Social disorganization and violent crime across nonmetropolitan areas of Kentucky.

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SOCIAL DISORGANIZATION AND VIOLENT CRIME ACROSS NONMETROPOLITAN AREAS OF KENTUCKY

By

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B.A., Morehead State University, 2009
M.S., Morehead State University, 2015

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ENVIRONMENTAL INJUSTICE, SOCIAL DISORGANIZATION, AND VIOLENT CRIME ACROSS NONMETROPOLITAN AREAS OF KENTUCKY

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DEDICATION

I dedicate this work to my mother, Connie Jude (2011) father, Henry Jude (2017)
I will always remember that you told me to “Remember where you come from”, and two
brothers, Jason (2012) and John Henry Jude (2018). May you all rest in peace. and I hope
to make you all proud.
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A few people made this writing possible, and without them I daresay I would not have gone so well. To Dr. Viviana Andreescu and Dr. George Higgins, my two chairs, thank you both for your extradentary patience and guidance throughout my dissertation, I honestly would have been lost without your calls Dr. Andreescu and your emails Dr. Higgins. Thank you both for setting me on the right path and keeping me on that path.

I would also like to thank Dr. Gennaro Vito for reading my dissertation and offering his feedback and advice, as well as Dr. Catherine Marcum for her feedback and support. I would also like to thank my cohort, as they were able to aide me in so many ways, both big and small throughout my journey to becoming a Ph.D.

Thank you to my friends, Eric, Jeremy, Amber, Charity, Brad and others who have offered me feedback and support during this entire time of my life as well as providing many good times along the way. I am incredibly fortunate to have met each one of you.
ABSTRACT
SOCIAL DISORGANIZATION, AND VIOLENT CRIME ACROSS NONMETROPOLITAN AREAS OF KENTUCKY

Daniel R. Jude
November, 1, 2021

This macro-level study examines the effects of social disorganization predictors on violent crime registered in nonmetropolitan areas of Kentucky from 2012 to 2016. The study intends to expand the line of research interested in verifying the applicability of the social disorganization theory (Shaw & McKay, 1942), including its new theoretical developments, to non-urban settings and plans to contribute to the literature willing to provide a better understanding of violent crime in rural areas. In response to Narag et al.’s (2009) call for a theoretical integration of environmental contaminants among the ecological factors that influence variations in crime, the study also examines the effect of potential exposure to lead, seen here as an additional structural disadvantage, which may affect interpersonal violence. The results of a parallel mediation analysis show that for the most part, social disorganization theory has the ability to explain variations in violent crimes occurring in rural areas. Consistent with the theoretical predictions, residential instability, ethnic heterogeneity (percent Blacks), and family disorganization predict higher levels of violent crime. Yet, although poverty has a significant positive indirect effect on violent crime via family disorganization, the total effect of economic disadvantage on violent crime is negative. Exposure to lead contamination in water has only an indirect
significant positive effect on violent crime, while potential exposure of lead in old housing does not impact violent crime, as it has been anticipated. Moreover, different from the theoretical expectations, social capital (i.e., church adherence) predicts higher and not lower violent crime rates. The study limitations and the policy implications of the findings are further discussed and recommendation for future research are presented.
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CHAPTER I - INTRODUCTION

Violent crime in the United States has seen some dramatic declines in the past thirty years. This decreases in violent crime rates ranged from 51% to 71% (Gramlich, 2019). Several scholars tried to determine why the violent crime rate has fallen. Yet, the reason behind the crime decline has remained shrouded in mystery (Ford, 2016). While some scholars contend that the violent crime decrease was a result of lower rates of illegal drug use, such as crack cocaine consumption (Blumstein & Farrington, 2006; Geoghegan, 2011), others have argued that the legalization of abortion was an additional potential reason behind the crime drop (Donohue & Levitt, 2000). Further, economic factors have also been cited as a reason for the sharp crime decrease, because the economic growth registered in the 1990s coincided with the crime drop (Van Dijk et al., 2012). Changes in policing practices have also been cited among the factors responsible for the decrease in violent crime rates in the United States (Levitt, 2004; Messner, et al., 2007; Weisburd et al., 2014). Moreover, some scholars contend that the decrease in exposure to lead (Pb) contamination contributed to the violent crime rate decline as well (Doleac, 2017; Nevin, 2007; Stretesky & Lynch, 2004). Nonetheless, even if violent crime rates decreased, they continue to be higher in United States than in other developed democracies (Harrendorf et al., 2010).

1 According to the Uniform Crime Reports (UCR), violent crimes include murder, nonnegligent manslaughter, rape, robbery and aggravated assault (U.S Department of Justice, 2020).
In the past five years (2014-2019), violent crime has remained at a relatively stable rate after the massive downward trend that started in the 1990s (Gramlich, 2019). Research questions have risen within the past five years such as: does undocumented immigration increase violent crime (Light & Miller, 2018), how does Mexico’s drug war impact the violent crime rate (Ennamorado & Lopez-Calva, 2016), or how does park use in low income neighborhoods interact with the violent crime rate (Han, et al., 2018). All these research studies do have one thing in common. They all examine the impact of socioeconomic inequality on crime rates. Researchers also tried to explain why the violent crime rate has abruptly stopped decreasing or, even increased in some years of the recent past. Studies generally suggest that there are large geographical variations in crime rates and research shows that differences in community type (metro vs. nonmetro) are not the main source of variations in crime rates (Donnermeyer & DeKesserdy, 2013). On the other hand, official reports suggest that factors such as population density and economic conditions do influence variations in crime rates (Gramlich, 2019).

Yet, while criminologists and other social scientists examined the causes and correlates of crime, violent crime included, most of these studies are based on data from large urban areas, even though small and rural communities are affected by crime as well (Saunders et al., 2018). Rural violent crime follows a less clear path than overall violent crime in the U.S. Violent crime in rural areas decreased in the 1980s, but an ascending trend was noticed in the early 1990s contrasting with the overall violent crime rates which by 1995, started to decline\(^2\) (Saunders et al., 2018; Uniform Crime Report, 2020;

\(^2\) The US Census defines “rural” as “all population, housing, and territory not included within an urbanized area or urban cluster” (Ratcliffe et al., 2016, p. 3). However, there are multiple definitions of “rural” and the definition most widely used by researchers and others who analyze conditions in “rural” America is based on the economic concept, which identifies as rural the 2,050 nonmetropolitan (nonmetro) counties
Weisheit et al., 2005). In fact, a 2018 report noted that, for the first time in a decade, violent crime rates in rural areas rose above the national average. Increases in drug trafficking and other drug-related offenses, prostitution and theft, as well as increases in intimate partner violence are some of the factors that fueled recent rises in violent crime in many nonmetropolitan areas in the United States (Crime and Justice News, 2018).

Moreover, although UCR data indicate that in 2014, violent crime rates were about twice higher in urban areas than in rural areas (nonmetropolitan counties), analyses based on National Crime Victimization Survey data showed that violent crime victimization rates were only slightly lower in rural areas (18.3 per 100,000) than they were in urban (22.2) and suburban (19.3) areas of US. The same report also showed that the average aggravated assault victimization rate was actually higher in nonmetropolitan counties (4.9) than it was in metropolitan counties (3.8) or in cities outside metro areas (4.1) (Office for Victims of Crime, 2016).

Nonetheless, despite factual data showing that violence in rural communities is an equally serious public health problem as it is urban areas, systematic research on violent crime and its impact on rural communities is limited (Dawson, 2017). By examining the correlates of violent crime in a nonmetropolitan setting, the present study intends to address this apparent gap in the literature and plans to expand the line of research willing to provide a better understanding of violence in rural areas. Specifically, this dissertation will focus on recent violent crime in nonmetropolitan areas of Kentucky and will try to

lying outside metro boundaries (Economic Research Service, 2019). Although according to the US Census definition, nonmetropolitan and rural are not identical geographic entities, they do overlap (Ratcliffe et al. 2016). In this study, “nonmetropolitan” and “rural” will be used interchangeably.[for complete references see: Economic Research Service (2019), https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/what-is-rural/]
identify some of the factors that predict variations in violent crime rate in an understudied rural area.

Although nonmetropolitan crime is ranked among the least studied social problems in criminology (Donnermeyer & DeKesserdy, 2013), in recent years, a limited number of studies did focus on violent crime in nonmetropolitan areas. Some of the research questions these studies addressed were: how do drugs and violence interact in the rural setting (Oser, Mooney & Staton-Tindall, 2009), how civic engagement and population change impact rural violent crime rates (Lee & Thomas, 2010), how social capital impacts rural violent crime rates (Deller & Deller, 2010), or how poverty impacts violent crime rates in the nonmetropolitan setting (Edwards, Mattingly & Dixon, 2014).

This dissertation examines violent crime in nonmetropolitan areas in Kentucky, using social disorganization theory (Shaw & McKay, 1942). The study is also informed by the green criminology theoretical perspective (see Lynch, 1990, 2004). Most of the empirical tests of social disorganization theory have focused on urban crime, but research on crime in the nonmetropolitan settings, informed by social disorganization theory is sparse. Further, the number of studies that have integrated the most recent developments of social disorganization theory such as those discussed by Kubrin and Wo (2016) is even lower. This dissertation will contribute to the literature by focusing on the more recent developments of social disorganization theory and will verify their application to a nonmetropolitan setting. Specifically, it will examine not only the effects of poverty, residential instability and ethnic heterogeneity on violent crime, but also the effects of family instability and social capital.
As stated previously, research tried to determine if a decrease in exposure to lead contamination contributed to the crime decline of the 1990s. As Lynch (2004, p. 114) noted, research derived from the social disorganization theory showed that crime has an ecological distribution. Beneath this well-known distribution there are other factors (e.g., environmental contaminants) associated with the ecological distribution of crime. As research suggests, lead is one of the factors that play some role in the etiology of crime and violence.

Lead (Pb) contamination occurs when a person has been exposed to lead through a variety of anthropogenic sources such as lead-based paint, car batteries, smelting plants, glass, drinking water, soil, and air pollution levels (Barrett, 2017; Devoz et al., 2017; Lersch & Hart, 2014; Marcus, Fulton & Clarke, 2010; Stretesky & Lynch, 2001). After persons are exposed to lead, they may become contaminated, and once several people are contaminated, then a community could be considered lead contaminated and crime may increase in that community (Environmental Protection Agency, 2019). Exposure to lead may impact behavior because lead is a neurotoxin that negatively affects decision making processes (Aizer & Currie; 2017; Barrett, 2017; Bellinger, 2008; Boutwell et. al, 2016; Jaffee, 2019; Lynch & Barrett, 2015; Marcus et al., 2010; Martin & Wolfe, 2020; Mbonane et. al. 2019; Nevin, 2000; Nevin, 2007; Narag et. al, 2009; Reyes, 2011; Reyes, 2015; Sampson & Winter, 2018; Stretesky & Lynch, 2004; Taylor et al., 2016). In

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3Lead is a chemical element with the symbol Pb. Lead is a heavy metal that is soft and malleable, and when cut, it appears silver and blue. There are three forms of lead, elemental lead, inorganic lead, and organic lead (Agency for Toxic Substances & Disease Registry, 2017). Historically in the United States lead has been used in paint, gasoline, recycling operations, mining operations, commercial operations, and other various lead-contaminated products such as toys.
addition, studies show that lead (Pb) exposure may modulate genes expression (a modification of behavior due to neurotoxic impact on the brain) by changes in epigenetic status (Devoz et al., 2017). Further, Devoz and colleagues (2017) found that even low levels of lead exposure may result in impairment in the regulation of gene expression. As a result, health in general and mental health in particular, may be negatively affected. In sum, numerous behavioral, neuropsychological, and biological studies suggest that exposure to lead can promote brain dysfunction (Stretesky, & Lynch, 2001). Yet, even if lead has been shown to be an environmental correlate of crime, little research has been completed on this topic focusing on nonmetropolitan areas and to the author’s knowledge, no study examined the link exposure to environmental contaminants – violent crime using data from Kentucky.

Research also showed that exposure to lead is not uniformly distributed and certain communities are more affected than others. These communities tend to have a higher proportion of residents with a lower socioeconomic status and higher percentages of residents belonging to ethnic/racial minority groups (Lynch, 2014). In short, minority and economically disadvantaged communities tend to be subjected to environmental injustice as well. This study intends to determine if this is the case in nonmetropolitan Kentucky. By examining the effect of lead exposure on violent crime, which Narag et al. (2009, p. 965) labeled an “additional structural ill,” this dissertation will also contribute to the literature that focuses on the link environmental justice – crime. Specifically, the current study will try to determine if potential exposure to lead at the macro level does appear to contribute to increases in violent crime in rural Kentucky areas.
The Commonwealth of Kentucky provides an opportunity to determine if potential exposure to lead contributes to the increase in violent crime in its rural areas. A decade ago, a study on pollution, energy use, and environmental policy ranked KY as the 40th least ‘green state’ in terms of carbon footprint, toxic waste, and other environmental hazards (McIntyre, 2010). Among these hazards are coal sludge spills (Kilborn, 2000). These environmental issues have been documented in a manner that can be used for this research study and may provide insights that can assist in preventing environmental injustice at the community level.

Violent crime in nonmetropolitan Kentucky is also an issue that needs to be researched, as it is a topic that few have delved into, and the number of recent studies on violence in the area is relatively low. Kentucky is an Appalachian state (i.e., almost a third of KY counties are part of the Appalachian region⁴) and several studies that examined violence in Appalachia used KY data (e.g., Andreescu et al., 2011; Davidov et al., 2017). However, these studies did not include separate analyses that focused on Kentucky and the limited literature that examined violent offending and/or victimization in nonmetropolitan Kentucky explored the correlates of domestic violence or intimate partner violence (Adelman, 2004; Swank et al., 2011; Teaster et al., 2006; Websdale, 1995; Websdale, 1998; Websdale & Johnson, 1997) and not the predictors of violent crime in general, as this study intends to do.

⁴ The Appalachian Region is politically defined by the Appalachian Regional Commission (ARC) as the 205,000 square mile region that follows the spine of the Appalachian Mountains from southern New York to Northern Mississippi. As of FY 2021, 54 KY counties are included in the region. Among them, 38 are considered by ARC “distressed” counties. Within the Appalachian region, this is the largest economically distressed area.
The primary purpose of the dissertation is to empirically test the connection between social disorganization theory and violent crime in a nonmetropolitan Kentucky area. The dissertation is informed by green criminology’s idea of environmental injustice via exposure to lead contamination. Potential lead contamination is viewed here as an additional social ill that might contribute to violence. The methods section of the paper will define each of the variables to be used in multivariate analyses. To date, no study has tested social disorganization theory in nonmetropolitan Kentucky.

The remaining chapters of the dissertation will deepen the understanding of the issues presented here. Chapter 2 will examine the literature of both social disorganization theory, as well as environmental injustice as described by Lynch (2004). Chapter 2 will also discuss violent crime in nonmetropolitan Kentucky. Chapter 3 will discuss the methods of the dissertation and will describe how social disorganization concepts will be operationalized. Chapter 3 will also define terms that are important to the study. Chapter 4 will discuss the results, and the implications of those results, Chapter 5 will close the dissertation out with policy implications and propose solutions to violent crime in nonmetropolitan Kentucky.
One of the oldest theoretical traditions of American criminology, which continues to have a significant influence on contemporary community studies of violence, is Shaw and McKay's (1942) social disorganization theory of crime (Bursik, 2004, p. 98). Following prior research on delinquency and crime in rural areas (e.g., Bouffard & Muftic, 2006; Kaylen & Pridemore, 2013; Osgood & Chambers, 2000), the current study will examine the effects of social disorganization predictors on violent crime in nonmetropolitan areas of Kentucky. Moreover, this dissertation will be informed by the green criminology perspective (Lynch, 1990). While "there is no overarching green criminological theory," one of the topics frequently addressed by green criminologists refers to the effect of ecological and environmental justice on human behavior (Lynch, 2017, p. 450). Specifically, as previously noted, this study will determine to what extent exposure to environmental contaminants may influence the ecological distribution of violent crime in rural areas.

A decade ago, Narag, Pizarro, and Gibbs (2009) performed a thorough review of the literature on the lead-crime relationship and concluded that ecological-level studies documented an association between structural disadvantage, lead exposure, aggression,
and crime/delinquency. The authors argued that "lead may be a distal predictor of crime [that] can promote crime in various ways" and noted that "lead exposure may be related to community social disorganization and/or structural processes driven by powerful groups" (p. 967). Consequently, Narag and colleagues (2009) called for a theoretical integration of the ecological concentration of lead into social disorganization theory, stating that "high levels of lead exposure add an additional structural ill and obstacle for residents of disadvantaged communities, perhaps adding to higher levels of crime in these areas" (p. 965). In sum, using Narag et al.'s (2009) proposed integrative theoretical framework, the current study plans to determine if structural factors are theoretically linked to social disorganization at the community level and if exposure to environmental contaminants, such as lead, have a cumulative negative effect on interpersonal violence.

Social Disorganization Theory

Social disorganization theory (Shaw & McKay, 1942) is a macro-level theory that evolved from studies of urban crime and delinquency conducted by sociologists at the University of Chicago. The development of social disorganization theory was strongly influenced by the works of the Chicago school sociologists, such as Robert Park, Ernest Burgess, and Roderick McKenzie (1925), who were among the first scholars to document the interaction between larger institutions and larger social structures. In 1929, Shaw, Zorbaugh, McKay, and Cottrel (1929) conducted a study and identified a city area that was predisposed to higher levels of crime and delinquency. The 1929 study was expanded in the book written by Shaw and McKay and published in 1942. While the book made no formal mention of the term social disorganization, Shaw and McKay (1942) used spatial maps to show that rates of crime were not evenly dispersed across
Chicago. Instead, crime rates were concentrated in some regions of the city. These findings were explained using Burgess’ concentric zone theory, a theory of urban ecology that presented urban settlements as an ecological pattern of five concentric zones (i.e., the central business district; the zone in transition; the workingmen’s homes zone; residential zone; commuter zone) that spread from the city center to the edge of the city (Park et al., 1925).

The highest rates of delinquency and crime were found in an area adjacent to the commercial and business core of the city – the transition zone (Park et al., 1925). This area was characterized by high poverty levels, physical decay, poor housing, incomplete and broken families, high rates of illegitimate births, people in poor health, and unstable, ethnically heterogenous population. The high rates of deviance and lawlessness found in this area were interpreted by Shaw and McKay (1942) as the outcome of social disorganization or as “the normal response of normal people to abnormal social conditions” (Akers & Sellers, 2004, p.160).

Shaw and McKay’s (1942) analysis showed that delinquency and crime remained relatively high in some regions of the city, regardless of the racial makeup of that area. Because of this find, Shaw and McKay tried to identify the characteristics of the specific neighborhoods that experienced higher crime rates. Shaw and McKay (1942) argued that three structural factors accounted for variations in crime and delinquency in the city. These three factors were: low economic status, ethnic heterogeneity, and residential mobility (Sampson & Groves, 1989). These are also characteristics of socially disorganized neighborhoods. Crime is more likely to occur in these neighborhoods because these communities lack social cohesion and the ability to prevent and informally
control delinquency and crime (Kornhauser, 1978; Kubrin & Wo, 2016; Shaw & McKay, 1942). Conversely, socially organized neighborhoods have three characteristics: (1) solidarity, or an internal consensus on essential norms and values, (2) cohesion, or a strong bond among neighbors and (3) integration, with social interaction on a regular basis (Shaw & McKay, 1942). In sum, social disorganization can be defined as the inability of a community to realize its members' shared values and maintain adequate social controls (Shaw & McKay, 1942). Furthermore, "social disorganization exists in the first instance when the structure and culture of a community are incapable of implementing and expressing the value of its residents" (Kornhauser, 1978, p. 63).

Some of the earliest works in social disorganization were performed in nonmetropolitan Harlan County, Kentucky. Paul Frederick Cressey wrote in his 1949 article that people residing at the time in Harlan County, an Appalachian county of KY, resembled culturally the Boers5 from the South African east cape, who, in the late 1800s were essentially farmers (Cressey, 1949). Cressey (1949) found similarities between Appalachians and Boers in terms of societal organization. The Appalachians of Harlan County had many characteristics of a folk society, which is generally viewed as being morally, religiously, politically, and socially cohesive. The author also noted that societal arrangements in Harlan County lacked the stability and class stratification, which are generally found in typical peasant cultures (Cressey, 1949). This is a note of importance as this lack of stability was increased as the result of the rapid population boom brought on by the industrial revolution in the area, and stratification was introduced due to occupational transitioning.

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5 Boers were descendants of Dutch immigrants who settled in South Africa starting with the 17th century.
While Cressey (1949) contained no empirical testing, it did analyze the rapid expansion of Harlan county during the industrial revolution. Specifically, this ethnographic study presented the effects of the mining boom that occurred in that area. Cressey noted that, as more men moved into the county to work in the mines, crime rates, such as murder and assault increased (Cressey, 1949). The new mining jobs replaced the traditional, more stable agriculturally-based occupations, and these new mining jobs depended on the fluctuations of the national economy, which were out of the workers’ control. The development of coal mining coupled with the population increase destroyed the stabilized frontier culture of the area, and the most immediate consequence of this was the disruption of economic life in the area. Further, coal mining jobs had a set structure of power, whereas the traditional agriculturally based jobs were more equal in structure. Men in the area were now classified as either a boss or a laborer. This new power dynamic was foreign to the area and the mountain miner resented being ordered around by a foreman. The foremen were generally immigrants to the area, and as outsiders, they were received with hostility by locals, especially after foremen started to increase their control over miners and prevented the introduction of miner unions in the Harlan County area (Cressey, 1949).

The breaking down of the economic structure continued as people who had lived previously in stable primary groups were thrown together with many other individuals who had been uprooted from other parts of the country in the mining company sponsored coal camps. The mining camps were a condition of the miners’ employment. In these camps, the coal companies owned everything – from the store and the church to the school and any other facility and in some cases, even the currency (known as company
The camps were populated with locals and migrant workers and because of rapid population movements among mining camps social bonds to the community weakened. Competition and exploitation replaced the friendly and mutually supportive interpersonal relationships (Blevins, 2008; Cressy, 1949). Consequently, the community’s capacity to exercise informal social control over its residents decreased and crime increased, as subsequent writings on social disorganization explained (Sampson & Groves, 1989).

Moreover, these societal changes affected the family structure, the distribution of roles in the family, and the values of the family clan. The care and discipline of the children fell almost entirely on the mother and life in the coal camp villages completely transformed the mother’s role as well. Adult married females with children were no longer helpers on the farm and they were no longer in charge of winter preservation and storage of food because the coal companies replaced or eliminated many of the women’s domestic tasks. The children also had no farm chores or other duties. The rapid rise of the divorce rate at the time reflects the family disorganization. Between 1922 and 1932, one in four marriages registered in Harlan County ended in divorce, which was an 80% increase in divorce rate compared to the divorce rates recorded between 1901 and 1906 (Cressey, 1949). Further, these disruptions in family controls and community controls (informal social control) left miners with a feeling of restlessness. Alcoholism increased and so did firearm possession, which in turn lead to an increase in assault and murder cases in the area. Between 1920 and 1925, the average murder rate in Harlan County was 78 per 100,000 people, making it the highest rate for any county in the United States at the time, not counting murder cases that were reported to authorities (Cressey, 1949). It
should be noted that in 2016, there were no murders in Harlan County, KY and the Kentucky murder rate per 100,000 was 7.6 (U.S Department of Justice, 2016).

These social problems identified by Cressey illustrate several modern concepts of social disorganization such as informal social control, residential instability, economic disadvantage, social capital, and family disorganization. The social changes experienced by residents of Harlan County prior to WWII resemble those of immigrant groups that moved to America from stable farming societies in Europe. Thomas and Znaniecki argued that at the beginning of the last century, the decay of immigrants’ primary group organization, which used to confer a person a sense of security and responsibility, generated social unrest and demoralization among immigrant communities in the US (Thomas & Znaniecki, 1918).

Years later, Shaw and McKay (1942) used statistical information collected over several years to explore the causes of delinquency and crime in Chicago, a city that hosted a relatively large number of residents of immigrant origin. While in the 1930s and 1940s, ethnographic studies, such as Cressey’s (1949) work, provided useful details, they had a limited coverage and lacked the data variation that a macro-level study would require (Heitgerd & Bursik, 1987; Sampson & Groves, 1989). Using neighborhood-level data, Shaw and McKay’s (1942) were able to overcome these limitations and the social disorganization theory was born. However, due to the emergence of new criminological theories that became more popular in the years that followed Shaw and McKay’s work, “social disorganization theory languished” for more than three decades (Miller et al., 2015, p. 86).
Social disorganization theory (SDT) received renewed theoretical attention in the late 1970s and during the 1980s, through the works of Kornhauser (1978), Bursik (1984), Sampson and Groves (1989), and others who have reexamined the theory and addressed some of criticisms Shaw and McKay’s (1942) theory received. Sampson and Groves (1989) and Bursik (1984, 1988) noted the need to measure social disorganization directly if the theory is to be properly tested. However, a significant challenge of STD is that the social disorganization concept is difficult to measure. Equally difficult is to identify the social mechanisms that account for heightened crime rates in socially disorganized neighborhoods, or rather determine what mediates the effect of community characteristics on crime (Bursik, 1988; Byrne & Sampson, 1986; Kubrin & Weitzer, 2003; Kubrin & Wo, 2016).

Sampson and Groves (1989), for instance, showed (see Figure 1) how the original exogenous variables (poverty, ethnic heterogeneity, and residential instability) and two new additions (family disorganization and degree of urbanization) directly and indirectly influence variations in delinquency and crime at the community level. In Sampson and Groves’ (1989) adapted theoretical model, social disorganization mediates the effect of structural factors on crime and is measured through a set of indicators. These intervening variables are: the community’s ability to supervise and control teenage peer groups; a community’s local friendship networks; and, the community’s participation in local voluntary organizations. In summary, the basic social disorganization model states that neighborhood characteristics affect the residents’ social ties, which in turn will influence their capacity to informally control crime (Kubrin & Wo, 2016).
Since the 1980s, social disorganization theory has expanded even more, and new theoretical concepts have been added to the theory. In addition to poverty, residential instability, and ethnic heterogeneity, the new theoretical concepts include social capital, collective efficacy, social networks (Bursik & Grasmick, 1993; Coleman, 1988; Kornhauser, 1978; Putnam, 2000; Sampson & Groves, 1989; Sampson, Raudenbush, & Earls 1997; Shaw & McKay, 1942). Although during the eight decades that passed since Shaw and McKay (1942) have published their seminal work researchers have failed to operationalize social disorganization in a way that is universally accepted, the newer theoretical developments – collective efficacy, social capital, and social networks show promise in addressing what mediates crime in communities.

Because the theory was originally formulated to explain urban crime, the literature is limited regarding empirical tests of social disorganization in the...
nonmetropolitan settings. The literature referring to SDT tests conducted in Kentucky is even more limited. That is why in this section, the author also included research conducted in the Appalachian region, KY being one of the thirteen Appalachian states.

**Economic Disadvantage and Violent Crime**

As noted earlier, social disorganization theorists state that the ecological characteristics of a community may favor or impede the development of social ties that promote the ability to solve common problems, including delinquency and crime (Kornhauser, 1978; Kubrin & Wo, 2016; Sampson & Groves, 1989; Shaw & McKay, 1942). Among the community characteristics that negatively affect social cohesion are poverty, joblessness, or high unemployment rates, or extensive economic disadvantage. Although poor people are not more likely to commit delinquency and crime than better-off residents, when a community has few economic resources its ability to combat local crime decreases. Examples of such resources that are missing in disadvantaged neighborhoods would include access to grocery stores in close proximity (travel reduction), readily available social networks that help single-parent households, and public resources such as libraries, food pantries, and community resource centers (Kubrin & Wo, 2016). Poor neighborhoods receive low public investments and are more likely to have insufficient resources for the development of useful social programs. This means that economic disadvantage negatively affects social networking at the community level because it impedes the ability of community members to socialize (Weyers et al., 2008). Further, some studies have found that economic disadvantage has led to less crime reporting in the neighborhood (Goudriaan et al., 2006).
The literature consistently showed that economic disadvantage is significantly and positively associated with crime, violent crime included. A meta-analysis of studies (N = 214 studies) that provided empirical tests of social disorganization theory showed that the socioeconomic status variable had a mean effect size score of .097, which ranked it among the bottom predictors of crime. However, the authors noted that poverty had a mean effect size (.234) more than twice higher that socioeconomic status did.

Nonetheless, research examining the effect of poverty/economic disadvantage on violent crime showed mixed findings. Pridemore (2002) reported that the relationship between poverty and homicide is one of the most consistent positive and significant findings in the literature. These findings were reported across time periods, levels of analysis, various measures of poverty, cross-section and longitudinal studies, and model and relation specifications. Economic disadvantage tends to be associated with assault, bias crime, gang homicide, homicide, juvenile delinquency, motor vehicle theft, property crime, rape, robbery, and vandalism. Yet, Sampson and Groves (1989) found that socioeconomic status was not statistically related to violence or victimization, and Kubrin and Herting (2003) found that economic disadvantage was not consistently significantly associated with domestic homicides.

Studies examining the effect of poverty/economic disadvantage in rural/non-metropolitan areas produced inconsistent findings as well. Economic disadvantage is commonplace in the nonmetropolitan settings because poverty levels and unemployment rates are significantly higher, and income levels are lower than in metropolitan communities (Albrecht et al., 2000; Albrecht et al., 2005). There are four regions of nonmetro economic disadvantage in the United States; these include Appalachia, the
Deep South, the southwest, and the Native American reservations in the west (Albrecht et al., 2005). As noted earlier, only a limited number of studies examined the effect of poverty on crime in non-metropolitan areas. While Osgood and Chambers (2000) found that economic disadvantage and delinquency rates had no meaningful relationship with crime, Goodson and Bouffard (2017) found support for the theoretical predictions. These authors found that poverty had varying impacts on violent crime in different settings; poverty predicted assault by family or intimate partner in metro areas and also predicted assault by an acquaintance in nonmetro areas. Moore and Sween (2015) found that among all the effects analyzed, poverty was the only significant predictor of violent crime. Lee et al. (2003) contended that socioeconomic disadvantage had a significant impact on homicide rates outside the metropolis. However, spatial concentrations of poverty did not have a significant effect on violent crimes. Moreover, poverty, low socioeconomic status, and income inequality have not produced a significant effect on crime rates in several other studies that focused on rural areas (Lanier & Huff-Corzine, 2006; Petee & Kowlaski, 1993; Wells & Weisheit, 2004, 2012). However, none of the studies that found no significant effects of socioeconomic disadvantage on crime explored the indirect effect of poverty on violence via a mediator, such as social capital or collective efficacy, as social disorganization theory would imply.

Regarding macro-level research on violent crime in areas, such as the Appalachian region, which included Kentucky counties among the units of analysis, findings generally indicate a positive a significant association between poverty and violent crime. As previously noted, the Appalachian region is a predominantly rural area and thirteen U. S. states include Appalachian counties. The region is politically defined
since the mid-1960s by the Appalachian Regional Commission (ARC) and is characterized among others, by high levels of socio-economic disadvantage. Rather than having poverty concentrated in racially minority areas, Appalachian areas tend to have their poverty rooted in the decline of heavy manufacturing, the mechanization of coal mining, and the reduction of coal use (Albrecht et al., 2005). This description seemingly echoes Cressy’s (1949) assessments made more than seventy years ago.

In an analysis focusing on predictors of argument-related homicides in Appalachia, Andreescu, Shutt, and Vito (2011) found that white male homicide rates were consistently and positively related to economic disadvantage in the entire sample of southern Appalachia, which includes Kentucky. In a prior study, Andreescu (2000) found that an index of economic deprivation was significantly and positively associated with homicide rates in the entire Appalachian region when the analysis included only non-metropolitan counties (N = 719 out of 1,101 counties). Among the thirteen states included in the county-level analysis, Kentucky was the only state in which murder rates were significantly higher in Appalachia (Eastern KY area) than in non-Appalachia (Andreescu, 2000). Melde, who used a sample consisting of 236 Appalachian counties, including Kentucky counties, also found a positive relationship between percent families below poverty and violent crime. In fact, the study showed that a higher incidence of families below the poverty level was significantly related to three of the five violent crimes that were examined in the study (Melde, 2006).

**Residential Instability and Violent Crime**

*Residential instability* is defined as population turnover in an area. In their meta-analysis, Pratt and Cullen (2005) found that residential instability had a mean effect size
of .102, which ranked it toward the middle of the predictors of crime. The authors marked the variable as a moderate predictor of crime that was moderately stable. Bursik argues that residential instability contributes to the social disorganization of the community because the rapid rates of population turnover often lead to a greater proportion of strangers in the neighborhood. These strangers are less likely to intervene when a crime occurs or otherwise help prevent crime in the neighborhood (Bursik, 1988).

Most of the studies that empirically tested Social Disorganization Theory used cities as units of analysis. These studies had specifically discussed the effect of residential stability on variations in delinquency and crime. Most of these studies consistently found that residential instability predicted increases in crime (Browning, 2009; Bursik, 1986; Grattet, 2009; Heitgerd & Bursik, 1987; Kubrin & Herting, 2003; Martinez et al., 2008; Morenoff & Sampson, 1997; Nielsen et al., 2005; Oh, 2005; Pizarro & McGloin, 2006; Sampson et al., 1999; Simcha-Fagan & Schwartz, 1986; Taylor, 1997; Triplett et al., 2005; Warner, 2003; Warner & Pierce 1993).

Among studies that tested social disorganization theory using rural counties as units of analysis (Bouffard & Muftic, 2006; Melde, 2006; Osgood & Chambers, 2000; Petee et al., 1994; Reisig & Cancino, 2004; Ward et al., 2018; Wells & Weisheit, 2004, Wells & Weisheit, 2012) or a mixture of urban and rural communities (Vowell & Howell, 1998), several have found positive and significant relationships between residential instability and crime. For instance, Osgood and Chambers (2000) found a positive relationship between residential instability and rape, aggravated assault, weapons violations, and simple assault. While there was no test of violent crime, Petee et al. (1994) found a positive association between residential instability and property crime.
Similarly, Bouffard & Muftic (2006) found a positive association between residential instability and violent crime. Other studies also identified a positive relationship between population instability and crime rates in rural areas (Jobes, 1999; Wells & Weisheit, 2004). Residential instability was also found to be a significant predictor of variations in crimes such as murder, rape, assault, and weapon violations offenses (Moore & Sween, 2015).

Andreeescu (2000) however, did not find that a decennial population change significantly affected variations in murder rates in the rural areas of the states that contain Appalachian counties. Similarly, Melde (2006) reported a nonsignificant relationship between residential instability and violent crime in Appalachian areas. Conversely, Andreeescu et al. (2011) found a significant positive relationship between residential instability and argument-related homicide rates across Appalachian counties. Wells and Weisheit (2004) used a broad sample of varied rural counties that included Kentucky and found that crime and residential instability were positively related. Even if the studies included in this review are few, findings are inconsistent, suggesting that more research needs to be performed in non-urban settings. Nonetheless, residential instability is an important explanatory variable of crime in rural areas because it may affect the community’s ability to exercise informal social control. The relocation of new community members into rural communities as well as population turnover may diminish the citizens’ capacity to prevent and control crime because lasting interpersonal relationships are less frequent (Freudenberg, 1986; Ward et al., 2018).
Ethnic Heterogeneity and Violent Crime

*Ethnic heterogeneity* or ethnic diversity is another important concept of social disorganization theory (Shaw & McKay, 1942). Social disorganization theory argues that when people in a community belong to diverse ethnic groups a unified value system is less likely to occur. As a result, the social institutions’ ability to establish and maintain social control would be undermined and social cohesion would be weakened. According to Bursik (2004), ethnic heterogeneity is thought to be associated with increases in crime only if the heterogeneous group of people in the neighborhood cannot reach a consensus on the appropriate rules and values for the community to abide by.

Ethnic heterogeneity has been measured by various means. The measures that have been used in the literature include percentage nonwhite, percent Black, percentage foreign-born, number of residents who immigrated within the past ten years, and/or the index of diversity (i.e., the probability that any two residents, chosen at random, would be of different ethnicities) (Melde, 2006; Osgood & Chambers, 2000). In their meta-analysis, Pratt and Cullen (2005) found the average effect size of ethnic heterogeneity to be .218, which is a relatively large effect size. The authors stated that ethnic heterogeneity had moderate strength and moderate stability. Pratt and Cullen (2005) also found that percent nonwhite was a stronger predictor of crime than other measures of ethnic heterogeneity (i.e., mean effect size = .235). Similarly, percent black had a mean effect size of .209 and was also a highly stable and robust predictor of crime.

Although research generally suggests that communities that undergo major shifts from one ethnicity to another appear to be more criminogenic (Welch, 2012), the direction of the relationship is often inconsistent and changes with variations in the type
of crime it must explain. For instance, increases in ethnic heterogeneity explained mugging and street robberies (Sampson & Groves, 1989). Robbery, assault, and burglary were also found to be related to ethnic heterogeneity by Warner and Pierce (1993). Mares (2010) also found that gang homicide was strongly related to ethnic heterogeneity. Further, White and Quick (2019) found that ethnic heterogeneity had a positive and significant relationship with either animal abuse or domestic violence in an analysis done by city block. Yet, Goodson and Bouffard (2019) did not find ethnic heterogeneity to be significantly related to forcible rape.

Ethnic heterogeneity has been a staple of social disorganization models. However, that does not seem to be the case when testing social disorganization theory in nonmetropolitan settings (Ward et al., 2018). Moreover, noting that rural communities are generally homogenous, as they are primarily white, Bouffard and Muftic (2006) contended that ethnic heterogeneity does little to explain crime rates in those communities. The authors did not find ethnic heterogeneity and violent crime to be significantly related. Yet, Petee et al. (1994) found racial heterogeneity to be positively associated with violent crime and property crime in rural areas. Moore and Sween (2015) found that ethnic heterogeneity impacted variations in all violent crimes tested, which were murder, rape, assault, simple assault, weapons charges, and robbery. Similarly, Lanier and Huff-Corzine (2006) found that ethnic heterogeneity and homicide were significantly and positively related and Petee & Kowalski (1993) identified a positive and significant relationship between ethnic heterogeneity and violent crime.

Furthermore, Ward and colleagues (2018) found that percent population black had the strongest impact on crime in rural areas, when compared to any other social
disorganization concept tested. Osgood and Chambers (2000) also found that an increase in percentage black contributed to an increase in crime rates in the non-metropolitan area under study. Andreescu (2000) also found a significant non-linear effect when examining variations in percent Black at the county level and homicide rates in non-metropolitan areas. The author’s findings show that while homicide rates tend to increase with an increase in the proportion of Black residents, murder rates decrease significantly in counties that had higher proportions of African American residents (i.e., 39% and higher).

Few papers have tested ethnic heterogeneity in nonmetropolitan Kentucky. When ethnic heterogeneity was included among predictors, studies were based on aggregated county-level data that included nonmetropolitan Kentucky areas. Melde (2006) reported that there was no relationship between ethnic heterogeneity and violent crimes in rural Appalachia. In contrast to Melde’s (2006) finding, Wells and Weisheit (2004) found that racial diversity did not impact property crime but had a positive and significant effect on violent crime.

**Family Disorganization and Violent Crime**

Samson and Groves (1989) used family disruption as a measure of social disorganization, and since then, *family disorganization* has appeared in a large section of the literature. Family disorganization is generally measured as the percentage of female-headed households. Other measures include the percentage of divorced women, the percentage of children under 18 not living with both parents, the proportion of separated and divorced adults, and the percentage of single-parent households. A scale was also developed to measure the family disorganization concept, and it is called the *Area Family*
Disorganization. This scale consisted of percentage married, male separation rate, divorce rate, and percentage of children in two-parent families (Simcha-Fagan & Schwartz, 1986). Pratt and Cullen (2005) found that family disorganization has a relatively high mean effect size at .152 with high strength and high stability in predicting crime.

Family disorganization exhibits one of the strongest correlations and consistently positive relationships with crime across all studies (Land et al., 1990; Pizarro & McGloin, 2006; Pridemore, 2002). Based on research findings, the higher the level of family disruption in a geographic area, the greater the odds of association with criminal activity such as violent offenses (Osgood and Chambers, 2000), as well as personal violence and total victimization (Sampson and Groves, 1989).

Tests of social disorganization theory in nonmetropolitan settings frequently found higher levels of crime in areas with higher levels of family disruption. Kaylen and Pridemore (2011) found that while most concepts of social disorganization did not have significant effects on delinquency, percent female-only households, was positively and significantly related to delinquency. Further, Moore and Sween (2015) found that family disorganization was significantly and positively related to violent crimes, such as robbery, assault, weapons charges, and simple assault among youth in rural areas. However, family disorganization had no significant impact on murder or rape. In a study that utilized U.S. counties that had at least 1% Native American populations, it was found that family disruption had a significant and positive effect on homicide (Lanier & Huff-Corzine, 2006).
In general, higher levels of family disruption, which are commonly indexed by the proportion of female-headed households, are strongly and consistently associated with violent crime in the nonmetropolitan setting (Osgood & Chambers, 2000, 2003). In the Appalachian region of the United States, which includes nonmetropolitan Kentucky counties, family stability is probably a stronger indicator of social stability than in other U.S. regions (Andreescu et al., 2011). While Andreescu and colleagues (2011) found no significant relationship between family stability and homicide rates, the authors noted that family disorganization appeared to mediate the relationship between poverty and crime, as it was found that both northern and southern regions of Appalachia had higher argument-related homicide rates when the communities were impoverished. Further, areas with higher levels of economic disadvantage were characterized by weak family ties (Andreescu et al., 2011). Also, Wells and Weisheit (2004) found that family disruption predicted violent crime in a sample that included nonmetropolitan Kentucky counties. In a prior study, Andreescu (2000) found that homicide rates were significantly higher in areas of Appalachia that had a higher percentage of female-headed households. The author also found a regional differential effect of family disorganization on homicide rates.

**Social Capital and Violent Crime**

*Social capital is defined as "the investment in social relations with expected returns" (Lin, 1999, p. 30, cited in Kubrin & Wo, 2016). Putnam (1995, 2000) defined social capital as a multidimensional concept reflected by two general forms: trust and social participation. Much of our knowledge of social capital originates from our understanding of small groups, such as families and religious ties (Castle, 2002; Cancino,
The concept of social capital has been operationalized as political participation, civic participation, religious participation, workplace connections, informal social ties, philanthropy, altruism, and volunteering (Kubrin & Wo, 2016). Social disorganization theory presumes that certain local organizations, such as churches, youth groups, charities, civic associations, and political groups can enhance neighborhood informal social control because they facilitate the sharing of common values and goals among residents. Consequently, these social and civic organizations disseminate information and may mobilize resources and utilize social networks to combat crime (Kubrin & Wo, 2016, p. 128).

Therefore, social capital is a component of a socially organized neighborhood. Putnam (2000) indicated that there are two types of social capital - bonding social capital and bridging social capital. Bonding social capital consists of network structures in which connections are primarily or entirely among members of the same group while bridging social capital consists of network structures in which connections crosscut members of different groups (Beyerlein & Hipp, 2005; Putnam, 2000). While social capital is generally regarded as a positive characteristic of a community, not all social networks mobilize for the common good. For instance, groups such as the Ku Klux Klan utilize social networks to do antisocial things. Further, in urban areas (and arguably nonmetropolitan areas), gangs may utilize social networks to conduct antisocial actions (Putnam, 2000).

While the literature that examined the effect of social capital on crime rates is sparse, there are a few studies that should be mentioned here. Wells and Weisheit (2012) used a sample of counties that were classified into four categories (i.e., metropolitan
counties: n = 778; nonmetropolitan counties with a city that had at least 20,000 people: n = 290; nonmetropolitan counties that had a city populated with at least 2,500 people but no more than 20,000 people: n = 1,281; and, nonmetropolitan counties that had no cities or other urban designated places that had more 2,500 people: n = 779) and found that civic engagement, as a measure of social capital, failed to consistently predict violent crime rates in metropolitan areas; however, it was a crime deterrent in nonmetropolitan areas.

An example of civic engagement showing a significant negative impact on violent crime in the nonmetropolitan setting is shown in the work of Putnam (2000). Putnam (2000) constructed a state-level analysis of archival and survey data, which revealed both trust and social participation to be negatively associated with crime (Kubrin & Wo, 2016). Another study developed an index that included religious organizations, civic associations, sports leagues, hobby, and special interest groups. This index was developed for a study of U.S. rural counties and found that counties that had higher levels of civic engagement had lower levels of crime (Lee, 2008). Deller and Deller (2010) obtained mixed results but concluded that higher levels of social capital reduced violent crime in rural areas. However, they state later in the paper that social capital should be clearly defined because it can contribute to increases in crime when it includes criminal networks as opposed to prosocial groups (Deller & Deller, 2010).

**Exposure to Environmental Contaminants and Violence**

As noted earlier, this study will examine the effect on violence of an additional structural ill – exposure to lead. Although the "lead's neurotoxic properties have been documented for decades, and studies on lead poisoning were published in medical journals as early as 1904" (Barrett, 2017, p. 205), only in the past twenty years social
scientists started to pay increased attention to the detrimental effects of lead contamination and conducted systematic research meant to explore the lead-crime link. A brief review of the literature is presented below.

**Individual-level studies: Lead contamination effects on cognitive functioning and behavioral outcomes**

Based on a detailed review of a multitude of individual-level studies that examined the effects of lead exposure on mental and cognitive functioning, Nagard and his colleagues concluded that research conducted in the United States and in other countries consistently found a positive relationship between exposure to lead and mental and cognitive deficits. In general, these studies have also suggested that lead levels interact with the social environment. For instance, children from families with a lower socioeconomic status were more vulnerable to the effects of lead than children who grew up in better-off families (Nagard et al., 2009).

Lead contamination is especially harmful to children (Sampson & Winter, 2018) and may cause irreversible brain damage, which may impact both social and behavioral development, as well as one's ability to control impulsive behaviors, which can lead to delinquency and crime (Banks, Ferretti & Shucard, 1997; Lidsky & Schneider, 2000; Needleman et al., 1992). Numerous studies have also shown the effect of lead on externalizing behaviors (i.e., hyperactivity, inattentiveness, restlessness), conduct disorders, and aggression (Nagard et al., 2009, p. 958). In general, there is a consensus among researchers that higher levels of lead in the bloodstream are associated with decreased cognitive functioning, which may cause problem behavior (Burns et al. 1999; Sampson & Winter, 2018; Reuben et al., 2017; Marcus et al., 2010; Lanphear et al., 2000;
Martin et al., 2015). Research conducted in the United States and elsewhere generally indicates that this might be the case.

Olympio and colleagues, for instance, reviewed the results presented in various medical journals and concluded that neurotoxicity caused by low levels of lead triggered aggressive behavior in children (Olympio et al., 2009). Additional research focusing on Brazilian adolescents also documented a positive relationship between lead levels in surface dental enamel and antisocial behavior (Olympio et al., 2010). Based on the results of their longitudinal study, Fergusson, Boden, and Horwood (2008) also found that an increase in dentine lead levels in childhood predicted criminal behavior in late adolescence. A case-control study that compared bone lead levels of a group of adjudicated delinquents with the level of lead in a control group of non-delinquent adolescents concluded that after controlling for covariates such as race, parent education and occupation, presence of two parental figures in the home, number of children in the home, and neighborhood crime rate, adjudicated delinquents were four times more likely to have higher bone lead concentrations (e.g., >25 ppm) than controls (Needleman et al., 2002). The positive relationship between exposure to lead in early childhood and juvenile delinquency has been documented by other studies as well (see Dietrich et al., 2001).

Marcus, Fulton, and Clarke (2010) conducted a meta-analysis based on the results of 19 studies that used samples of children and adolescents and examined the association between exposure to lead and behavioral problems. Studies included in the analysis were conducted between 1983 and 1999 and used hair element analysis or assessed lead exposure using, blood, tooth, or bone lead levels. All these studies found a significant positive association between lead levels and conduct problems, and the average
correlation coefficient across these studies indicated a medium-size effect ($r = .19$). Although no significant gender or age effects were identified, results also showed significant negative relationships between lead contamination and I.Q. The authors contended that it would take 1,206 studies with null effects to conclude that lead had no negative influence on behavioral outcomes. A recent longitudinal study conducted by Sampson and Winter (2018) also "presented new evidence of a consistent link between childhood lead exposure and antisocial behavior in both childhood and later adolescence, with an estimated magnitude of effect greater than many standard predictors in criminology" (p. 292).

Nonetheless, even if most studies that examined the effect of lead contamination on behavioral outcomes found that an increase in lead levels is generally associated with conduct problems and/or aggressive/violent behavior, exceptions do exist. The results of a longitudinal study that featured a birth cohort of 1,000 children from New Zealand, indicated that low socioeconomic status had no significant association with lead exposure, and lead exposure had no impact on crime but predicted negative health outcomes (Beckley et al., 2017).

**Aggregate-level studies: Lead contamination/exposure effects on delinquency and crime**

As Nagard, Pizarro, and Gibbs (2009, p. 960) noted, research findings revealing an individual-level association between lead exposure, delinquency, and crime prompted social scientists to examine the association between lead and crime rates using ecological units of analysis. With few exceptions, most of these studies documented a positive relationship between lead contamination at the area level and crime. Masters, Hone, and
Doshi (1998), for instance, found that county lead levels were positively related to violent and property crime rates even after controlling for social disorganization predictors of crime, such as income, population density, and ethnic composition. Similarly, Stretesky and Lynch (2001) found that an increase in air lead levels predicted an increase in county-level homicide rates. In a subsequent analysis, Stretesky and Lynch (2004) found that the relationship between air lead levels and violent and property crime rates was stronger in counties characterized by economic deprivation. Based on additional research findings, Lynch (2004, p. 114) contended that "the ecology of lead (and crime) is explicable with reference to the influence of race and class structures in America" (i.e., communities with elevated lead levels have higher percentages of ethnic minorities and low-income families).

In a more recent analysis, Barrett (2017) explored the relationship between exposure to lead and youth violence, using 77 community areas in Chicago as units of analysis. When controlling for structural indicators, such as concentrated disadvantage, residential mobility, racial/ethnic heterogeneity, and family disruption, the author found that youth violence rates increased significantly with an increase in the percentage of children with elevated blood lead levels. The author also found that Chicago areas characterized by economic disadvantage, a higher percentage of divorced individuals, and higher levels of residential instability were more likely to have a higher percentage of children with higher lead blood levels. Ethnically diverse areas, however, had a lower proportion of children that experienced lead contamination.

Nevin's (2007) trend analysis that used data from nine countries, including the United States, also showed a very strong association between a lagged measure of
preschool blood lead and subsequent crime rate trends over several decades. According to Nevin (2007), "the hypothesis that murder rates are especially affected by severe lead poisoning is consistent with international and racial contrasts and a cross-sectional analysis of average 1985–1994 USA city murder rates" (p. 333). The author argued that a decrease in childhood exposure to lead might be partially responsible for the decline in violent crime registered in the United States since the 1990s.

Sampson and Winter (2018) performed an 18 year follow up on a birth cohort in Chicago, and they found a link between blood lead levels and antisocial behavior, specifically children around the age of 3 exhibited more antisocial behavior once they became age 17 if they were exposed to more lead at age 3. Further, they found that as blood lead levels increases, so did antisocial behavior intensity.

Martin and Wolfe (2020) used Boston, Massachusetts as the setting for their study where they involved 167 census tracts. This study used concentrated disadvantage as a measure, which they constructed using six variables: percentage population black, percentage of population under age 18, percentage of population that are unemployed, percentage of female-headed households, percentage of households receiving public assistance, and the percentage of families living below the poverty line. The researchers found that as concentrated disadvantage increases, so did elevated blood lead levels and violent crime.

Yet, not all macro-level studies documented significant positive relationships between lead exposure and crime. Using census tracts as the unit of analysis, Lersch and Hart (2014) examined the relationship between the spatial distribution of manufacturing industries that release lead and lead compounds, community characteristics, and levels of
violent and property crime in Hillsborough County, Florida. The authors used the Toxic Release Inventory (TRI) to estimate the toxic chemicals released into the air and found that higher levels of toxicity were concentrated in areas that had higher proportions of residents belonging to ethnic minority groups and higher proportions of people with lower educational attainment. However, the level of environmental pollution did not predict variations in violent or property crime.

When analyzing 1973-2012 crime trends in U.S. comparatively based on UCR and NCVS data, Lauritsen, Rezet, and Heimer (2016, p. 348) found a strong relationship between the level of serious violence as measured in the UCR and a lagged measure of gasoline lead exposure. However, the authors did not find a similar significant relationship between lead exposure and homicide, or between lead exposure and any of the NCVS violence measures and concluded that the association lead – crime was an artifact caused by reliance on UCR data.

The studies in this section are all findings regarding the relationship between lead and crime in the metropolitan setting, while it will not translate directly over to a nonmetropolitan setting, it is evidence that there is an empirical link between lead content and criminality. This sets the stage for the more limited literature that demonstrates the link between lead and crime in the nonmetropolitan setting, and for the current study.

**Current study**

Informed by the social disorganization theory, the present research will contribute to the literature that assessed the applicability of the social disorganization theoretical tenets to non-urban environments. Different from most studies that examined the social disorganization correlates of crime in rural settings, the current study will also consider
the most recent developments of the theory (Bursik, 2004; Kubrin & Wo, 2016, Osgood & Chambers, 2000) and will assess the mediating effect of family disorganization and social capital on violent crime in nonmetropolitan counties. Furthermore, in response to Sampson and Winter's (2018, p. 294) "call for increased attention to lead exposure specifically, as well as to toxic inequality more generally, in the field of criminology," the study will use Nagard, Pizarro, and Gibbs's (2009) integrative theoretical framework, and will also estimate the effect of environmental hazards (lead contamination) on violent crime, when controlling for social disorganization predictors. The study will also examine the impact on violent crime of gun laws violations and alcohol and illegal-drug use. Specifically, DUI arrests rates, drug arrest rates, and arrest rates for weapons violations will be used as additional mediating variables.

The relationship between illegal drug use and violence has been examined by a multitude of studies. Goldstein (1985) noted that three types of violence could occur due to illicit drug use, which links drug use to violent crime. Goldstein mentioned three types of violence that occurred as a result of illicit drug use: psychopharmacological violence, systemic violence and economic compulsive violence. Empirical research (e.g., Boles & Miotto, 2003) showed support for Goldstein’s (1985) assertions. Moreover, several studies found that cocaine use was a significant predictor of domestic violence in general (Bennett, 1995) and intimate partner violence (IPV), in particular (Kantor & Straus, 1990; Stalans & Ritchie, 2008). A review of the literature conducted by Boles and Miotto (2003) showed that cocaine and heroin were the strongest predictors of IPV among all tested illicit substances, including alcohol.
More recent literature review shows similar results (Gilbert, et al., 2012; Orsi et al., 2018). In a meta-analysis of 285 studies, Cafferky, Mendez, Anderson, and Stith (2018) found that alcohol use and drug use were significantly related to IPV perpetration. When effect sizes were compared, drug use had a stronger positive effect on IPV than alcohol abuse did. Prior studies based on samples of Appalachian residents found a positive association between opiate usage and violent victimization and violence perpetration. (Pallatino et al., 2018; Shannon et al., 2016; Victor, 2019) as well.

Macro-level studies that included metro and nonmetropolitan areas also documented a positive relationship between illegal drug usage and violence. For instance, Stults and Baumer (2008) found that homicide rate was positively and significantly related to drug-related crime rate ($r = .496$), and drug mortality rate ($r = .290$). Degenhardt et al.’s (2005) macro-level study also documented a positive and significant relationship between violent crime and arrests for cocaine use and possession. Similarly, a study based on city-level data found a positive and significant relationship between drug abuse and violent crime (Valdez et al., 2007). Lee and Bartkowski (2004) also found that arrests for cocaine and opiates are related to violent crime. Yet, while drug arrest rates had a significant and positive relationship with juvenile homicide rates in urban areas, this was no longer the case in rural areas. In nonmetropolitan areas, the level of civil engagement tended to lower crime rates (Lee & Bartkowski, 2004).

The positive relationship between alcohol abuse and violence has been documented by research as well (Bennett, 1995; Boles & Miotto, 2003). Much like cocaine and heroin abuse, alcohol abuse is related to IPV (Bennett. 1995; Boles & Miotto, 2003; Gilbert et al., 2018; Stalans & Ritchie, 2008). Studies also showed that
alcohol consumption was a significant risk factor for violence perpetration and violence victimization (Abbey, 2011; Chermack & Giancola, 1997; Leonard, 2008; Lipsey et al., 1997; Roizen, 1997). Research also documented a link between excessive alcohol use and violent crimes, such as homicide, assault, robbery, and/or domestic violence (Bye, 2007; Gordis, 1993; Liu et al., 2013). Furthermore, some studies found that alcohol consumption mediates the effects of other predictors on violent crime (Zhang, et al., 1997) or juvenile delinquency (Barnes, et al., 2005).

A macro-level time series analysis that examined alcohol sales and violent crime convictions registered between 1880 and 2003, showed that as alcohol sales increased, so did the amount of violent crime convictions (Bye, 2007). Bye (2007) also found that alcohol and divorce rates were significantly related to violent acts. Similarly, Roberts (2009) found that the level of alcohol sales in an area was a reliable predictor of intimate partner homicide.

Research also found a higher incidence of violent crimes when illegal use of firearms was detected (Boles & Miotto, 2003; Roberts, 2009; Wintemute, 2015). Additionally, a systematic review recently conducted by Santaella-Tenorio, Cerda, Villaveces, and Galea (2016) concluded that with an increase in gun-control laws at the state level, violent crime rates, especially intimate partner homicides, decreased significantly. Furthermore, Wyant, Taylor, Ratcliffe and Wood (2012) found that with an increase in arrests for firearm violations the likelihood of another shooting occurring later decreased significantly. Thus, firearm violation arrests had a significant violence deterring effect.
Research also examined the relationship between gun activity in a community and the rates of violence in an area. Wintemute (2015) reported that firearm-related deaths and injuries were not deemed a public health problem until late in the twentieth century. In 1989, the American Medical Association declared gun violence a “critical public health issue” (p. 6). Data show that gun violence spiked in the mid-1970s, slightly increased in the early 1990s, continued to decrease until 1999, and has remained stable since (Wintemute, 2015). While in the 1980s, 60% of all murder victims were killed with a firearm, guns were involved in 69.6% of all homicides and 50.9% of suicides recorded during the past decade (Wintemute, 2015).

Furthermore, firearm violence is among the leading causes of death for teenagers and young adults. Firearm homicide alone, and by extension firearm violence, was the leading cause of death for Black men ages 15–34 in 2012. Among White and Hispanic men ages 15–34, firearm violence ranked second after unintentional injuries. Firearm violence ranked second as a cause of death among Black women ages 15–24 (Wintemute, 2015).

In a county-level analysis, Roberts (2009) found that firearm ownership and the extent of gun-control laws were reliable predictors of intimate partner homicide. There is a strong gun culture in the rural communities of Appalachia (Lynch & Jackson, 2018). Although Lynch and Jackson (2018) recently noted that in rural Appalachia “people [would] bury their guns before they [would] surrender them” (p. 315), the authors’ research findings indicate that restricting gun access reduced intimate partner violence in rural Kentucky. Furthermore, Lynch and Jackson (2018) observed that even if gun ownership is strongly supported by Appalachians, the study participants were also
supportive of gun control laws and legislation that would restrict access to firearms for perpetrators of domestic violence.

In accordance with the theoretical predictions and the most common empirical findings, the following hypotheses have been formulated:

**Hypothesis 1:** As stated by the social disorganization theory, a positive relationship between poverty and violent crime is anticipated. Although Shaw and McKay (1942) did not contend that poverty is conducive to delinquency and crime, they argued that concentrated disadvantage will be associated with higher levels of social disorganization, which in turn, will contribute to increased crime levels. In this analysis, poverty is expected to negatively affect family stability as well as civic engagement at the community level.

**Hypothesis 2:** Higher residential instability is expected to predict higher levels of violent crime. When the population of an area is constantly changing, there is less opportunity for residents to develop personal ties to one another and community organizations (Bursik, 1988 in Osgood & Chambers, 2000). In addition to a negative impact on social capital, residential instability is expected to negatively influence family stability.

**Hypothesis 3:** According to the social disorganization theory, ethnic heterogeneity and crime will be positively related. Shaw and McKay (1942) argued that ethnic diversity will negatively affect interpersonal communication because differences in customs and a lack of shared experience may breed fear and mistrust, even when groups share conventional values that discourage delinquency and crime (Sampson & Groves, 1989). Kentucky is a state characterized by a relatively low level of ethnic heterogeneity, and ethnic diversity is even lower across nonmetropolitan counties. In 1990, for instance, non-Hispanic
whites represented 92% of the population (Gibson & Jung, 2002). Census estimates for 2015 indicate that the ethnic composition of the state's population did not change much 25 years later when 88% of the residents did not belong to ethnic minority groups. Since for many decades the main ethnic groups in KY were non-Hispanic whites and African Americans (7% in 1990; 8% in 2015), in this study, ethnic diversity is measured as the proportion of blacks at the county level. Considering the fact that during the past decades, Kentucky witnessed a slight increase in the foreign-born population from 0.9% in 1990 to 3.8% in 2018 (Migration Policy Institute, ND), the proportion of first-generation immigrants will be used as an additional measure of ethnic heterogeneity. It is hypothesized that higher levels of violent crime will be found in areas with higher levels of ethnic diversity.

**Hypothesis 4:** Violent crime rates will be higher in nonmetropolitan communities with higher levels of lead-contaminated water and in counties with a larger proportion of housing units built before 1960. According to the Environmental Protection Agency (2016), the likelihood of being exposed to lead-based paint hazards is significantly higher in older houses.

**Hypothesis 5:** It is expected that rates of violent crime will be positively related to family disruption. Sampson (1985) and Sampson and Groves (1989) added family disorganization (population divorced and/or single-parent households) to Shaw and McKay's list of structural indicators of social disorganization. This inclusion of the concept among SDT predictors stems from the thought that single parents cannot supervise their children as effectively as dual parents do. As a result, more delinquency and crime will occur in areas with higher levels of family disruption.
**Hypothesis 6:** Religious participation, as a measure of social capital, is expected to be negatively related to violent crime rates. In Putnam's (1995, 2000) view, social capital is a multidimensional concept, reflecting social trust and social participation. Frequent measures of social capital refer to political participation, civic participation, religious participation, workplace connections, informal social ties, philanthropy, altruism, and volunteering. Consistent with social disorganization theory, civically active communities should have a greater ability to solve and prevent crime, all other factors being equal (Kubrin & Wo, 2016, p. 127).

**Hypothesis 7:** Violent crime rates and DUI arrests rates will be positively related.

**Hypothesis 8:** Violent crime rates will be higher in communities with higher arrest rates for cocaine and opium use.

![Figure 2. Hypothesized relationships](image-url)
As previously noted, the current study plans to determine if in addition to known macro-level predictors of crime, environmental injustice (e.g., higher exposure to environmental hazards/pollutants) may also impact the social organization of rural communities and their ability to informally control unruly behavior, including violent crime. The study utilizes theoretically relevant predictors of violent crime derived from community characteristics, which are commonly used in empirical tests of the social disorganization theory. This chapter will present the data sources, the operationalization of concepts and variables, and the methods of analysis that will be used to determine which factors are more likely to influence variations in the 2012-2016 violent crime rates among nonmetropolitan counties in Kentucky.

Data Sources and Sampling Procedures

The unit of analysis is the county. Following prior research that examined the application of the social disorganization theory to rural settings using nonmetropolitan counties as the unit of analysis (Barnett & Mencken, 2002; Lee et al., 2003; Osgood & Chambers, 2000), the selected sample includes nonmetropolitan counties in KY (N=85),
as a proxy of rural areas. However, the author is aware that even if “nonmetropolitan is often used synonymously with rural, while there is overlap, these geographic entities are not identical” (Radcliffe et al., 2016, p. 4). The analysis will be based on pooled cross-sectional data that will use four years of violent crime rates (i.e., 2012, 2013, 2014, and 2016), while other variables report socio-economic indicators at one point in time or averaged for the period under study.

The analysis will use a newly created data set that merged data from several sources. FBI’s Uniform Crime Reports (UCR) for the years 2012, 2013, 2014, and 2016 have been used to compute the dependent variable, violent crime rate. The 2010 US Census and the US Census American Community Survey (2012-2016 5-year estimates) have been the source of socio-demographic indicators and housing information (e.g., families and living arrangements, homeownership occupancy rate; year housing units were built). ACS collects data from a sample of over 3.5 million housing unit addresses is interviewed each year over a 12-month period. The estimates are based on five years of ACS sample data and describe the average value of person, household and housing unit characteristics over this period of collection. KY Higher Education Assistance Authority (KHEAA) was the source for data on mining activities in KY (KHEAA, ND). Data on water contamination with lead (Pb) was obtained from the EPA’s water quality data discovery tool (2020), a cooperative service sponsored by the United States Geological Survey. The 2010 census of religious congregations and membership in United States served as a data source for the data on religious participation in Kentucky. The study was designed and carried out by the Association of Statisticians of American Religious Bodies (ASARB). Data have been compiled on the number of congregations and
adherents for 236 religious’ groups in each county of the United States (Grammich et al., 2012). The data on arrests for DUI violations, cocaine and opiate use, and weapons violations were extracted from the Kentucky State Police annual reports. The total number of observations included in the analysis is 340.

**Dependent variable**

The violent crime rate per 100,000 people is the dependent variable used in this study. UCR’s violent crime figures include the offenses of murder, rape, robbery, and aggravated assault. The variable includes violent crime rates for the years 2012, 2013, 2014, and 2016. It is a continuous variable that takes values from 5.91 to 149.48. The variable has a relatively normal distribution (Skewness = 1.038; Kurtosis = 1.025).

**Independent variables**

This study used two independent variables as indicators of environmental injustice (water contamination with lead; lead hazard in housing units). In order to examine the effect of social disorganization predictors on violent crime, the analysis used measures of poverty, ethnic heterogeneity, residential instability, family disorganization, and social capital. These predictors are described below:

*Lead (Pb) contamination (water)*. This is a continuous variable that records the average amount of lead (Pb) found every year from 2009 to 2012, when underground water samples were collected in each county. The calculation was based on the number of samples taken during the period under study in each KY county and the amount of lead reported each time the water was sampled. The average concentrations of Pb in the
groundwater samples ranged from zero micrograms (non-detected) per liter (mg/L) to 13.1 mg/L. (Skewness = 3.878; Kurtosis = 16.129)

**Lead (Pb) contamination (housing).** This is also a continuous variable that represents the percentage of houses built before 1960, in each county. The data were provided by the 2012-2016 American Community Survey, 5-year estimates. The measure is used here as a proxy of exposure to lead contamination. While lead-based paint was banned in US in 1978, it remains in housing built before that time (KFTC, 2016). The measure is considered by the Environmental Protection Agency (EPA) an indicator of the likelihood of having significant lead-based paint hazards in the home (U.S. EPA, 2016). (Skewness = .231; Kurtosis = -.429)

**Poverty Index.** This composite measure has been created through principal component analysis (PCA) and includes three measures (percent of population below poverty in 2010, percent civilian labor force unemployed in 2010, and percent social security beneficiaries that also received old age, survivors, and disability insurance in 2010). These three measures will then combine into an index. When PCA was conducted, only one factor with a value higher than one has been obtained (Eigenvalue = 2.325;

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6 The Environmental Protection Agency (EPA) states that a body of water is considered polluted if the pollutant is found in the water with a frequency of occurrence at least 2.5 percent and the pollutant have been produced in significant quantities, as reported in Stanford Research Institute’s “1976 Directory of Chemical Producers, USA (EPA, 2019). According to EPA, the maximum contaminant level goals (MCLGs) are non-enforceable health goals based solely on health risks. For lead, the MCLG is zero. The EPA has set this level to zero, as there are no safe levels of lead exposure (EPA, 2019; SciLine.org 2020). However, for most contaminants, the EPA has set an enforceable regulation called a maximum contaminant level (MCL). These MCLs are set as close as possible to the MCLG. The MCL considers costs, benefits, and the abilities of the public water systems to detect and remove contaminants using suitable treatment technologies. Due to the nature of lead contamination; however, there is not an MCL for lead either. This is because plumbing materials can corrode and contaminate water supplies with lead. Because of this, the EPA has set a treatment technique called the Lead and Copper Rule that requires water systems to control the corrosivity of the water. The regulation requires that systems collect tap water samples from sites served by the system that are more likely to have plumbing materials containing lead. If more than 10 percent of the tap water sample exceeds the lead action level of 15 parts per billion, then it is considered contaminated (EPA, 2019).
variance explained =77.50; factor loadings vary from .77 to .94). Higher values indicate a higher level of economic disadvantage. (Skewness = .495; Kurtosis = -.599)

*Residential mobility.* This is a composite measure constructed through principal component analysis (PCA). In each county, the measure combined the 2012-2016 average percentage of housing units that were not occupied by homeowners and the average percentage of people one year old and older who lived in a different house one year before the American Community Survey was administered. The measure appears to be reliable (alpha = .686) and is unidimensional (Eigenvalue =1.539; variance explained 76.97%; factor loadings =.877). Higher index values indicate a higher level of residential instability. (Skewness =.733; Kurtosis =.648)

*Black population.* The variable is used here as a proxy of ethnic heterogeneity. The continuous variable represents the percentage of black population in each county in 2010. It includes people who indicated their race was "Black or African American." In KY nonmetropolitan areas, the variable varied from 0.10% to 23.60%. (Skewness = 2.705; Kurtosis = 10.877)

*Foreign-born population.* This continuous variable is the second measure of ethnic heterogeneity. It indicates the percentage of foreign-born population at the county level, based on the 2012-2016 American Community Survey, 5-year estimates. The foreign-born population includes anyone who was not a U.S. citizen or a U.S. national at birth when data were collected. This includes respondents who indicated they were a U.S. citizen by naturalization or not a U.S. citizen. In KY nonmetropolitan counties, the percentage of first-generation immigrants varied from 0% to 5.6%. (Skewness = 1.676; Kurtosis = 4.489)
Mediators

*Family disorganization.* The percentage of female-headed households in 2010 has been used to measure family disorganization at the county level. This continuous variable takes values from 7.70% to 16.50% and has a relatively normal distribution (Skewness = .181; Kurtosis = .055).

*Religious participation.* As previously noted, recent developments of the social disorganization theory (Kubrin & Wo, 2016) indicate that social ties (social capital) at the community level have the capacity to increase the community’s level of informal social control, which in turn would decrease the incidence of crime. Religious participation is viewed as a proxy of social capital. As a measure of religious participation, the study uses church adherence. The church adherence rate takes values from 5.13% to 93.27% and has a relatively normal distribution (Skewness = .113; Kurtosis = -.699).

*Weapons-Law Violations.* The variable represents the 2011-2012 average arrest rate for weapons violations per 100,000 people. The variable takes values from 6.34 to 301.65 and has a slightly positive skew with a leptokurtic distribution (Skewness = 2.318; Kurtosis = 6.729), suggesting some deviation from normality. However, Tabachnick and Fidell (2013) state that deviation from normality of skewness and kurtosis often do not make a substantive difference in the analysis when the sample size is larger than 200. Additionally, Kline (2011) contended that deviation from normality could be problematic when skewness is greater than 3 and kurtosis is greater than 10. In sum, although the values for skewness and kurtosis are relatively high, they are lower than the acceptable values recommended by Kline (2011) and the size of the sample used in the multivariate analysis is larger than 200.
Alcohol use. In order to assess the level of alcohol use at the county level, the study uses as a proxy the 2011-2012 arrest rate for driving under the influence (DUI) per 100,000 people. The variable takes values from 110.55 to 1025.89 and has a relatively normal distribution (Skewness = .797; Kurtosis = .046).

Drug use. In order to assess the level of illegal drug use, the study includes a variable that averaged the 2011 and 2012 arrest rates per 100,000 people for opium and cocaine possession and use. The variable takes values from 0.00 to 127.59 and its distribution is positively skewed and leptokurtic (Skewness = 2.168; Kurtosis = 6.729). As noted previously, although the values corresponding to skewness and kurtosis indicate some deviation from normality, these values are within the acceptable range (see Kline, 2011) and they will not negatively affect the analysis.

Analytic Strategy

The analysis for this study will include univariate, bivariate, and multivariate analyses. Univariate statistics (mean, standard deviation, range, skewness, and kurtosis) for all the variables included in multivariate analyses will be provided. Following the descriptive analysis, in order to observe the strength of the relationship between the main predictors and the dependent variable, as well as the strength of the association among independent variables, bivariate correlations will be conducted. The inter-correlation matrix will be examined to determine potential multicollinearity issues pertaining to the selected predictors (Berry & Feldman, 1985; Fox, 1991).

The multivariate analysis will be a parallel multiple mediation analysis using ordinary least square path analysis (Haynes, 2018). The proposed analysis will estimate the direct effects of the selected predictors on violent crime as well as the indirect effect
on violent crime of the measures of environmental hazard, when controlling for rival explanations of crime, such as poverty, residential instability, and ethnic heterogeneity. As mediators, the analysis will use two social disorganization theoretical predictors, family disorganization and social capital, as well as three other predictors of violent crime, such as weapon violations, alcohol use, and drug usage at the county level. Figure 2 presents the statistical model that will be estimated using ordinary least square (OLS) regression analysis. OLS regression analysis is used because the dependent variable as well as the mediators are continuous indicators with a relatively normal distribution, suggesting the OLS’s assumptions may be satisfied by the data (see (Hardin & Hilbe, 2012; Hilbe, 2011, 2012; Piza, 2012). Data analysis will be conducted using the Statistical Package for the Social Sciences (SPSS) version 26.0, macro PROCESS, version 3.4 (Haynes, 2019).
CHAPTER IV - RESULTS

The present study tests for social disorganization in the nonmetropolitan setting within Kentucky.

Step One: Univariate Statistics

Descriptive statistics for the sample are provided in table 1. A total of 12 variables are reported. The analysis is based on a pooled data set that combined 2012-2016 county-level violent crime rates and socioeconomic indicators corresponding to each non-metropolitan county in KY. The total number of observations is 340 (85 counties x 4 years). The statistics for each variable included in the study are as follows. During the period under study, in rural KY, there were on average about 39 violent crime cases per 100,000 population. Violent crime appears to be normally distributed (skewness = 1.04; kurtosis =1.03). Violent crime rates vary from 5.91 per 100,000 in Garrard county to 149.48 per 100,000 in Taylor county.

Poverty index in nonmetropolitan KY had showed several eastern Kentucky counties with higher than average scores for poverty, of the 85 counties observed, 17% of the counties scored above a 2 (maximum 2.5), all of which were eastern Kentucky counties. Further 18% of the counties scored between 1 and 2 with all those counties also
being in Eastern Kentucky. On average, KY non-metropolitan counties appear to be relatively homogenous in terms of racial/ethnic composition. During the period under observation, the proportion of foreign-born population varied between 0% and 5.6%, averaging 1.21%. Although a small number of counties (4) had more than 10% African American residents and one county had more than 20% African American residents, at the area level, non-metropolitan KY has on average approximately 3% African American residents.

About 12% of households in rural KY are headed by women and approximately 22% of the housing stock includes houses built prior to 1960, suggesting that about one fifth of the population might be exposed to lead contamination. Water contamination in lead has a range of .0001 micrograms per liter (Todd County) and 13.10 micrograms per liter (Perry county), with the average lead water contamination in a county being 1.15. The USA EPA has set the maximum to water lead content at 15 micrograms per liter, however researcher have contended that anything above 10 micrograms per liter is unsafe (Pennstate Extension, 2016). Only 1% of the counties have lead content higher than 10 micrograms per liter, while another 1% have higher lead content than 5 micrograms per liter.

Church adherence, which represents religious participation, is at its highest in Hickman county (93.27) and at its lowest in Elliot county (5.13). On average, the church adherence rate was 49.7 per 100. DUI arrest rates vary in the nonmetropolitan area from 110.55 per 100,000 to 1025.89 per 100,000, with an average of 425.95 per 100,000. The majority of nonmetropolitan had DUI arrest rates lower than 700 per 100,000. Only 4% of the counties had DUI arrest rates higher than 700. Drug arrests rate varied between
.001 per 100,000 (Carlisle county) and 127.59 per 100,000 (Franklin County); both values are being relative outliers. The average drug arrest rate in nonmetropolitan Kentucky is 20.05 and the distribution is slightly skewed at 2.17 with a relatively high kurtosis at 4.70. Only 11 were above 2000 drug arrest per 100,000 in this sample. Finally, weapons violations rates ranged from 6.34 (Lee county) per 100,000 to 301.65 (Martin) per 100,000. The average weapons violations rate in nonmetropolitan Kentucky is 65.23 per 100,000. This distribution has a higher kurtosis at 6.72 and a more positive skew of 2.32, because only 14% of the counties had higher weapons violations rates that were higher than 100, and of these only 4% were higher than 200 and among these only four were higher than 300.
<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
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<td>Violent crime</td>
<td>5.91</td>
<td>149.48</td>
<td>38.88</td>
<td>24.38</td>
<td>1.04</td>
<td>1.03</td>
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<td>0.94</td>
<td>0.50</td>
<td>-0.60</td>
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<td>Residential instability</td>
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<td>0.86</td>
<td>0.73</td>
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<td>2.99</td>
<td>3.63</td>
<td>2.71</td>
<td>10.88</td>
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<td>Percent foreign born</td>
<td>00</td>
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<td>1.21</td>
<td>0.93</td>
<td>1.68</td>
<td>4.49</td>
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<td>22.29</td>
<td>6.97</td>
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<td>-0.43</td>
</tr>
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<td>Lead contamination (water)</td>
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<td>13.10</td>
<td>1.15</td>
<td>2.28</td>
<td>3.88</td>
<td>16.13</td>
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<td>Family disorganization</td>
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<td>16.50</td>
<td>11.81</td>
<td>1.63</td>
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<td>0.06</td>
</tr>
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<td>Church adherence</td>
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<td>93.27</td>
<td>49.70</td>
<td>20.49</td>
<td>0.11</td>
<td>-0.70</td>
</tr>
<tr>
<td>Weapons-laws violations</td>
<td>6.34</td>
<td>301.65</td>
<td>65.23</td>
<td>50.79</td>
<td>2.32</td>
<td>6.72</td>
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<td>DUI arrest rate</td>
<td>110.55</td>
<td>1025.89</td>
<td>425.95</td>
<td>205.53</td>
<td>0.80</td>
<td>0.05</td>
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<td>Drug arrests rate</td>
<td>0.001</td>
<td>127.59</td>
<td>20.05</td>
<td>26.76</td>
<td>2.17</td>
<td>4.70</td>
</tr>
</tbody>
</table>

N = 340
Step Two: Bivariate Statistics

Table 2 shows the results of the bivariate correlations. Most of the selected predictors appear to be significantly related to the dependent variable, violent crime. While counties with elevated levels of lead contaminated water do not have significantly different violent crime rates than counties that do not have higher elevated levels of contaminated water, violent crime rates appear to be higher in counties with a higher proportion of old houses, which are more likely to have lead-based paint ($r = .18; p < .01$). All other correlations were positively associated and significant. When the effect of other predictors is not taken into account, results indicate that Kentucky nonmetropolitan counties that have higher rates of violence are also characterized by higher levels of residential mobility ($r = .40; p < .01$), family disorganization ($r = .29; p < .01$), higher levels of ethnic heterogeneity ($r = .43; p < .01$ and $r = .30; p < .01$ respectively), and a higher incidence of arrests for weapons-law violations ($r = .24; p < .01$), driving under the influence of alcohol ($r = .33; p < .01$), and drug-related crimes ($r = .51; p < .01$).

Different from what has been hypothesized, KY counties with higher proportions of church adherence have also higher levels of violent crimes ($r = .38; p < .01$). Conversely, lower levels of violent crimes can be found in economically disadvantaged counties ($r = -.29; p < .01$). Additionally, an examination of the correlation matrix shows that the highest inter-item correlation equals .515 (between violent crimes and arrests for opium and cocaine possession), tentatively suggesting that multicollinearity is not going to be problematic, based on these bivariate relationships, multivariate analysis is required for further diagnostics on multicollinearity issues.
Table 2. Bivariate Correlations

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<th>Variable</th>
<th>1</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
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<th>11</th>
<th>12</th>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Poverty</td>
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<tr>
<td>Residential mobility</td>
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<td>-0.17**</td>
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<tr>
<td>Percent Blacks</td>
<td>0.42**</td>
<td>-0.28**</td>
<td>0.38**</td>
<td>1</td>
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</tr>
<tr>
<td>Percent Foreign Born</td>
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<td>0.45**</td>
<td>0.22**</td>
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<tr>
<td>Pb contam (houses)</td>
<td>0.18**</td>
<td>-0.43**</td>
<td>0.00</td>
<td>0.35**</td>
<td>0.06</td>
<td>1</td>
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<tr>
<td>Pb contam (water)</td>
<td>-0.06</td>
<td>-0.11*</td>
<td>-0.01</td>
<td>-0.1</td>
<td>-0.07</td>
<td>-0.04</td>
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<td>Fam. disorganization</td>
<td>0.29**</td>
<td>0.42**</td>
<td>0.30**</td>
<td>0.28**</td>
<td>-0.16**</td>
<td>-0.04</td>
<td>0.18**</td>
<td>1</td>
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<tr>
<td>Church adherence</td>
<td>0.38**</td>
<td>-0.54**</td>
<td>0.03</td>
<td>0.48**</td>
<td>0.35**</td>
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<td></td>
</tr>
<tr>
<td>Weapons violations</td>
<td>0.24**</td>
<td>-0.06</td>
<td>0.13*</td>
<td>0.40**</td>
<td>0.03</td>
<td>0.08</td>
<td>0.15**</td>
<td>0.23**</td>
<td>0.22**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dui arrest rate</td>
<td>0.31**</td>
<td>-0.07</td>
<td>0.32**</td>
<td>0.18**</td>
<td>0.15**</td>
<td>-0.13*</td>
<td>0.39**</td>
<td>0.43**</td>
<td>0.00</td>
<td>0.34**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Opium/Cocaine arrests</td>
<td>0.32**</td>
<td>-0.42**</td>
<td>0.30**</td>
<td>0.67**</td>
<td>0.24**</td>
<td>0.33**</td>
<td>-0.07</td>
<td>0.26**</td>
<td>0.48**</td>
<td>0.34*</td>
<td>0.277</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: *p < .05; **p < .01
Step Three: Multivariate Statistics

Mediation analyses

The social disorganization theorists (Shaw & McKay, 1942) argued that poverty, ethnic heterogeneity, and residential instability are not directly conducive to increases in delinquency and crime. They are, however, predictors of social disorganization, which in turn increases the probability of increases in crime levels. Further analyses have been conducted to verify this assertion. Table 4 presents the results of the mediation analysis (i.e., the direct and indirect effects of the social disorganization predictors and the selected measures of environmental injustice (lead contamination) on violent crime).

Baron and Kenny (1986) contended that mediation analyses can be conducted when several conditions are satisfied (the key independent variables should be correlated with the outcome; these variables should be related with the mediators; and, the mediators should be correlated with the outcome). Although more recent scholarship (see Hayes, 2009) indicates that the first condition does not have to be satisfied for mediation to be established, results previously presented (see Table 2) show that with one exception, the selected predictors of violent behavior as well as the mediators are significantly correlated with the outcome (violent behavior).

Table 3 presents the mediators of the study regressed on the selected measures of social disorganization. Table 4 shows the indirect, direct, and total effects of the variables included in the model. Multicollinearity was not an issue for any of the relationships in the regression as no VIF factors were higher than 2.5. Multicollinearity is an issue when VIF statistics are higher than 5 (Kim, 2019). Allison (1999) also noted that there is no strict cutoff, and that one should show concern when tolerance is below .40. If no VIFs
are higher in 2.5 in a model then all values for tolerance should be lower than .40 (Allison, 1999). VIF scores are as follow: Poverty (1.881), Residential instability (1.711), percentage black (2.454), percentage foreign born (1.703), percentage of houses build before 1960 (1.513), water contamination (1.316), church adherence (2.040), weapons violations (1.365), DUI arrests rate (1.623), and cocaine and heroin arrests (2.197).

Table 3 shows how the social disorganization variables impact the mediators of the study. In sum, as predicted by SDT, poor areas have higher levels of family disorganization and lower levels of social capital. As predicted by SDT, areas with higher levels of residential mobility also have a higher proportion of disorganized families and significantly lower levels of church adherence, used here as a proxy of social capital. In sum, counties that have a higher proportion of black residents appear to have significantly higher levels of female headed- households and church goers. These counties also registered significantly higher levels of arrests for DUI, weapons violations and opium and cocaine related crimes.

The percentage of female-headed households is lower in areas with a higher proportion of foreign-born people and the level of social capital (church adherence) is higher. The increase in the foreign-born population does not have a significant impact on arrests for drugs, alcohol misuse, and weapon-laws violations. Counties that had higher levels of water-based lead contamination also had higher levels of single parent households, as well as higher level of weapons violations. Increased levels of water based lead pollution does not seem to have an impact on any other variable in the model. Finally, counties that had housing that was built before 1960 saw higher levels of DUI arrests, as well as higher levels of church adherence.
Results included in table 3 also show that the selected predictors explain approximately 45% of the variation in family disorganization, 49.5% of the variation in social capital, 51% of the variation in drug-related arrests, 31% in the variation for DUI arrests, and about 21% of the variation in arrests for weapon-laws violations.

Findings also show that each of the selected mediators are significantly related to at least two social-disorganization theoretical predictors. This satisfies one of the conditions that need to be satisfied (i.e., significant relationships between predictors and mediators) for mediation analysis to be conducted (see Baron & Kenny, 1986).
Table 3. Mediators regressed on the selected measures of social disorganization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Family disorganization</th>
<th>Church adherence</th>
<th>DUI arrests</th>
<th>Drug arrests</th>
<th>Weapons violations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SE)</td>
<td>Beta</td>
<td>B (SE)</td>
<td>Beta</td>
<td>B (SE)</td>
</tr>
<tr>
<td>Poverty</td>
<td>.90*** (0.089)</td>
<td>.52</td>
<td>-.64*** (1.07)</td>
<td>-.30</td>
<td>-.26*** (12.6)</td>
</tr>
<tr>
<td>Residential instability</td>
<td>.62*** (0.092)</td>
<td>.33</td>
<td>-.672*** (1.11)</td>
<td>-.28</td>
<td>58.55*** (13.00)</td>
</tr>
<tr>
<td>Black residents (%)</td>
<td>.14*** (0.022)</td>
<td>.32</td>
<td>2.26*** (0.259)</td>
<td>.40</td>
<td>9.71*** (3.04)</td>
</tr>
<tr>
<td>Foreign residents (%)</td>
<td>-.29** (0.089)</td>
<td>-.13</td>
<td>5.34*** (1.07)</td>
<td>.24</td>
<td>-2.26 (12.55)</td>
</tr>
<tr>
<td>Lead (water)</td>
<td>.11*** (0.029)</td>
<td>.16</td>
<td>-.74 (1.353)</td>
<td>-.08</td>
<td>37.74*** (4.14)</td>
</tr>
<tr>
<td>Lead (housing)</td>
<td>.02 (0.011)</td>
<td>.08</td>
<td>.53*** (1.259)</td>
<td>.14</td>
<td>-6.54*** (1.50)</td>
</tr>
<tr>
<td>Constant</td>
<td>10.877 (395)</td>
<td>10.877</td>
<td>.14</td>
<td>.46</td>
<td>55.82*** (1.75)</td>
</tr>
</tbody>
</table>

F (df = 6) = 45.82***
R^2 = .452
N = 340

Note: *p < .05; **p < .01; ***p < .001. B = unstandardized regression coefficient; SE = standard error. Beta = standardized regression coefficient.
Figure 3 and Table 4 present the results of the parallel mediation analysis. As anticipated by the theory, poverty has a nonsignificant direct effect on violent crime. However, poverty has a significant positive indirect effect on violent crime via family disorganization, which is significantly and positively related to violent crime. It can be concluded that family disorganization fully mediates the effect of poverty on violent crime. The effect of poverty on violent crime is significantly affected by arrests for drug-related offenses. (B = -0.58; p < .05). Specifically, arrests for drug-related crimes were less likely to occur in economically disadvantaged areas. Overall, due to additional effects examined here, the total effect size of poverty on violent crime is significant and negative (total effect size = -3.319; p < .05).

In the present analysis, residential instability is the only social disorganization predictor that has a significant direct effect on violent crime. Increases in residential mobility are associated with higher violent crime levels (Beta = .196; p < .001) Family disorganization mediates the effect of residential instability on violent crime as well (Beta = .064; p < .05). Residential instability has significant indirect effects on violent crime via church adherence (Beta = .036; p < .05) and DUI arrests (Beta = -.055; p < .05). Residential instability also lowers how church adherence impacts violent crime (Beta = -.055; p < .05). The total effect size of residential instability is significant and positive with a total effect size of 6.956 (p < .001). Directly and indirectly, residential instability contributes to significant increases in violent crime.

As the theory would predict, ethnic heterogeneity does not directly affect variations in violent crime. Although the overall effect of foreign-born population, one of the indicators of ethnic heterogeneity is not significant, it can be noticed that family
disorganization significantly mediates the effect of foreign-born population on violent crime. Specifically, results show that indirectly, an increase in the foreign-born population (Beta = -0.026; p< .05), would be associated with lower levels of violent crime because counties that have a higher proportion of non-native people also have lower levels of family disruption. Nonetheless, even if an increase in the foreign-born population is associated with an increase in church adherence, because this mediator had an unexpected positive association with violent crime, the indirect effect of foreign-born via social capital is positive and significant (Beta = 0.047; p < .05).

The second indicator of ethnic heterogeneity (percent Black resident population) does not have a significant direct effect on the dependent variable as well. In short, an increase in the Black population at the county level does not directly impact an increase in violent crime. However, because counties that have a higher percentage of African American residents also have significantly higher levels of family disruption, church adherence, and arrests for misuse of alcohol and drugs, which are all positively and significantly related to violent crime, the overall effect of percent Black on violent crime is positive and significant (Total effect = 1.813; p< .001).

The present analysis used two indicators of environmental injustice (lead contamination) to examine the effect of two sources of lead contamination on violent crime. Contrary to what has been hypothesized, counties that had higher levels of lead in water, tended to have significantly lower levels of violent crime (Beta = -.096; p< .05). Yet the effect of lead in water on violent crime is mediated by two variables, which are significantly and positively related to the dependent variable. Specifically, counties with higher levels of lead in water tend to have a higher percentage of female-headed
households (Beta = .156; p< .001) and also a higher rate of arrests for driving under the influence (Beta = .419; p < .001). Both mediators are positively related to violent crime. In sum, indirectly, lead contamination contributes to an increase in violent crime.

The second predictor of environmental justice (potential exposure to lead in houses built prior to 1960) does not have a significant direct effect on violent crime. Yet counties with a higher proportion of old houses tend to have a higher rate of church adherence, an unexpected predictor of violent crime in this analysis. Consequently, even if the total effect of lead contamination on violent crime is not significant, indirectly, lead contamination in housing is significantly related to violent crime via church adherence (Beta = .129; p< .01).

When controlling for the other predictors of violent crime used in this analysis, results show that violent crime rates increase significantly with an increase in the proportion of disorganized families (Beta = .196; p< .01), as social disorganization theory would predict. As previously noted, contrary to the theoretical expectations, the measure of social capital used in this study (church adherence rate) is positively and significantly related to violent crime (Beta = 193; p< .01). As anticipated, violent crime rates tend to be higher in counties with a higher incidence of arrests for drug-related offenses, such as opium and cocaine possession and use (Beta = .232; p< .001) and arrests for driving under the influence of alcohol (Beta = 146; p< .05). Although bivariate analyses show a positive and significant correlation between arrests for weapons-law violations and violent crime, in the multivariate model this variable did not impact significantly variations in violent crime and could not mediate the effects of the selected predictors on the dependent variable.
Table 4. Direct, indirect, and total effects of the selected predictors on violent crimes in Kentucky

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty (DE)</td>
<td>-2.484</td>
<td>1.892</td>
<td>-0.096</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>2.603*</td>
<td>.987</td>
<td>.101</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>-1.480*</td>
<td>.596</td>
<td>-.057</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>-.457</td>
<td>.305</td>
<td>-.018</td>
</tr>
<tr>
<td>IE -&gt; Drug arrests</td>
<td>-1.490*</td>
<td>.534</td>
<td>-.058</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>-3.319*</td>
<td>1.528</td>
<td></td>
</tr>
<tr>
<td>Residential instability (DE)</td>
<td>5.501***</td>
<td>1.640</td>
<td>.196</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>1.789*</td>
<td>.640</td>
<td>.064</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>-1.546*</td>
<td>.606</td>
<td>-.055</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>1.014*</td>
<td>.408</td>
<td>.036</td>
</tr>
<tr>
<td>IE -&gt; Drug arrests</td>
<td>.2144</td>
<td>.311</td>
<td>.008</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>6.956***</td>
<td>1.579</td>
<td></td>
</tr>
<tr>
<td>Black residents (DE)</td>
<td>-.2824</td>
<td>.4449</td>
<td>-.042</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>.414*</td>
<td>.154</td>
<td>.062</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>.520*</td>
<td>.212</td>
<td>.078</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>.168*</td>
<td>.090</td>
<td>.026</td>
</tr>
<tr>
<td>IE -&gt; Drug arrests</td>
<td>.918*</td>
<td>.287</td>
<td>.038</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>1.813***</td>
<td>.369</td>
<td></td>
</tr>
<tr>
<td>Foreign residents (DE)</td>
<td>1.329</td>
<td>1.467</td>
<td>.051</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>-.671*</td>
<td>.377</td>
<td>-.026</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>1.229*</td>
<td>.484</td>
<td>.047</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>-.0391</td>
<td>.235</td>
<td>-.002</td>
</tr>
<tr>
<td>IE -&gt; Drug arrests</td>
<td>-.119</td>
<td>.342</td>
<td>-.05</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>1.695</td>
<td>1.524</td>
<td></td>
</tr>
<tr>
<td>Lead (water) (DE)</td>
<td>-1.021*</td>
<td>.518</td>
<td>-.096</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>.321*</td>
<td>.130</td>
<td>.003</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>-.171*</td>
<td>.091</td>
<td>-.160</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>.653*</td>
<td>.275</td>
<td>.011</td>
</tr>
<tr>
<td>IE -&gt; Drug arrests</td>
<td>.026</td>
<td>.077</td>
<td>.024</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>-.142</td>
<td>.503</td>
<td></td>
</tr>
<tr>
<td>Lead (housing) (DE)</td>
<td>.049</td>
<td>.184</td>
<td>.014</td>
</tr>
<tr>
<td>IE -&gt; Family disorganization</td>
<td>.019</td>
<td>.011</td>
<td>.083</td>
</tr>
<tr>
<td>IE -&gt; Church adherence</td>
<td>.088</td>
<td>.046</td>
<td>.025</td>
</tr>
<tr>
<td>IE -&gt; DUI arrests</td>
<td>-.113*</td>
<td>.061</td>
<td>-.032</td>
</tr>
<tr>
<td>IE -&gt; Drug-related arrests</td>
<td>.011</td>
<td>.043</td>
<td>-.002</td>
</tr>
<tr>
<td><strong>Total effect</strong></td>
<td>.085</td>
<td>.193</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Direct, indirect, and total effects of the selected predictors on violent crimes in Kentucky (cont.)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family disorganization (DE)</td>
<td>2.881**</td>
<td>.994</td>
<td>.193</td>
</tr>
<tr>
<td>Church adherence (DE)</td>
<td>.2301**</td>
<td>.0730</td>
<td>.193</td>
</tr>
<tr>
<td>DUI arrests (DE)</td>
<td>.0173*</td>
<td>.0069</td>
<td>.146</td>
</tr>
<tr>
<td>Drug-related arrests (DE)</td>
<td>.2118***</td>
<td>.0587</td>
<td>.232</td>
</tr>
<tr>
<td>Weapon-laws violations arrests (DE)</td>
<td>.0115</td>
<td>.0237</td>
<td>.024</td>
</tr>
<tr>
<td>F (df = 11)</td>
<td>21.241***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>.416</td>
<td></td>
</tr>
<tr>
<td>N = 340</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *< .05; **p< .01; ***p< .001; DE = direct effect; IE = indirect effect. SE = standard error of the estimate and boot standard error for the indirect effect. The number of bootstrap samples for the 95% bias corrected bootstrap confidence intervals (CI) = 5,000.
Figure 3: Direct, indirect, and total effects on violent crimes in Kentucky

Note: Figure 1 depicts only the significant paths. The reported coefficients are standardized regression coefficients. *p < .05; **p < .01; ***p < .001
CHAPTER V - DISCUSSION

The purpose of this study was to test social disorganization theory in a rural setting. Specifically, the study examined the direct and indirect effects of social disorganization predictors (poverty, residential instability, and ethnic heterogeneity) and environmental hazards (i.e., lead contamination) on violent crime in nonmetropolitan areas of Kentucky. Additionally, when assessing the effects on violent crime of the previously mentioned predictors, this research explored the potential mediating effects of family disorganization, social capital, and indicators of illegal activity in the study area.

To date, only a limited number of studies focused on rural crime using SDT as a theoretical framework and to the author’s knowledge, no study focused exclusively on violent crime in rural Kentucky. This dissertation fills a gap in the literature. Most of the existing quantitative research (i.e., Bouffard & Muftic, 2006; Kaylen & Pridemore, 2011; Osgood & Chambers, 2000; Petee & Kowalski, 1993) that focuses on rural crime used samples from midwestern or southern regions and very few studies have included Kentucky when rural counties were used as units of analysis. To fulfil the purpose of the dissertation, data were pooled from 85 nonmetropolitan Kentucky counties from the years 2012, 2013, 2014 and 2016. The data were then used to perform parallel multiple mediation analyses to determine the predictors and mediators of violent crime in
nonmetropolitan Kentucky. The motivation behind this study stemmed from the limited research focusing exclusively on nonmetropolitan areas.

This dissertation proposed eight hypotheses and this section will address each hypothesis that was presented in chapter 2. As predicted by Shaw and McKay (1942), findings indicate that poverty had no direct effect on violent crime in Kentucky. This finding is consistent with prior research (Kaylen & Pridemore, 2011; Lanier & Huff-Corzine, 2006; Osgood & Chambers, 2000; Petee & Kowalski, 1993; Wells & Weisheit, 2004, 2012) that also did not find that areas characterized by socioeconomic disadvantage have significantly higher levels of violent crime than better-off areas. Yet none of the previously mentioned studies examined the indirect effect of poverty on delinquency or crime.

The present analysis found that poverty does affect significantly variations in violent crime, but its effects are fully mediated by family disorganization, religious participation, and indicators of criminal activity, such as drug-related offenses. Nonetheless, different from prior research that identified a significant positive link between poverty and homicide rates (Andreescu, 2000; Andreescu et al., 2011) or poverty and violent crime in general (Melde, 2006), the total effect of poverty on violent crime was negative and not positive, as anticipated by social disorganization theory.

Residential instability appears to be the most consistent predictor of violent crime in rural and nonmetropolitan areas in the United States, as this is a common finding in the literature (Andreescu et al. 2011; Bouffard & Muftic, 2006; Osgood & Chambers, 2000; Petee et al., 1994; Reisig & Cancino, 2004; Vowell & Howell, 1998; Ward et al., 2018; Wells & Weisheit, 2004, Wells & Weisheit, 2012). Although the studies reviewed here
did examine only the direct effect of residential instability on violent crime, it should be noted that the study findings show that residential instability influences variations in violent crimes indirectly as well. KY counties with higher population turnover rates tend to be characterized by a higher proportion of disorganized families, by lower religious participation rates, and by a higher level of arrests for driving under the influence of alcohol, which are all significant predictors of violent crime. Overall, the total effect of residential instability on violent crime is positive and significant as it has been hypothesized.

According to Shaw and McKay (1942), socially disorganized communities are characterized not only by socioeconomic disadvantage and residential instability, but also by ethnic/racial heterogeneity. Given the relatively low level of ethnic/racial diversity that characterizes KY areas, particularly the rural areas of the state, the present analysis used two measures (percent Black population and percent foreign-born population) to operationalize ethnic/racial heterogeneity. To reiterate, it has been hypothesized that areas with a higher proportion of Black and/or foreign-born residents will have higher levels of violent crime. Research findings, however, indicate that neither foreign born population percentage and black population percentage directly predicted violent crime. Although these findings appear to concur with Ward et al.’s (2018) and Bouffard and Muftic’s (2006) contention that ethnic heterogeneity does little to explain crime in the nonmetropolitan settings, these researchers refer only to the direct effects of ethnic heterogeneity on crime. An examination of the indirect effect ethnic heterogeneity has on violent crime is for the most part supportive of the theoretical predictions. Specifically,
results show that areas with a higher proportion of Black residents have a higher incidence of female-headed households and have registered higher rates of arrests for drug-related offenses and alcohol misuse, which are all significant predictors of violent crimes. Overall, the total effect of percent Black population on violent crime is significant and positive.

Regarding the second predictor used to measure ethnic heterogeneity (i.e., percent foreign-born population), it can be noted that while the overall effect is not significant, rural areas in KY with a higher proportion of first-generation immigrants tend to be characterized by a lower proportion of disorganized families. Indirectly, a higher concentration of the foreign-born might have a violent-crime protective effect, which is consistent with Sampson’s (2008) research findings. Based on a rigorous analysis of urban neighborhoods, the author contended that “cities of concentrated immigration are some of the safest places around” (Sampson, 2008, p. 31). Future research, however, should explore further and in more detail the impact of immigration on violent crimes in rural areas.

As anticipated, results showed that areas with a higher concentration of lead in water also had a higher proportion of disorganized families and registered more DUI arrests. Thus, indirectly this environmental harm contributed to a significant increase in violent crime rates. Nonetheless, even if the direct effect of lead in water on violent crime was negative and significant, the total effect of lead concentration in water was not significant. Regarding the second measure used here to examine the effect of environmental problems on violent crime, the total effect of the variable on the dependent variable is also nonsignificant. In both cases, the ambiguous results of the analysis might
be caused by the limitation of the measures used to assess the environmental problems at the area level. Future research should overcome this limitation by selecting indicators, which would have a better ability to measure environmental disadvantage. While few, if any papers covered social disorganization with a lead (pb) emphasis in rural areas exist, some studies that used metropolitan area samples do exist. Specifically, Barrett (2017) found that areas with higher levels of concentrated disadvantage were more likely to have residents with higher blood lead levels.

The study hypothesized that poverty, residential instability, and ethnic heterogeneity would contribute to family disorganization and that family disruption positively predicts violent crime. As hypothesized, family disorganization mediated the anticipated effects on violent crime of poverty, lead concentration in water, residential instability, and percentage blacks. Findings also showed that areas with a higher proportion of foreign-born individuals have a significantly lower incidence of female-headed households, which might explain the significant negative indirect effect of immigration on violent crime. Much like residential instability, family disruption/disorganization is one of the strongest and most consistent predictors of delinquency and crime in the social disorganization literature (Land et al., 1990; Pizarro & McGloin, 2006; Pridemore, 2002). This is also the case here, as family disruption is directly related to violent crime. The finding is consistent with Osgood and Chambers’s (2000) results as well. The authors noted that family disruption is an especially critical element of social disorganization in nonmetropolitan communities and they mentioned a potential mediating role of family disorganization when examining delinquency and crime, noting that adults who are actively engaged in a parental role are critical to
bringing informal and formal social controls that help prevent violent crime. In sum, directly and as a mediator, family disorganization contributes significantly to increases in violent crime rates.

Recent developments of the social disorganization theory (Bruinsma, 2013; Drakulich, 2013; Sampson, Raudenbush & Earls, 1997, Sampson, 2017) asserted that socially disorganized areas would be characterized by higher levels of delinquency and crime because the social capital in these areas is relatively low. The results of the present analysis do not offer support for this hypothesis. In fact, the analysis showed that areas with higher levels of social capital tend to have significantly higher violent crime rates. Nonetheless, even if the direct effect as well as several indirect effects suggest that social capital would actually contribute to increases in violent crime rates, results should be cautiously interpreted. Specifically, the variable used here to operationalize social capital (i.e., church adherence) was not the best indicator of the concept and future research should overcome the limitation of the current analysis by using a composite measure that would better account for social ties at the community level. For instance, Wells and Weisheit (2012) found that civic engagement, which was measured with several variables which included: residential investment in a community, percent voting in the last election, church adherence, self-employed business in the community, and how many farms of 50 or less acres were present in a community, was a crime deterrent in nonmetropolitan areas despite the variable failing to predict crime in metropolitan areas. Overall, the predictor of civic engagement on crime is fairly strong in the literature for the nonmetropolitan areas (Lee, 2008; Putnam, 2000; Wells and Weisheit, 2012).
In addition, the current analysis also explored the direct and mediating effects of three measures of illegal behavior, which have been linked in the literature to violent crime (i.e., alcohol and drug abuse, as well as illegal use of firearms and other weapons. While the rate of arrest for weapon-laws violations did not appear to directly affect violent crime rates, as anticipated, arrests for DUI and for drug-related offenses were significant predictors of violent crimes. These two variables also mediated the positive effects on violent crime of social disorganization predictors, such as residential instability and percent Blacks. Results are consistent with prior research that also found that areas with higher prevalence of alcohol and drug misuse at the area level increase the incidence of violent crime (Britt et. al, 2005; Dittmer et al, 2021; Khaleel, et, al, 2019; Miller et al, 2017).

In sum, the analysis presented here demonstrated that for the most part, the social disorganization theory’s predictions apply well to rural areas when attempting to explain variations in violent crime. Although further research is needed to verify the stability of the findings presented here and determine why certain predictors, such as poverty had an unexpected direct deterrent effect on violent crime, results indicate that in nonmetropolitan areas family disruption and residential instability are among the strongest predictors of violent crime. Before discussing the implications of the analysis presented here, the study limitations should be noted.

**Strengths and Limitations**

As previously noted, some unexpected results, such as the effect of social capital or environmental contamination on crime, might be caused not by faulty theoretical assumptions, but by the operationalization of certain concepts. A limitation within the
water data can also be found. The water data itself is based on local waterways for lead contamination, specifically the drinking water. The data does not include areas where well water may be drawn, and if included the dataset would be more robust and meaningful.

Another limitation of the study is the reliance on official police data. The UCR data include only crimes that have been reported to the police or are known by the police. One of the many issues with the UCR is the hierarchy rule, which essentially means that only the most serious part I crime is reported; this impacts the data. For instance, if a homicide occurred during a robbery, only the homicide is recorded in UCR data. (Tabarrok et al., 2010). Other data limitations involved the use of geographical data which may result in a “spill-over” effect that contributes to crime in county from adjacent counties. This limitation has also been discussed in several other papers that test social disorganization (Fitzgerald, Kalof & Dietz, 2009; Mennis et al., 2011; Zhang & Song, 2014). Future research should also test for potential spatial autocorrelation, which might have affected the results here.

A strength of this dissertation, and its best asset, is that the analysis used is parallel mediation analysis which parses out mediating relationships – something very few studies have performed with nonmetropolitan social disorganization. Further, the study also included environmental factors– such as water pollution. This adds some innovation to the social disorganization model which included the physical living conditions on those in more impoverished areas – a variable that is worth investigation which this dissertation provided and gives ample evidence to pursue this even further. Despite the study limitations, results show that the social disorganization model does
perform well in nonmetropolitan Kentucky. Even if lead poisoning does not appear to influence directly violent crime, it does so indirectly via family disorganization, which is a strong predictor of violent behavior at the area level. This knowledge is a contribution to the literature.

**Policy Implications**

Policy should be put in place to prevent crime in the nonmetropolitan setting. While crime in rural areas is not a substantial problem, given that rural residents accounted for 20% of the U.S population but sustained 15% of all violent crime and property crime in the U.S (NCVS, 2021), it ought to be pursued, nevertheless. As the results suggest, communities that are more unstable and have higher levels of family disruption such as single parent households, job loss and communities with higher percentages African Americans have more difficulty accessing the levers of formal and informal social control. Because family disorganization heavily impacts violent crime it would be prudent to develop programs that help out families in impoverished areas that are single parent in nature or have other issues in the household. Improving social work networks in rural areas helps address issues with family disruption. It is noteworthy to highlight the finding that counties with higher percentages of black families also had higher incidences of single parent households, therefore implementing policy that would prevent single parent households from occurring in those counties could result in some insulating effects. Policymakers have addressed the single parent household problem with several solutions; these solutions can be seen as levers to pull to help the problem. For example, The Appalachian Regional commission cited that the rapid economic growth in the 1990s, welfare reform legislation, increased immigration, the decline in teen
pregnancy rates, and the increase in joint custody divorces all contributed to stabilizing single parent families (ARC, 2004). Another way to tackle the issue of single parent households contributing to crime, is to provide adequate childcare in areas of Appalachia, so that it is at less disadvantage to be in a single parent household. By providing childcare to more impoverished areas once can hope to see the level of single mother employment to start to rise, which in turn may reduce crime in those areas.

Having a method to anchor the young and college educated would prove to be prudent, for example, research has shown that capital and skilled labor are compliments to one another, and that the clustering of college educated worker has a spillover effect, which enhances an area’s economic growth (Artz, 2003). Developing economic development programs that help diversify the economy and specifically hires professionals and that are “homegrown” from nonmetropolitan areas may be extremely beneficial for the area as it solves two major issues that the social disorganization model points out: issue 1 – Residential mobility increases rates of violent crime, especially in impoverished areas. A solution to the residential mobility issue in rural areas would be to support programs through government funds, that specifically hire professionals who have graduated from local universities. This would improve the economic situation as well as decrease brain drain from the area. It is extremely important to only hire nonmetropolitan professionals to solve this issue of economic diversity to develop nonmetropolitan solutions, which would help with the issue of residential mobility. The second problem that this program solves is that by anchoring rural educated youth in the nonmetropolitan community, family disruption may begin to decrease as more families in the area may develop well. Improving the quality of homes that are lived in in the
nonmetropolitan areas of Kentucky would also benefit in the local economy development as well as the local area by investing in its people (ARC, 2014)

**Future Research and Conclusion**

The results of this study provide a foundation for future research, especially given the limitations of the study discussed above. Results suggest that future research needs to be conducted to examine the stability of the findings. Specifically, investigating the exact impact that family disorganization has on crime in the rural area when compared with the urban areas that social disorganization theory originated in. Future research would benefit if a measure of civic participation were used in the study to determine if there is an association between civic participation between civic participation and violent crime. More research on the topic of lead contamination and its effects on nonmetropolitan areas would be prudent as well, specifically if modeled with social disorganization and how it impacts family stability and residential mobility within the model.

Overall, the dissertation found empirical support for the social disorganization model when applied to nonmetropolitan areas, specifically nonmetropolitan Kentucky. This dissertation opens new routes to social disorganization research in the nonmetropolitan setting because it revealed a relationship between lead contamination and family disorganization. Further studies need to explore the possibilities of lead contamination and residential mobility and family disorganization. The implementation of the suggested programs and practices would also warrant examination and research as it does attempt to solve two issues: crime and poverty.
REFERENCES


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CURRICULUM VITAE

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**Education**

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<thead>
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<tr>
<td>2021</td>
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<td>2015</td>
<td>MA</td>
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**Academic Positions**

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<tr>
<td>2020-Present</td>
<td>Assistant Adjunct Professor, University of Louisville, Kent School of Social Work</td>
</tr>
<tr>
<td>2017-2020</td>
<td>Graduate Teaching Assistant, University of Louisville, Department of Criminal Justice</td>
</tr>
<tr>
<td>2015-2016</td>
<td>Instructor, Morehead State University, Department of Sociology, Social Work and Criminology</td>
</tr>
<tr>
<td>2013-2015</td>
<td>Graduate Assistant, Morehead State University, Department of Sociology, Social Work and Criminology</td>
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2016-2017  Autism Therapist. Centria Health Care, Novi, MI.

Awards

2020  Brown Forman Spirit Award – BF Next Generation Tracker
2020  Brown Forman Spirit Award – Covid Project
2017  Graduate Assistantship. University of Louisville.
2015  Outstanding Graduate Student Award from Morehead State University
2013  Graduate Assistantship. Morehead State University

Research Interests

Animal Cruelty, Criminological theory, Cybercrime, Economics, Green Criminology, Juvenile Delinquency, Marketing Research, Methods, Rural Crime, Rural Policing, Statistics, White Collar Crime

Publications

Peer Review Journal Articles


Technical Reports


Preliminary Program Evaluation Report to Louisville Metro Police Department, Louisville Metro Department of Corrections, and Centerstone Mental Health Services, April 2018, Louisville, Kentucky. Presentation Title: Program Evaluation of the Living Room Program.

Teaching Experience
Courses taught – Department of Sociology, Social Work and Criminology, Morehead State University

Undergraduate
Sociology of Deviance (SOC/CRIM 210)
Special Topics: Animal Cruelty (SOC/CRIM 399)
Criminological Theory (CRIM 401)
Juvenile Delinquency (SOC/CRIM/SWK 306)
White Collar Crime (SOC/CRIM 375)
Criminogenic Family (SWK/CRIM 300)

Department of Criminal Justice, University of Louisville

Undergraduate
Quantitative Analysis (CJ 326)

Kent School of Social Work, University of Louisville

Graduate
Research Methodology and Design (SW 626)

Undergraduate
Introduction to Social Statistics (SW 204)

Presentations

2018 2nd Annual Criminal Justice Student Conference, April 2018, Louisville, Kentucky Presentation Title: “Mining for Crime: an Exploratory Study”

2018 From the Coastline to the City: Cellphone Location Data and Carpenter v U.S. Midwestern Criminal Justice Association. Chicago, IL.

2018 Roundtable Discussion for the Misdemeanor Justice Project. American Society of Criminology. Atlanta, GA.

2021  Structural Disadvantage in Rural Kentucky. Mid-South Sociological Association: Reconstructing Reality Through Research. Charlotte, NC

Service

Manuscript Reviewer

2017  Journal of Qualitative Criminal Justice & Criminology

Volunteer

Volunteer at the registration table for the Midwestern Criminal Justice Association 2018 Annual Meeting – Chicago, IL