ).

Multiple incident-level variables were drawn from the CPD NIBIN lead logs. Each was gathered from the original incident linked to each crime gun and geocoded to its corresponding census tract. Suspect identification was conceptualized as whether or not the suspect(s) in the original incident linked to a specific crime gun was identified. This variable was operationalized as a dichotomous indicator coded (1 = yes; 0 = no). Suspect identification represents a categorical, nominal-level measurement as it is mutually exclusive and exhaustive. Gang involvement was conceptualized as a criminal incident in which the suspect or the victim was a known gang member. This concept was operationalized as a dichotomous measure with (1) indicating that either the suspect or victim associated with the original incident linked to a crime gun was gang-involved and (0) indicating that they were not gang-involved. Gang involvement represents a categorical, nominal-level measurement as it is mutually exclusive and exhaustive. A violent incident was conceptualized as an interpersonal crime resulting in severe injury or death (or the threat of severe injury or death) to another person. This concept was operationalized as a dichotomous indicator measuring whether the original incident involved homicide or aggravated assault (1 = yes; 0 = no). Again, this variable represents a categorical, nominal-level measurement as it is mutually exclusive and exhaustive. A multi-victim crime was conceptualized as an incident in which two or more people were criminally victimized. This concept was operationalized as a dichotomous indicator of whether the original incident involved more than one victim (1 = yes; 0 = no). This variable represents a categorical, nominal-level measurement as it is mutually exclusive and exhaustive. Finally, time in circulation was conceptualized as the amount of time between when a firearm was used in its first criminal

offense and when it was seized by police<sup>5</sup>. This measure was operationalized as the number of days between the date on which a firearm was used in its first crime and the date it was seized by CPD<sup>6</sup>. To address issues of skew and kurtosis, this measure was converted to its natural logarithm. Further, this variable is a continuous, ratio-level measurement because it is mutually exclusive, exhaustive, can be ranked in order, has equal intervals between each value, and has a true zero.

### Analytic Approach

This study adopts a multiple regression technique to explore the factors that influence the likelihood of a crime gun being used in multiple incidents. Considering the dependent variable is dichotomous in nature, binary logistic regression is selected as the appropriate statistical technique. Indeed, binary logistic regression permits an examination of the individual effects of both binary and continuous independent variables on a dichotomous dependent variable (Gua, 2019; Walker & Maddan, 2009). To do so, this approach utilizes a maximum likelihood method that involves calculating the natural log of odds that an event will occur (Walker & Maddan, 2009). Simply put, this method is used to determine the probability of Y predicting X (0,1), with 1 being the desired outcome (Gua, 2019). Binary logistic regression is useful in that it does not

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<sup>5</sup> The NIBIN Program produces digital images of the markings transferred to a bullet or cartridge found as evidence at a crime scene or used in functionality tests of seized firearms. These images are uploaded to the NIBIN database, and in turn, used for comparisons with other ballistic images that have been entered into the database. If images are matched, the evidence is further investigated by trained NIBIN analysts for confirmation. Confirmed matches are reported to investigators of the department in which the firearm has been associated with (National Institute of Justice, n.d.). This process determines if a firearm has been used in more than one offense.

<sup>6</sup> The reader should interpret this variable with caution, as the 'first criminal offense' refers to the first criminal offense that was known to police and reported in NIBIN. It is possible that a firearm was used in offenses prior that evidence was not available for and thus, was unknown by law enforcement and the NIBIN Program.

require unbounded variables, does not assume linearity between the dependent and independent variables, and does not require normal distribution of the dependent variable (Walker & Maddan, 2009).

## CHAPTER V

### RESULTS

#### Descriptive Statistics

Descriptive statistics for the variables in the analysis are displayed in Table 1. In terms of the variables that comprised the community disadvantage and violence index, an average of approximately 31% of the population in the sample census tracts lived below the federally established poverty threshold ( $SD=14.416$ ), 8% were unemployed ( $SD=4.145$ ), 63% ( $SD=25.374$ ) were Black individuals, 53% ( $SD=25.222$ ) of households were headed by a single female with children, 21% ( $SD=9.823$ ) of the population over 25 years of age had not earned either a high school diploma or GED, and 32% ( $SD=14.759$ ) of households received SNAP benefits. In terms of the measures comprising the ethnic heterogeneity index, an average of approximately 5% of the population ( $SD=7.387$ ) identified as Hispanic, while approximately 4% ( $SD=3.845$ ) identified as foreign born. An average of 85% of residents had lived in the same home for at least 1 year. Regarding community investment, an average of 45% of homes were owner-occupied ( $SD=15.753$ ), with a range of 1.17 to 68.22.

Other neighborhood-level controls included age structure, income inequality, and total population. An average of approximately 13% ( $SD=3.395$ ) of the population was between the ages of 15 and 24, with a range of 5.90 to 22.83. The average GINI coefficient of income inequality was .466 ( $SD=.059$ ) Finally, the population of the average census tract was 3884.695 ( $SD=1357.004$ ).

Multiple incident-level variables were drawn from the CPD NIBIN lead logs. 37.5% of crime guns were linked to an original incident in which the suspect(s) were identified. 51.4% of firearms were used in a homicide or aggravated assault in the original incident. 63.4% of crime guns were associated with an original incident that involved a suspect or victim who was gang-involved. 11.3% of crime guns were used in an original incident that involved more than one victim. In addition, the average number of days between the date in which a firearm was used in its first crime and the date it was seized by CPD was approximately 164 days ( $M=163.776$ ) ( $SD=297.004$ ). Finally, the dependent variable, *multiple offenses*, indicated that 33.9% of crime guns were used in multiple offenses.

Table 1 Descriptive Statistics for Variables in the Analysis (n = 309)

Variable	<i>M</i> / %	<i>SD</i>	Min	Max
Total Population	3884.695	1357.004	1194	6564
Total Population (Ln)	8.198	.377	7.09	8.79
CDV Index	.293	.765	-1.15	1.61
Homicide Rate <sup>a</sup>	33.398	29.588	.00	123.07
% Poverty	31.230	14.416	5.28	64.18
% Unemployed	7.452	4.145	.10	15.34
% Black	62.836	25.374	4.67	94.41
% FHH	53.072	25.222	.00	89.34
% Low Ed	20.522	9.823	4.47	42.23
% Snap	32.114	14.759	4.02	64.44
Ethnic Heterogeneity	-.243	.838	-.96	2.30
% Hispanic	5.382	7.387	.00	27.97
% Foreign Born	4.093	3.845	.39	16.92
GINI Index	.466	.059	.349	.656
Residential Stability	85.156	6.920	60.69	95.74
Community Investment	44.972	15.753	1.17	68.22
Age Structure	12.933	3.395	5.90	22.83
Time in Circulation	163.776	297.004	.00	2400.00
Days in Circulation (Ln)	3.010	2.502	.00	7.78
Violent Incident	.514	-	0	1
Suspect Identification	.375	-	0	1
Gang Involvement	.634	-	0	1
Multiple Victims	.113	-	0	1
Multiple Offenses	.339	-	0	1

Note: <sup>a</sup> Rate per 100,000.

### Bivariate Statistics

Results from the bivariate correlation analysis are displayed in Table 2. First, the correlation analysis revealed a weak, negative, and statistically significant relationship between the dependent variable *multiple incidents* and suspect identification ( $r = -.147, p < .01$ ). Simply put, a crime gun was associated with being used in more than one offense if a suspect was not identified in the original incident. In contrast, gang involvement and *multiple incidents* shared a positive, moderate, and statistically significant correlation ( $r = .289, p < .01$ ), indicating that guns used in an initial incident that involved a gang were associated with being used in more

than one offense. Time in circulation was the only remaining variable that exhibited a statistically significant relationship with the dependent variable *multiple offenses* ( $r = .383, p < .01$ ) in the bivariate correlation analysis. Specifically, this relationship was found to be positive, moderate, and statistically significant, indicating that an increase in the time between the initial incident and gun seizure yielded an increase in a crime gun being used in more than one offense. All other relationships with the dependent variable failed to achieve statistical significance at the bivariate level.

Table 2 Bivariate Correlations Between Variables in the Analysis (n = 309)

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13
V1: Total Pop (Ln)	1.0	-	-	-	-	-	-	-	-	-	-	-	-
V2: CDV Index	-.254**	1.0	-	-	-	-	-	-	-	-	-	-	-
V3: Ethnic Heterogeneity	-.094	-.236**	1.0	-	-	-	-	-	-	-	-	-	-
V4: Residential Stability	.613**	-.093	-.100	1.0	-	-	-	-	-	-	-	-	-
V5: Community Investment	.423**	-.647**	-.069	.217**	1.0	-	-	-	-	-	-	-	-
V6: Age Structure	-.298**	.240**	.114*	.011	-.319**	1.0	-	-	-	-	-	-	-
V7: Income Inequality	-.174**	.197**	-.118*	-.072	-.171**	.234**	1.0	-	-	-	-	-	-
V8: Suspect Identification	.005	-.041	.109	-.033	-.009	-.034	-.043	1.0	-	-	-	-	-
V9: Gang Involvement	-.145*	.033	-.034	-.119*	-.021	.023	-.041	-.230**	1.0	-	-	-	-
V10: Violent Incident	-.092	-.056	.046	-.031	-.053	-.002	.033	.218**	.123*	1.0	-	-	-
V11: Multi-Victim Crime	-.084	.027	-.050	-.062	-.044	.037	.089	-.045	.102	.245**	1.0	-	-
V12: Time in Circ (Ln)	-.065	.032	-.118*	-.073	.064	-.002	-.011	-.335**	.327**	-.035	-.023	1.0	-
V13: Multiple Incidents	-.066	-.048	-.006	-.009	-.012	.002	-.025	-.147**	.289**	.000	.024	.383**	1.0

Note: \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$

## Logistic Regression Analysis

Table 3 displays the results of the three binary logistic regression models used to test the effects of incident and neighborhood level variables on the likelihood of a crime gun being used in multiple offenses. Model fit statistics showed that Model 1 improved from the constant-only model when predictor variables were added ( $-2 \text{ Log Likelihood} = 328.722$ ,  $\chi^2 = 67.358$ ,  $p \leq .000$ ). Model 1 correctly classified 71.8% of cases. Among the independent variables, three variables shared statistically significant relationships with the outcome measure. First, the disadvantage and violence index, the proxy for street culture, shared a negative and statistically significant relationship with the dependent variable ( $OR = .604$ ,  $p < .05$ ). In other words, crime guns used in neighborhoods where street culture was more entrenched were less likely to be used in multiple offenses. Not only does this finding represent a departure from the non-significant relationship described in the bivariate analysis above, it is also counter to the expectations expressed in Hypothesis 1. Next, and in support of Hypothesis 2, firearms that were used in incidents in which the suspect or victim was a known gang member were comparatively more likely to be used in multiple offenses ( $OR = 3.075$ ,  $p < .001$ ). Finally, time in circulation was associated with a positive and statistically significant increase in the odds that a crime gun would be used in multiple offenses ( $OR = 1.410$ ,  $p < .001$ ). Simply stated, the longer a firearm remained in the community following its known use in a crime<sup>6</sup>, the more likely it was to be used in another offense. All remaining variables failed to exhibit statistically significant relationships with the outcome measure. This prompted rejection of Hypothesis 3, as crime guns used in a homicide or aggravated assault were no more or less likely to be used to additional offenses.

Table 3 Binary Logistic Regression on Dependent Variable (Firearm Used in Multiple Incidents; n = 309)

Variable	Model 1 Exp( <i>b</i> )	Model 2 Exp( <i>b</i> )	Model 3 Exp( <i>b</i> )
Total Population (Ln)	.607(.511)	.615(.512)	.610(.515)
CDV Index	.604*(.252)	.722(.383)	.335***(.334)
Ethnic Heterogeneity	1.032(.181)	1.029(.181)	1.021(.183)
Residential Stability	1.036(.025)	1.036(.025)	1.035(.025)
Community Investment	.981(.012)	.981(.012)	.979(.012)
Age Structure	.976(.044)	.973(.045)	.976(.045)
Income Inequality	.900(2.410)	.960(2.414)	.525(2.467)
Suspect Identification	1.056(.319)	1.051(.319)	1.031(.324)
Gang Involvement	3.075***(.329)	3.032***(.329)	3.263***(.339)
Violent Incident	.773(.299)	.776(.299)	.774(.304)
Multi-Victim Crime	1.285(.427)	1.262(.428)	1.385(.431)
Time in Circulation (Ln)	1.41***(.063)	1.411***(.063)	1.414***(.065)
CDV x Gang Involvement		.777(.407)	
CDVxViolent Incident			2.873**(.376)
Constant	.891(-.115)	.801(-.222)	1.537(.430)
-2 log likelihood	328.722		
Chi-square	67.358 ( <i>df</i> =8)		
Nagelkerke <i>R</i> <sup>2</sup>	.271		

Note: \**p* <.05 \*\**p* <.01 \*\*\**p* <.001

Hypothesis 4 expressed the expectation that the impact of gang-involvement on the likelihood that a crime gun would be used in multiple offenses would be exacerbated by higher levels of neighborhood disadvantage and violence. Counter to this expectation, however, the interaction between the disadvantage and violence index and the binary indicator of whether the original incident was gang involved failed to achieve statistical significance (Model 2). This finding suggests that the entrenchment of street cultures does not condition the impact of gang violence on the likelihood that crime guns will be used in multiple offenses, and prompts rejection of Hypothesis 4.

Hypothesis 5 described the expectation that the impact of an original incident involving a homicide or aggravated assault on the odds that a crime gun would be used in multiple offenses would be conditioned by levels of disadvantage and violence. Consistent with this approach, Model 3 included an interaction term between the community disadvantage and violence index and the binary indicator of whether the original incident involved a homicide or aggravated assault. Consistent with Hypothesis 5, the interaction was significant and positive (OR = 2.873,  $p < .01$ ), indicating that the impact of offense severity on the likelihood that a crime gun will be used in multiple offenses is exacerbated in neighborhoods maintaining comparatively higher levels of disadvantage and violence when holding all else constant.

Table 4 Summary of Findings in Relation to Hypotheses

Hypothesis 1	Rejected
Hypothesis 2	Supported
Hypothesis 3	Rejected
Hypothesis 4	Rejected
Hypothesis 5	Supported

## CHAPTER VI

### DISCUSSION

The purpose of the current study was to explore neighborhood and initial incident characteristics that influence the likelihood that a crime gun will be used in multiple offenses. Existing literature pertaining to the issue of gun violence has examined the impact of characteristics of the community, victims, and offenders on both the likelihood and frequency of gun-related crimes (Anderson, 1994, 1999; Burgason et al., 2014; Dierenfeldt et al., 2021; Maimon & Browning, 2010). These works have established a positive relationship between community disadvantage and gun violence. Anderson's (1994, 1999) description of street culture has produced similar effects (e.g., Burgason et al., 2014).

The presence of gangs has also been found to increase gun violence within communities (Huebner et al., 2016). Gang violence tends to permeate in communities marked by socioeconomic deprivation and street culture (Anderson, 1999; Matsuda et al., 2013). Within this context, the emphasis on campaigning for respect among gang members and street code participants may increase the likelihood of violence during public disputes (Matsuda et al., 2013) – particularly violence involving guns. These relationships are somewhat unsurprising given the symbolic status of firearms among street code adherents and gang members. In sum, research has provided a robust understanding of the community and individual factors that influence the likelihood of gun crime, yet comparatively little is known about crime guns themselves or the factors that promote the continued use. Indeed, prior works have seemingly implied that each

crime involves a unique firearm – particularly through the use of measures such as the percent of suicides by firearm or percent of non-felony homicides as they relate to gun crime (Cook, 1979; Kleck, 2015; Kleck & Patterson, 1993) However, this study aimed to address this potential misstep in the literature through examination of how neighborhood and incident characteristics influence the likelihood of a crime gun being used in multiple offenses.

Results of the binary logistic regression models produced several significant findings that merit discussion. First, in line with social disorganization theory (Park & Burgess, 1924; Sampson & Groves, 1989; Shaw & McKay, 1942) and Anderson’s (1994, 1999) description of street code, it was expected that higher levels of neighborhood disadvantage and violence would be associated with an increase in the odds that a crime gun would be used in multiple offenses. Contrary to this expectation, however, crime guns initially used in neighborhoods maintaining higher levels of disadvantage and violence were less likely to be used in multiple offenses. This finding was surprising given the descriptions of the symbolism, both in terms of power and protection, ascribed to firearms by street-oriented populations (Anderson, 1994, 1999; Kubrin, 2005). Simply put, the symbolic status attached to gun ownership and use among street culture might suggest a desire to preserve a firearm once it has been obtained—leading to its use in multiple offenses. There are, however, several potential explanations for the finding reported in this thesis. First, the result may be an artifact of how the thesis operationalized street culture. Rather than using standardized attitudinal items like those adopted by Stewart et al. (2006) and Kwak et al. (2019), this study quantified street culture through a summary index of disadvantage and violence , which is a proxy that might fail to capture the entrenchment of street culture.

Alternatively, this finding could be related to greater police presence in more violent neighborhoods. That is, law enforcement agencies may already prioritize gun crimes in these

neighborhoods which, in turn, could produce quicker case clearances and gun seizures. Such an explanation is not unlikely given the efforts of the city associated with the partnering department in this study. For example, the Office of Internal Audit in Chattanooga, Tennessee, distributes an annual survey to gather data relating to the perceptions of city services – including measures of satisfaction with police, perceived safety, and characteristics relating to the wellbeing of their neighborhood – to improve police practice and areas with higher levels of crime (Sewell, 2019). Moreover, the Crime Gun Intelligence Grant (No. 2020-DG-BX-0008) used for this thesis suggests that the police department in the city of study is dedicated to the seizure of firearms and prevention of gun violence in the community. Nonetheless, it is important to note that this finding may have been a limitation of the sample. Indeed, all crime guns were nested within 29 census tracts within the city and limited the sample to the most violent areas more likely to be entrenched in street code.

In contrast, firearms that were used in incidents in which the suspect or victim was a known gang member were comparatively more likely to be used in multiple offenses. This finding is consistent with certain aspects of gang involvement and aligns with prior works. Like street culture, gang involvement encourages preemptive and retaliatory violence as a means of establishing or protecting pride, honor, and toughness (Melde et al., 2009), which tends to place individuals at a greater risk of engaging in gun violence, both as victims and offenders (Copes et al., 2013; Wright & Rossi, 1986). Moreover, given that gang leaders have been found to distribute, loan, or rent out guns to others within the gang (Cook et al., 2007), it is no surprise that a firearm used in an initial incident that was gang-involved is more likely to be used in more than one offense. Thus, the findings reported here are supportive of prior works and suggest that

relationship suggests that firearms used in gang-involved incidents are more likely to be re-used rather than discarded.

The literature has noted that serious and violent offenses, such as murders and aggravated assaults using firearms, are more likely to reach the attention of police (Tarling & Morris, 2010). In this vein, the firearms used to commit such crimes may be less likely to be used again, as offenders may be eager to create distance between themselves and the crime gun used to carry out a violent offense to avoid being linked with the crime. It was therefore expected that crime guns used in an original incident involving a homicide or aggravated assault would have a lower likelihood of being used in multiple offenses. This relationship, however, failed to achieve statistical significance. This finding suggests that the severity of the initial incident was not as impactful as expected in relation to a gun being used in more than one offense. In particular, offense severity did not appear to create a strong motivation for the offender to create distance between themselves and the crime gun (e.g., through discarding the weapon). This finding may also be a possible artifact of functionality tests of firearms. That is, the initial incidents associated with many of the crime guns in this study may have been test fires in preparation for more serious crime (e.g., homicides/aggravated assaults). However, determination of such incident characteristics was beyond the scope of this study.

Given that incidents involving gangs are often nested within areas entrenched in subcultural violence (e.g., Matsuda et al., 2013; Mitchell et al., 2017), and guns maintain symbolic importance among such actors (Anderson, 1999; Kleck & Hogan, 1999), this thesis also explored the degree to which neighborhood levels of disadvantage and violence moderate the relationship between gang involved offenses and the likelihood that guns used in those crimes will be used in additional offenses. The results of this cross-product interaction indicated

that the entrenchment of street cultures does not condition the impact of gang violence on the likelihood that crime guns will be used in multiple offenses. At face value, this finding suggests that street culture may not be as influential as suggested by prior studies. Instead, gang involvement during the initial incident appears to be a driving force in the likelihood that crime guns will be used again. As noted, gang members tend to maintain high levels of cynicism towards law enforcement (Curry & Decker, 2003), and in turn, may refuse to cooperate with police. Moreover, this fear or lack of confidence in police may lead to self-help social control mechanisms and more violence within the community. That is, in the event of victimization, individuals or groups tend to retaliate (Gau & Brunson, 2015; Haas et al., 2014; Jacobs & Wright, 2006; Rosenfeld et al., 2003). Gang members may also instigate violence to insulate themselves from future victimization (McNeeley & Wilcox, 2015a, 2015b; McNeeley & Yuan, 2017) and thus, increase the likelihood of firearms being used in multiple offenses.

For reasons similar to those stated above, further conditioning effects of street code were explored in relation to incidents involving a homicide or aggravated assault on the likelihood of a crime gun being used in multiple offenses. The results indicated that the impact of offense severity on the likelihood that a crime gun would be used in multiple offenses is exacerbated in neighborhoods maintaining comparatively higher levels of disadvantage and violence. As noted, street culture has been characterized by high levels of disadvantage and public displays of preemptive and retaliatory violence (Anderson, 1994, 1999). Moreover, gangs tend to rise in communities entrenched in street culture (Matsuda et al., 2013) and both gang members and street adherents place great symbolic value on guns (Huebner et al., 2016). Thus, the symbolic nature of firearms among street code participants and gangs may explain the conditioning effects of street culture on whether a gun used in an initial incident involving a violent crime is used

again. That is, the symbolic status affixed to firearms (Anderson, 1999; Kleck & Hogan, 1999) may be even more powerful in communities entrenched in street culture if those particular firearms are known to have been used in the shooting or murder of a rival.

Finally, and perhaps the most novel contribution of this study revolves around the relationship between time in circulation and the likelihood of a crime gun being used in more than one offense. As expected, the longer a firearm remained in the community following its use in a crime, the more likely it was to be used in another offense. While this finding appears to be somewhat banal, it illustrates the importance of seizing crime guns following their initial use. Although an arrest may be made, a crime gun may circulate through other criminogenic individuals, and thus, create more violence in the community. This finding suggests that law enforcement agencies may benefit from reconceptualizing how they define case clearance and, in turn, begin emphasizing gun seizures along with arrests.

## CHAPTER VII

### CONCLUSIONS

Despite this study's contribution to the literature, there are several limitations worth noting. First, as a cross-sectional study (Walker & Maddan, 2009), this thesis can only interpret findings in terms of correlation rather than causation. Second, this study employed a binary logistic regression analysis to explore the factors that influence the likelihood of a crime being used in multiple incidents. As noted by Liao (1994), a major criticism surrounding the use of this approach relates to coefficients and their dependence on the values of independent variables. While this may not be an issue among larger samples, coefficients within smaller samples may become biased (Liao, 1994). Moreover, binary logistic regression techniques may be sensitive to outliers, as these cases tend to inflate the degrees of freedom and alter results (Walker & Maddan, 2009). An additional consideration of this study is the concentration of all crime guns used within 29 census tracts in the city. Indeed, there is a total of 56 census tracts in Chattanooga, yet the disproportionate number of crime guns in certain tracts merits concerns of the generalizability of the findings presented here. Although the findings were preliminary in nature, future studies should explore these relationships across other cities and jurisdictions for a more representative sample.

Next, the operationalization of street code used in this study represents a significant limitation. Although this measure has been accepted and used in recent studies examining the effects of street code (Burgason et al., 2014; Dierenfeldt et al., 2021), a more direct measure of

the values and behaviors described by Anderson (1994, 1999) may have been obtained through survey methodology implemented by Stewart et al. (2006) and Stewart and Simons (2010). Stewart and colleagues (2006) incorporated measures relating to perceptions of neighborhood violence, census data pertaining to neighborhood disadvantage, as well as the extent to which individuals accepted ‘street’ behaviors and beliefs for a robust measure of Anderson’s (1994) framework (see also, Stewart & Simons, 2010). Similarly, Kwak et al. (2019) utilized data collected by the Seattle Neighborhoods and Crime Survey (SNCS) that measured adherence to street code values and perceptions of retaliation, socializations, and protection mechanisms consistent with the core concepts of code of the street culture – including a question pertaining to the symbolism of guns. Incorporating these approaches in future studies may (a) provide a more thorough examination of the relationship between disadvantage and subcultural violence on the likelihood of a crime gun being used in more than one offense and (b) further explain the conditioning effects illustrated in this study.

Additionally, it is possible that this study suffers from omitted variable bias and issues related to unreported crime. As a consequence, relationships regarding the impact of street code may be spurious. For example, given that areas with higher levels of street code have been associated with higher levels of legal cynicism (Anderson, 1994, 1999), it is possible that a multitude of firearm-related incidents were not reported to police – particularly among Black victims (see Kwak et al., 2019). Indeed, reporting crimes has been found to be lower among individuals residing in areas entrenched in subcultural violence due to the threat of retaliation or loss of rapport (Anderson, 1994, 1999; Kubrin & Weitzer, 2003). Moreover, the literature has noted that incidents that do not involve injury of the victim or offender are less likely to be reported to officials (Harlow, 1985; Harries, 1990). Youth-aged individuals have also been

associated with lower crime reporting compared to adult victims (Hart & Rennison, 2003). On the other hand, some studies have suggested that crimes against females and Black victims are more likely to be reported (Hart & Rennison, 2003). Despite the importance of these factors, this study was unable to include suspect or victim characteristics at the incident-level due to incomplete data provided by the partnering police department. Although demographic identifiers may have been reported in NIBRS or TIBRS, this information was not provided in the data used for this study. The issues with missing data are indicative of the importance of thorough record keeping within law enforcement agencies. If available, future studies would benefit from the inclusion of factors such as age, race, and sex of victims and offenders for a better understanding of crime gun use and reporting. Furthermore, a direct measure of levels of legal cynicism may provide insight on the nature of reporting gun crime in areas with higher levels of disadvantage and violence. City-level comparisons with results from the National Crime Victimization Survey may also be useful in addressing the dark figure of gun crime in low-reporting areas.

Alternatively, it is possible that areas more entrenched in street culture and violence may be more heavily policed and, subsequently, produce a negative impact on multiple uses of crime guns. Therefore, it is also recommended that future studies incorporate measures of patrol deployment, daily arrest rates, and policing strategies within areas entrenched in subcultural violence for a more nuanced examination of the factors that influence a crime gun being used in more than one offense. Finally, in the event that crime guns were used in more than one offense, future works should also consider whether repeated uses of crime guns used in an initial incident involving a gang were specific to the same gang or individual. Although such measures were beyond the scope of this study, examination of these factors are pertinent to the continuation of crime gun literature.

Despite these limitations, this study maintains important implications for policy and practice. First, it appears necessary for academics and practitioners to reconsider the conceptualization of case closure. Currently, law enforcement personnel may consider a case ‘closed’ once a suspect has been identified and arrested, charged, and/or convicted. However, the increase in gun-related homicides over the last decade (Center for Disease Control, n.d.) along with the findings presented in this study, suggest that this approach may be a misstep. Simply put, future research and practice should prioritize offenders *and* gun seizures simultaneously when addressing gun violence in the community.

Of course, to address violence and have a better chance of seizing firearms, law enforcement must rely on reporting among victims. Yet, the literature has consistently explained the difficulties in addressing violence in more cynical communities, as perceived police ineffectiveness (Goudriaan et al., 2004) and fear of crime (Sargeant & Kochel, 2018) have been associated with lower levels of reporting. Thus, alternative mechanisms for reporting appear necessary. Perhaps departments would benefit from the introduction of anonymous tip-lines, whether that be through phone calls or discrete applications downloadable on an individual’s cellphone. Moreover, agencies should focus on familiarizing themselves with the communities they police, as the public may be more likely to report if they feel that officers are integrated and legitimate within their community (as opposed to an external force) (Tyler, 2017). Perhaps stronger police-community relations could also lessen the need for self-help social control that characterizes many urban areas.

Finally, higher crime areas may benefit from the introduction of ShotSpotter technology (Mazzerolle et al., 1999). ShotSpotter sensors are used to detect noises like those discharged from a firearm across large areas. Once sound has been detected, ShotSpotter software

determines whether or not the sound was firearm-related and alerts local authorities of its location. Although there are few empirical tests of ShotSpotter technology, some studies have illustrated reductions in officer response times (Mazzerolle et al., 1999) and increased awareness of geographical hotspots of gun crime (Ratcliffe et al., 2018). ShotSpotter implementation has also been associated with quicker care and safety among gunshot victims (Goldenberg et al., 2019), which in turn, may increase confidence in police within the community. However, other studies have noted that ShotSpotter technology had little to no effect on case closures relating to gun crime (Choi et al., 2014). Nonetheless, the growing body of literature on ShotSpotter technology warrants further testing of the longitudinal affects it may have on identifying, seizing, and developing gun-related strategies for reducing crime in the community. The use of this technology may also provide insight on the nature of gun crime as it compares to case closures and arrests. With the introduction of new technology, however, it is critical that local, state, and federal agencies focus on thorough record keeping. Moreover, given the limitations faced in this study regarding incomplete data, agencies should gravitate towards standardized reporting techniques and organization to ensure quality, accuracy, and feasibility when released for multi-level testing.

In conclusion, prior literature relating to firearms has focused on the likelihood and frequency of gun crime, as well as the characteristics of victims and offenders as they relate to such offenses (Anderson, 1994, 1999; Burgason et al., 2014; Bursik, 1989; Dierenfeldt et al., 2017). This thesis deviated from the focus on gun crime towards a focus on crime guns. Indeed, this study provided an original contribution to the literature through an examination of incident and neighborhood characteristics, as well as time in circulation, on the likelihood of a crime gun being used in multiple offenses. The findings presented demonstrate the need for increased

efforts pertaining to the prioritization of gun seizures alongside arrests when addressing violence in the community. Moreover, the conclusions of this thesis provide empirical evidence that may be useful to the development of policies and practice aimed at decreasing levels of gun crime among urban neighborhoods.

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## VITA

Samantha Scott was born in Chattanooga, Tennessee, to parents Nancy and J.D. Scott. She attended Chattanooga State Community College where she earned her associate degree in Criminal Justice. She continued her education by pursuing a Bachelor and Master's degree in Criminal Justice at the University of Tennessee at Chattanooga. Samantha has assisted her professors as a graduate assistant at the Department of Social, Cultural, and Justice Studies at the University of Tennessee at Chattanooga, and served as a research assistant on the Scenic City Crime Gun Intelligence Center grant funded by the Department of Justice Assistance. Samantha graduated with a Master's of Science degree in Criminal Justice in May 2022, and intends to continue working with agencies that address urban violence in the community.