

## ABSTRACT

Title of Thesis:

VARIATION IN THE DRUG-CRIME  
RELATIONSHIP ACROSS RURAL-URBAN  
CONTEXTS

Jordan Pierce, Master of Arts, 2024

Thesis Directed By:

Professor Bianca E. Bersani  
Department of Criminology and Criminal Justice

In the past several decades, a significant amount of research has examined the relationship between substance or drug use and crime. Empirically, there appears to be a positive relationship between these phenomena, but the reasons for this are unclear. While scholars often focus on how individual characteristics may influence this relationship, there is emerging evidence that social context may matter as well. For example, the drug-crime relationship may not manifest in the same way or be as strong in some contexts given variables such as social norms and values, opportunity structures, and informal social controls. One such context that should be considered is rural areas. In these spaces, despite having a similar incidence of substance use to urban areas, other types of crime are comparatively low. Furthermore, patterns of substance use and crime diverge across these contexts in a variety of ways. It may be that

different features of these areas, including environmental characteristics and social processes, help explain this patterning.

Using the National Survey on Drug Use and Health (2019), the current study examined whether the relationship between substance use (including alcohol) and delinquency is moderated by rural contexts. Differing levels of informal social controls or social bonds (parental attachment, school attachment, and religious involvement) in rural areas are proposed as a possible mechanism in this relationship, and their influence on the substance-delinquency relationship is assessed both independently and in combination with rural context to determine whether these variables explain any contextual variation. Findings suggest mixed support for the moderation of rural context. While those living in nonmetropolitan areas appear to have a weaker association between substance use and delinquency than their metropolitan counterparts, data and measurement issues reduce confidence in this finding. For instance, context may be related to how substance use relates to engagement in delinquency but not the extent of that delinquency. In contrast, those with higher levels of parental and school attachment exhibit a stronger relationship between substance use and delinquency; more highly attached individuals tend to engage in less delinquency when they use no or few substances, but they engage in similar levels and perhaps even more delinquency than their less attached peers as substance use variety increases. Finally, accounting for how rural context and informal social controls both may change the strength of the substance-delinquency relationship does not yield any substantially different results, indicating that the informal social controls examined in this study do not act as a mechanism of any contextual variation in this relationship. The findings of this research help fill the gap in the drug-crime literature concerning social context, contribute to the

rural criminological literature regarding how crime manifests in these areas, and provide new evidence about the role of informal social controls in understanding the drug-crime relationship.

VARIATION IN THE DRUG-CRIME RELATIONSHIP ACROSS RURAL-URBAN  
CONTEXTS

by

Jordan Pierce

Thesis submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Master of Arts  
2024

Advisory Committee:

Dr. Bianca Bersani, Associate Professor, Chair

Dr. Robert Brame, Professor

Dr. Wade Jacobsen, Associate Professor

© Copyright by  
Jordan Pierce  
2024

## Acknowledgements

First, I would like to thank my thesis chair and advisor Dr. Bianca Bersani for her constant support and direct contribution to the success of my research. I am thankful to her for pushing me to make this the best project possible and without her I would not have been able to complete this thesis. Second, I would like to thank my thesis committee members Dr. Robert Brame and Dr. Wade Jacobsen for agreeing to take part in this process and providing their expertise, help, and advice. Third, I would like to thank my mother and best friend Cassie for answering my endless calls and helping me talk through my thoughts and ideas. Finally, I would like to thank my cohort members (Elena, Jane, Jess, Lydia, Sylvia, and Xandie) for helping me through this process and providing mountains of advice, both as researchers and as great friends.

## Table of Contents

|                                                                           |      |
|---------------------------------------------------------------------------|------|
| Acknowledgements.....                                                     | ii   |
| Table of Contents.....                                                    | iii  |
| List of Tables .....                                                      | vi   |
| List of Figures .....                                                     | viii |
| Chapter 1: Introduction .....                                             | 1    |
| Chapter 2: Literature Review.....                                         | 5    |
| The Drug-Crime Relationship.....                                          | 5    |
| Mechanisms of the Drug-Crime Relationship.....                            | 8    |
| The Role of Social Context .....                                          | 11   |
| Empirical Status of Social Context.....                                   | 14   |
| Rurality, Context, and Crime .....                                        | 16   |
| Definitions and the Rural-Urban Continuum .....                           | 16   |
| Crime in Rural Areas .....                                                | 18   |
| Rural Criminology.....                                                    | 21   |
| Substance Use and The Drug-Crime Relationship in Rural Areas.....         | 24   |
| Theoretical Framework: Informal Social Controls .....                     | 27   |
| Informal Social Control and the Drug-Crime Relationship.....              | 27   |
| Informal Social Controls as a Mechanism for Rural-Urban Differences ..... | 29   |
| Mediation or Moderation? .....                                            | 30   |

|                                                  |    |
|--------------------------------------------------|----|
| Current Research .....                           | 33 |
| Chapter 3: Data and Methods .....                | 37 |
| Variables and Measurement .....                  | 41 |
| Dependent Variables.....                         | 41 |
| Independent Variable.....                        | 45 |
| Moderator Variables .....                        | 46 |
| Rural Context .....                              | 46 |
| Informal Social Controls.....                    | 51 |
| Control Variables.....                           | 54 |
| Analytic Strategy.....                           | 56 |
| Chapter 4: Results .....                         | 60 |
| Descriptive Statistics.....                      | 60 |
| Bivariate Analyses.....                          | 64 |
| Multivariate Models Including Interactions.....  | 67 |
| Rural Context Interactions.....                  | 67 |
| Informal Social Control Interactions .....       | 69 |
| Full Models with All Interactions.....           | 73 |
| Sensitivity Analysis.....                        | 76 |
| Logistic and Binomial Models with Controls.....  | 76 |
| LPM, Poisson, and Negative Binomial Models ..... | 77 |

|                                                      |     |
|------------------------------------------------------|-----|
| Robustness Check .....                               | 78  |
| Three-Category Rural Context Measures .....          | 78  |
| Restricted Rural-Urban Context Measure .....         | 80  |
| Delinquency Variables including Handgun Measure..... | 81  |
| Chapter 5: Discussion and Conclusion .....           | 83  |
| Discussion .....                                     | 83  |
| Limitations.....                                     | 88  |
| Policy and Theoretical Implications .....            | 93  |
| Conclusions .....                                    | 95  |
| Tables.....                                          | 97  |
| Figures.....                                         | 107 |
| Appendix.....                                        | 122 |
| References.....                                      | 125 |

## List of Tables

|                                                                                                                                                         |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Table 1.</b> Contingency Table of Metropolitan County Status and Population Density Measures (Adolescent, School-Going Subsample of NSDUH 2019)..... | 97  |
| <b>Table 2.</b> Descriptive Statistics for Main Analytic Variables (N = 12066).....                                                                     | 98  |
| <b>Table 3.</b> Descriptive Statistics for Control/Demographic Variables.....                                                                           | 99  |
| <b>Table 4.</b> Group Differences for all Variables by Metropolitan County Status (Two Sample T-Tests).....                                             | 91  |
| <b>Table 5.</b> Bivariate Associations with Delinquency .....                                                                                           | 92  |
| <b>Table 6.</b> Logistic Regression Models Predicting Delinquency by Context and Substance Use ..                                                       | 93  |
| <b>Table 7.</b> Binomial Regression Models Predicting Delinquency by Context and Substance Use                                                          | 94  |
| <b>Table 8.</b> Logistic Regression Models Predicting Delinquency by Parental Attachment and Substance Use .....                                        | 95  |
| <b>Table 9.</b> Logistic Regression Models Predicting Delinquency by School Attachment and Substance Use .....                                          | 96  |
| <b>Table 10.</b> Logistic Regression Models Predicting Delinquency by Faith-Based Activities and Substance Use .....                                    | 97  |
| <b>Table 11.</b> Binomial Regression Models Predicting Delinquency by Parental Attachment and Substance Use .....                                       | 98  |
| <b>Table 12.</b> Binomial Regression Models Predicting Delinquency by School Attachment and Substance Use .....                                         | 99  |
| <b>Table 13.</b> Binomial Regression Models Predicting Delinquency by Faith-Based Activities and Substance Use .....                                    | 100 |

|                                                                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Table 14.</b> Logistic Regression Models Predicting Delinquency by All Informal Social Controls and Substance Use, With and Without Interactions..... | 101 |
| <b>Table 15.</b> Binomial Regression Models Predicting Delinquency by All Informal Social Controls and Substance Use, With and Without Interactions..... | 102 |
| <b>Table 16.</b> Logistic Regression Models Predicting Delinquency by All Main Variables, With and Without Interactions.....                             | 103 |
| <b>Table 17.</b> Binomial Regression Models Predicting Delinquency by All Main Variables, With and Without Interactions.....                             | 104 |
| <b>Table 18.</b> Logistic Regression Models Predicting Delinquency by All Main Variables, With and Without Controls.....                                 | 105 |
| <b>Table 19.</b> Binomial Regression Models Predicting Delinquency by All Main Variables, With and Without Controls.....                                 | 106 |

## List of Figures

|                                                                                                                                                                             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Figure 1.</b> Substance Use and Delinquency (Bivariate, Logistic Model).....                                                                                             | 107 |
| <b>Figure 2.</b> Substance Use and Delinquency (Bivariate, Binomial Model).....                                                                                             | 108 |
| <b>Figure 3.</b> Parental Attachment and Delinquency (Bivariate, Logistic Model) .....                                                                                      | 109 |
| <b>Figure 4.</b> School Attachment and Delinquency (Bivariate, Logistic Model) .....                                                                                        | 110 |
| <b>Figure 5.</b> Faith-Based Activities and Delinquency (Bivariate, Logistic Model) .....                                                                                   | 111 |
| <b>Figure 6.</b> Parental Attachment and Delinquency (Bivariate, Binomial Model).....                                                                                       | 112 |
| <b>Figure 7.</b> School Attachment and Delinquency (Bivariate, Binomial Model).....                                                                                         | 113 |
| <b>Figure 8.</b> Substance Use and Delinquency by Metropolitan County Status (Logistic Model)..                                                                             | 114 |
| <b>Figure 9.</b> Substance Use and Delinquency for Select Levels of Parental Attachment (Logistic Model).....                                                               | 115 |
| <b>Figure 10.</b> Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Logistic Model) .....    | 115 |
| <b>Figure 11.</b> Substance Use and Delinquency for Select Levels of School Attachment (Logistic Model).....                                                                | 116 |
| <b>Figure 12.</b> Substance Use and Delinquency for Select Levels of School Attachment: One SD Below Average, Average, and One SD Above Average (Logistic Model) .....      | 116 |
| <b>Figure 13.</b> Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities (Logistic Model).....                                          | 117 |
| <b>Figure 14.</b> Substance Use and Delinquency for Select Levels of Faith-Based Activities: One SD Below Average, Average, and One SD Above Average (Logistic Model) ..... | 117 |
| <b>Figure 15.</b> Substance Use and Delinquency for Select Levels of Parental Attachment (Binomial Model).....                                                              | 118 |

|                                                                                                                                                                                                              |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Figure 16.</b> Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Binomial Model) .....                                     | 118 |
| <b>Figure 17.</b> Substance Use and Delinquency for Select Levels of School Attachment (Binomial Model).....                                                                                                 | 119 |
| <b>Figure 18.</b> Substance Use and Delinquency for Select Levels of School Attachment: One SD Below Average, Average, and One SD Above Average (Binomial Model) .....                                       | 119 |
| <b>Figure 19.</b> Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities (Binomial Model).....                                                                           | 120 |
| <b>Figure 20.</b> Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities: One SD Below Average, Average, and One SD Above Average (Binomial Model).....                  | 120 |
| <b>Figure 21.</b> Substance Use and Delinquency by Metropolitan County Status (Full Logistic Interaction Model) .....                                                                                        | 121 |
| <b>Figure 22.</b> Substance Use and Delinquency by Metropolitan County Status (Full Logistic Interaction Model Including Controls).....                                                                      | 122 |
| <b>Figure 23.</b> Substance Use and Delinquency for Select Levels of Parental Attachment (Full Logistic Interaction Model Including Controls) .....                                                          | 123 |
| <b>Figure 24.</b> Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Full Logistic Interaction Model Including Controls) ..... | 123 |
| <b>Figure 25.</b> Substance Use and Delinquency for Select Levels of Parental Attachment (Full Binomial Interaction Model Including Controls) .....                                                          | 124 |

**Figure 26.** Substance Use and Delinquency for Select Levels of Parental Attachment: One SD

Below Average, Average, and One SD Above Average (Full Binomial Interaction Model

Including Controls) ..... 124

## Chapter 1: Introduction

The link between substance use and crime has been an issue at the forefront of criminal justice policy and in the minds of criminologists for the past several decades (Bennett, Holloway, & Farrington, 2008; Chaiken & Chaiken, 1990; Goldstein, 1985; MacCoun, Klimer, & Reuter, 2003). During the crack epidemic in the United States in the 1980s and 1990s, as well as in the broader “War on Drugs”, there was great public concern about how drug use fueled crime, particularly violent crime (MacCoun et al., 2003; MacCoun & Reuter, 2001). These issues have brought about a significant amount of research examining the potential relationship between these phenomena. Empirically, substance misuse exists to a much higher degree among those in the criminal legal system than in the general population (Bronson et al., 2017; Fazel, Bains, & Doll, 2006), straining the health capabilities of correctional institutions. Furthermore, those who use various kinds of drugs have significantly greater odds of offending (Bennett et al., 2008), and reviews of the literature confirm that this relationship exists, but may differ by demographic characteristics, crime type, substance, and frequency of use (Boles & Miotto, 2003; Deitch, Koutsenok, & Ruiz, 2000; Foran & O’Leary, 2008; Friedman, 1998; Parker & Auerhahn, 1998; Nurco, Hanlon, & Kinlock, 1991). The interaction between these phenomena may also make continued offending or recidivism more likely (Ford, 2005; Hussong et al., 2004; Kirk, 2020; Laub & Sampson, 2003; Menard et al., 2001; Schroeder et al., 2017), therefore making understanding how substance use and crime/delinquency work together an imperative for criminological research.

The current literature assessing the drug-crime relationship often focuses on individual characteristics, such as demographics, and cognitive processes that may contribute to how substance use increases the likelihood of offending, how involvement in criminal activity may

lead to more substance use, or how these behaviors may be reciprocally related (Bennett et al., 2008; Fagan, 1990). Yet, the drug-crime relationship cannot be fully explained by these variables (Chaiken & Chaiken, 1990; Kuypers et al., 2020); many more factors and processes are likely at play in determining how, when, where, and to what degree the relationship manifests (Fagan, 1990; Parker & Auerhahn, 1998). For instance, emerging research suggests that social, environmental, and contextual factors may influence this relationship (Contreras & Hipp, 2020; Duncan, Duncan, & Strycker, 2002; Fagan, 1990; 1993a; 1993b; Gorman et al., 2001; Kuypers et al., 2020; Lardier et al., 2018; Martínez, Rosenfeld, & Mares, 2008; Parker & Auerhahn, 1998; Speer et al., 1998; Watters, Reinerman, & Fagan, 1985; Zimring & Hawkins, 1997), both at the group- and individual-level. Social and contextual variables may influence individual substance use, offending, and their interaction through a complex interplay of forces that are important to understand when addressing these issues.

While extant literature probes the possible implications of context, no research in this area has investigated the implications for the drug-crime relationship across rural-urban contexts. This is a major oversight given the unique patterns of substance use and crime/delinquency in rural areas (Abraham & Ceccato, 2022; Donnermeyer & DeKeseredy, 2014; Weisheit & Donnermeyer, 2000) and the salient problems with substance misuse and addiction in these places (Donnermeyer & DeKeseredy, 2014; Havens et al., 2007; Weisheit, Falcone, & Wells, 2006). Even though crime rates remain relatively low in rural spaces (Bureau of Justice Statistics, 2018), substance use is comparable to (Substance Abuse and Mental Health Association [SAMHSA], 2023) or even greater than (Havens et al., 2007), urban contexts. Moreover, rural residents face unique challenges regarding barriers to substance use related health care (Borders & Booth, 2007) and urban-based policies often do not address the needs of

rural communities including the extent and nature of rural poverty combined with other structural disadvantages (Pruitt, 2009). Relatedly, people in rural places tend to have different preferences and approaches for solving individual and community problems which can change how these groups respond to policy interventions (Wuthnow, 2018). Consequently, both theoretical and policy concerns come into focus for the drug-crime relationship in rural areas.

The issues of substance use and crime are also particularly problematic for rural youth given their likelihood of developing substance use problems and the unique disadvantage they may face in their communities (Donnermeyer, 1992; Pruitt, 2009). Lack of adequate health care (Borders & Booth, 2007; Ricketts, 2000) and increased likelihood of disadvantage in institutions like schooling (Roscigno & Crowle, 2001) place these youth at great risk for negative life-course trajectories regardless of lower crime and delinquency rates in rural areas. However, some literature suggests that rural communities have greater or differing levels of informal social controls that protect them from crime and delinquency (Donnermeyer & DeKeseredy, 2014; Elder & Conger, 2000; Marshall & Johnson, 2005; Weisheit & Donnermeyer, 2000; Wuthnow, 2018), thus creating questions about whether and how these assertions comport with the presence of substance misuse and disadvantage among youth in these areas. In turn, examining drug-crime connections among youth and understanding whether this relationship differs substantially for rural youth is imperative to tackling these issues (in both rural and urban areas).

The current study seeks to fill this gap in the drug-crime relationship literature by examining 1) the role of rural compared to urban context, 2) the role of informal social controls, and 3) how informal social controls may provide a possible mechanism for differences in how this relationship emerges depending upon geographic context. Doing so increases our understanding of the impact of rural geographic context through a comparative perspective and

contributes to our theoretical grasp of elements at play in the drug-crime relationship. This research uses an adolescent subsample from the 2019 National Survey on Drug Use and Health (NSDUH). Adolescents are examined specifically given that they face great risk for substance misuse problems (Chen et al., 2009) while simultaneously being at the peak time for offending to begin and possibly be sustained long-term (DeLisi et al., 2015; Hirschi & Gottfredson, 1983; Sweeten, Piquero, & Steinberg, 2013).

First, I determine whether the relationship between substance use and delinquency is moderated by rural context among these participants. Prior literature noting differences in opportunity structures, social norms and values, and informal social controls in rural areas suggest that context will moderate the substance-delinquency relationship. Second, I examine whether this relationship is moderated by informal social controls (parental attachment, school attachment, and religious involvement through participation in faith-based activities) without accounting for context. Informal social controls may contextualize the drug-crime relationship given their proposed importance for this relationship and both substance use and delinquency generally. Finally, I draw both of these foci together to assess whether any moderating effect of rural context is altered by the introduction of informal social controls given the possibility of differences in these variables and how they function by rural-urban contexts. If the relationship between rural context and the substance-delinquency relationship is changed when accounting for informal social controls, both independently and in interaction with substance use, then this is suggestive that these processes help explain some of the variation across context.

## Chapter 2: Literature Review

### THE DRUG-CRIME RELATIONSHIP

The drug-crime relationship refers to the ways in which substance use (which includes both illicit drugs and alcohol), particularly its misuse, and crime or delinquency are related (Goldstein, 1985; MacCoun & Reuter, 2001). This relationship can manifest for individuals through personal substance use and criminal behavior as well as at the group or societal level in the interaction between drug markets and crime. The focus of the current study will be on the substance-delinquency relationship at the individual level, although this relationship should be investigated at multiple levels.

A robust literature finds evidence of a statistical association between substance use and crime. A meta-analysis by Bennett, Holloway, and Farrington (2008; see also Boles & Miotto, 2003; Deitch et al., 2000; Foran & O'Leary, 2008; Friedman, 1998; Nurco et al., 1991; White & Gorman, 2000; Zhong et al., 2020) found that the odds of offending were significantly greater for substance users compared to non-substance users. However, the strength and nature of the relationship depends upon other factors, both individual and environmental (McGinty, Choksy, & Wintemute, 2016). For instance, some studies have found that even though substance use may be more strongly linked to deviant behaviors like aggression and violence for males, substance use in adolescence may be more predictive of later violent or criminal behavior for females (Bennett et al., 2008; Friedman, 1998; Kandel, Simcha-Fagan, & Davies, 1986).

Additionally, the drug-crime relationship varies by the kinds of substances used and offense types. For substance type, current evidence suggests that alcohol is a greater contributor to violent behavior than other kinds of substances (Boles & Miotto, 2003; Boyum, Caulkins, & Kleiman, 2011; Branas, Han, & Wiebe, 2016; Fagan, 1990; 1993a; Friedman, 1998; White &

Gorman, 2000). The exact reasons for this are unclear, but it may be related to the specific intoxicating effects of alcohol as well as individual and environmental factors impacting whether an intoxicated person becomes violent (Boles & Miotto, 2003; Fagan, 1990; 1993a; Kuypers et al., 2020; Parker & Auerhahn, 1998). However, more serious illicit drug use, such as the use of crack or cocaine, is also found to have a stronger association with engagement in crime compared to substances like marijuana (Bennett et al., 2008; Fagan, 1990). Furthermore, across crime types, crimes against persons and selling illicit substances appear to be more highly related to substance use than other kinds of crimes (Bennett & Holloway, 2009; Kuhns & Clodfelter, 2009; Kuhns et al., 2014; White et al., 2002).

Among adolescents, who are the focus of the current study, the relationship between substance use and deviant behavior is also apparent, although studies diverge regarding the nuances of this connection (D'Amico et al., 2008; Dawkins, 1997; Deitch et al., 2000; Fagan et al., 1990). For instance, the drug-crime link does not appear to be empirically as strong for adolescents (Bennett et al., 2008; Fagan, 1990; White & Gorman, 2000) and some of the substance-delinquency relationship might be driven by variables related to increased “problem behaviors” among youth (Elliot, Huizinga, & Menard, 1989; Feldstein & Miller, 2009). Despite this, young people may face more substantial risks when using substances given that such use during this critical developmental period given the state of adolescent brain development (Chen, Storr, & Anthony, 2009) may send them down delinquent, and later criminal, paths (DeLisi et al., 2015; Fagan, 1990; White et al., 2012; 2015a). Substance use during adolescence can increase the likelihood of substance dependency problems (Chen et al., 2009), especially with higher frequency and duration of use. Substance use initiation is also most likely during this

period, with risk declining significantly with age (Chen & Kandel, 1995; Kandel & Logan, 1984), indicating that adolescence is a pertinent time to study drug-crime connections.

Overall, substance use has been found to be predictive of and precede crime/delinquency (Fergusson, Boden, & Horwood, 2013; Schroeder, Giordano, & Cernkovich, 2007; White et al., 2013; 2015a), and criminal/delinquent behavior often precedes and is predictive of later substance use (Chaiken & Chaiken, 1990; Elliot et al., 1989; Kandel et al., 1986; Simpson, 2003; White & Gorman, 2000) indicating the potential for a reciprocal relationship between substance use and crime (Deitch et al., 2000; Horney, Osgood, & Marshall, 1995; Menard, Mihalic, & Huizinga, 2001). In addition, those who engage in both substance use and crime/delinquency may be more likely to persist in offending (Chaiken & Chaiken, 1990; D'Amico et al., 2008; Deitch et al., 2000; Hussong et al., 2004; Kirk, 2020; Laub & Sampson, 2003; Schroeder et al., 2007). This work reveals that the drug-crime relationship is complex, and the reasons behind its existence remain unsettled, requiring more research to clarify these findings.

In sum, while there is general (though not universal, see Fagan et al., 1990; Gottfredson & Hirschi, 1990; Otero-Lopez et al., 1994; White, 1997) agreement that substance use and crime are related in a meaningful way, questions persist about the nature of this relationship, relevant mechanisms, and what variables need to be considered. The following section therefore addresses the theoretical discussion of the drug-crime relationship at the individual level. Then, I discuss the role of social context both theoretically and empirically to inform an understanding of how and why social context, specifically rural context, may matter for this relationship and the relevant theoretical and policy implications that come with it.

### *Mechanisms of the Drug-Crime Relationship*

Among the scholars who pose a non-spurious connection between substance use and crime or delinquency, explanations of the relationship primarily rely on the possible pathways through which these phenomena might be related. These include that (1) substance use increases the likelihood of criminal/delinquent behavior, (2) criminal/delinquent behavior increases the likelihood of substance use, and (3) substance use and criminal/delinquent behavior have some sort of reciprocal or multiplicative relationship (Bennett et al., 2008; Bennett & Holloway, 2009; Chaiken & Chaiken, 1990; Deitch et al., 2000; MacCoun et al., 2003; MacCoun & Reuter, 2001; Menard et al., 2001).

The former two explanations have a significant amount of literature examining the mechanisms of these possible pathways. How substance use may lead to involvement in crime/delinquency is the most often examined mechanism and therefore has incited more explanations than the other two pathways. The most prominently cited framework for understanding this pathway is Goldstein's (1985) tripartite framework, which proposes three explanatory models: (1) the *psychopharmacological model*, (2) the *economically-compulsive model*, and (3) the *systemic model*. While the systemic model is important to consider, the former two models are based on an individual-level analysis rather than a group- or society-level one and thus are relevant for this review. First, the psychopharmacological model proposes that the physiological effects of certain substances may increase aggression or lower inhibitions (Fagan, 1990; Goldstein, 1985; Parker & Auerhahn, 1998). Similarly, some argue that intoxication by certain substances, particularly alcohol, may alter cognitive perceptions such that one perceives more threats or is more easily provoked (Fagan, 1990). Second, the economic model suggests that the physical and/or psychological need, desire, or want to support a substance use habit may

increase one's likelihood to turn to crime to obtain money or to steal drugs (Chaiken & Chaiken, 1990; Collins, Hubbard, & Rachal, 1985; Goldstein, 1985).

The second pathway, that involvement in crime/delinquency may increase the probability of subsequent substance use, has also received substantial attention in the literature. These possible explanations elucidate how substance use may be a response to offending behavior or an organic part of criminal/deviant structures or environments, thus increasing the likelihood of substance use initiation (White & Gorman, 2000). For example, individuals may use substances to celebrate successful crimes (Menard et al., 2001), and this usage of substances is not unlike wider social and cultural uses of alcohol (Sudhinaraset, Wigglesworth, & Takeuchi, 2016). Furthermore, a qualitative study by Bennett and Holloway (2009) found that some who are engaged in crime use substances as a means for making criminal acts easier by either lowering anxiety or building "courage" to act, therefore aiding in the reduction of inhibitions. While this may seem like an explanation of how substances can contribute to criminal behavior, instead the decision to offend leads to the use of substances as a means of facilitating this behavior. Criminal or delinquent behavior may also yield greater access to situations where certain illegal substances are accessible or seen as desirable to use (Collins et al., 1985).

Finally, explanations in the life-course criminology and related literature can help explain how substance use and crime/delinquency may be reciprocally and/or multiplicatively related (in addition to possible combinations of the previous common explanations). For example, as previously mentioned, adolescents may be more susceptible to the negative impacts of illicit drugs and alcohol in terms of dependency given the harmful impact of substances on brain development (Chen et al., 2009; Squeglia, Jacobus, & Tapert, 2009). Furthermore, these effects may negatively influence life course trajectories likely to be established during this period,

further cementing drug-crime connections in adulthood (Ford, 2005; Hussong et al., 2004).

These negative impacts in childhood and adolescence can then progress into adulthood through a process of cumulative disadvantage (Sampson & Laub, 1997), making desistance more difficult. Substance use and addiction may therefore contribute to individual acts of offending in the short-term and decrease the probability of desistance/increase the probability of persistence in the long-term (Kirk, 2020; Hussong et al., 2004; Laub & Sampson, 2003; Menard et al., 2001; Schroeder et al., 2007). In this way, substance use and crime/delinquency might reinforce each other, cultivating deviant and criminal trajectories, rather than only one increasing the probability of the other.

Despite these possible mechanisms, some scholars argue that the drug-crime relationship is spurious and due to a common cause(s) of both behaviors (Bennett et al., 2008; Menard et al., 2001). For example, Gottfredson and Hirschi (1990) contend that criminal/delinquent behavior and substance use are caused by low self-control, thus creating the illusion of a causal connection between the two. While there is some evidence for spuriousness (Fagan et al., 1990; Otero-Lopez et al., 1994; White, 1997), exogenous factors can both influence substance use and crime/delinquency while not completely dissolving the existence of a meaningful connection between the two. Some research has shown that even though self-control may be an important predictor of substance use, as well as other “analogous behaviors”, and criminal/delinquent behavior, it does not fully explain this association (Paternoster & Brame, 1998; Piquero, Gibson, & Tibbetts, 2002). It is likely other variables matter for producing these behaviors independently and jointly, as well as for their interrelation.

With these possible mechanisms in mind, the following section examines the role of social context and environmental variables as possible factors influencing the drug-crime and

substance-delinquency relationship, laying the foundation for understanding how and why rural context may matter, particularly for youth. Then, the empirical literature examining environmental influences will be addressed before moving into an assessment of rurality and its pertinence for the current research.

### *The Role of Social Context*

The importance of sociological factors in the drug-crime relationship has been a topic of inquiry since Goldstein's (1985) original paper. However, the role of social context has not been thoroughly investigated. Some scholars argue that social context interacts with the drug-crime relationship and is important for determining when and how substance use may lead to offending, especially violence (Fagan, 1990; 1993a; 1993b; Parker & Auerhahn, 1998; Watters et al., 1985). Social context can include the immediate situational characteristics that exist when/where someone engages in substance use or crime/delinquency, as well as the larger sociocultural factors that influence normative behavior and relevant social controls (Fagan, 1990). Since one's social environment can impact their behavior, including whether they engage in crime or not, it is also likely that it can alter how substances and the circumstances surrounding their use influence subsequent deviant behavior. These potential environmental influences hold implications for how the drug-crime relationship should be understood theoretically and addressed by policy.

In drug-crime research, both Fagan (1990, 1993a, 1993b) and Parker and Auerhahn (1998) have discussed the potential importance of social context for this relationship, specifically the alcohol-violence relationship, across a wide array of potential sociological influences at the macro- and micro-levels. For instance, while much of the literature focuses on the psychopharmacological model, Fagan (1990) argues that macro-level contextual features such as

social, cultural, and other contextual elements likely play a large role in determining whether a person under the influence of alcohol, or in spaces where alcohol is present, becomes violent. Similarly, Parker and Auerhahn (1998) discuss the situational and environmental components of the alcohol-violence relationship specifically at this situational-level.

At the micro-level, there appears to be variation in substance-violence relationships depending upon the specific social situation or setting (Fagan, 1990; Parker & Auerhahn, 1998). Factors like anonymity, the people one is around, the victim-offender relationship, and the strength of controls present in a specific place influence one's behavior. The expectations of certain social settings and of the people in that setting may allow for deviant behavior, whereas others may constrain such behavior (Fagan, 1990; Parker & Auerhahn, 1998). For example, an intoxicated person in a local bar might be controlled by the presence of people known to the individual, while this is not necessarily the case in an establishment further away from one's residence or in an area of town explicitly structured for hedonistic activities. Similarly, properties of drug distribution, the availability/accessibility of substances, and the existence of spaces where substance use is prolific might influence broader patterns of use and behavioral constraints (Goldstein, 1985; Parker & Auerhahn, 1998). Since these social elements are specific to certain places and scenarios rather than broader contextual characteristics, they will not be addressed further by the current research. However, these explanations can still play a role in our understanding of the potential impact of rural context, and such mechanisms will be considered as they pertain to this issue (albeit briefly).

At the macro-level, cultural and broader social-contextual variables may also influence the drug-crime relationship. For example, studies examining substance-violence relationships outside of the United States (U.S.) have not found the same aggression-causing properties noted

in U.S. based research (Fagan, 1990); instead, when, how, and whether using substances is related to subsequent aggressive or violent behavior depends on culture. If it is considered normative or permissible to be violent or aggressive while drunk in a particular culture, like in the U.S. where such behavior is more common, then people may engage in that behavior; while in other cultures, where said behavior is unacceptable, individuals would be more likely to restrain themselves (Fagan, 1990; Parker & Auerhahn, 1998). Furthermore, people may blame their bad behavior on substances more so in certain cultures, neutralizing controls and allowing for deviance (Fagan, 1990). For adolescents, peer networks and encouragement, or discouragement, or substance use behaviors and delinquency in tandem may also be informed by these broader normative structures regarding the permissibility of such behavior for youth. The symbolic meaning of substance use across cultures as well as norms about using drugs and concurrent behavior may therefore differentially influence this relationship. In turn, contextual variables can influence individual-level behavior and how phenomena like substance use and crime/delinquency interact.

Within this context, informal social controls that govern a variety of situations and exist within certain cultural settings may be one of the primary variables that impact the relationship between substances and violence as well as other deviant behavior (Fagan, 1990; 1993a, 1993b; Parker & Auerhahn, 1998). Externally, the strength of cultural norms around substance use and deviant behavior as well as informal monitoring of individuals by one's community, family, or even peers, may act as mechanisms for decreasing criminal and delinquent behavior among substance users. Internally, the extent to which a person has internalized certain behavioral norms and beliefs about what behaviors are permissible when under the influence of substances or about appropriate behavior more generally in public spaces may also influence this

relationship (Fagan, 1990). Each of these manifestations of informal social controls, both at the community- and individual-level, can influence how substance use and crime/delinquency appear or interact for people in specific situations or in their lives more broadly.

As will be discussed later in this review, factors like informal social controls may exist to a higher degree or manifest differently in certain places, like rural areas, which could alter drug-crime relationships. These theoretical explanations point to the fact that the drug-crime relationship might differ across context. In turn, certain social contexts may moderate the drug-crime or substance-delinquency relationship. Some social settings may convey stronger norms and rules for behavior, limiting the likelihood that an intoxicated person chooses violence or criminal behavior as a means for obtaining some goal (Fagan, 1993a). In contrast, other social contexts might provide greater cultural incentives or opportunities for engaging in substance use in a way that facilitates criminal behavior, possibly increasing the strength of the relationship. These mechanisms are particularly pertinent for adolescents who are likely to be strongly influenced by the behavior of those around them and both formal and informal social controls, norms, and behavioral expectations of their settings. With these theoretical and mechanistic considerations in mind, the next section examines the current empirical literature that tackles the influence of social context on the drug-crime relationship.

#### *Empirical Status of Social Context*

Empirically, limited research investigates how social contextual variables may be related to the drug-crime relationship at the individual-level outside some of the work discussed in the previous section, and research in this area often focuses on alcohol and violence. For instance, Kuypers and colleagues (2020) find that even with a direct relationship between alcohol and aggression, the influence of alcohol appears to depend upon individual and social contextual

factors. The specific stimuli in the environment matter for how a person behaves as these factors interact with the inebriating or aggression-inducing effects of alcohol, particularly in terms of whether a person is or feels provoked to act violently.

While individual-level research on how social variables influence the drug-crime relationship is scarce, some studies attempt to address the role of context in the drug-crime relationship by assessing the possible association between neighborhood social control, social cohesion, and related factors and the drug-crime relationship. While these influences cannot be assessed by the current study, some of the insights from this research are useful for understanding the role of social context in this relationship, including as it may apply to rural areas. For instance, certain studies indicate that variables like neighborhood sense of community and neighborhood-level social cohesion may influence the relationship between substance use and delinquency among adolescents (Duncan et al., 2002; Lardier et al., 2018), which might be applicable to rural contexts (as will be discussed in the next section).

In a similar vein, other scholars focus on physical spaces and how substance use activity relates to crime in those areas, providing tests of the situational and spatial explanations for drug-crime connections. Zimring and Hawkins (1997) argue that social context has an important impact on the drug-crime relationship in terms of the influence of drug markets and resultant behavior; they point out that the mere presence of drug markets is not sufficient for high levels of lethal violence, as the United States remains uniquely situated in that respect even though other countries have substantial drug markets as well. There is also some evidence supporting the idea that drug activity at the neighborhood-level is related to crime rates (Contreras & Hipp, 2020; Martínez et al., 2008) and that the presence of alcohol or liquor outlets is spatially linked to

criminal activity (Gorman et al., 2001; Speer et al., 1998; White et al., 2015b), violent crime in particular.

These studies demonstrate the ways that researchers have begun to test variation in the drug-crime relationship by environmental or contextual conditions. However, this work is limited and often cannot speak to how social contextual variables might influence individual level behavior. The next section will address how rural context and related characteristics may matter for this relationship as a means of extending this work.

## RURALITY, CONTEXT, AND CRIME

Rurality is one contextual feature that may condition the relationship between substance use and crime. The following section provides important definitional nuance to rurality as a concept, reviews descriptive trends of the prevalence and patterns of crime in rural spaces, and briefly summarizes the growth of rural criminology. Next, substance use and its significance in rural areas is assessed regarding how context may be important for the drug-crime relationship, particularly for adolescents.

### *Definitions and the Rural-Urban Continuum*

“Rural” can be defined in many ways. First, it is often defined by geographic and/or demographic features, such as population size/density, as these are the most accessible, standardized forms of measurement (Weisheit & Donnermeyer, 2000). Specifically, researchers tend to use the U.S. Census Bureau’s categorization of counties as metropolitan or nonmetropolitan (Donnermeyer & DeKeseredy, 2014; Lichter & Ziliak, 2017; Weisheit & Donnermeyer, 2000), both to varying degrees of geographic granularity, and these definitions will be discussed further in the methodological section. Second, other definitions conceptualize rurality using the characteristics of rural areas that are said to diverge from urban/metropolitan

ones including economic factors, social structures, and culture (Marshall & Johnson, 2005). For example, rural places are often characterized by homogeneity, strong community ties and relations, shared values/beliefs/norms, and collective efficacy; and there is evidence to suggest that these characterizations are true to some extent (Donnermeyer & DeKeseredy, 2014; Elder & Conger, 2000; Marshall & Johnson, 2005; Weisheit & Donnermeyer, 2000; Wuthnow, 2018). Residents of rural areas are more likely to “know each other’s business” and be aware of the activities of those in their neighborhoods and connected communities (Donnermeyer & DeKeseredy, 2014; Wuthnow, 2018). These attributes of rural life have led some to define rurality based on these community characteristics rather than geographic features alone.

However, the distinctions between rural and urban spaces are becoming less discernible with increasing urbanization (Lichter & Brown, 2011; Lichter & Ziliak, 2017; Wuthnow, 2018) and out-migration from nonmetropolitan areas (Johnson & Lichter, 2019; United States Census Bureau, 2022). Moreover, social and cultural differences in these contexts may not be as influential in today’s world as they were at the beginning of industrialization (Lichter & Brown, 2011). These changes have made it more difficult to draw both spatial and social or cultural boundaries to define what areas are considered rural or not. Because of this, the mechanisms related to phenomena of interest for these spaces may be more similar than they were in the past, creating difficulty for researchers trying to assess whether or to what extent certain rural-urban differences matter for crime in the modern world.

Despite these considerations, scholars continue to explore the divergent cultural and social characteristics in rural areas. Beliefs among rural residents such as a distaste for welfare and “handouts”, as well as divergent approaches to deal with deviance among community members, may influence responses to and experiences of poverty, substance use, and crime

(Lichter & Brown, 2011; Lichter & Jensen, 2002; Sherman, 2006; Wuthnow, 2018).

Furthermore, rural areas, and rural youth in particular, often experience great levels of disadvantage including poverty (Bishaw & Posey, 2016; Osgood & Chambers, 2000; Pruitt, 2009) and other structural disadvantages in social institutions like education (Roscigno & Crowle, 2001) and health care (Borders & Booth, 2007; Ricketts, 2000). These differences are pertinent for the current study as they may inform why divergent patterns of substance use and crime/delinquency occur across rural-urban contexts. Such considerations also inform why understanding the drug-crime or substance-delinquency relationship in rural areas compared to urban ones is important for theory and policy. As such, the unique characteristics of rural crime and delinquency will be discussed in the next section before examining rural substance use.

### *Crime in Rural Areas*

In general, rural places appear to have lower crime rates than urban ones based on official and victimization data (Bureau of Justice Statistics, 2018; Thompson & Tapp, 2023; Weisheit & Donnermeyer, 2000; Weisheit et al., 2006). The Federal Bureau of Investigation's (FBI) Uniform Crime Reports' (UCR) most recent data (2019) found that lower crime rates are reported across index offense categories in nonmetropolitan counties compared to both metropolitan statistical areas and cities outside metropolitan areas (UCR, 2019a). Metropolitan juveniles also appear to experience arrest at higher rates than their nonmetropolitan counterparts within the age-distribution of offenses (UCR, 2019b; 2019c).

While these findings may be compelling for the argument that crime is lower in rural places, these statistics rely on crimes being reported to police and police departments giving this information to the FBI. This is problematic for understanding crime in rural areas for several reasons. Those living in certain rural areas may be less likely to report their victimization(s) to

the police (Bureau of Justice Statistics, 2018) as community members might be inclined to handle crime and deviance internally given a greater reliance on informal social controls (Boggs, 1971; Weisheit & Donnermeyer, 2000). There may even be cases where rural residents attempt to control information about crime in their community or allow for certain issues with crime/deviance to persist beyond the scope of the law (Barclay, Donnermeyer, & Jobes, 2004).

Paradoxically, greater trust in and relationships with law enforcement in these spaces may further facilitate informal handling of crime (Hurst, 2007; Peterson, 2021; Weisheit & Donnermeyer, 2000). For example, rural police officers appear less likely to pursue domestic violence cases or crimes related to violence against women (Donnermeyer & DeKeseredy, 2014; Edwards, 2015; Rennison, DeKeseredy, & Dragiewicz, 2013). If responding officers know both the offender and victim, they may be more likely to handle these issues outside of formal procedures (Weisheit et al., 2006). This can extend to confronting juvenile delinquency as well (Peterson, 2021), as there might be greater incentive to protect these youth from the criminal legal system. Police departments may also handle information differently when reporting to agencies like the FBI, since those living in rural areas, including police, express more distrust of government that can influence the extent to which departments engage with government entities in crime statistic reporting (Weisheit & Donnermeyer, 2000).

Outside of official statistics, the National Crime Victimization Survey (NCVS), which records victimization experiences regardless of whether they were reported to police, provides evidence that those living in nonmetropolitan areas have the lowest victimization rate (Weisheit & Donnermeyer, 2000). A Bureau of Justice Statistics (BJS) report from 2018 drawing on NCVS data notes that rural areas have much lower victimization rates than urban ones, but this was dependent on other factors. For example, LGBTQIA+ or queer students appear to experience

higher levels of victimization at school in rural areas. This is likely due to the more conservative, and less tolerant, attitudes of those living in rural areas towards queer populations (Peterson, 2021; Wuthnow, 2018).

The existence of lower crime and victimization rates across all crime types in all nonmetropolitan or rural areas is also not guaranteed. In the 2019 UCR data, the rates for certain crimes (such as murder and nonnegligent manslaughter, rape, and burglary) are greater in nonmetropolitan counties with populations under 10,000 people (Uniform Crime Reports, 2019d). It is difficult to ascertain whether these communities are reporting more to the police than proposed by the literature or if there are true crime rate differences. Other kinds of crime in rural areas, such as domestic violence and drug use, are either higher than or comparable to urban areas as well (Donnermeyer & DeKeseredy, 2014; Edwards, 2015; Gfroerer, Larson, & Colliver, 2007; Herz & Murray, 2003; Rennison et al., 2013) and said drug use rates are important to note for the forthcoming discussion of substance use in rural areas.

Besides sheer crime rate differences, rural areas also experience distinctive crime trends and victimization patterns (Weisheit et al., 2006). Victims of violent crimes in rural areas are much more likely to be family members or friends of the offender and crime trends/patterns often do not match urban ones (Bachman, 1992; Weisheit & Wells, 2005). During the crime increases and subsequent declines in the 1970s-1990s, rural counties saw variations in how property and violent crimes rose and fell during this period that diverged from urban areas, and the gap in crime rates between rural and urban spaces has not stayed constant over time (Bachman, 1992; Weisheit et al., 2006). Rural areas also allow for types of crime that cannot occur in urban areas, such as agricultural and certain environmental crime (Abraham & Ceccato, 2022; Donnermeyer & DeKeseredy, 2014). Nuances like these within larger geographic units

such as rural or nonmetropolitan areas/counties exemplify some of the problems with making broad generalizations about rural areas compared to urban ones, while also providing evidence for the distinctness of rural areas regarding crime and substance use. These issues will be discussed more within the context of rural criminology and how they inform our understanding of why the drug-crime relationship may be context dependent in the following section.

### *Rural Criminology*

The apparent differences in crime across geographic contexts have led some scholars to investigate the particularities of rural spaces, motivating endeavors like theory testing using rural data, but rural criminology remains relatively uncommon (Donnermeyer & DeKeseredy, 2014). Abraham and Ceccato (2022) in their systematic review of the literature from 1980 to 2020 were able to identify only 840 publications that were associated with rurality and criminology, 410 of which met certain specifications to be considered for their review. Compared to the expansive criminological literature focusing on urban contexts, rural criminological work is limited but growing.

The paucity of criminological work examining rural areas may stem from several views about the nature of rural spaces and communities as well as assumptions about criminological theory (Donnermeyer & DeKeseredy, 2014), and these considerations are important for contextualizing why examining rural crime is needed. First, scholars may avoid examining rural crime because aggregate rural crime rates are low relative to urban crime rates (Bureau of Justice Statistics, 2018; Donnermeyer & DeKeseredy, 2014; UCR, 2019a). Higher rates of urban crime have led criminologists to focus on the urban landscape and how it may uniquely contribute to crime. For instance, the work of Shaw and McKay (1942) and the Chicago School are important in criminology, yielding theories and intellectual frameworks that may emphasize urbanity

(Donnermeyer & DeKeseredy, 2014). Second, only about 20% of the population resides in rural areas (United States Census Bureau, 2022), potentially leading one to conclude that research on urban areas is of greater utility. Additionally, since this relatively small number of rural residents are spread out across 75% of the landmass of the United States (Weisheit & Donnermeyer, 2000), it may be more difficult and costly for researchers to collect data from those living in rural areas, discouraging investigation of these contexts (Crockett, Shanahan, & Jackson-Newsom, 2000). Finally, general theories of crime like control, social learning, strain, rational choice, etc., assume that their propositions are applicable to all people in all contexts, meaning that examining rural spaces specifically is unnecessary as it would not provide any greater insight into the causes of crime (Weisheit & Wells, 1996; Ward, Kirchner, & Thompson, 2018).

Rural criminologists have pointed out several issues with these rationales for not studying rural crime. For instance, even though crime rates in the aggregate are lower in rural and nonmetropolitan areas, crime still exists in these places (in addition to the areas with potentially higher rates of certain crimes) and said crime is meaningful for the people who live there (Donnermeyer & DeKeseredy, 2014; Weisheit & Wells, 1996). Criminologists often study groups of people that make up relatively small portions of the United States population, but these groups are no less significant and may require unique policy considerations.

In addition, since most theory creation, testing, and application is done using urban-based samples and data, the universal applicability of these theories, even ones intended to be general, to rural contexts is unclear (Donnermeyer, 2019; Donnermeyer & DeKeseredy, 2014; Osgood & Chambers, 2000; Ward et al., 2018; Weisheit & Wells, 1996). Rural areas have specific crime problems and experience changes in crime rates and patterns that are important to understand (Cebulak, 2004; Weisheit et al., 2006). The qualities of rural contexts may influence a variety of

variables related to crime, even those considered to be universal, producing the crime differences seen empirically. For example, in Osgood and Chambers' (2000) seminal piece, when testing social disorganization in rural areas the authors found that juvenile violence rates were not related to poverty (possibly given its inverse relationship to residential instability) or population size. These findings demonstrate that while theories like social disorganization may be somewhat generalizable to rural areas, there are differences in how theoretically relevant factors and mechanisms manifest or function by geographic context. In turn, while the current research does not suggest the need for new theories to explain rural crime and substance use *per se*, it does argue for the importance of testing these ideas and assumptions across rural-urban contexts to discern if practical differences exist. Applicability and the explanatory power of criminological theories should not be assumed *a priori* and instead should be subject to empirical testing across contexts.

The specific processes which produce criminogenic effects may be context dependent to some degree as well. For example, some research suggests that intimate partner violence is a greater issue in rural contexts because it is easier to socially isolate one's partner (Lanier & Maume, 2009) and avoid detection, or accountability, from authorities (Weisheit & Wells, 1996; Weisheit & Donnermeyer, 2000). Further, different opportunity structures likely play a role in how crime manifests in rural counties (Lee & Alshalan, 2005; Weisheit & Donnermeyer, 2000), but how these structures can influence substance use behavior and its relationship to crime and delinquency remains unclear. The lack of research in this area leaves questions about how theory, criminogenic processes, and other relationships and variables of interest may diverge in addition to their application to the drug-crime relationship across contexts.

### *Substance Use and The Drug-Crime Relationship in Rural Areas*

Beyond theoretical concerns, within the empirical rural criminological and sociological literature that exists, there is a sizable focus on substance use given its distinct and harmful presence in rural spaces (Abraham & Ceccato, 2022; Borders & Booth, 2007; Dew, Elifson, & Dozier, 2007; Donnermeyer & DeKeseredy, 2014; Gfroerer et al., 2007; Havens et al., 2007). Data from the most recent wave of the National Survey on Drug Use and Health (NSDUH) indicate relatively similar percentages of substance use across metropolitan and nonmetropolitan areas, including among youth (SAMHSA, 2023). Moreover, research in this area indicates that rural adolescents tend to engage in a similar level of alcohol and marijuana use as their urban peers, although rural youth may consume alcohol more frequently (Weisheit et al., 2006). However, urban adolescents tend to use more cocaine/crack, sedatives, and hallucinogens, whereas rural adolescents use more inhalants and stimulants (Donnermeyer, 1992). Methamphetamine is also much more common in rural areas (Weisheit et al., 2006) and non-prescription use of Oxycontin has been a pervasive issue in rural counties and among those engaged in crime in rural areas (Havens et al., 2007).

Despite these concerning trends, research moving beyond descriptives and examining the nuances of substance use and misuse in these contexts is scarce (Abraham & Ceccato, 2022; Donnermeyer & DeKeseredy, 2014). Research examining both substance use and crime or delinquency in rural areas typically provides descriptive accounts of rural versus urban substance use (Brown, Voskuhl, & Lehman, 1977; Donnermeyer, 1992; Gfroerer et al., 2007; Hertz & Murray, 2003) or tests broader beliefs and findings derived from urban areas within rural samples (Chilenski & Greenberg, 2009; Dew et al., 2007; Rhew et al., 2011; Scheer et al., 2000). This body of work suggests that unique social influences and structures in rural areas may result

in differential exposure to factors related to crime and substance use, leading to different manifestations of these phenomena. For example, among adolescents, factors like peers and religion may be more influential for substance use and deviant behavior in rural areas (Dew et al., 2007; Elder & Conger, 2000). Moreover, given the literature on crime rates, even within rural areas there may be meaningful variation in the emergence and functioning of substance use and abuse. For instance, Rhew and colleagues (2011) found that rural high-school aged youth living on farms may engage in more illicit drug use when compared to their non-farm peers and there were differences in risk and protective factors for substance use across these spaces.

One study by Simpson (2003) however has addressed the drug-crime relationship among nonmetropolitan people specifically by conducting an ethnography on the drug careers of 88 young people living in a nonmetropolitan, Northeastern town. Simpson found that substance use and crime appeared to be connected by exogenous factors, thus indicating a potentially spurious relationship. But, once substance use and criminal behavior occurred, these behaviors looped into each other, and the emergence of this relationship (along with other patterns of substance use) depended on local social environments.

Additionally, a study of youth in the Netherlands living in rural and non-rural areas by Weenink (2011) found that alcohol was a better predictor of delinquency for rural youth. He also found that communal social controls were not particularly meaningful for delinquency rates, although rural youth were exposed to greater levels of these variables. Instead, cultural variables related to gender and behavior around drinking were important; a finding that conforms to Fagan's (1990) arguments to some degree. These studies add a rare focus on the drug-crime relationships among nonmetropolitan and rural populations, although their applicability to rural youth in the United States specifically is unknown.

Other studies examining these issues have done so in a less direct manner. Studies using the PROSPER Peers Project data, which examines rural youth in two states longitudinally, have demonstrated the efficacy of its substance use intervention program in these communities (Spath et al., 2013; 2017). Further, in terms of substance misuse and crime/delinquency specifically, Fosco and colleagues (2024) found evidence for substance use being predictive of antisocial behavior among the rural PROSPER youth. Chilenski and Greenberg (2009) also examined the relationship between community-level factors and risk for engaging in substance use and delinquency among these youth, finding that contextual factors were important, although not entirely consistent, for understanding these outcomes. For example, like in other studies of rural areas (Osgood & Chambers, 2000; Ward et al., 2018), the researchers found that poverty does not play the same role for crime/delinquency in rural areas as it does in urban ones.

Unfortunately, despite the efforts of these researchers to bring rurality into the fold of the drug-crime conversation, this work does not clarify whether and how the relationship may differ in rural spaces. This literature also does not clarify how youth may be influenced by their geographic context and dependent social controls, norms, etc., that may influence substance use, delinquency, and their interaction; although, Weenink's (2011) study suggests that there may be meaningful differences across rural-urban contexts that are significant for theory and policy.

Given the literature, which suggests that unique social contexts may influence crime and/or delinquency, the differences between rural and urban areas in terms of substance use/misuse and crime/delinquency are suggestive of the potential importance of rurality on the drug-crime relationship. Furthermore, beyond simple crime rate differences, divergent patterns of crime and substance use and their relation to contextual factors in rural areas indicate potential differences in how these phenomena operate together or contribute to one another, but the extant

research does not address this possibility. The next section will elucidate how explanatory mechanisms and theory inform our understanding of these possible differences and their importance for the drug-crime literature and rural criminology.

#### THEORETICAL FRAMEWORK: INFORMAL SOCIAL CONTROLS

The primary theoretical framework I use to understand how rural contexts may influence the drug-crime relationship, specifically the substance-delinquency relationship (which includes alcohol use and is limited to adolescents), is informal social control. First, I will describe social control theory and the meaning of informal social controls for adolescents and adults. Second, I will examine how this theory may inform our understanding about the possibility of differences in how the substance-delinquency relationship emerges in rural compared to urban areas. The current study tests whether informal social controls are different across rural and urban areas in a way that helps explain any contextual influence on the drug-crime relationship for adolescents. I propose that informal social controls in rural areas may act as an explanatory mechanism for rural-urban differences in drug-crime connections. This work thus contributes to the comparative literature of rural-urban contexts regarding how theory may help explain potential differences in crime, substance use, and their connection in different contexts.

##### *Informal Social Control and the Drug-Crime Relationship*

Social control theory posits that certain social factors constrain individuals from engaging in crime through a variety of mechanisms. People fundamentally vary in terms of their internal moral constraints, and thus prosocial environmental factors can be necessary for some to prevent some from pursuing behavior that is in one's self-interest but is considered deviant (Costello & Laub, 2020). Informal social controls specifically describe factors like family and prosocial institutions which keep us from engaging in deviant behavior that are not the formal institutions

of the state or criminal legal system (Costello & Laub, 2020). In *Causes of Delinquency* (1969), Hirschi argues that bonds to society and family help influence whether adolescents engage in delinquency. For example, a child with a strong connection/attachment to their parent or guardian will engage in less delinquency because they will not want to put that bond at risk by behaving inappropriately. Similarly, adolescents with strong bonds to school or other prosocial institutions will not want to engage in delinquency as such behavior would jeopardize those connections (Hirschi, 1969).

With these definitions in mind, informal social controls can come into play when thinking about the drug-crime relationship. For example, as discussed in the section on mechanisms of the drug-crime relationship, the life-course criminological literature provides evidence for how social control theory can help us understand this relationship. Substance use may weaken social bonds or damage informal social controls, “knife off” of prosocial networks and opportunities, create snares for continued offending, and increase participation in criminogenic networks, thus increasing persistence in offending or hindering desistance (Ford, 2005; Hussong et al., 2004; Kirk, 2020; Laub & Sampson, 2003; Menard et al., 2001; Sampson & Laub, 1997; Schroeder et al., 2007). For adolescents, while much of this literature examines adulthood, substance use may weaken crucial social bonds or influence related factors and set people on negative life-course trajectories or reduce opportunities for prosocial trajectories (Laub & Sampson, 2003; Schroeder et al., 2007). As such, while the current study is not able to leverage a life-course perspective, this work demonstrates how social controls may matter for the drug-crime or substance-delinquency relationship.

### *Informal Social Controls as a Mechanism for Rural-Urban Differences*

As discussed in the section about rural sociology and criminology, there is some research suggesting that rural areas may have higher levels of informal social controls or that they experience these controls differently compared to urban areas (Elder & Conger, 2000; Marshall & Johnson, 2005; Weisheit & Donnermeyer, 2000). For example, those in rural communities may utilize social ties and community controls to combat local problems like crime and delinquency (Elder & Conger, 2000; Hofferth & Iceland, 1998). Religion and religious activities also appear to be important in rural communities to a greater extent (American Communities Project, 2022; Dew et al., 2007; Elder & Conger, 2000), and these institutions can act as mechanisms of informal social controls.

Further, some literature suggests that rural adolescents experience greater levels of social controls and protective factors, both in their community and at home, which may explain decreased levels of delinquency (Biggar et al., 2016; Lysterly & Skipper, 1981). Social bonds also may be more salient for rural compared to urban youth (Gardner & Shoemaker, 1989; Lysterly & Skipper, 1981). For instance, Gardner and Shoemaker (1989) found that social bonds provided a more robust explanation of variation in delinquency and substance use among rural than among urban eighth to twelfth graders. However, the sample of youth from urban areas were significantly more likely to be Black, meaning variables related to the racial composition of the samples may be driving these differences. The differences in the influence of social bonds may be due to the stronger levels of other kinds of controls in rural areas as discussed previously as well as more consistent roles and norms for adolescent behavior (Lysterly & Skipper, 1981). Despite this, given low value placed on formal education and disadvantages that exist for rural

youth in school (Pruitt, 2009), it is possible that informal social controls or social bonds to such institutions will be weaker in these places.

Given that informal social controls may influence the drug-crime relationship (Fagan, 1990) and that they play an important role in the lives of rural youth, the current study examines whether informal social controls (including parental attachment, school attachment, and religious involvement) are meaningful for understanding how the substance-delinquency relationship might differ across context. The aforementioned informal social controls are therefore investigated as possible mechanisms for rural-urban differences in the substance-delinquency relationship. Literature assessing how individual-level informal social controls will specifically diverge across context is limited, and it is possible that levels of these controls may not differ but how they function. Regardless, informal social controls for youth will aid in our understanding of how and why the substance-delinquency relationship might diverge across context.

#### *Mediation or Moderation?*

With this information in mind, the current study examines how rural context and informal social controls may influence the relationship between substance use and delinquency, but how this should be done given the literature needs clarification. It is sometimes unclear whether social influences and informal social controls are meant to be mediating or moderating the drug-crime relationship, or if there is a more complicated conditional process occurring. As such, these terms will be defined and why this research conceptualizes rural context and informal social controls as moderators rather than mediators will be explained.

*Mediation* refers to how a third variable may operate as the mechanism through which an independent variable impacts a dependent variable (Hayes, 2022). If we consider substance use to be the independent variable and crime/delinquency to be the dependent, then a mediator

variable would be something that substance use would influence that would in turn impact crime/delinquency. For example, using substances may increase access to criminal or delinquent opportunities which would then increase the likelihood of such behavior.

*Moderation* refers to how the magnitude or sign of a relationship between an independent and dependent variable may depend on some other variable (Hayes, 2022). Moderator variables are thus not mechanisms, but conditioning variables or characteristics that alter how a relationship manifests. For instance, gender, which is a characteristic of a person, may influence the strength of the relationship between substance use and crime/delinquency, but substance use cannot impact gender. Gender would therefore be a moderator.

Based on this and the mechanisms of the drug-crime relationship, certain social or environmental variables may act as either mediators or moderators depending upon their conceptualization. However, what social variables are particularly meaningful and how they would operate in the interaction of these phenomena is unknown. Fagan (1990) suggests that research in this area considers various social and individual factors as mediators in the relationship between aggression and violence, but he also notes that social contextual variables may moderate the relationship between substance use and aggression (Fagan, 1993a). This discrepancy may stem from the kinds of variables being addressed and how they are operationalized: i.e., are we discussing broader situational and contextual features that would act as the backdrop/stage where a drug-crime interaction occurs, or are we referring to characteristics of the environment that are influenced by substance use or criminal behavior which would in turn either disrupt or facilitate this relationship? Either could be the case depending upon the variables examined and the purpose of one's research or question.

First, in my conceptualization of rural context, I consider context to be the backdrop for drug-crime interactions, a moderating variable rather than a mediating one. While *situational* factors may be influenced by substance use that then impacts crime/delinquency, this cannot be said, in general, for the geographic context in which one resides. There may be cases where someone's involvement in crime/delinquency or substance use leads to changes in their residence, but there does not appear to be evidence for this influencing the drug-crime relationship. Instead, residing in a rural context can and should be considered as part of the general setting where drug-crime interactions may happen.

Second, for informal social controls, their role as either a moderator or mediator is less clear. Certainly, engaging in substance use may weaken social bonds or other informal social controls which would then increase the likelihood of criminal/delinquent involvement (and vice versa). This considers informal social controls to be mediators in the substance-delinquency or drug-crime relationship. As discussed in the last section, informal social controls as mediators in this relationship is a common idea within the life-course criminological literature (Ford, 2005; Laub & Sampson, 2003; Menard et al., 2001; Sampson & Laub, 1993). In contrast, informal social controls can also be considered part of the setting where drug-crime interactions occur. For example, neighborhood- or group-level informal social controls such as monitoring and intervention by community members as well as cultural norms and attitudes may influence behavior or opportunities surrounding crime and substance use and thus the drug-crime relationship. As it relates to the current research, if connections to one's parents, school, and religious institutions are significantly set or informed by the community/place where they reside, then these controls should exist as a contextualizing feature for the individual. For instance, Elder and Conger (2000) find in their investigation of rural Iowan youth that the unique

intergenerational family, community, and religious ties in farm communities (along with the norms, values, and social resources that these ties produce) generate more positive outcomes in academics, social relations, and avoidance of problem behaviors. The suggestions made by this study are supported by the literature previously discussed regarding rural-urban youth differences in social bonds and protective factors. In turn, informal social controls may operate as a characteristic of setting that can result in a moderating relationship.

For this research, the questions addressed by examining informal social controls as mediators are separate from the ones being asked here. Such conceptualizations address possible mechanisms of the drug-crime relationship itself rather than the mechanisms of the role of context. As discussed in the rural sociological and criminological literature, greater or different informal social controls in rural areas, including differences in how they function, may therefore be important for understanding any contextual differences in the drug-crime or substance-delinquency relationship. These features of rurality can be thought of as one possible explanation for divergent drug-crime patterns and levels given their proposed role for this relationship independent of context. As such, the current study examines the role of context for this relationship and utilizes informal social controls or social bonds, each as moderators, to explain any present context dependency.

## CURRENT RESEARCH

The current research will seek to understand the role of rural context in the drug-crime relationship using informal social controls as a possible contributing mechanism. The focus of this study is on adolescents given their vulnerability to both substance misuse and offending, as well as their unique age-graded informal social controls which may be different in rural areas and helpful for understanding this relationship. Whereas prior research has established a robust

relationship between substance use and offending that may be conditioned by context, this body of work has yet to grapple with potential differences across rural-urban spaces. In turn, this research aims to help fill this gap by addressing whether rural context moderates the relationship between self-reported substance use and delinquency, and whether informal social controls play a role in this process. The first research questions and hypotheses assess whether the pattern of findings regarding contextual variation in social control, and the relationship between delinquency and substance use, observed in prior research are replicated in these data:

1. Do levels of informal social controls (e.g., parental attachment, school attachment, and religious involvement) vary by geographic context?

**H1:** Levels of informal social controls will vary by geographic context.

2. Is there a relationship between substance use and delinquency?

**H2:** There will be a relationship between substance use and delinquency.

These first research questions establish fundamental proposed relationships across geographic contexts and in how substance use is related to delinquency. The possibility of either positive or negative relationships are allowed for each question given conflicting literature about rural-urban social control differences and the literature which suggests not all substances increase offending behavior. Next, the primary research question and hypothesis asks:

3. Is the relationship between substance use and delinquency moderated by rural context?

**H3:** Rural context will moderate the strength of the relationship between substance use and delinquency.

Given the differences between rural and urban areas in crime, substance use, crime patterns, and related environmental characteristics, rural context is proposed as a possible moderator for the substance-delinquency relationship. The persistence of substance use in the

absence of corresponding crime and delinquency combined with divergent patterns of changes in these phenomena over time may be indicative of drug-crime differences. Furthermore, characteristics of rural contexts related to the manifestation of these phenomena may also influence the drug-crime relationship, such as through informal social controls, opportunity, and/or other environmental characteristics.

For example, stronger informal social controls in rural areas may suggest that rural context would decrease the likelihood that those engaged in substance use will commit criminal acts (Fagan, 1990). Similarly, monitoring by community members and increased knowledge of those who live in one's neighborhood, thus decreased anonymity, may act as a check on the behavior of intoxicated individuals in rural areas. In contrast, the potentially multiplicative nature of substance use and criminal behavior coupled with a lack of substance use treatment availability in rural spaces (Borders & Booth, 2007) may yield stronger drug-crime connections among these populations. Less criminogenic opportunity structures in rural areas and/or increased presence of certain informal social controls may reduce general criminality while those who have more serious substance use problems may make up the bulk of the smaller number of people engaged in crime as they lack resources to properly cope with their addiction. As such, rural context may moderate the drug-crime relationship in either a positive or negative direction.

Given these possibilities, the fourth and fifth research questions and hypotheses are as follows:

4. Is the relationship between substance use and delinquency moderated by informal social controls (e.g., parental attachment, school attachment, and religious involvement)?

**H4:** Informal social controls will moderate the strength of the relationship between substance use and delinquency.

5. If so, does accounting for the moderating effect of informal social controls negate any moderating effect of rural context?

**H5:** Rural context will no longer moderate the relationship between substance use and delinquency when accounting for the moderating effect of informal social controls.

As previously discussed, informal social controls in rural areas may provide pertinent information about contextual differences that may be influencing substance use, delinquency, and their relationship together. While the literature suggests informal social controls should weaken the drug-crime relationship, the possibility of an alternative effect is left open given the lack of firm empirical tests of these relationships. Furthermore, if the rural context moderating effect dissipates when accounting for informal social controls and any moderating effect they may have, then it may be the case that these variables help explain the impact of rural context. If these variables do not alter the relationship, then the possible mechanism(s) behind a rural contextual effect remains in question.

## Chapter 3: Data and Methods

The data I used to assess the current research questions are from the public use file of the National Survey of Drug Use and Health (NSDUH), a general population survey conducted annually by the Substance Abuse and Mental Health Services Administration (SAMHSA). The 2019 sample is used because it is the most recent version of the NSDUH that was not impacted by the COVID-19 pandemic and subsequent changes to the methodological procedures of the survey (Center for Behavioral Health Statistics and Quality, 2023).

The survey uses a stratified, multistage area probability sample constructed from geographic information established by the U.S. Census Bureau (Center for Behavioral Health Statistics and Quality, 2020a). These data are intended to be generalizable to the civilian, noninstitutionalized, aged 12 and older population of the United States. Those under the age of 12 or on active duty in the U.S. military are ineligible for the survey (Center for Behavioral Health Statistics and Quality, 2020b). The sample includes individuals from all 50 states and the District of Columbia living in typical households as well as those living in “noninstitutional group quarters” such as college dormitories and military installations, and even those without a permanent residence who can be found in places such as shelters and single hotel rooms. To capture relevant populations, the NSDUH also oversamples youth and young adults given concern about substance use among these populations.

These data are well suited to assess the current research questions as they contain information about whether a person lives in a nonmetropolitan county in addition to delinquency and substance use. While general population surveys do not pick up on as much delinquent and substance use behavior as high-risk or delinquent samples, this sample avoids issues of selection bias that may occur among such tailored samples (Watters et al., 1985; White & Gorman, 2000).

For example, given the co-occurrence of substance use and delinquency, samples of solely delinquent adolescents may artificially inflate the amount of said co-occurrence observed (White & Gorman, 2000). White and Gorman (2000) point out that offenders significantly involved in substance use may be more likely to be arrested or incarcerated, leading to overrepresentation of these individuals in offender samples. Such samples may increase the likelihood of these phenomena appearing causally related even if they are only connected by a third variable such as low self-control (Gottfredson and Hirschi, 1990). Further, these samples may not provide as many counterfactual cases where someone engages in one behavior but not the other. In turn, while research should examine these questions using a variety of samples, including ones with a greater number of high-risk or delinquent youth, the NSDUH is an appropriate data source for the current study.

The NSDUH, like all surveys, has some issues with non-response and missing data. Non-response in the survey exists both due to eligible respondents not agreeing to take part in the survey and from difficulties gaining access to potentially eligible respondents. If issues arose for surveyors regarding controlled access to certain areas or buildings, these problems were noted and then often resolved through follow-up measures by supervisory staff to access such locations (Center for Behavioral Health Statistics and Quality, 2020a). Procedures to address such instances were also in place for accessing military bases and college campuses. Of eligible dwelling units for the survey, there was a 70.41% unweighted and a 70.50% weighted response rate. Among these dwelling units, for interviews there were response rates of 66.62% unweighted and 64.92% weighted. As such, the overall response rates are 46.90% unweighted and 45.77% weighted (Center for Behavioral Health Statistics and Quality, 2020a).

Cases in the NSDUH considered to be “usable” for analysis only include participants who provided sufficient information about their substance use behaviors (Center for Behavioral Health Statistics and Quality, 2020b). Those who did not complete the initial demographic questions of the survey or those who did not provide their birthdate or age were not considered eligible and had their interviews terminated (Center for Behavioral Health Statistics and Quality, 2020b). Participants also must have properly answered the question about lifetime cigarette use and at least nine of the other substances inquired about in the questionnaire (excluding pipe tobacco and contingent substance questions, such as the use of crack, since that requires the use of some kind of cocaine).

Many variables had some level of missingness, and in general, items had missingness due to “bad data” (usually due to logical inconsistencies in a respondent’s answers), participants stating that they “don’t know” the answer to the question, refusal to answer a question, and certain items being left blank. Items left “blank” were either not answered by the respondent or they were not asked the question by the interviewer (Center for Behavioral Health Statistics and Quality, 2020b). This may have occurred if a respondent stopped the interviewing process at some point before the end of the questionnaire, if a respondent entered blank spaces for a question, or if the computer-assisted interview (CAI) program skipped a question but it was unclear whether that question should have been skipped for that respondent.

Some of this missingness is dealt with through imputation or logical assignment procedures. Logical assignment is used to indicate when certain values were changed through survey editing procedures based on a respondent’s answers to related questions. For example, if a respondent’s answers indicate that they used a substance very recently, but their answer to the recency question was not consistent with this, then the recency answer was adjusted (Center for

Behavioral Health Statistics and Quality, 2020b). In the current analysis, these adjustments were regarded as proper answers to minimize missingness on relevant items. In addition, some variables in the NSDUH public use data file are only available in imputed form. For instance, certain demographic information like family household income and race/ethnicity are not available in a non-imputed form. Furthermore, information about sex (whether a participant is male or female) is not permitted to be missing in these data. As such, some of the control variables used in this study have no missing data making missing data analyses and procedures were unnecessary for these items. All dependent, independent, and moderator variables in this analysis allowed for missingness.

Given that the NSDUH is a person-level survey, my unit of analysis is the individual. This allows me to address whether the relationship between substance use and delinquency for persons, rather than larger units such as groups or communities, is moderated by metropolitan context and/or informal social controls. I restrict the sample to those aged 12 to 17 ( $n=13397$ , 22.59% of the total sample) since this study focuses on adolescents.

Within the sample of adolescents, among those who answered the questions about schooling, 4.28% ( $n=567$ ) reported not currently attending any kind of school. These individuals ranged across the age categories, with the modal category being 12-year-olds, which is not indicative of early graduation being responsible for most of these responses. Analysis indicates that these respondents are more likely to be male, non-White, and have a lower family household income. These individuals have a greater likelihood of reporting having engaged in delinquency, but they are less likely to report substance use. Despite these differences, the current study focuses on school going adolescents aged 12 to 17 and therefore non-school-going individuals are dropped from the analysis, leaving 12,830 school-going adolescent respondents.

For the purposes of this study's analytic sample, responses with missingness on any of the dependent, independent, or moderator variables are not suitable for analysis and are therefore dropped through case-wise deletion. This results in a final analytic sample size of 12066, or about 94.05% of the school-going adolescent subsample. Those who had missing data on the non-imputed control variables were included in the main analysis, but they were dropped in the final models that use these controls in the sensitivity analyses (N = 11976). Missingness on these variables is further addressed in the results.

Those missing on the main outcome, delinquency, are significantly different from the analytic sample on several metrics. Those who did not answer the delinquency questions were more likely to be male, non-white, of the lowest income bracket, and younger. However, these individuals were not significantly different in terms of risk-taking behaviors. Of the main predictors, the missing individuals are significantly more likely to have lower school attachment and to report attending less faith-based activities. These individuals are not significantly different in terms of whether they use substances generally or whether they use substances other than alcohol and marijuana. They are also not significantly different in terms of parental attachment. The detriments of nonresponse and how it may impact the results is discussed in the limitations.

## VARIABLES AND MEASUREMENT

### *Dependent Variables*

**Delinquency.** The primary outcome variable for this analysis is self-reported delinquency. The NSDUH asked adolescents about how many times (0 times, 1 or 2 times, 3 to 5 times, 6 to 9 times, 10 or more times) they engaged in certain delinquent behaviors in the past 12 months. These included getting into a serious fight at school or work, taking part in a fight where their group of friends fought another group, carrying a handgun, selling illegal drugs, stealing or

trying to steal anything worth more than \$50, and attacking someone with the intent to seriously hurt them.

Preliminary analyses indicated that adolescents in rural contexts report engaging in similar levels of delinquent behaviors as their urban and suburban peers; however, rural adolescents report carrying handguns at a higher rate. Among those who answered the question regarding handguns in the analytic sample, 4.33% of adolescents living in a metropolitan county compared to 7.59% of nonmetropolitan residing respondents reported having carried a handgun sometime in the past 12 months. This may be due to differences in the availability and normality of gun access in rural areas as rural and nonmetropolitan youth may have greater access to guns (Beachy & Liang, 2024; Coker et al., 2017; Peterson, 2021; Rowhani-Rahbar, Oesterle, & Skinner, 2020) which poses issues for understanding general delinquency in this sample. For example, some evidence suggests that while guns are more prevalent in rural areas and more often used in suicides (Reeping et al., 2023), they are less likely to be used in the commission of a crime (Weisheit & Donnermeyer, 2000; Weisheit et al., 2006). Furthermore, while gun-ownership is related to antisocial behavior, the reason for ownership may also matter for its relationship to such behavior (Cunningham et al., 2000), and these nuances are unavailable in the NSDUH. Given these considerations, I exclude the handgun measure from the general analysis. However, to determine the stability of the main analytic conclusions, analyses are also conducted using delinquency measures that include the handgun measure as a robustness check.

I examine self-reported delinquency measures rather than arrest or other kinds of formal criminal justice contact given the likelihood of disparities across rural to urban counties in terms of the likelihood of formal processing by police (Donnermeyer & DeKeseredy, 2014; Weisheit & Donnermeyer, 2000; Weisheit et al., 2006). Moreover, self-reported delinquency measures, while

vulnerable to issues with honesty and memory (Bachman & O'Malley, 1981; Harrison, 1995; Williams & Nowatzki, 2005), may provide a better idea of general delinquency than formal criminal justice contact (Elliot et al., 1989). These measures are also useful for analysis when using a general population survey where serious delinquent behavior and contact with the criminal legal system among participants is low (as only 2.99% of the analytic adolescent subsample reports ever being arrested). These variables provide information on the relevant constructs without being limited by formal detection or to more uncommon behaviors.

It is important to note that while delinquency could have been the independent variable, most literature in this area focuses on how substance use influences crime/delinquency or observes a reciprocal relationship (Bennett et al., 2008). In addition, Fagan's (1990) argument regarding the potential moderating effect of context focuses on how substance use, specifically intoxication from alcohol, may lead to crime or violence. The current analysis therefore conceptualizes the drug-crime relationship through the lens that delinquency is the outcome of substance use although there may be a reciprocal relationship.

I measure delinquency in two ways to determine whether the results are dependent upon how the outcome is measured. First, I use a dichotomous measure of delinquency in which those who have not engaged in any form of delinquency in the past 12 months are coded as 0 and those who report that they have engaged in any delinquent act any number of times in the past 12 months are coded as 1. This provides a simple measure of delinquency for preliminary analyses that does not account for delinquent behavioral differences therein, such as frequency, severity, or variety.

Second, I use a variety scale to account for a more nuanced measure of delinquency. In this measure of delinquency, those coded as 0 have engaged in no delinquency, those engaged in

only one kind of delinquency are coded as 1, and those who have engaged in multiple kinds of delinquency are given a score according to how many kinds of delinquency (maximum 5 items) they report doing in the past 12 months. Variety scales are a reliable and valid tool for approximating the extent of delinquency among participants for several reasons. Since less serious offending tends to occur more frequently, scales that account for frequency of offending may over-weight the more frequent but lower-level acts of crime and delinquency (Sweeten, 2012). Variety is also linked with other aspects of offending, including frequency and seriousness; this allows one to tap into the latent construct underlying these characteristics given limited offending information.

A variety score is appropriate for measuring delinquency in the NSDUH (2019) specifically given limitations of measurement and infrequent offending by respondents. In the NSDUH (2019), participants are not asked the exact number of times they have engaged in delinquent behaviors, instead they are given grouped count options such as “1 or 2 times” or “3 to 5 times.” It is therefore not possible to obtain a proper count or frequency of delinquent behaviors among participants. Additionally, very few participants report engaging in delinquent acts more than 1 or 2 times, although this is not unexpected given the nature of general population surveys. Most participants who reported engaging in delinquent behavior participated in different kinds of fighting. For the other, more serious, delinquency items, only about 2-5% of the sample indicated engaging in those behaviors, and only 24.90% indicated engaging in any kind of delinquency in the past 12 months. As such, a variety scale is an appropriate measure for capturing the delinquency of participants with more nuance than a dichotomous measure.

The current analysis accounts for both the relationship between substance use and general delinquency as well as how this may vary with the variety of delinquent behaviors engaged in by respondents.

### *Independent Variable*

**Substance Use.** General substance use is measured through a variety score capturing whether a participant has used any kind of illicit drug or alcohol within the past 12 months. The NSDUH (2019) asks participants how long it has been since they last used many different substances (“Within the past 30 days” = 1, “More than 30 days ago but within the past 12 months” = 2, “More than 12 months ago” = 3) and these measures can be transformed into dichotomous indicators of substance use for each individual indicator in the past 12 months. The dichotomous indicators for each substance can then be summed to create a variety scale to indicate how many kinds of substances a person has used in the past 12 months. This, like the delinquency variety scale, helps capture both general substance use among respondents that is temporally consistent with the delinquency measures and the variety of substances used where more serious substance users are expected to have used more than one kind of substance.

Besides alcohol and marijuana, more serious illicit substances in the variety measure include cocaine (and crack cocaine), hallucinogens (such as LSD, PCP, peyote, etc.), inhalants (such as amyl nitrite/poppers, gasoline, anesthetic, etc.), methamphetamine, misuse of prescription pain medications (such as oxycontin, Vicodin, Percocet, etc.), misuse of tranquilizers (such as Xanax, alprazolam, Ativan, valium, etc.), misuse of stimulants (such as Adderall, Dexedrine, Ritalin, etc.), and misuse of sedatives (such as Ambien, zolpidem, etc.). The misuse categories include use of prescription substances when not directed by a doctor, thus

accounting for how adolescents may misuse substances that are only legal if properly prescribed. Heroin use is not included as no respondent indicates having used heroin in the past 12 months.

Some issues with this measure should be addressed. First, the veracity of the reported substance use, particularly the more serious substance use, cannot be verified. It is possible that these individuals are not being truthful about their substance use, particularly higher levels of reported substance use (Harrison, 1995), which would impact the results. However, some studies indicate that self-reported substance use is generally reliable and valid for producing estimates (Darke, 1998; Johnson & Mott, 2001). Second, given the difficulties of capturing heavier drug use in general population surveys like the NSDUH, it is likely that more serious adolescent substance users are excluded from this sample (Reuter et al., 2021). Relatedly, the number of individuals who report using more than 2 kinds of substances in the past 12 months is relatively small (2.86%, n=346), meaning estimates and predictions for this group of individuals have greater levels of sampling error. With these issues in mind, the current measures attempt to mitigate these problems as much as possible, and the limitations of using general population surveys with limited substance use and delinquency are acceptable for the purposes of this study.

#### *Moderator Variables*

##### ***Rural Context***

The current analysis utilizes two measures of rural context: county metropolitan status and population density. County metropolitan status is a more commonly used measure of rural-urban context (Weisheit & Donnermeyer, 2000), but population density might be a more conservative measurement of rurality given its greater constraints on the upper bound of population size, thus reducing the number of places that qualify as rural. Both measures were established by the surveyors given the geographic location of the participant.

**Metropolitan County Status.** Whether a person lives in a county that is considered nonmetropolitan or large/small metropolitan is used as the primary measure of rural context following precedent in prior research (Lichter & Ziliak, 2017; Osgood & Chambers, 2000; Weisheit & Donnermeyer, 2000). In the NSDUH, counties are categorized based on the U.S. Census 2013 Rural/Urban Continuum Codes (or “Beale codes”), and these codes have been adjusted over the past several decades to account for county changes in demography by urban population size and proximity to metropolitan areas (Office of Management and Budget, 2010; Lichter & Ziliak, 2017). Nonmetropolitan counties include those with a lower bound of “completely rural or less than 2,500 urban population” that are “not adjacent to a metro area”, and an upper bound of an “urban population of 20,000 or more” that are “adjacent to a metro area” (United States Department of Agriculture, 2020). For metropolitan counties, there is a lower bound of “counties in metro areas of fewer than 250,000 population” and an upper bound of “counties in metro areas of 1 million population or more.” Greater granularity in geographic information by these categorizations is available in the restricted version of the NSDUH, but these data were unavailable for the current study.

The NSDUH includes categories for large metropolitan, small metropolitan, and nonmetropolitan counties based on these codes; however, they do not specify what population categorizations were considered “large” versus “small” metropolitan counties. To determine the nature of this distinction, I compared this county categorization with their measure of population density. Population density is based on the Office of Management and Budget (OMB) classification of Core Based Statistical Areas (CBSA) in which there are three levels: segments in a CBSA with 1 million or more people, segments in a CBSA with fewer than 1 million people, and segments not in a CBSA. According to the Office of Management and Budget, the 2010

standard defines a CBSA as “a geographic entity associated with at least one core of 10,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties” (Office of Management and Budget, 2010).

Based on the overlap between these two measures (See **Table 1**), it appears that all individuals in the sample living in small metropolitan areas are categorized as living in places with less than 1 million people. This indicates that, in general, large metropolitan counties are categorized as those with 1 million people or more while small metropolitan counties are those within metropolitan areas with less than 1 million people. From these data alone, the population sizes are unknown for nonmetropolitan counties as the Census defines this information relative to their proximity to urban populations, meaning exact population sizes are not provided in the aggregate groupings. Because of potential variations which may emerge by these classifications, I examine differences between people in nonmetropolitan and any metropolitan counties as well as whether these results differ when examining nonmetropolitan, small metropolitan, and large metropolitan counties separately as a robustness check.

There are several issues with this measure, and with definitions of “rural”, which have implications for research (Weisheit & Donnermeyer, 2000). First, there is disagreement regarding whether the Census categorization of counties as “nonmetropolitan” is a good measure of rural context. Currently, the U.S. Census Bureau classifies urban areas as places with either at least 2000 housing units or a population of at least 5000 people (United States Census Bureau, n.d.). Such a distinction for measurement purposes does not necessarily reflect the lived reality of the rural-urban continuum for residents (Wuthnow, 2018). For example, what counties are considered “nonmetro” may include spaces that would not be considered “rural” while

simultaneously places that are near urban counties may be classified as metropolitan even if residents consider themselves to be in a rural area.

Second, as discussed in the literature review, in an increasingly urbanized world, the boundaries of rural and urban areas are becoming more and more blurred (Lichter & Brown, 2011; Lichter & Ziliak, 2017; Wuthnow, 2018). Donnermeyer (2019) points out that some of the reason for this dichotomization in rural criminology was meant to address the lack of research on rurality and the need to expand outside of the city, but this is no longer as helpful to our understanding of these issues. In addition, with continued out migration from rural areas into suburban and urban ones (Johnson & Lichter, 2019; Lichter & Brown, 2011; United States Census Bureau, 2022), drawing geographic boundaries between rural and urban spaces is likely to become an even greater issue in studies examining rural contexts. Measuring rurality empirically to understand how these geographic distinctions, no matter how slight, may influence substance use, crime, and their relationship, is therefore a challenge for research in this area.

Third, these geographic measures of rurality may be problematic since they exist only in relation to urban or metropolitan areas (Crockett et al., 2000; Weisheit & Wells, 1996). As previously mentioned, it is not the case that rural and urban areas can be neatly categorized or separated (Lichter & Ziliak, 2017), and this poses issues for conceptual definitions and operationalization (Donnermeyer & DeKeseredy, 2014). For instance, what places are considered “rural” may be a subjective assessment by residents or based upon factors like culture and social structure (Weisheit & Donnermeyer, 2000). Furthermore, rural communities are not a monolith, as different regions of the United States, and across the world, experience rurality in unique ways that may be meaningful for how crime and deviant behavior manifests, but these

differences can be difficult to define and subsequently measure (Crockett et al., 2000; Donnermeyer & DeKeseredy, 2014).

Despite these issues, the Census county categories are the most readily accessible and provide a quantitative method for categorizing rural versus non-rural areas meaning that these operationalizations of rurality can be used as an empirical measure of rural context (Weisheit & Donnermeyer, 2000). Metropolitan county status measures allow researchers to draw on consistent definitions of broader geographic constructs like urbanity and rurality, thus providing a standardized way that allows scholars to compare their results across studies. For example, if a study like this is to be repeated on different samples or across large swaths of land/population (as this study does), having a replicable measure of rural context is needed. Comparative work examining rural and urban areas is benefited by clear categorizations of these constructs, and the findings from this study can be compared with those of other work in this literature.

**Population Density.** Besides metropolitan county categorizations, population density is another way to capture rural context that is more stringent than county type. Given the potential issues with the metropolitan measure, separate analyses using population density are also conducted to determine whether using this measure of context significantly alters the results. For county type, 80.04% of adolescent participants in the analytic sample lived in either a large or small metropolitan area leaving only 19.96% living in a county considered “non-metro.” In contrast, based on population density, only 9.08% of participants lived in a non-CBSA segment of the country. When examining these two variables together, almost all participants considered to be in a non-CBSA segment were also considered to be in a nonmetropolitan county and these measures are moderate to strongly, positively correlated ( $r = 0.611$ ), but a significant portion of individuals living in “nonmetropolitan” counties are within CBSA segments. The population

density measure may therefore provide a more conservative estimate of rurality than the Rural-Urban continuum codes.

Population density as a measure of rural context is defined as a dichotomous indicator of whether an individual lives in a non-CBSA segment or not (“In a CBSA Segment” = 0, “Not in a CBSA Segment” = 1). However, like metropolitan county status, there are also three levels of population density measured in the survey: “Segment in a CBSA with 1 million or more people”, “Segment in a CBSA with fewer than 1 million people”, and “Segment not in a CBSA.” In turn, this three-category ordinal variable is also used as a measure of context as a robustness check to determine whether results differ when accounting for these categorical differences. Further, an additional robustness check is conducted only examining individuals living in both a non-CBSA and nonmetropolitan county compared to those in the most urban areas to determine if excluding the middle categories of these measures changes the results.

### ***Informal Social Controls***

The following variables are used to capture various informal social controls that may be experienced by adolescents; these include parental attachment, school attachment, and religious involvement (through participation in faith-based activities) as these factors appear to be influential for adolescents regarding their delinquency and substance use (Costello & Laub, 2020; Elder & Conger, 2000; Hirschi, 1969). Each kind of informal social control is considered separately in the models to determine how each may independently be associated with the relationship between substance use and delinquency.

**Parental Attachment.** One of the most important social bonds/informal social controls is how attached an adolescent is to their parents (Hirschi, 1969). I created a measure of this construct using two items: an ordinal measure of how often in the past 12 months an adolescent

reports that their parents let them know they did a “good job” (“Always” = 1, “Sometimes” = 2, “Seldom” = 3, “Never” = 4) and an ordinal measure of how often in the past 12 months an adolescent reports that their parents told them they were proud of them for something they did (“Always” = 1, “Sometimes” = 2, “Seldom” = 3, “Never” = 4). I re-coded the two variables such that higher values correspond to higher attachment and lower values correspond to lower attachment (“Never” = 0, “Seldom” = 1, “Sometimes” = 2, “Always” = 3) before combining them into a mean scale of parental attachment. This is done to minimize the amount of missingness in the scale.

While neither of these measures capture how an adolescent feels emotionally towards their parents, which is often used in attachment scales (Dornbusch et al., 2006), they do provide some information about the parent-child relationship. The two items are strongly correlated ( $r = 0.771$ ) indicating that these measures are likely capturing a similar underlying construct, and they may help measure some positive parental actions towards the child as is common in parental attachment scales (Dornbusch et al., 2006).

**School Attachment.** While there are several measures assessing how adolescents felt about school and their school work, I use a single measure that asked how adolescent participants felt overall about going to school during the past 12 months (“You liked going to school a lot” = 1, “You kind of liked going to school” = 2, “You didn’t like going to school very much” = 3, and “You hated going to school” = 4) as the primary means for capturing school attachment. This item measures an adolescent’s emotional connection to school for any reason.

There is disagreement within the literature regarding how to measure school attachment (Jimerson, Campos, & Greif, 2003). Some measure this construct through academic performance while others use indexes that attempt to capture how adolescents feel towards school, their

teachers, and the safety and support they felt at school (Dornbusch et al., 2006; Henry & Slater, 2007; Yuksek & Solakoglu, 2016). The NSDUH does have an item asking participants about their average grades for the last semester/grading period (within categories of As, Bs, Cs, and Ds), but about 4.32% (n = 521) of the analytic sample reports that their school does not use this kind of grading system and there is also a significant amount of missingness (5.85%, n=706) on this variable. Furthermore, feelings about school and academic performance are only weakly positively correlated ( $r = 0.236$ ). Given these considerations, academic performance is not included in the school attachment measure. In turn, while the current measure is limited, it does capture at least part of the construct addressed by measures cited in the literature. I reverse coded this item such that lower values indicate lower school attachment (“You hated going to school” = 0, “You didn’t like going to school very much” = 1, “You kind of liked going to school” = 2, “You liked going to school a lot” = 3).

**Faith-Based Activities.** A potentially important informal social control, particularly for rural youth, is that of religion. Involvement with religion, including religiosity and church attendance, is associated with decreased likelihood of delinquency and substance use (Benda, Pop, & Kelleher, 2006; Kelly et al., 2015). For rural adolescents, religious ties appear to be related to decreased substance use and delinquency (Elder & Conger, 2000) as well as juvenile homicide (Lee & Bartkowski, 2003). Such connections can be classified as an informal social control due to how religious ties connect one to a broader community and provide prosocial normative structure. As such, a measure of how many kinds of church or faith-based activities a respondent has participated in during the past 12 months (“None” = 0, “One” = 1, “Two” = 2, “3 or more” = 3) is included.

This measure is intended to capture behaviorally, rather than by self-reported religious beliefs alone, how involved one is in their religious community and the attachments formed therein. While Hirschi (1969) considers belief to be a distinct social bond to be considered, the focus of this study is on informal social controls that are related to external factors like community, family, or institutions rather than self-reported religious beliefs which may be reported as strong even without any major religious engagement outside of the home.

#### *Control Variables*

While this analysis is associative/correlational in nature rather than causal, control variables are included in the final models as a sensitivity analysis. This ensures that the substantive results don't significantly change when accounting for other theoretically relevant variables. Additionally, these variables are used for descriptive purposes of the entire analytic sample and in examining whether differences in sample characteristics emerge by nonmetropolitan context.

**Demographics.** Basic demographic information including age, sex, and race/ethnicity is controlled for as each of these characteristics are likely to be related to both delinquency and substance use. Demographic variables are only available in the public use file as imputed or revised measures. In turn, unlike previous measures, no missingness is permitted on these variables.

All participants in the relevant subsample are aged 12 to 17 and this is a continuous variable coded such that the participant is ascribed their exact age rather than converting this into an ordinal measure.

Sex includes only male and female and is measured as a dichotomous measure for being male ("Female" = 0, "Male" = 1).

Race/ethnicity is a categorical variable that includes White, Black/African American, Native American/Alaskan Native, Native Hawaiian/Other Pacific Islander, Asian, multiple races, and Hispanic. These categories are left as defined by the NSDUH rather than combined into broader groups. Each race/ethnicity category is coded as a dichotomous variable for analysis, with White as the reference category.

**Family Household Income.** Whether a respondent lives in a household that makes less than \$20,000, \$20,000 to \$49,999, \$50,000 to \$74,999, or \$75,000 or more is included to account for economic disadvantage given its relationship to both substance use and delinquency. This measure is also only available in imputed form such that no missing data is permitted. Having a family household income of less than \$20,000 is used as the reference category.

**Risk-Taking Behavior.** Given the literature suggesting that the drug-crime relationship may be spuriously related due to their concurrent relationship to an underlying deviance variable like self-control (Gottfredson & Hirschi, 1990), two measures of a related construct, risk-taking behavior, are combined into a scale and included as a control. The first measure is an ordinal variable about how often a respondent gets “a real kick out of doing things that are a little dangerous” (“Never” = 1, “Seldom” = 2, “Sometimes” = 3, “Always” = 4). The second measure is a similar ordinal variable with the same response categories that asks participants about how often they “like to test [themselves] by doing something a little risky.” These measures are moderate to strongly positively correlated ( $r = 0.652$ ) indicating that they may be capturing a similar underlying construct. I re-coded these variables for analysis to make zero the lowest value, leaving it so higher values indicate more participation in risk taking behaviors. These items are combined into a mean scale to reduce missingness and because they both capture a similar underlying construct.

**Arrest.** Formal system contact is accounted for through a dichotomous indicator of whether a respondent has ever been arrested (“Never arrested” = 0, “Ever Arrested” = 1). In the NSDUH (2019), respondents are asked “[n]ot counting minor traffic violations, have you ever been arrested and booked for breaking the law?” where they defined “booked” as being “taken into custody and processed by the police or by someone connected with the courts, even if you were then released” (Center for Behavioral Health Statistics and Quality, 2020b)<sup>1</sup>. Formal contact with the criminal justice system may increase the likelihood of both future offending and substance use through processes like labeling (Bernburg et al., 2006) and cumulative disadvantage (Sampson & Laub, 1997); but, as discussed in the literature review, such contact may be contingent upon context as those in rural areas may be less likely to come into contact with police and other formal institutions of control (Weisheit & Donnermeyer, 2000). As such, arrest is included as a control to determine whether accounting for formal system contact substantially alters the results, particularly for how rural context may moderate the substance-delinquency relationship.

## ANALYTIC STRATEGY

The current study assesses the importance of rural context for the substance-delinquency relationship as well as the role of informal social controls. To do so, I conduct several analyses to answer each of the research questions.

---

<sup>1</sup> As with all survey questions about arrest, the wording of this measure may have implications for the information captured in terms of what people do and do not report as an arrest. This measure is better than some in that it attempts to only include situations where a person was taken into custody and formally processed as opposed to a simple stop by a police officer, but it is possible that instances of detainment by a police officer or other law enforcement agent where some formal processing appear to occur, but no official arrest was recorded, are included. Issues like these make self-reported arrest measures difficult to assess without official records to confirm the information provided by participants.

First, I examine the descriptive results for the full sample to understand variation in demographics, delinquency, substance use, and informal social controls among these adolescents. I utilize two-sample, two-tailed t-tests to assess if there are significant differences between those who live in nonmetropolitan counties and those who live in metropolitan ones. This is done for both the main dependent, independent, and moderator variables as well as for the supplement control variables to see how relevant demographic characteristics may diverge across these groups. These tests provide information about whether delinquency, substance use, and informal social controls differ by context in this sample as anticipated by the literature. The latter examination will address the first research question comparing informal social controls across context.

Second, I conduct bivariate analyses of the main independent and moderator variables on the outcome of delinquency to assess whether these relationships emerge as expected by the literature. This addresses the second research question, establishing the baseline anticipated relationship between these variables. I conduct similar analyses using the moderator variables to assess their relationships with delinquency including rural context again to see their independent effects in the regression models before adding interactions.

Third, I run models including the main predictor, substance use, and the moderator variables independently and then with the relevant interactions. This addresses the third and fourth research questions concerning whether rural context moderates the relationship between substance use and delinquency and whether the informal social control variables moderate the relationship.

Finally, I run models including interactions with all moderator variables and their independent relationships to determine whether the moderating influence of rural context is

altered by the informal social controls and their requisite interactions. This allows me to answer the final research question concerning whether any moderating effect of rural context can be explained by informal social controls.

For all models, I use logistic and binomial regressions to assess the relationship for the appropriate delinquency outcome (dichotomous and variety measures, respectively); these tests are all two-tailed given the non-directional nature of the hypotheses. NSDUH (2019) probability sample weighting procedures are also applied in each regression.

While most criminological research uses Poisson or negative binomial models for such analyses, I use a binomial regression model given that variety scores are bounded count variables (Britt et al., 2018). Bounded count variables are a kind of count variable that has a built-in upper limit. In variety scores, there is a maximum number of crime types one can engage in depending upon what behaviors are recorded in the data, and this means that no one in the data can exceed that highest value (Britt et al., 2018). Poisson and negative binomial regressions allow for values exceeding the maximum count possible as they are meant for unbounded count variables. Binomial regression models can be specified to account for the upper bound of the variety score to prevent the prediction of impossible values (Britt et al., 2018). In turn, I use a binomial regression model to account for the bounded nature of the dependent variable.

To further contextualize the nature of my results and aid in interpretability, I also compute the average marginal effects of my main analytic predictors and provide average predicted values of delinquency given certain values of the predictors. Assessing these values, along with graphical representations of these relationships, provides more information about how the relevant variables are related beyond regression coefficients. This information also

acknowledges the non-linearities involved in the current models and how outcomes may vary across values of the predictors.

I also conduct several sensitivity analyses and robustness checks. For the sensitivity analyses, I run the full models, both logistic and binomial, with the control variables. I then repeat all levels of my analysis using linear probability models for the dichotomous delinquency outcome and Poisson and negative binomial models for the delinquency variety score. For the robustness checks, I first repeat all analyses using the three category measures of rural context for metropolitan county status and population density. Next, I repeat these analyses using a more stringent measure of rural versus urban that excludes those living in CBSAs with less than 1 million people and small metropolitan counties to isolate only individuals living in the most “urban” geographic contexts and the most “rural” geographic context. Finally, I run each analysis when the delinquency outcome measures include whether a respondent has carried a handgun in the past 12 months.

## Chapter 4: Results

### DESCRIPTIVE STATISTICS

For the descriptive analysis, there are two elements of the sample that need to be examined. First, I examine the descriptive statistics for the entire analytic sample (see **Tables 2 & 3** for these descriptives on the main analytic variables and control variables respectively)<sup>2</sup>. Second, I examine these characteristics for those living in nonmetropolitan areas compared to metropolitan areas and test whether there are significant differences between these groups (See **Table 4** for all t-tests).

On average, youth are 14.604 (1.679) years of age, and the distribution is slightly skewed towards older ages. The sample is primarily White (52.23%), Hispanic (23.40%), and Black (12.79%), while other races/ethnicities, including multiple races, comprise the remaining, small portion of the sample (11.58%). The sample is equally split by respondent sex (50.62% male). The modal income category is \$75,000 or more (43.55%) followed by \$20,000 to \$49,999 (27.09%), and with 15.34% of respondents being in the \$50,000 to \$74,999 category. Only 14.01% of respondents are in the less than \$20,000 category.

Nearly a quarter (24.90%) of the sample reported engaging in any of the five delinquency variables included in this analysis. Furthermore, among those who engaged in delinquency, the majority only reported participation in one kind of delinquency (63.78%). Similarly, among those who report using any substance in the past 12 months, most report using alcohol (81.31%) or marijuana (52.63%), while only 18.54% report that they have used any other kind of drug

---

<sup>2</sup> Since the main analytic sample does not include control variables, the final sample size is 12066 as the individuals dropped from the main analysis only include those missing on the main analytic variables. However, for the sensitivity analysis, there is further missingness on the arrest and risk-taking behaviors measures, and these individuals are dropped from that supplemental analysis but kept in the main analysis. In turn, the sensitivity analysis sample is comprised of 11976 adolescents. The descriptive statistics for the main sample and the sensitivity analysis subsample can be seen in **Table 3**.

such as cocaine, methamphetamine, etc. This means that more serious involvement in delinquency and substance use is limited in this sample.

For the informal social control variables, the average score on the parental attachment scale is 2.363 (0.785) indicating a high level of parental attachment in the sample. For school attachment, the average score is 1.921 (0.834), indicating a slight tendency towards liking school. Finally, for faith-based activities, the average respondent reported engaging in 1.123 (1.193) faith-based activities, as most respondents did not engage in any faith-based activities. This distribution was right-skewed, but a significant percentage of youth reported engaging in three or more faith-based activities, driving this average up despite the modal response being participation in no faith-based activities.

When comparing the adolescents who live in a nonmetropolitan area to those who live in a metropolitan one, some similarities and differences emerge (See **Table 4**). First, the groups are similar in terms of age and gender, but those in nonmetropolitan areas are significantly more likely to be White ( $p < 0.001$ ) and they are more likely to be in lower income categories ( $p < 0.001$ ). Rural and nonmetropolitan counties tend to be majority non-Hispanic White, although diversity is increasing (Johnson & Lichter, 2022), meaning that this sample appears to represent population-level expectations. In terms of income, according to the U.S. Census Bureau (Bishaw & Posey, 2016), rural Americans tend to have a lower median household income, and this sample reflects this difference as well.

Second, the adolescents in this sample do not significantly differ on delinquency, substance use, risk taking behaviors, or arrest on average. Similarities in substance use are as anticipated by the literature, but indications of delinquency and justice involvement are not. While official statistics expect lower participation in crime from nonmetropolitan youth

(Uniform Crime Reports, 2019b; 2019c), the lack of such a difference in this sample may exist for several reasons. Given that delinquency has declined substantially over the past several decades (Baumer, Cundiff, & Luo, 2021), there may be a convergence of such behaviors across rural-urban spaces (Abraham & Ceccato, 2020). Further, it may be the case that offending by juveniles is not being reported to or picked up by law enforcement (Barclay et al., 2004; Boggs, 1971; Bureau of Justice Statistics, 2018), and issues may be handled informally by police (Weisheit et al., 2006; Weisheit & Donnermeyer, 2000). Real differences in juvenile delinquency by context might exist as well, but only for certain kinds of delinquency or more serious delinquency, not captured by this sample.

In terms of the analysis, rural and urban youth engaging in similar levels of delinquency does not remove the possibility that the substance-delinquency relationship differs across context (although it is an interesting finding contrary to other work). The arguments made previously regarding the nature and meaning of substance use and deviant behavior, as well as how they may interact, across contexts still hold. Whether substance use contributes to delinquency and to what extent is not dependent on the amount of such behavior one participates in alone, but how and when these behaviors occur which are not captured by these data and therefore cannot be assessed.

Finally, the groups are not significantly different in terms of parental attachment on average, but they are different in school attachment ( $p < 0.001$ ) and involvement in faith-based activities ( $p < 0.001$ ). As such, there is some support for the first hypothesis concerning differing levels of informal social controls by context. Those in nonmetropolitan areas engage in more faith-based activities, in line with data suggesting slightly greater religiosity in these areas (American Communities Project, 2022). Those in nonmetropolitan areas in this sample also

report more negative feelings about school than those in metropolitan areas. It is not settled in the literature why this is the case, but it might be due to the quality of education, economic differences, or beliefs about formal education in nonmetropolitan areas (Pruitt, 2009). For example, nonmetropolitan youth may be more concerned with work, either in a formal job or in one's family, compared to school (Elder & Conger, 2000). Relatedly, there is evidence that those in rural communities often place less value in formal education (Pruitt, 2009) and rural youth sometimes experience greater levels of disadvantage in schooling, attaining lower levels of education (Roscigno & Crowle, 2001). Given that queer or otherwise non-conforming youth in nonmetropolitan areas are more likely to be victimized (Bureau of Justice Statistics, 2018), it may also be the case that these youth experience more bullying in school thus leading to a greater proportion reporting negative feelings about school (Peterson, 2021). None of these possible explanations will be explored in this study, although further inquiry may be of interest to research concerning educational attitudes/attachment by context.

These similarities and differences in informal social controls, like those found regarding delinquency and arrest, also raise questions regarding previous findings on this issue. The lack of uniform differences in informal social controls (as measured in this study) across context might indicate that rurality does not exert the anticipated effects on informal social controls for rural youth. However, as discussed in the literature review, sheer differences in informal social controls as measured here does not mean these controls function the same across context, therefore not precluding the possibility of informal social controls being a mechanism for rural context differences. Furthermore, measurement issues, particularly for parental and school attachment, may influence the observation of differences across contexts. The implications of these differences will be examined further in the limitations.

## BIVARIATE ANALYSES

For the first part of the main analysis, I examine the relevant bivariate relationships for dichotomous delinquency outcome and the delinquency variety score, starting with its relationship to the substance use variety score, then rural context, and finally the informal social control variables (see **Table 5** for all bivariate relationships and average marginal effects).

Consistent with the literature, the substance use variety score is a significant, positive predictor of the dichotomous delinquency measure ( $b = 0.516$ ,  $se = 0.037$ ,  $[0.444, 0.587]$ ,  $p < 0.001$ ; AME = 0.090,  $se = 0.006$ ,  $[0.078, 0.101]$ ,  $p < 0.001$ ). This means that as substance use increases, the likelihood of delinquency also increases. To illustrate this relationship, one can examine the average predicted probabilities of delinquency at different levels of the predictor (See **Figure 1**). For example, the probability of delinquency for an individual who reported using no substances is 0.196 ( $se = 0.005$ ,  $[0.186, 0.207]$ ,  $p < 0.001$ ), whereas the probability of delinquency for an individual who reported using 1 substance is 0.290 ( $se = 0.007$ ,  $[0.276, 0.304]$ ,  $p < 0.001$ ), and the probability continues to increase with every additional substance used.

Like the logistic models, the binomial models also show that the substance use variety score is positively, significantly associated with the delinquency variety score ( $b = 0.424$ ,  $se = 0.025$ ,  $[0.375, 0.473]$ ,  $p < 0.001$ ; AME = 0.140,  $se = 0.009$ ,  $[0.123, 0.156]$ ,  $p < 0.001$ ) (See **Figure 2**). As an example, the predicted average number of delinquent acts for someone engaged in no substance use is 0.287 ( $se = 0.008$ ,  $[0.271, 0.304]$ ,  $p < 0.001$ ) while it is 0.894 ( $se = 0.047$ ,  $[0.578, 0.669]$ ,  $p < 0.001$ ) for someone who reports using 4 kinds of substances. Each of these findings confirm the existence of a positive association between substance use and delinquency in this sample.

Contrary to the literature, no statistically significant association was found between being in a nonmetropolitan context and delinquency in both the logistic and binomial models ( $p > 0.05$ ). This result remained the same when using the population density measure of rural context. This does not mean there is no independent relationship between these two phenomena, but these surveyed youth appear to engage in similar levels of delinquency across these geographic context categorizations.

For the informal social control variables, as predicted by the literature, each measure is negatively and significantly associated with delinquency. In the logistic regressions, parental attachment ( $b = -0.369$ ,  $se = 0.034$ ,  $[-0.435, -0.303]$ ,  $p < 0.001$ ; AME =  $-0.066$ ,  $se = 0.006$ ,  $[-0.078, -0.055]$ ,  $p < 0.001$ ), school attachment ( $b = -0.380$ ,  $se = 0.034$ ,  $[-0.447, -0.313]$ ,  $p < 0.001$ ; AME =  $-0.068$ ,  $se = 0.006$ ,  $[-0.080, -0.056]$ ,  $p < 0.001$ ), and participation in faith-based activities ( $b = -0.057$ ,  $se = 0.023$ ,  $[-0.102, -0.012]$ ,  $p < 0.05$ ; AME =  $-0.010$ ,  $se = 0.004$ ,  $[-0.019, -0.002]$ ,  $p < 0.05$ ) are all associated with a decrease in the probability that one engaged in delinquency in the past 12 months (See **Figures 3, 4, & 5**).

When examining predicted values, for parental attachment, the probability of delinquency for someone with the lowest level of parental attachment (a score of 0), is 0.426 ( $se = 0.020$ ,  $[0.386, 0.465]$ ,  $p < 0.001$ ) while for the highest level of parental attachment (a score of 3), the probability of delinquency is 0.197 ( $se = 0.006$ ,  $[0.185, 0.208]$ ,  $p < 0.001$ ), indicating a significant reduction in the probability of delinquency as parental attachment increases. Similar results emerge for school attachment and participation in faith-based activities, although the differences in predicted probabilities for different levels of participation in faith-based activities are not substantial compared to the former two informal social controls.

Consistent with the logistic regressions, in the binomial model, parental attachment ( $b = -0.350$ ,  $se = 0.031$ ,  $[-0.410, -0.290]$ ,  $p < 0.001$ ; AME =  $-0.117$ ,  $se = 0.011$ ,  $[-0.138, -0.097]$ ,  $p < 0.001$ ) and school attachment ( $b = -0.416$ ,  $se = 0.033$ ,  $[-0.480, -0.353]$ ,  $p < 0.001$ ; AME =  $-0.139$ ,  $se = 0.011$ ,  $[-0.161, -0.117]$ ,  $p < 0.001$ ) are associated with a decrease in the number of delinquent activities one reports engaging in during the past 12 months (See **Figures 6 & 7**). These relationships can be further seen using parental attachment as an example again, where the average predicted number of delinquent acts for an individual with the lowest level of parental attachment is  $0.739$  ( $se = 0.046$ ,  $[0.650, 0.828]$ ,  $p < 0.001$ ), while it is  $0.286$  ( $se = 0.010$ ,  $[0.267, 0.305]$ ,  $p < 0.001$ ) for an individual with the highest level of parental attachment, and a similar relationship emerges for school attachment.

Unlike the logistic model, engaging in faith-based activities was not significantly associated with the delinquency variety score ( $p > 0.05$ ). Divergence of this kind in the results between the logistic and binomial models may be due to differences in what the delinquency measures, dichotomous and variety score, are capturing; this will be further addressed in the next section.

In sum, substance use and delinquency have a significant, positive relationship in this sample, supporting the second hypothesis and confirming expectations from the literature. However, nonmetropolitan and non-CBSA contexts do not have significant independent associations with delinquency, indicating that, independently, context is not predictive of delinquency in this sample. This aligns with the findings from the t-tests examining delinquency across the nonmetropolitan and metropolitan groups. Finally, these models confirm the existence of a negative relationship between the informal social control variables, albeit less so for faith-based activities, and delinquency as anticipated by the literature.

## MULTIVARIATE MODELS INCLUDING INTERACTIONS

The following models assess whether there are interactions between substance use and rural context as well as the informal social control variables in their relationships with delinquency. Each model is run with both the main independent variable and each moderator independently before adding the relevant interactions. Doing so allows one to see how the independent relationships may change when introducing the interactions. Since the main analysis is correlational in nature, the following models do not contain controls.

### *Rural Context Interactions*

The following models examine the relationship between substance use, rural context, and their interaction and delinquency (see **Table 6** for the logistic models and **Table 7** for the binomial models). According to the logistic regressions, being in a nonmetropolitan county or non-CBSA is not associated with any change in delinquency independently, but the interaction term between being in a nonmetropolitan county and the substance use variety score is significantly, negatively associated with delinquency ( $b = -0.171$ ,  $se = 0.080$ ,  $[-0.328, -0.015]$ ,  $p < 0.05$ ). This indicates that the relationship between substance use and delinquency is weaker for those living in nonmetropolitan counties. Nonmetropolitan context therefore moderates the relationship between substance use and delinquency in this model, providing evidence for the third hypothesis.

Adding nonmetropolitan context as a moderator to the model revealed differences in delinquency at different levels of substance use between these groups (See **Figure 8**). When examining the predicted probabilities of delinquency at varying levels of substance use, the predictions are similar across contexts at lower levels of substance use but diverge as the number of substances used increases. For example, the average predicted probability of delinquency for a

person who reports no substance use and resides in a metropolitan area is 0.195 ( $se = 0.006$ , [0.0183, 0.206],  $p < 0.001$ ) and 0.206 ( $se = 0.012$ , [0.182, 0.230],  $p < 0.001$ ) in a nonmetropolitan area. For a person who reports using 5 substances, the average probability of delinquency for a person living in a metropolitan area is 0.675 ( $se = 0.032$ , [0.611, 0.738],  $p < 0.001$ ) while for a person living in a nonmetropolitan area it is 0.529 ( $se = 0.062$ , [0.408, 0.650],  $p < 0.001$ ). The confidence intervals around each prediction overlap point-by-point, but significant effects can still appear under such conditions as occurs here (Schenker & Gentleman, 2001). The confidence intervals here also do not account for the covariation of the variables examined and are likely impacted by the noisiness of the data and relevant measures. In turn, there appears to be a moderation effect of rural context given that the slope of the relationship between substance use and delinquency is greater for those living in metropolitan areas, but this effect is relatively weak.

For the population density logistic model, the interaction term was not statistically significant ( $p > 0.05$ ). This finding is in opposition to the third hypothesis and indicates the importance of potential discrepancies between rural context measures/classifications. Why the measurement of rural context in these models may lead to different results, and what this means for the study of rural context in this relationship, will be addressed further in the discussion section.

Unlike the logistic regressions, in the binomial model the interaction term for both being in a nonmetropolitan county as well as a non-CBSA with substance use were not statistically significant. These results further weaken the assessment of the third hypothesis. However, these contradictory results may be due to the differences in what the variety score and the dichotomous delinquency measure are capturing. The dichotomous measure is assessing whether an individual

reports doing any kind of delinquency in the past 12 months, whereas the variety score captures the number of different kinds of delinquent acts one has undertaken. The latter measure may therefore reflect a more nuanced aspect of delinquency that is not related to rural or nonmetropolitan context in the same way as simply whether one engages in delinquency. The implications of this will be examined in the discussion and conclusion.

In sum, nonmetropolitan context moderates the relationship between substance use and delinquency in the logistic model using the binary delinquency outcome, but not in the binomial model using the variety score. However, being in a non-CBSA does not moderate the relationship in either model.

#### *Informal Social Control Interactions*

The next models contain substance use, the informal social control variables separately in each model, and the interaction between these variables in their relationship with delinquency (See **Tables 8** through **10** for the logistic models and **Tables 11** through **13** for the binomial models). In the logistic models, as suggested by the literature, each of the social control variables were significantly, negatively related to delinquency in each of their respective models as they were in the bivariate case; but, despite some indication that informal social controls may weaken the relationship between substance use and delinquency (Fagan, 1990), parental attachment yielded a significant, positive interaction with substance use ( $b = 0.110$ ,  $se = 0.033$ ,  $[0.044, 0.175]$ ,  $p < 0.01$ ). Similar results emerged for school attachment ( $b = 0.077$ ,  $se = 0.035$ ,  $[0.009, 0.146]$ ,  $p < 0.05$ ) and involvement in faith-based activities ( $b = 0.054$ ,  $se = 0.027$ ,  $[0.002, 0.107]$ ,  $p < 0.05$ ). This suggests that the relationship between substance use and delinquency is stronger for those with higher levels of informal social controls.

**Figures 9 through 14** display these moderating relationships for different levels of each informal social control<sup>3</sup>. One can see that those with higher levels of these controls engage in lower levels of delinquency at low levels of substance use, but as substance use increases, the predictive ability of substance use indicates more participation in delinquency relative to their peers with weaker bonds. Like with the rural context interaction the confidence intervals overlap in some instances for these points, but an aggregate relationship is still detected. The predictive relationship between substance use and delinquency appears to either converge for those with higher and lower informal social controls or it becomes a greater predictor of delinquency for those with higher informal social controls. Regardless of the extent of the effect, these results provide support for the fourth hypothesis that informal social controls moderate the relationship between substance use and delinquency.

Like the logistic models, the informal social control variables yield significant positive interaction terms with substance use on the delinquency variety score. These variables were also better predictors of the delinquency variety score than of the dichotomous delinquency measure. Parental attachment ( $b = 0.097$ ,  $se = 0.021$ ,  $[0.056, 0.138]$   $p < 0.001$ ), school attachment ( $b = 0.081$ ,  $se = 0.023$ ,  $[0.036, 0.125]$ ,  $p < 0.001$ ), and involvement in faith-based activities ( $b = 0.039$ ,  $se = 0.019$ ,  $[0.003, 0.075]$ ,  $p < 0.05$ ) all had positive interactions with substance use.

---

<sup>3</sup> For the purposes of illustrating the moderating effects, I show both graphs with example values of each informal social control well as graphs including a more standardized presentation of these effects. The first graphs include the predicted substance-delinquency relationship for those at real levels of the informal social controls. For example, Figure 9 shows the predicted substance-delinquency relationships for those at the lowest level of parental attachment, those at the middle level, and those with the highest level of parental attachment. Figure 10 shows this relationship using a standard deviation above and below the average value for parental attachment.

While the figures showing real values of the informal social controls and predictions at different levels of substance use provide a better visual representation of the relationship, there are not always individuals who fall at both that level of the informal social control and have each of the possible predicted levels of substance use (although there are significant numbers of real individuals at each level of the informal social controls). Because of this, these graphs are making predictions for cases not represented in the sample. The inclusion of the standard deviation categorization graphs therefore accounts for this by limiting the predictions to the center of the distribution.

These relationships can be seen further in **Figures 15** through **20**. Like in the logistic models, the confidence intervals overlap between the groups at certain points. However, when examining the average marginal effects for these variables, some of these effects at higher values for substance use are significant in their positive relationship with delinquency.

Overall, informal social controls appear to have a positive moderating effect on the relationship between substance use and delinquency in this sample.

It is also important to examine how each of these informal social control variables and their interactions with substance use behave in a singular model. Models including the independent effects of each moderator without any interactions are compared with the respective model including each interaction to determine how estimates may change with the introduction of these moderator effects (See **Tables 14 & 15**). In the logistic model, substance use, parental attachment, and school attachment all have significant independent relationships with delinquency in the appropriate directions, reflecting the previous models. However, participation in faith-based activities has no significant relationship with delinquency once accounting for the other informal social control variables. The same result emerges for the binomial model.

When including all three informal social control variables and their interactions with substance use in the same model, both the independent and interactive effects change in some respects and remain consistent in others. In the logistic model, substance use is no longer independently, significantly associated with delinquency. Parental attachment and school attachment remain negatively associated with delinquency and participation in faith-based activities stays unassociated with delinquency. The interaction between parental attachment and substance use stays positive and significant ( $b = 0.089$ ,  $se = 0.033$ ,  $[0.024, 0.155]$ ,  $p < 0.01$ ), but the interactions for school attachment and faith-based activities are no longer significant.

For parental attachment, the average marginal effects on delinquency at each value of substance use mirror the patterns from the previous logistic model. One can once again look at the predicted probabilities of delinquency for different levels of parental attachment (as shown in the previous figures): for a person who has the lowest level of parental attachment, their average predicted probability of delinquency when they report no substance use is 0.330 ( $se = 0.023$ , [0.286, 0.374],  $p < 0.001$ ), while when they report using 5 kinds of substances their probability is 0.676 ( $se = 0.078$ , [0.524, 0.828],  $p < 0.001$ ). In contrast, for a person with the highest level of parental attachment, their average predicted probability of delinquency when they report no substance use is 0.169 ( $se = 0.006$ , [0.157, 0.182],  $p < 0.001$ ), while when reporting using 5 kinds of substances their probability is 0.765 ( $se = 0.036$ , [0.694, 0.836],  $p < 0.001$ ).

This example demonstrates that individuals with high levels of parental attachment at low levels of substance use have a lower average probability of engaging in delinquency compared to those with low levels of parental attachment; but the former individuals have a higher probability of delinquency on average at higher levels of substance use compared to those with low levels of parental attachment.

In the binomial model, the independent relationships mirror those of the logistic model, and there remains a significant, positive interaction between parental attachment and substance use ( $b = 0.078$ ,  $se = 0.022$ , [0.034, 0.121],  $p < 0.001$ ) and no significant interaction between faith-based activities and substance use. However, unlike the logistic model, the interaction between school attachment and substance use ( $b = 0.060$ ,  $se = 0.024$ , [0.014, 0.106],  $p < 0.05$ ) is significant and positive as well. The average marginal effects of parental attachment and school attachment are very similar to previous results. Further, in line with the logistic model, those with the lowest level of parental and school attachment are predicted to engage in more acts of

delinquency than their highly attached peers at low levels of substance use, but they are predicted to have lower levels of delinquency at higher levels of substance use relative to their highly attached counterparts on average.

Overall, these findings suggest the existence of an average positive interaction between substance use and parental attachment, as well as perhaps school attachment when predicting the delinquency variety score, but not participation in faith-based activities.

#### *Full Models with All Interactions*

Before examining the independent relationships and interactions with substance use for rural context and the informal social controls, like the informal social control model, a full model with the independent relationships between the independent variable, moderator variables, and delinquency should be examined. From this model, the relevant interactions with substance use are introduced to see how the relationships change (See **Tables 16 & 17**).

For the logistic model, the independent relationship between substance use and delinquency remained significant and positive (both when using the nonmetropolitan county measure of rural context and the population density measure), although the coefficient was attenuated towards zero somewhat. Similarly, the rural context measures did not have an independent relationship with delinquency. For informal social controls, both parental attachment and school attachment remained significantly, negatively related to delinquency in these models, also with attenuated coefficients. However, unlike the bivariate model, participation in faith-based activities is no longer significantly independently related to delinquency. Each of these results are mirrored in the binomial models as well. These results confirm the general story of the independent relationships between these variables and delinquency.

To test whether informal social controls are related to how rural context moderates the relationship between substance use and delinquency, both rural context and its interaction with substance use are included in a single model with the informal social control variables and their requisite interactions.

In the logistic model, substance use, nonmetropolitan county status, and faith-based activities are not independently associated with delinquency, but parental attachment and school attachment both remain significant, negative correlates of delinquency ( $p < 0.001$ ). The interaction between substance use and nonmetropolitan county status, like the previous logistic models, is significant and negative ( $b = -0.183$ ,  $se = 0.077$ ,  $[-0.334, -0.031]$ ,  $p < 0.05$ ). This indicates that even when accounting for informal social controls, the relationship between substance use and participation in any delinquency in the past 12 months is weaker for those living in nonmetropolitan counties (See **Figure 21**). However, the interaction between being in a non-CBSA and substance use remains insignificant in this model.

When examining the predicted probabilities across levels of substance use by nonmetropolitan context, like in the previous models, the probability of delinquency for metropolitan and nonmetropolitan respondents is similar at lower levels of substance use but diverges at higher values. For example, on average, now accounting for informal social controls and their interactions with substance use, an individual who resides in a metropolitan area and reports using 1 kind of substance has a probability of engaging in delinquency of 0.199 ( $se = 0.006$ ,  $[0.188, 0.211]$ ,  $p < 0.001$ ) while a nonmetropolitan individual has a probability of 0.211 ( $se = 0.012$ ,  $[0.187, 0.235]$ ,  $p < 0.001$ ). However, the probability of delinquency for a metropolitan individual that reports using 6 substances is 0.844 ( $se = 0.028$ ,  $[0.790, 0.899]$ ,  $p < 0.001$ ) and 0.666 ( $se = 0.081$ ,  $[0.507, 0.825]$ ,  $p < 0.001$ ) for a nonmetropolitan individual.

In the logistic model, the interaction for parental attachment remains significant and positive ( $b = 0.091$ ,  $se = 0.034$ ,  $[0.024, 0.157]$ ,  $p < 0.01$ ), while the interactions for school attachment and faith-based activities are not significant. The average marginal effect of parental attachment on delinquency at different levels of substance use mimics the pattern seen in previous models, and the average positive relationship persists despite ambiguity at high values of the substance use variety score.

In the binomial model, substance use, nonmetropolitan county context, and participation in faith-based activities are not significantly, independently associated with delinquency while parental attachment and school attachment are significantly, negatively associated with the outcome. For the interactions, like the previous iterations of this model, the interactions between nonmetropolitan county status and the population density measure and substance use are not significant, nor is the interaction between faith-based activities and substance use.

However, like previous versions of this model, the interactions between substance use and parental attachment ( $b = 0.077$ ,  $se = 0.022$ ,  $[0.034, 0.121]$ ,  $p < 0.001$ ) and school attachment ( $b = 0.060$ ,  $se = 0.024$ ,  $[0.014, 0.106]$ ,  $p < 0.05$ ) are significant and positive. The average marginal effects of parental attachment and school attachment on delinquency for different levels of substance use also remain similar to the previous models, as do their predicted probabilities in particular cases.

In sum, based on these models, the associations and interactions for both rural context and informal social controls stay generally consistent in the full models. This means that the introduction of informal social controls and their interactions with substance use did not alter any moderating effect of rural context detected. Furthermore, accounting for context did not alter the

moderating effects of the informal social controls either. The fifth hypothesis is therefore not supported.

## SENSITIVITY ANALYSIS

As a sensitivity analysis, I assess whether the results change when including controls and when using alternative regression models. First, the final logistic and binomial models include control variables for age, gender, race, income, risk-taking behavior, and arrest. When including controls, the sample size drops to 11,976 due to missingness on the risk-taking behavior scale and arrest. Including these incomplete cases in the missing data analysis, the differences addressed in the original missingness analysis for the analytic sample remain the same. Second, the primary models of the analysis, including the controlled models, are conducted using linear probability models as well as Poisson and negative binomial regressions to confirm the results from the logistic and binomial models.

### *Logistic and Binomial Models with Controls*

**Tables 18 and 19** contain the full interaction models (using nonmetropolitan county status as the rural context indicator) with controls, both logistic and binomial. In the logistic model, the results remain the same with being in a nonmetropolitan county having a significant, negative interaction with substance use ( $b = -0.220$ ,  $se = 0.082$ ,  $[-0.382, -0.059]$ ,  $p < 0.01$ ) and parental attachment having a significant, positive interaction with substance use ( $b = 0.099$ ,  $se = 0.036$ ,  $[0.027, 0.170]$ ,  $p < 0.01$ ). The predicted probabilities and average marginal effects of these interactions remain similar to those of the previous models as well. It is notable however that including controls increased the apparent strength of the moderating effect of nonmetropolitan context in the logistic model.

Like the other binomial models, when including controls there is no significant interaction between nonmetropolitan county status and substance use ( $p > 0.05$ ), and there are significant, positive interactions for parental attachment ( $b = 0.076$ ,  $se = 0.023$ ,  $[0.031, 0.121]$ ,  $p < 0.01$ ) and school attachment ( $b = 0.060$ ,  $se = 0.024$ ,  $[0.013, 0.106]$ ,  $p < 0.05$ ). These average marginal effects and predicted probabilities tell a similar story to the previous models as well.

Overall, for both the logistic and binomial models, these results are the same as the uncontrolled model, albeit with slightly altered coefficients. These models affirm the findings of the previous models<sup>4</sup>.

#### *LPM, Poisson, and Negative Binomial Models*

The outcomes from the linear probability, Poisson, and negative binomial models yield results similar to those of the original models. However, for the informal social control interactions, the linear probability models only yield a significant interaction between parental attachment and substance use in the models with only substance use and parental attachment, and no significant interactions in the model with all the informal social controls and their interactions. Significant interactions between the informal social controls and substance use persist in the Poisson and negative binomial models.

In the full model with controls, the linear probability model continues to yield a significant, negative interaction between nonmetropolitan county status and substance use, but not for any of the informal social control interactions. The results from the Poisson and negative binomial models remain consistent with the findings from the binomial models.

---

<sup>4</sup> Figures of the nonmetropolitan county status moderating effect in the logistic model and the moderating effects of parental attachment in each relevant model including controls are included in the Appendix. These figures demonstrate that the substantive graphical findings of the main analysis are similar when including controls.

Overall, the results from these models are fairly aligned with the overarching conclusions of the logistic and binomial models, although the linear probability model does not yield the same interactions with the informal social control variables.

## ROBUSTNESS CHECK

As a robustness check, the following analyses assess whether the results are further dependent upon the measurement of the outcome, delinquency, and the moderator, rural context. First, all relevant analyses (including those with control variables) that include context are conducted using both the three-category metropolitan county status measurement and the population density measurement of rural context. Second, all analyses that include context are conducted using a restricted measure of rural vs urban contexts that excludes those in middle geographic categories including small metropolitan counties and CBSAs with less than 1 million people. Finally, all analyses are conducted using delinquency measures that include whether a participant has carried a handgun in the past 12 months.

### *Three-Category Rural Context Measures*

In the primary bivariate models (as in the main analysis) no significant, independent association between rural context and delinquency is found in these data. For the logistic model, using the three-county type ordinal measure, relative to those residing in large metropolitan counties, those in nonmetropolitan counties have negative and significant interactions with substance use ( $b = -0.226$ ,  $se = 0.082$ ,  $[-0.387, -0.066]$ ,  $p < 0.01$ ) but those living in small metropolitan counties do not. This aligns with the results from the dichotomous indicator of nonmetropolitan context. Unlike the dichotomous indicator of being in a non-CBSA, the three-category population density measure reveals a significant, negative interaction term between those living in a CBSA segment with fewer than 1 million people and substance use relative to

those living in places with more than 1 million people ( $b = -0.180$ ,  $se = 0.072$ ,  $[-0.321, -0.039]$ ,  $p < 0.05$ ); this was not the case for those not living in a CBSA segment. These findings may reflect something about how context categorizations matter for this relationship.

However, the distinction between the kinds of counties does not matter for the interactions in the binomial models, as all interactions remain insignificant. The implications of the differences between these models and the nuances of the three-category rural context measurements will be addressed in the discussion and conclusion.

In the models containing all main predictors and their interactions with substance use, for county status, relative to large metropolitan counties, being in a nonmetropolitan county yields a negative, significant interaction with substance use in the logistic model ( $b = -0.236$ ,  $se = 0.080$ ,  $[-0.392, -0.080]$ ,  $p < 0.01$ ). For population density in the logistic model, relative to those living in a CBSA segment with 1 million or more people, those living in CBSA segments with less than 1 million people have a negative interaction with substance use ( $b = -0.176$ ,  $se = 0.068$ ,  $[-0.310, -0.042]$ ,  $p < 0.05$ ) while the interaction between those in non-CBSA segments and substance use is not significant. In the binomial model, none of the context interactions are significant but the results for the informal social controls and their interactions remain substantively the same in these models.

Finally, in the logistic models accounting for controls, both small metropolitan and nonmetropolitan yield significant negative interaction terms with substance use relative to large metropolitan counties. Furthermore, this result also emerges in the three-category population density measure with both those living in CBSA segments with less than 1 million people and those in a segment not in a CBSA having significant, negative interactions with substance use

relative to those in segments in a CBSA with 1 million or more people. The interactions remain not significant in all versions of the binomial models.

In sum, while there are some nuances revealed using the three-category measures, the substantive story of the results regarding the existence of a nonmetropolitan context moderating effect in the logistic but not binomial models remains the same. The implications for the importance of how rural context is measured will be assessed further in the discussion and limitations.

#### *Restricted Rural-Urban Context Measure*

The restricted rural-urban context measure only considers those living in both a nonmetropolitan county and a non-CBSA to be “rural” and those living in a large metropolitan county and a CBSA with 1 million people or more to be “urban.” This measure thus excludes anyone who lives in a small metropolitan county *or* a CBSA with less than 1 million people. Those living in a rural area are coded as 1 and those living in an urban area are coded as 0. The main analytic sample using this measure includes only 6058 respondents while the sample including control variables contains 6013.

In both the logistic and binomial regressions, rural context continues lack an independent association with delinquency. Like the population density measure, no significant interaction appears between this measure of rural context and substance use in any of the models excluding control variables while other substantive findings remain the same (including the positive moderating effects of parental and school attachment). When including controls, the interaction between this measure and substance use is negative and marginally significant ( $p < 0.1$ ) in both the logistic and binomial models; however, these effects are not considered significant in the current study which uses a threshold of 0.05 given the large sample size.

In sum, the restricted rural-urban context measure further weakens the case that rural context moderates the substance-delinquency relationship. It is notable that the sign remains consistent in these models and that including additional controls increases the strength of any possible effect as they are noted to do in the sensitivity analysis. Further, unlike in the sensitivity analysis models including controls, a marginally significant negative interaction appears between rural context and substance use in the binomial models including controls. The implications of these findings will be assessed in the discussion section.

#### *Delinquency Variables including Handgun Measure*

Using both the dichotomous delinquency measure and the variety score including the handgun measure, the results of the models change in a few expected ways. First, being in a nonmetropolitan county or non-CBSA is not associated with delinquency in the bivariate case in any of the logistic models. However, in the bivariate binomial model, being in a small metropolitan county is significantly positively associated with delinquency relative to large metropolitan counties ( $p < 0.05$ ). Similarly, in the models that include substance use, being in a nonmetropolitan county becomes significantly, positively associated with delinquency ( $p < 0.05$ ) which is likely due to the disparity between handgun carrying youth by geographic context. It is also positively associated with delinquency when breaking down location by population density in some of the models ( $p < 0.05$ ). Nonmetropolitan context remains a significant, positive predictor of delinquency in the logistic models that include informal social controls but not in the models that include all control variables. This demonstrates the influence that a single delinquency item can have on the contextual results. Despite this, the independent association does not persist in any of the binomial models that include substance use and other variables which mimic the contextual results from the main analytic binomial models.

Even with the change in the independent association of rural context with delinquency, the interactions between rural context and substance use remain significant and negative in all the logistic models, therefore aligning with the main analytic findings. This provides further confirmation of the original results in terms of how context may interact with substance use. These outcomes remain similar for the informal social control variables as well, apart from faith-based activities which are not significantly associated with delinquency in any of these models. In addition, in the logistic models, school attachment does not yield a significant interaction with substance use, but it does in the binomial models.

In sum, these models confirm the substantive story of the main analysis but demonstrate how handgun carrying can alter the independent association between rural context and delinquency.

## Chapter 5: Discussion and Conclusion

### DISCUSSION

The current research contributes to our understanding of contextual variation in the drug-crime relationship and how theory may play a role in this process. The relationship between substance use and crime or delinquency is a consequential one for short and long term offending behavior, and the influence of this relationship for rural compared to urban youth should be explicated to determine whether unique interventions or considerations depending upon context are needed. This study therefore examined the relationship between substance use and delinquency for a sample of adolescents across the United States to determine 1) whether the relationship is conditioned by context and 2) how informal social controls may help explain potential context variation.

The results suggest mixed support for the moderating effect of rural context on the relationship between substance use and delinquency. Rural context appears to be helpful for understanding the strength of the relationship between substance use and delinquency when looking at whether one engaged in delinquency or not but does not help to distinguish among levels (i.e., variety of offenses) of engagement of those actively involved in offending. No substantial effect emerges when using the delinquency variety score outcome or using population density as a measure of rural context. The inconsistency in findings could be the result of several factors, including a data artifact, measurement issues, or a sampling feature.

Data artifact aspects may arise in a few ways. It may be the case that how the surveyors for the NSDUH (2019) conducted their sampling, interviews, or other data gather techniques influenced characteristics of the sample in a way that yielded the relationships found in this study. For example, since the NSDUH relies on Census and OMB geographic measures, the

ways in which geographic boundaries are drawn or the level at which these units are aggregated may produce different results than other kinds of boundary definitions. In turn, there may be something about how these geographic categorizations are drawn which produces the effect seen rather than the substance-delinquency relationship being dependent on nonmetropolitan county context. Moreover, significant statistical effects in any study only indicate that an identified relationship is unlikely (if all analytic assumptions hold) to be due to chance, but that does not mean they are substantively meaningful, nor does it address how other factors might explain such findings. It is also the case that significant effects become more likely the more models one runs, therefore making conclusions about such an inconsistent effect potentially problematic.

Relatedly, measurement of delinquency and rural context also may have influenced the results. For delinquency, the binary measure of delinquency only makes a distinction between respondents who report engaging in delinquency and those who report abstaining, while the variety score provides greater nuance regarding which respondents engaged in a wide variety of delinquent behaviors, which is also connected to other metrics like severity and frequency (Sweeten, 2012). It may be that knowing whether someone resides in a nonmetropolitan county is helpful for understanding differences in how substance use may be related to whether one engages in any delinquency, but not for the extent or variety of that delinquency. If this is the case, rural or nonmetropolitan context may require further examination regarding how it can inform our understanding of the predictive power of substance use for whether one engages in delinquency or not (even though it is not informative for delinquency variety).

Regarding the measurement of rural context, nonmetropolitan county status and population density are readily available measures of rural context but their veracity, particularly given the declining distinctions between rural and urban spaces (Lichter & Brown, 2011; Lichter

& Ziliak, 2017), in capturing the construct of interest is difficult to determine. These geographic measures may be tapping into novel context distinctions not addressed by this research. For example, proximity to a metropolitan area could be related to how the relationship between substance use and delinquency manifests rather than rurality. If this is the case, then further questions must be asked regarding the nature of metropolitan county categorizations. Moreover, results from the robustness checks suggest nuance may exist within population density categories and excluding those in small metropolitan counties and CBSAs with less than 1 million people may alter results to some degree. In general, while there is some effect detected in some models and it may be revealed to a greater extent when including other covariates, the substantive nature of this finding is difficult to assess.

Additionally, since information is limited regarding the nature of more prevalent or severe delinquent and substance use behavior in this sample, it is possible that context differentially matters depending upon the severity or frequency of these behaviors. For instance, rural context may be meaningful for the substance-delinquency relationship among the most delinquent or at-risk youth but these individuals are not captured in this analysis. Overall, skepticism should be reserved for the nature of the rural context effect given its small contribution to explaining variation in the data and its inconsistent effects, but the possibility of contextual dependency for the substance-delinquency relationship when delinquency is a binary outcome remains. More research is needed using different samples and measures to determine if context matters in this way for the relationship.

Second, the findings suggest that informal social controls increase the strength of the substance-delinquency relationship, although the direction of this relationship was not strongly indicated by the literature. Parental attachment consistently moderates this relationship and

school attachment appears to moderate the relationship as well but not as consistently. In contrast, participation in faith-based activities or religious involvement only appeared to matter for this relationship when not accounting for other informal social controls, making any possible influence of religious involvement unclear.

One possible explanation for these effects is that the influence of substance use on delinquency might be stronger when an individual experiences greater informal social controls or social bonds. Since adolescents that have weaker social bonds are already more likely to engage in delinquency, substance use may not be as informative as a predictor for such behavior.

Another reason for this moderating effect may be that while informal social controls predict lower levels of delinquency for more highly controlled individuals at low levels of substance use, individuals converge on their expected levels of delinquency at higher levels of substance use.

This possibility appears to describe the graphical representations of the relationship and acknowledges the ambiguities in predictions at high levels of substance use given few observations. A stronger relationship between substance use and delinquency is therefore observed for adolescents with higher parental and school attachment because they start at lower levels of delinquency at low levels of substance use but rise to meet their less attached peers with increased substance use. Essentially, the protective nature of informal social controls and social bonds might lose relevance once a certain amount of substance use occurs.

It could also be the case that some of the individuals who report having used more kinds of substances were untruthful in their accounts but answered the parental- and school-related questions honestly. Relatedly, since there are more participants in the sample who report higher levels of informal social controls (particularly parental attachment), there is more opportunity for variation in substance use among the highly attached respondents compared to the smaller

number of respondents at low levels of attachment. In turn, these results could be an artifact of the measures used, the truthfulness of respondents regarding their substance use and delinquency, and the makeup of the sample.

Finally, any effect of nonmetropolitan county status on the substance-delinquency relationship was unchanged by the inclusion of informal social controls and their interactions. Given that the significant moderating relationships for rural context and informal social controls functioned in opposite directions, any dependence of the substance-delinquency relationship on rural context does not appear to be linked to informal social controls as operationalized in this study. This runs counter to the idea that the interaction between rural context and substance use may be partially or entirely explained by how informal social controls operate within this process. It is important to note however that since a context effect was only found when using nonmetropolitan county context as the measure of rurality and the binary measure of delinquency, no moderating effect of rural context existed to be explained outside of said model(s).

If there is a moderating effect of rural context, one explanation for the aforementioned findings is that the mechanisms related to why geographic context may change the strength of the substance-delinquency relationship is unrelated to informal social controls. It may be the case that something else about rural areas, such as opportunity to engage in various types of delinquency (particularly more serious delinquency), results in the substance-delinquency relationship being weaker. For example, if opportunities for substance use remain ubiquitous in rural areas, but opportunities for crime/delinquency are not as available, then more individuals may engage in substance use but not delinquency in these areas. Other mechanisms such as

social learning and peer networks might also matter but are not considered in this study (Schroeder et al., 2007).

It is also possible that informal social controls are related to these processes, but not the kinds examined in this study. Parental attachment, school attachment, and religious involvement are all individual-level informal social controls or social bonds (Hirschi, 1969). As discussed in the literature review, Fagan (1990, 1993a), in his discussion of how informal social controls may decrease the strength of the relationship between alcohol and violence, may have only considered community-level informal social controls as being a moderator that would weaken the alcohol-violence relationship. The extent to which community members monitor each other's behavior as well as community-wide norms and values may decrease the strength of this relationship and account for a rural context effect, but these factors are not tested in the current study. Future research should examine these relationships with different kinds of informal social controls as well as other potentially relevant variables, like opportunity, to determine whether these factors can help explain potential contextual differences.

### *Limitations*

There are several limitations of the current study. First, in line with the discussion, since the NSDUH takes a sample of the general population, very few respondents engaged in more serious delinquency or substance use, causing two issues: 1) limited variation in substance use and delinquency among participants means that how these variables may be related and any differences by context/informal social controls might not appear as they would in a sample with more high-risk or delinquent respondents, and 2) the impact of context/informal social controls may vary based on the severity of delinquency or substance use but this is masked given the small number of individuals exhibiting such behaviors.

A very small number of people in the sample engaged in more than 2 acts of delinquency (2.53%, n=305) and a similarly small number used more than 2 kinds of substances of the 9 available (2.86%, n=346). As such, predictions at higher levels of delinquency and substance use are being made on a small number of respondents and are therefore more tenuous. Future research should attempt to address this issue by comparing the relationship between substance use and delinquency for high-risk or delinquent rural and urban youth or replicating this study with a similar sample that is able to detect more substance use and delinquency in some other way. Examining the present connections among youth that engage in more of these behaviors may aid our ability to see differences across context and by informal social controls.

Second, as mentioned previously, there are measurement issues for the constructs relevant to this study, particularly rural context. Measuring rurality is a consistent and impactful issue in this study, even with the robustness checks used to attempt to address said concerns. The public use file of the NSDUH only provides information on broad categorizations of metropolitan county status, per the U.S. Census Bureau's classifications, and population density, based upon OMB of CBSAs. It is possible that neither of these measures sufficiently capture "rurality" to see relevant effects (Donnermeyer & DeKeseredy, 2014; Lichter & Ziliak, 2017). Future studies should attempt to use data providing more granular geographic information. For instance, if one is to base the rural-urban continuum on features like population density, then having smaller categories may allow for more accurate geographic distinctions not captured by large geographic categories. Furthermore, having information about zip codes or census blocks may allow researchers to implement better strategies for parsing out relevant geographic regions or areas. It may also be beneficial to ask participants in surveys whether they consider their place of residence to be rural, suburban, or urban; resident opinion may provide a fruitful metric for

determining the lived experience of geographic diversity along the rural-urban continuum, particularly in an increasingly urbanized world (Wuthnow, 2018).

Measurement is also an issue for the informal social controls examined in this study, as the items used to capture the relevant constructs are limited. For parental attachment, neither of the items used to create the scale can assess the feelings of the child toward the parent, as is common in such measures and may be important for understanding attachment. Similarly, for the school attachment measure, it is possible that individual feelings towards school do not capture an adolescent's desire to do well or maintain good standing in their school. For example, some respondents might love going to school because they get to socialize with their friends, while others might hate it because they face bullying. Religious involvement faces similar issues in that it is predicated on only participation in faith-based activities, although this measure suffers from less conceptual ambiguity than the former two (Benda et al., 2006). Regardless, the measurement of these constructs likely impacts whether they are seen to differ across context and in their relationship with other relevant variables.

Third, response rates and missingness bring about problems for generalizability. Respondents who did not answer the items for key variables were distinct from those who did on several metrics, as addressed in the data and methods section. Since these individuals are neither missing completely at random nor missing at random, the probability someone did not answer all the relevant items and were therefore excluded from the analysis is not independent of either the independent or dependent variables, substance use or delinquency respectively (Brame, Turner, & Paternoster, 2010). Because of this, bias is introduced into the sample. However, the number of individuals dropped from the analysis relative to the entire sample is small (5.95%) and those missing on delinquency were not significantly different from the rest of the sample on substance

use or risk-taking behaviors, which are both correlated with delinquency themselves. These considerations lessen the potential impact of missingness on this study, but these concerns must be considered when interpreting the external and internal validity of the results.

Fourth, this study only examines how substance use relates to delinquency as the independent variable. A significant amount of drug-crime literature suggests that this relationship may be driven by criminal/delinquent behavior increasing substance use, a reciprocal relationship, or a spurious association (Bennett et al., 2008). If the relationship is reversed, and delinquency drives increased substance use, the statistical results should remain similar but the interpretation would change. For example, the positive moderating effects of parental and school attachment might mean that either (1) those with stronger attachment engage in more substance use at high levels of delinquency relative to their less attached peers, or (2) that substance use converges at high levels of delinquency for adolescents regardless of attachment. These interpretations are similar to the former discussion, but the implications for intervention may differ.

Furthermore, if there is a reciprocal relationship between these variables, then the reasons why these behaviors may be more compounding for those with higher levels of parental and school attachment should be investigated from a life-course perspective to determine how these phenomena interact over time. In terms of context, if rural context does influence the relationship, examining these mechanisms over a long period of time and how they interact with the environment would be prudent to understanding such effects. Simpson's (2003) study is somewhat emblematic of this in nonmetropolitan areas as he details the complex ways that substance use and offending behavior reinforce each other, although he examined adults.

Interpretation for reciprocal relationships becomes much more difficult for each of these findings as a better understanding of mechanisms and change over time is required.

Similarly, if the connection is spurious, then what other variables may be driving the observed relationships would need to be examined. For self-control, the findings regarding parental and school attachment are difficult to interpret, but the impact of rural context might be sensible given work that suggests how self-control manifests is partially dependent upon context (Zimmerman, 2010). It is also possible that other variables like opportunity significantly influence how rural-urban youth make decisions about their substance use and delinquent behavior, as well as how this relates to whether they are concerned about the likelihood that their behavior will jeopardize their social bonds. In sum, these alternative ways of conceptualizing the substance-delinquency relationship may influence the results as well as their substantive interpretation.

Finally, as this study is limited to adolescents, the association between rural context, informal social controls, and the drug-crime relationship among adults remains unexamined. It is possible that the rural context and informal social controls have a different association with the drug-crime relationship for adults. For example, the informal social controls experienced by adults are different from those for adolescents, and the kinds of exposure to substances and opportunities for crime diverge (Sampson & Laub, 1993). Either of these factors may alter how the moderating effect of the variables of interest would manifest for this group. Moreover, from a life-course perspective, how substance use and offending develop from adolescence to adulthood is important to consider given the arguments that substance use and crime may be reciprocally intertwined to produce long lasting patterns of antisocial behavior (Kirk, 2020; Hussong et al.,

2004; Laub & Sampson, 2003; Menard et al., 2001; Schroeder, 2007). In turn, future research should test these mechanisms for adults and over the life course.

### *Policy and Theoretical Implications*

Both implications for policy and criminological theory can be derived from this research. Regarding policy, the findings from this study indicate potentially divergent needs for addressing substance use and crime/delinquency both separately and together depending on context and other characteristics. If there is a weaker connection between substance use and delinquency in rural areas, then the needs of substance users and those involved in crime or delinquency may be different from their urban counterparts. For instance, those in urban areas who use substances and engage in crime might need more specific drug-crime tailored interventions than those in rural areas as programming for those involved in crime/delinquency who have substance use problems is different from programming to handle just one issue or the other (Deitch et al., 2000).

Furthermore, the unique disadvantages faced in rural communities (particularly for rural youth) influence what resources need to be distributed as well as how policies should be structured to address these issues (Pruitt, 2009), indicating a need to determine the extent and mechanisms of the drug-crime relationship in these contexts. In turn, policies that are helpful in addressing substance use and crime/delinquency as well as the combination of the two in urban areas may not work as well or in the same way in rural areas. This is especially so given that the mechanisms of any potential differences in the drug-crime relationship between contexts is not made clear by this study. Work such as research using the PROSPER data in terms of substance use interventions tailored for rural youth, as well as more research in this area assessing how to disrupt substance-delinquency connections should continue to fill the remaining gaps.

Relatedly, if it is the case that substance use is a better predictor of delinquency among adolescents with stronger parental and/or school attachments, then addressing substance use by such otherwise bonded individuals may be necessary to prevent involvement in later delinquency. Given the research in life-course criminology and the negative implications of such long-term connections, determining what individuals require the most intervention and how to tailor said intervention to their needs is of paramount importance. It is also important to examine other kinds of informal social controls and bonds, both in how they might differ across rural-urban contexts as well as how community-level controls may influence the relationship to further elucidate how these influences may or may not be meaningful to context.

As for theory, tests of the mechanisms of the substance-delinquency or drug-crime relationship are needed along with further inquiry into the role of environmental factors. Moving beyond an assumption of single factor causation or individual-characteristic mechanisms must be pursued to draw better conclusions about the nature of this relationship. In addition, the criminological literature examining informal social controls may be missing how these factors change the functioning of predictors for crime/delinquency, like substance use. The assumption that informal social controls, as well as other similar theoretical concepts, operate in a relatively uniform way may require further inquiry.

Overall, the role of context for the drug-crime relationship should be examined further in both rural settings and others, accounting for various possible mechanisms and environmental factors. Further, while this study does not necessarily suggest that rural places require different theories, it does argue for a better understanding of rural-urban differences in theoretical variables of interest. Various scholars within rural criminology have made important contributions in this area, but data remains limited on rural areas and communities or allows for

comparative work (Abraham & Ceccato, 2022). Such work is necessary to understand the potentially unique needs of rural communities in addition to testing criminological theory in a wider variety of settings (Donnermeyer & DeKeseredy, 2014; Pruitt, 2009; Osgood & Chambers, 2000). This will help us gain insight into how context should fit into our understanding of substance use and crime/delinquency as well as contribute to our knowledge regarding the explanatory power and utility of criminological theories in rural areas.

## CONCLUSIONS

In conclusion, the current research contributes to our understanding of the drug-crime relationship, how context may play a role, and the applicability of theory for these relationships. While some skepticism should be reserved for whether rural context matters for the substance-delinquency relationship given limitations to specific models and weak effects, the results suggest that nonmetropolitan context may be meaningful for the connection between substance use and whether one engages in delinquency or not. These findings indicate the potential for context increasing our understanding of substance use and its relations to the participation in delinquency, although more research is needed. For instance, the specificities of context effects in relation to measurement and the kind and granularity of geographic units require expansion along with investigations of offending populations specifically and adults.

Furthermore, the moderating effect of informal social controls raises questions about their role in these relationships. How informal social controls matter independently and why they did not have any influence on the impact of rural context is important to consider for several reasons. Informal social controls themselves appear to have a unique relationship with how substance use predicts delinquency, and this may be dependent upon the type of informal social control examined. In addition, accounting for these variables did not alter the rural context effect leaving

the mechanism through which rural context may influence the drug-crime relationship unclear. Other theoretical mechanisms such as opportunity or social learning might provide greater insight for unraveling the nuances of context effects. Understanding contextual mechanisms across the rural-urban continuum and relevant theoretical explanations as this work investigates will help inform policy, theory, and ensure that rural places and people are not left behind in our efforts.

## Tables

**Table 1.** Contingency Table of Metropolitan County Status and Population Density Measures (Adolescent, School-Going Subsample of NSDUH 2019)

|                    | In a CBSA with 1<br>million or more people | In a CBSA with fewer<br>than 1 million people | Not in a<br>CBSA | <i>Total</i> |
|--------------------|--------------------------------------------|-----------------------------------------------|------------------|--------------|
| Large Metropolitan | 5322                                       | 339                                           | 2                | 5663         |
| Small Metropolitan | 0                                          | 4578                                          | 31               | 4609         |
| Nonmetropolitan    | 6                                          | 1430                                          | 1122             | 2558         |
| <i>Total</i>       | 5328                                       | 6347                                          | 1155             | 12830        |

**Table 2.** Descriptive Statistics for Main Analytic Variables (N = 12066)

| <b>Variables</b>                        | <b>Mean</b> | <b>St. Dev.</b> | <b>Min</b> | <b>Max</b> |
|-----------------------------------------|-------------|-----------------|------------|------------|
| <i>Dependent Variables</i>              |             |                 |            |            |
| Delinquency (Dichotomous)               | 0.249       | 0.432           | 0          | 1          |
| Delinquency (Variety Scale)             | 0.376       | 0.768           | 0          | 5          |
| <i>Independent Variable</i>             |             |                 |            |            |
| Substance Use Variety Scale             | 0.440       | 0.871           | 0          | 9          |
| <i>Moderator Variables</i>              |             |                 |            |            |
| <b><i>Rural Context</i></b>             |             |                 |            |            |
| Nonmetropolitan County Status           | 0.200       | 0.400           | 0          | 1          |
| Non-CBSA                                | 0.091       | 0.287           | 0          | 1          |
| County Status                           |             |                 |            |            |
| Large Metropolitan                      | 0.440       | 0.497           | 0          | 1          |
| Small Metropolitan                      | 0.360       | 0.480           | 0          | 1          |
| Nonmetropolitan                         | 0.200       | 0.400           | 0          | 1          |
| Population Density                      |             |                 |            |            |
| In CBSA with 1 million people or more   | 0.414       | 0.493           | 0          | 1          |
| In CBSA with less than 1 million people | 0.495       | 0.500           | 0          | 1          |
| Not in CBSA                             | 0.091       | 0.287           | 0          | 1          |
| <b><i>Informal Social Controls</i></b>  |             |                 |            |            |
| Parental Attachment                     | 2.363       | 0.785           | 0          | 3          |
| School Attachment                       | 1.921       | 0.834           | 0          | 3          |
| Faith-Based Activities                  | 1.123       | 1.193           | 0          | 3          |

**Table 3.** Descriptive Statistics for Control/Demographic Variables

| <b>Variables</b>                       | <b><i>Main Analytic<br/>Sample (N = 12066)</i></b> |                 | <b><i>Sensitivity Analysis<br/>Sample (N = 11976)</i></b> |                 | <b>Min</b> | <b>Max</b> |
|----------------------------------------|----------------------------------------------------|-----------------|-----------------------------------------------------------|-----------------|------------|------------|
|                                        | <b>Mean</b>                                        | <b>St. Dev.</b> | <b>Mean</b>                                               | <b>St. Dev.</b> |            |            |
| Age                                    | 14.604                                             | 1.679           | 14.610                                                    | 1.678           | 12         | 17         |
| Male                                   | 0.506                                              | 0.500           | 0.507                                                     | 0.500           | 0          | 1          |
| <i>Race/Ethnicity</i>                  |                                                    |                 |                                                           |                 |            |            |
| White                                  | 0.522                                              | 0.500           | 0.523                                                     | 0.500           | 0          | 1          |
| Black/African American                 | 0.128                                              | 0.334           | 0.128                                                     | 0.334           | 0          | 1          |
| Native American/Alaskan Native         | 0.015                                              | 0.120           | 0.015                                                     | 0.120           | 0          | 1          |
| Native Hawaiian/Other Pacific Islander | 0.004                                              | 0.066           | 0.004                                                     | 0.065           | 0          | 1          |
| Asian                                  | 0.041                                              | 0.199           | 0.041                                                     | 0.199           | 0          | 1          |
| Multiple Races                         | 0.056                                              | 0.229           | 0.055                                                     | 0.229           | 0          | 1          |
| Hispanic                               | 0.234                                              | 0.423           | 0.233                                                     | 0.423           | 0          | 1          |
| <i>Family Household Income</i>         |                                                    |                 |                                                           |                 |            |            |
| Less than \$20,000                     | 0.140                                              | 0.347           | 0.140                                                     | 0.347           | 0          | 1          |
| \$20,000 to \$49,999                   | 0.271                                              | 0.445           | 0.271                                                     | 0.444           | 0          | 1          |
| \$50,000 to \$74,999                   | 0.153                                              | 0.360           | 0.154                                                     | 0.361           | 0          | 1          |
| \$75,000 or more                       | 0.436                                              | 0.496           | 0.436                                                     | 0.496           | 0          | 1          |
| Risk-Taking Behavior                   | --                                                 | --              | 0.967                                                     | 0.834           | 0          | 3          |
| Arrest                                 | --                                                 | --              | 0.030                                                     | 0.170           | 0          | 1          |

**Table 4.** Group Differences for all Variables by Metropolitan County Status (Two Sample T-Tests)

| Variables                   | Metropolitan |       |        |        | Nonmetropolitan |       |        |        | t-value | p-value |
|-----------------------------|--------------|-------|--------|--------|-----------------|-------|--------|--------|---------|---------|
|                             | Mean         | SD    | 95% CI |        | Mean            | SD    | 95% CI |        |         |         |
| Age                         | 14.600       | 1.678 | 14.563 | 14.630 | 14.633          | 1.682 | 14.566 | 14.700 | -0.952  | 0.341   |
| Male                        | 0.505        | 0.500 | 0.495  | 0.515  | 0.510           | 0.500 | 0.490  | 0.530  | -0.457  | 0.648   |
| White                       | 0.474        | 0.499 | 0.464  | 0.484  | 0.715           | 0.452 | 0.697  | 0.733  | -21.576 | < 0.001 |
| Income                      | 1.921        | 1.117 | 1.899  | 1.943  | 1.736           | 1.120 | 1.692  | 1.781  | 7.266   | < 0.001 |
| Risk-Taking Behavior        | 0.962        | 0.833 | 0.946  | 0.979  | 0.988           | 0.841 | 0.954  | 1.022  | -1.350  | 0.177   |
| Arrest                      | 0.029        | 0.166 | 0.025  | 0.032  | 0.035           | 0.185 | 0.028  | 0.043  | -1.755  | 0.079   |
| Delinquency (Dichotomous)   | 0.250        | 0.433 | 0.242  | 0.261  | 0.243           | 0.429 | 0.226  | 0.261  | 0.711   | 0.477   |
| Delinquency (Variety Score) | 0.381        | 0.775 | 0.366  | 0.397  | 0.352           | 0.734 | 0.322  | 0.381  | 1.695   | 0.090   |
| Substance Use               | 0.441        | 0.877 | 0.424  | 0.459  | 0.422           | 0.837 | 0.389  | 0.455  | 0.978   | 0.328   |
| Parental Attachment         | 2.358        | 0.791 | 2.343  | 2.374  | 2.383           | 0.759 | 2.353  | 2.413  | -1.378  | 0.168   |
| School Attachment           | 1.934        | 0.826 | 1.918  | 1.951  | 1.868           | 0.863 | 1.834  | 1.903  | 3.460   | < 0.001 |
| Faith-Based Activities      | 1.091        | 1.181 | 1.067  | 1.115  | 1.250           | 1.230 | 1.201  | 1.300  | -5.863  | < 0.001 |

**Table 5.** Bivariate Associations with Delinquency

| Variables                     | Logistic  |       |        |        |           | Binomial  |       |        |        |           |
|-------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                               | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Model 1                       |           |       |        |        |           |           |       |        |        |           |
| Substance Use                 | 0.516***  | 0.037 | 0.444  | 0.587  | 0.090***  | 0.424***  | 0.025 | 0.375  | 0.473  | 0.140***  |
| Constant                      | -1.411*** | 0.034 | -1.477 | -1.345 |           | -2.797*** | 0.031 | -2.858 | -2.737 |           |
| Model 2                       |           |       |        |        |           |           |       |        |        |           |
| Nonmetropolitan County Status | -0.038    | 0.071 | -0.178 | 0.102  | -0.007    | -0.057    | 0.069 | -0.193 | 0.079  | -0.019    |
| Constant                      | -1.147*** | 0.030 | -1.207 | -1.088 |           | -2.538*** | 0.029 | -2.594 | -2.481 |           |
| Model 3                       |           |       |        |        |           |           |       |        |        |           |
| Non-CBSA                      | -0.010    | 0.098 | -0.202 | 0.182  | -0.002    | -0.058    | 0.093 | -0.241 | 0.125  | -0.020    |
| Constant                      | -1.152*** | 0.029 | -1.209 | -1.096 |           | -2.542*** | 0.027 | -2.596 | -2.488 |           |
| Model 4                       |           |       |        |        |           |           |       |        |        |           |
| Parental Attachment           | -0.369*** | 0.034 | -0.435 | -0.303 | -0.066*** | -0.350*** | 0.031 | -0.410 | -0.290 | -0.117*** |
| Constant                      | 0.741***  | 0.300 | -0.460 | -0.141 |           | -1.752*** | 0.072 | -1.893 | -1.610 |           |
| Model 5                       |           |       |        |        |           |           |       |        |        |           |
| School Attachment             | -0.380*** | 0.034 | -0.447 | -0.313 | -0.068*** | -0.416*** | 0.032 | -0.480 | -0.353 | -0.139*** |
| Constant                      | -0.447*** | 0.067 | -0.578 | -0.315 |           | -1.798*** | 0.062 | -1.920 | -1.676 |           |
| Model 6                       |           |       |        |        |           |           |       |        |        |           |
| Faith-Based Activities        | -0.057*   | 0.023 | -0.102 | -0.012 | -0.010*   | -0.041    | 0.022 | -0.085 | 0.003  | -0.014    |
| Constant                      | -1.088*** | 0.038 | -1.162 | -1.013 |           | -2.498*** | 0.036 | -2.569 | -2.428 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 6.** Logistic Regression Models Predicting Delinquency by Context and Substance Use**Panel A. Nonmetropolitan County**

| Variables                                     | Model 1   |       |        |        |          | Model 2   |       |        |        |          |
|-----------------------------------------------|-----------|-------|--------|--------|----------|-----------|-------|--------|--------|----------|
|                                               | <i>b</i>  | SE    | 95% CI |        | AME      | <i>b</i>  | SE    | 95% CI |        | AME      |
| Substance Use                                 | 0.516***  | 0.037 | 0.444  | 0.587  | 0.090*** | 0.538***  | 0.041 | 0.457  | 0.619  | 0.089*** |
| Nonmetropolitan County Status                 | -0.015    | 0.074 | -0.160 | 0.129  | -0.003   | 0.071     | 0.083 | -0.092 | 0.234  | -0.004   |
| Substance Use x Nonmetropolitan County Status |           |       |        |        |          | -0.171*   | 0.080 | -0.328 | -0.015 |          |
| <b>Constant</b>                               | -1.409*** | 0.036 | -1.479 | -1.338 |          | -1.421*** | 0.038 | -1.494 | -1.347 |          |

**Panel B. Non-CBSA**

| Variables                | Model 1   |       |        |        |          | Model 2   |       |        |        |          |
|--------------------------|-----------|-------|--------|--------|----------|-----------|-------|--------|--------|----------|
|                          | <i>b</i>  | SE    | 95% CI |        | AME      | <i>b</i>  | SE    | 95% CI |        | AME      |
| Substance Use            | 0.516***  | 0.037 | 0.444  | 0.587  | 0.090*** | 0.519***  | 0.038 | 0.444  | 0.593  | 0.089*** |
| Non-CBSA                 | 0.037     | 0.100 | -0.159 | 0.233  | 0.006    | 0.065     | 0.116 | -0.161 | 0.292  | 0.006    |
| Substance Use x Non-CBSA |           |       |        |        |          | -0.063    | 0.113 | -0.284 | 0.158  |          |
| <b>Constant</b>          | -1.413*** | 0.035 | -1.481 | -1.345 |          | -1.415*** | 0.035 | -1.484 | -1.346 |          |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 7.** Binomial Regression Models Predicting Delinquency by Context and Substance Use**Panel A. Nonmetropolitan County**

| <b>Variables</b>                              | <b>Model 1</b> |       |        |        |          | <b>Model 2</b> |       |        |        |          |
|-----------------------------------------------|----------------|-------|--------|--------|----------|----------------|-------|--------|--------|----------|
|                                               | <i>b</i>       | SE    | 95% CI |        | AME      | <i>b</i>       | SE    | 95% CI |        | AME      |
| Substance Use                                 | 0.424***       | 0.025 | 0.375  | 0.473  | 0.140*** | 0.424***       | 0.027 | 0.370  | 0.477  | 0.140*** |
| Nonmetropolitan County Status                 | -0.029         | 0.069 | -0.164 | 0.107  | -0.010   | -0.031         | 0.080 | -0.188 | 0.126  | -0.009   |
| Substance Use x Nonmetropolitan County Status |                |       |        |        |          | 0.004          | 0.066 | -0.126 | 0.133  |          |
| <b>Constant</b>                               | -2.793***      | 0.033 | -2.858 | -2.728 |          | -2.793***      | 0.034 | -2.859 | -2.726 |          |

**Panel B. Non-CBSA**

| <b>Variables</b>         | <b>Model 1</b> |       |        |        |          | <b>Model 2</b> |       |        |        |          |
|--------------------------|----------------|-------|--------|--------|----------|----------------|-------|--------|--------|----------|
|                          | <i>b</i>       | SE    | 95% CI |        | AME      | <i>b</i>       | SE    | 95% CI |        | AME      |
| Substance Use            | 0.424***       | 0.025 | 0.375  | 0.473  | 0.140*** | 0.422***       | 0.026 | 0.371  | 0.473  | 0.140*** |
| Non-CBSA                 | -0.007         | 0.092 | -0.186 | 0.172  | -0.002   | -0.040         | 0.108 | -0.251 | 0.171  | 0.004    |
| Substance Use x Non-CBSA |                |       |        |        |          | 0.053          | 0.083 | -0.109 | 0.215  |          |
| <b>Constant</b>          | -2.797***      | 0.032 | -2.859 | -2.734 |          | -2.795***      | 0.032 | -2.858 | -2.732 |          |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 8.** Logistic Regression Models Predicting Delinquency by Parental Attachment and Substance Use

| <b>Variables</b>                    | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|-------------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                     | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                       | 0.480***       | 0.037 | 0.408  | 0.553  | 0.082***  | 0.250**        | 0.081 | 0.093  | 0.408  | 0.085***  |
| Parental Attachment                 | -0.295***      | 0.035 | -0.364 | -0.225 | -0.051*** | -0.366***      | 0.041 | -0.447 | -0.285 | -0.052*** |
| Substance Use x Parental Attachment |                |       |        |        |           | 0.110**        | 0.033 | 0.044  | 0.175  |           |
| <b>Constant</b>                     | -0.712***      | 0.090 | -0.888 | -0.535 |           | -0.551***      | 0.102 | -0.751 | -0.351 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 9.** Logistic Regression Models Predicting Delinquency by School Attachment and Substance Use

| <b>Variables</b>                  | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|-----------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                   | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                     | 0.477***       | 0.037 | 0.404  | 0.550  | 0.082***  | 0.354***       | 0.070 | 0.217  | 0.491  | 0.085***  |
| School Attachment                 | -0.304***      | 0.035 | -0.373 | -0.234 | -0.052*** | -0.350***      | 0.042 | -0.431 | -0.269 | -0.053*** |
| Substance Use x School Attachment |                |       |        |        |           | 0.077*         | 0.035 | 0.009  | 0.146  |           |
| <b>Constant</b>                   | -0.826***      | 0.074 | -0.971 | -0.681 |           | -0.744***      | 0.084 | -0.908 | -0.580 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 10.** Logistic Regression Models Predicting Delinquency by Faith-Based Activities and Substance Use

| <b>Variables</b>                       | <b>Model 1</b> |       |        |        |          | <b>Model 2</b> |       |        |        |          |
|----------------------------------------|----------------|-------|--------|--------|----------|----------------|-------|--------|--------|----------|
|                                        | <i>b</i>       | SE    | 95% CI |        | AME      | <i>b</i>       | SE    | 95% CI |        | AME      |
| Substance Use                          | 0.513***       | 0.037 | 0.441  | 0.585  | 0.089*** | 0.461***       | 0.044 | 0.375  | 0.548  | 0.091*** |
| Faith-Based Activities                 | -0.027         | 0.024 | -0.073 | 0.020  | -0.005   | -0.053         | 0.027 | -0.106 | -0.000 | -0.004   |
| Substance Use x Faith-Based Activities |                |       |        |        |          | 0.054*         | 0.027 | 0.002  | 0.107  |          |
| <b>Constant</b>                        | -1.379***      | 0.045 | -1.467 | -1.292 |          | -1.350***      | 0.046 | -1.441 | -1.260 |          |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 11.** Binomial Regression Models Predicting Delinquency by Parental Attachment and Substance Use

| <b>Variables</b>                    | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|-------------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                     | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                       | 0.392***       | 0.027 | 0.341  | 0.444  | 0.129***  | 0.200***       | 0.050 | 0.103  | 0.297  | 0.134***  |
| Parental Attachment                 | -0.266***      | 0.032 | -0.329 | -0.203 | -0.087*** | -0.355***      | 0.037 | -0.427 | -0.283 | -0.092*** |
| Substance Use x Parental Attachment |                |       |        |        |           | 0.097***       | 0.021 | 0.056  | 0.138  |           |
| <b>Constant</b>                     | -2.174***      | 0.082 | -2.335 | -2.013 |           | -1.981***      | 0.089 | -2.156 | -1.805 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 12.** Binomial Regression Models Predicting Delinquency by School Attachment and Substance Use

| <b>Variables</b>                  | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|-----------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                   | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                     | 0.378***       | 0.026 | 0.327  | 0.428  | 0.123***  | 0.268***       | 0.044 | 0.182  | 0.354  | 0.132***  |
| School Attachment                 | -0.327***      | 0.033 | -0.392 | -0.262 | -0.107*** | -0.394***      | 0.038 | -0.469 | -0.319 | -0.109*** |
| Substance Use x School Attachment |                |       |        |        |           | 0.081***       | 0.023 | 0.036  | 0.125  |           |
| <b>Constant</b>                   | -2.180***      | 0.069 | -2.315 | -2.045 |           | -2.072***      | 0.075 | -2.220 | -1.925 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 13.** Binomial Regression Models Predicting Delinquency by Faith-Based Activities and Substance Use

| <b>Variables</b>                       | <b>Model 1</b> |       |        |        |          | <b>Model 2</b> |       |        |        |          |
|----------------------------------------|----------------|-------|--------|--------|----------|----------------|-------|--------|--------|----------|
|                                        | <i>b</i>       | SE    | 95% CI |        | AME      | <i>b</i>       | SE    | 95% CI |        | AME      |
| Substance Use                          | 0.424***       | 0.025 | 0.374  | 0.473  | 0.139*** | 0.387***       | 0.031 | 0.326  | 0.448  | 0.142*** |
| Faith-Based Activities                 | -0.009         | 0.022 | -0.052 | 0.034  | -0.003   | -0.035         | 0.025 | -0.084 | 0.014  | -0.002   |
| Substance Use x Faith-Based Activities |                |       |        |        |          | 0.039*         | 0.019 | 0.003  | 0.075  |          |
| <b>Constant</b>                        | -2.787***      | 0.041 | -2.867 | -2.707 |          | -2.758***      | 0.042 | -2.840 | -2.675 |          |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 14.** Logistic Regression Models Predicting Delinquency by All Informal Social Controls and Substance Use, With and Without Interactions

| <b>Variables</b>                       | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|----------------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                        | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                          | 0.454***       | 0.038 | 0.380  | 0.528  | 0.077***  | 0.147          | 0.093 | -0.035 | 0.329  | 0.083***  |
| Parental Attachment                    | -0.240***      | 0.036 | -0.311 | -0.170 | -0.041*** | -0.297***      | 0.042 | -0.380 | -0.215 | -0.042*** |
| School Attachment                      | -0.256***      | 0.036 | -0.326 | -0.186 | -0.044*** | -0.285***      | 0.042 | -0.368 | -0.202 | -0.044*** |
| Faith-Based Activities                 | -0.004         | 0.024 | -0.050 | 0.043  | -0.001    | -0.022         | 0.027 | -0.076 | 0.032  | >0.001    |
| Substance Use x Parental Attachment    |                |       |        |        |           | 0.089**        | 0.033 | 0.024  | 0.155  |           |
| Substance Use x School Attachment      |                |       |        |        |           | 0.050          | 0.035 | -0.018 | 0.012  |           |
| Substance Use x Faith-Based Activities |                |       |        |        |           | 0.042          | 0.027 | -0.010 | 0.094  |           |
| <b>Constant</b>                        | -0.344**       | 0.105 | -0.549 | -0.138 |           | -0.144         | 0.118 | -0.374 | 0.087  |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 15.** Binomial Regression Models Predicting Delinquency by All Informal Social Controls and Substance Use, With and Without Interactions

| <b>Variables</b>                       | <b>Model 1</b> |       |        |        |           | <b>Model 2</b> |       |        |        |           |
|----------------------------------------|----------------|-------|--------|--------|-----------|----------------|-------|--------|--------|-----------|
|                                        | <i>b</i>       | SE    | 95% CI |        | AME       | <i>b</i>       | SE    | 95% CI |        | AME       |
| Substance Use                          | 0.360***       | 0.027 | 0.308  | 0.413  | 0.118***  | 0.099          | 0.056 | -0.011 | 0.210  | 0.130***  |
| Parental Attachment                    | -0.207***      | 0.033 | -0.272 | -0.141 | -0.067*** | -0.276***      | 0.038 | -0.351 | -0.202 | -0.070*** |
| School Attachment                      | -0.286***      | 0.034 | -0.353 | -0.220 | -0.093*** | -0.333***      | 0.039 | -0.410 | -0.256 | -0.094*** |
| Faith-Based Activities                 | 0.015          | 0.022 | -0.028 | 0.057  | -0.005    | -0.001         | 0.025 | -0.050 | 0.049  | 0.007     |
| Substance Use x Parental Attachment    |                |       |        |        |           | 0.078***       | 0.022 | 0.034  | 0.121  |           |
| Substance Use x School Attachment      |                |       |        |        |           | 0.060*         | 0.024 | 0.014  | 0.106  |           |
| Substance Use x Faith-Based Activities |                |       |        |        |           | 0.028          | 0.019 | -0.009 | 0.064  |           |
| <b>Constant</b>                        | -1.791         | 0.093 | -1.973 | -1.609 |           | -1.549***      | 0.101 | -1.746 | -1.351 |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 16.** Logistic Regression Models Predicting Delinquency by All Main Variables, With and Without Interactions**Panel A. Nonmetropolitan County Status Measure of Rural Context Models**

| Variables                                     | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|-----------------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                               | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                                 | 0.454***  | 0.038 | 0.380  | 0.527  | 0.077***  | 0.170     | 0.097 | -0.020 | 0.359  | 0.082***  |
| Nonmetropolitan County Status                 | -0.027    | 0.074 | -0.172 | 0.118  | -0.005    | 0.074     | 0.085 | -0.092 | 0.239  | -0.005    |
| Parental Attachment                           | -0.240*** | 0.036 | -0.311 | -0.170 | -0.041*** | -0.299*** | 0.042 | -0.382 | -0.216 | -0.042*** |
| School Attachment                             | -0.257*** | 0.036 | -0.327 | -0.186 | -0.044*** | -0.285*** | 0.042 | -0.368 | -0.202 | -0.044*** |
| Faith-Based Activities                        | -0.003    | 0.024 | -0.050 | 0.044  | -0.005    | -0.022    | 0.027 | -0.076 | 0.031  | < 0.001   |
| Substance Use x Nonmetropolitan County Status |           |       |        |        |           | -0.183*   | 0.077 | -0.334 | -0.031 |           |
| Substance Use x Parental Attachment           |           |       |        |        |           | 0.091**   | 0.034 | 0.024  | 0.157  |           |
| Substance Use x School Attachment             |           |       |        |        |           | 0.050     | 0.035 | -0.019 | 0.118  |           |
| Substance Use x Faith-Based Activities        |           |       |        |        |           | 0.041     | 0.119 | -0.383 | 0.084  |           |
| <b>Constant</b>                               | -0.340**  | 0.106 | -0.547 | -0.133 |           | -0.150    | 0.119 | -0.383 | 0.084  |           |

**Panel B. Non-CBSA or Population Density Measure of Rural Context Models**

| Variables                              | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|----------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                        | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                          | 0.454***  | 0.038 | 0.380  | 0.528  | 0.077***  | 0.151     | 0.094 | -0.033 | 0.334  | 0.083***  |
| Non-CBSA                               | 0.021     | 0.102 | -0.179 | 0.221  | 0.004     | 0.079     | 0.119 | -0.154 | 0.312  | 0.003     |
| Parental Attachment                    | -0.241*** | 0.036 | -0.311 | -0.170 | -0.041*** | -0.298*** | 0.042 | -0.381 | -0.215 | -0.042*** |
| School Attachment                      | -0.256*** | 0.036 | -0.326 | -0.185 | -0.044*** | -0.285*** | 0.042 | -0.368 | -0.202 | -0.044*** |
| Faith-Based Activities                 | -0.004    | 0.024 | -0.051 | 0.043  | -0.001    | -0.023    | 0.027 | -0.076 | 0.031  | < 0.001   |
| Substance Use x Non-CBSA               |           |       |        |        |           | -0.112    | 0.109 | -0.325 | 0.101  |           |
| Substance Use x Parental Attachment    |           |       |        |        |           | 0.090**   | 0.033 | 0.025  | 0.156  |           |
| Substance Use x School Attachment      |           |       |        |        |           | 0.049     | 0.035 | -0.019 | 0.117  |           |
| Substance Use x Faith-Based Activities |           |       |        |        |           | 0.043     | 0.027 | -0.009 | 0.095  |           |
| <b>Constant</b>                        | -0.345**  | 0.105 | -0.551 | -0.139 |           | -0.146    | 0.118 | -0.377 | 0.086  |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 17.** Binomial Regression Models Predicting Delinquency by All Main Variables, With and Without Interactions**Panel A.** *Nonmetropolitan County Status Measure of Rural Context Models*

| Variables                                     | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|-----------------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                               | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                                 | 0.360***  | 0.027 | 0.307  | 0.413  | 0.117***  | 0.100     | 0.057 | -0.012 | 0.212  | 0.130***  |
| Nonmetropolitan County Status                 | -0.047    | 0.068 | -0.180 | 0.086  | -0.016    | -0.039    | 0.081 | -0.198 | 0.119  | -0.014    |
| Parental Attachment                           | -0.206*** | 0.033 | -0.271 | -0.141 | -0.067*** | -0.276*** | 0.038 | -0.350 | -0.201 | -0.070*** |
| School Attachment                             | -0.287*** | 0.034 | -0.353 | -0.220 | -0.094*** | -0.332*** | 0.039 | -0.411 | -0.257 | -0.094*** |
| Faith-Based Activities                        | 0.015     | 0.022 | -0.028 | 0.058  | -0.005    | 0.000     | 0.025 | -0.049 | 0.050  | 0.007     |
| Substance Use x Nonmetropolitan County Status | 0.360***  | 0.027 | 0.307  | 0.413  |           | -0.006    | 0.066 | -0.135 | 0.123  |           |
| Substance Use x Parental Attachment           |           |       |        |        |           | 0.077***  | 0.022 | 0.034  | 0.121  |           |
| Substance Use x School Attachment             |           |       |        |        |           | 0.060*    | 0.023 | 0.014  | 0.106  |           |
| Substance Use x Faith-Based Activities        |           |       |        |        |           | 0.028     | 0.019 | -0.009 | 0.064  |           |
| <b>Constant</b>                               | -1.784*** | 0.094 | -1.968 | -1.601 |           | -1.543*** | 0.102 | -1.742 | -1.344 |           |

**Panel B.** *Non-CBSA or Population Density Measure of Rural Context Models*

| Variables                              | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|----------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                        | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                          | 0.360***  | 0.027 | 0.307  | 0.413  | 0.117***  | 0.099     | 0.057 | -0.012 | 0.210  | 0.130***  |
| Non-CBSA                               | -0.036    | 0.091 | -0.214 | 0.142  | -0.012    | -0.045    | 0.110 | -0.261 | 0.171  | -0.009    |
| Parental Attachment                    | -0.207*** | 0.033 | -0.272 | -0.141 | -0.067*** | -0.276*** | 0.038 | -0.351 | -0.201 | 0.070***  |
| School Attachment                      | -0.286*** | 0.034 | -0.353 | -0.220 | -0.093*** | -0.333*** | 0.039 | -0.411 | -0.256 | -0.094*** |
| Faith-Based Activities                 | 0.015     | 0.022 | -0.028 | 0.058  | 0.005     | < -0.001  | 0.025 | -0.050 | 0.049  | 0.007     |
| Substance Use x Non-CBSA               |           |       |        |        |           | 0.021     | 0.088 | -0.151 | 0.192  |           |
| Substance Use x Parental Attachment    |           |       |        |        |           | 0.077**   | 0.022 | 0.033  | 0.121  |           |
| Substance Use x School Attachment      |           |       |        |        |           | 0.060*    | 0.024 | 0.014  | 0.106  |           |
| Substance Use x Faith-Based Activities |           |       |        |        |           | 0.028     | 0.019 | -0.009 | 0.064  |           |
| <b>Constant</b>                        | -1.789*** | 0.093 | -1.972 | -1.606 |           | -1.547*** | 0.101 | -1.745 | 1.349  |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

**Table 18.** Logistic Regression Models Predicting Delinquency by All Main Variables, With and Without Controls

| Variables                                     | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|-----------------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                               | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                                 | 0.170     | 0.097 | -0.020 | 0.359  | 0.077***  | 0.172     | 0.109 | -0.042 | 0.385  | 0.080***  |
| Nonmetropolitan County Status                 | 0.074     | 0.085 | -0.092 | 0.239  | -0.005    | 0.076     | 0.089 | -0.100 | 0.251  | -0.007    |
| Parental Attachment                           | -0.299*** | 0.042 | -0.382 | -0.216 | -0.044*** | -0.317*** | 0.045 | -0.405 | -0.230 | -0.041*** |
| School Attachment                             | -0.285*** | 0.042 | -0.368 | -0.202 | -0.005    | -0.246*** | 0.045 | -0.334 | -0.159 | -0.033*** |
| Faith-Based Activities                        | -0.022    | 0.027 | -0.076 | 0.031  | -0.041*** | -0.026    | 0.029 | -0.082 | 0.030  | -0.001    |
| Substance Use x Nonmetropolitan County Status | -0.183*   | 0.077 | -0.334 | -0.031 |           | -0.220**  | 0.082 | -0.382 | -0.059 |           |
| Substance Use x Parental Attachment           | 0.091**   | 0.034 | 0.024  | 0.157  |           | 0.099**   | 0.036 | 0.027  | 0.170  |           |
| Substance Use x School Attachment             | 0.050     | 0.035 | -0.019 | 0.118  |           | 0.058     | 0.038 | -0.017 | 0.133  |           |
| Substance Use x Faith-Based Activities        | 0.041     | 0.119 | -0.383 | 0.084  |           | 0.040     | 0.029 | -0.017 | 0.097  |           |
| Age                                           |           |       |        |        |           | -0.222*** | 0.020 | -0.261 | -0.183 |           |
| Male                                          |           |       |        |        |           | 0.343***  | 0.063 | 0.220  | 0.466  |           |
| <i>Race/Ethnicity</i>                         |           |       |        |        |           |           |       |        |        |           |
| White (reference)                             |           |       |        |        |           | --        | --    | --     | --     |           |
| Black/African American                        |           |       |        |        |           | 0.854***  | 0.088 | 0.682  | 1.026  |           |
| Native American/Alaskan Native                |           |       |        |        |           | 0.577*    | 0.253 | 0.081  | 1.073  |           |
| Native Hawaiian/Other Pacific Islander        |           |       |        |        |           | 0.663     | 0.384 | -0.088 | 1.415  |           |
| Asian                                         |           |       |        |        |           | -0.073    | 0.188 | -0.442 | 0.296  |           |
| Multiple Races                                |           |       |        |        |           | 0.657***  | 0.129 | 0.405  | 0.909  |           |
| Hispanic                                      |           |       |        |        |           | 0.003     | 0.088 | -0.169 | 0.175  |           |
| <i>Family Household Income</i>                |           |       |        |        |           |           |       |        |        |           |
| Less than \$20,000 (reference)                |           |       |        |        |           | --        | --    | --     | --     |           |
| \$20,000 - \$49,999                           |           |       |        |        |           | -0.173    | 0.095 | -0.358 | 0.013  |           |
| \$50,000 - \$74,999                           |           |       |        |        |           | -0.348**  | 0.107 | -0.557 | -0.139 |           |
| \$75,000 or More                              |           |       |        |        |           | -0.529*** | 0.097 | -0.718 | -0.340 |           |
| Risk-Taking Behavior                          |           |       |        |        |           | 0.522***  | 0.039 | 0.446  | 0.599  |           |
| Arrest                                        |           |       |        |        |           | 1.127***  | 0.195 | 0.746  | 1.508  |           |
| <b>Constant</b>                               | -0.150    | 0.119 | -0.383 | 0.084  |           | 2.440***  | 0.315 | 1.822  | 3.057  |           |

Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

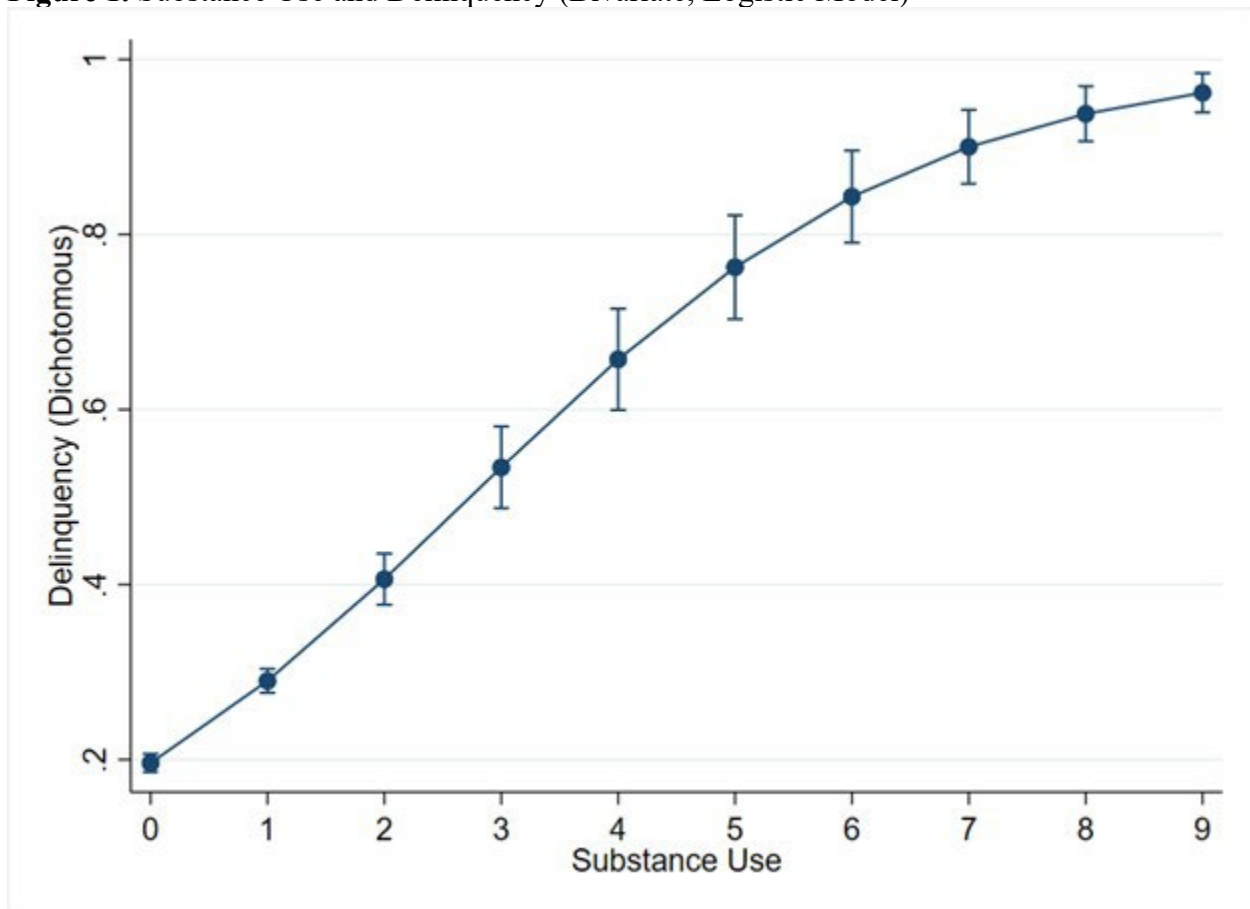
**Table 19.** Binomial Regression Models Predicting Delinquency by All Main Variables, With and Without Controls

| Variables                                     | Model 1   |       |        |        |           | Model 2   |       |        |        |           |
|-----------------------------------------------|-----------|-------|--------|--------|-----------|-----------|-------|--------|--------|-----------|
|                                               | <i>b</i>  | SE    | 95% CI |        | AME       | <i>b</i>  | SE    | 95% CI |        | AME       |
| Substance Use                                 | 0.100     | 0.057 | -0.012 | 0.212  | 0.130***  | 0.094     | 0.064 | -0.031 | 0.220  | 0.121***  |
| Nonmetropolitan County Status                 | -0.039    | 0.081 | -0.198 | 0.119  | -0.014    | -0.042    | 0.078 | -0.195 | 0.111  | -0.017    |
| Parental Attachment                           | -0.276*** | 0.038 | -0.350 | -0.201 | -0.070*** | -0.267*** | 0.037 | -0.340 | -0.194 | -0.066*** |
| School Attachment                             | -0.332*** | 0.039 | -0.411 | -0.257 | -0.094*** | -0.288*** | 0.039 | -0.364 | -0.212 | -0.076*** |
| Faith-Based Activities                        | 0.000     | 0.025 | -0.049 | 0.050  | 0.007     | -0.003    | 0.025 | -0.051 | 0.045  | 0.005     |
| Substance Use x Nonmetropolitan County Status | -0.006    | 0.066 | -0.135 | 0.123  |           | -0.017    | 0.062 | -0.139 | 0.105  |           |
| Substance Use x Parental Attachment           | 0.077***  | 0.022 | 0.034  | 0.121  |           | 0.076**   | 0.023 | 0.031  | 0.121  |           |
| Substance Use x School Attachment             | 0.060*    | 0.023 | 0.014  | 0.106  |           | 0.060*    | 0.024 | 0.013  | 0.106  |           |
| Substance Use x Faith-Based Activities        | 0.028     | 0.019 | -0.009 | 0.064  |           | 0.024     | 0.019 | -0.013 | 0.060  |           |
| Age                                           |           |       |        |        |           | -0.184*** | 0.017 | -0.217 | -0.151 |           |
| Male                                          |           |       |        |        |           | 0.322***  | 0.054 | 0.217  | 0.427  |           |
| <i>Race/Ethnicity</i>                         |           |       |        |        |           |           |       |        |        |           |
| White (reference)                             |           |       |        |        |           | --        | --    | --     | --     |           |
| Black/African American                        |           |       |        |        |           | 0.712***  | 0.072 | 0.571  | 0.853  |           |
| Native American/Alaskan Native                |           |       |        |        |           | 0.637**   | 0.242 | 0.162  | 1.112  |           |
| Native Hawaiian/Other Pacific Islander        |           |       |        |        |           | 0.646*    | 0.255 | 0.146  | 1.146  |           |
| Asian                                         |           |       |        |        |           | -0.157    | 0.157 | -0.464 | 0.151  |           |
| Multiple Races                                |           |       |        |        |           | 0.535***  | 0.105 | 0.330  | 0.741  |           |
| Hispanic                                      |           |       |        |        |           | 0.089     | 0.076 | -0.060 | 0.238  |           |
| <i>Family Household Income</i>                |           |       |        |        |           |           |       |        |        |           |
| Less than \$20,000 (reference)                |           |       |        |        |           | --        | --    | --     | --     |           |
| \$20,000 - \$49,999                           |           |       |        |        |           | -0.179*   | 0.077 | -0.331 | -0.028 |           |
| \$50,000 - \$74,999                           |           |       |        |        |           | -0.310*** | 0.088 | -0.483 | -0.138 |           |
| \$75,000 or More                              |           |       |        |        |           | -0.453*** | 0.083 | -0.616 | -0.291 |           |
| Risk-Taking Behavior                          |           |       |        |        |           | 0.452***  | 0.034 | 0.384  | 0.519  |           |
| Arrest                                        |           |       |        |        |           | 0.796***  | 0.131 | 0.540  | 1.052  |           |
| <b>Constant</b>                               | -1.543*** | 0.102 | -1.742 | -1.344 |           | 0.447     | 0.272 | -0.087 | 0.981  |           |

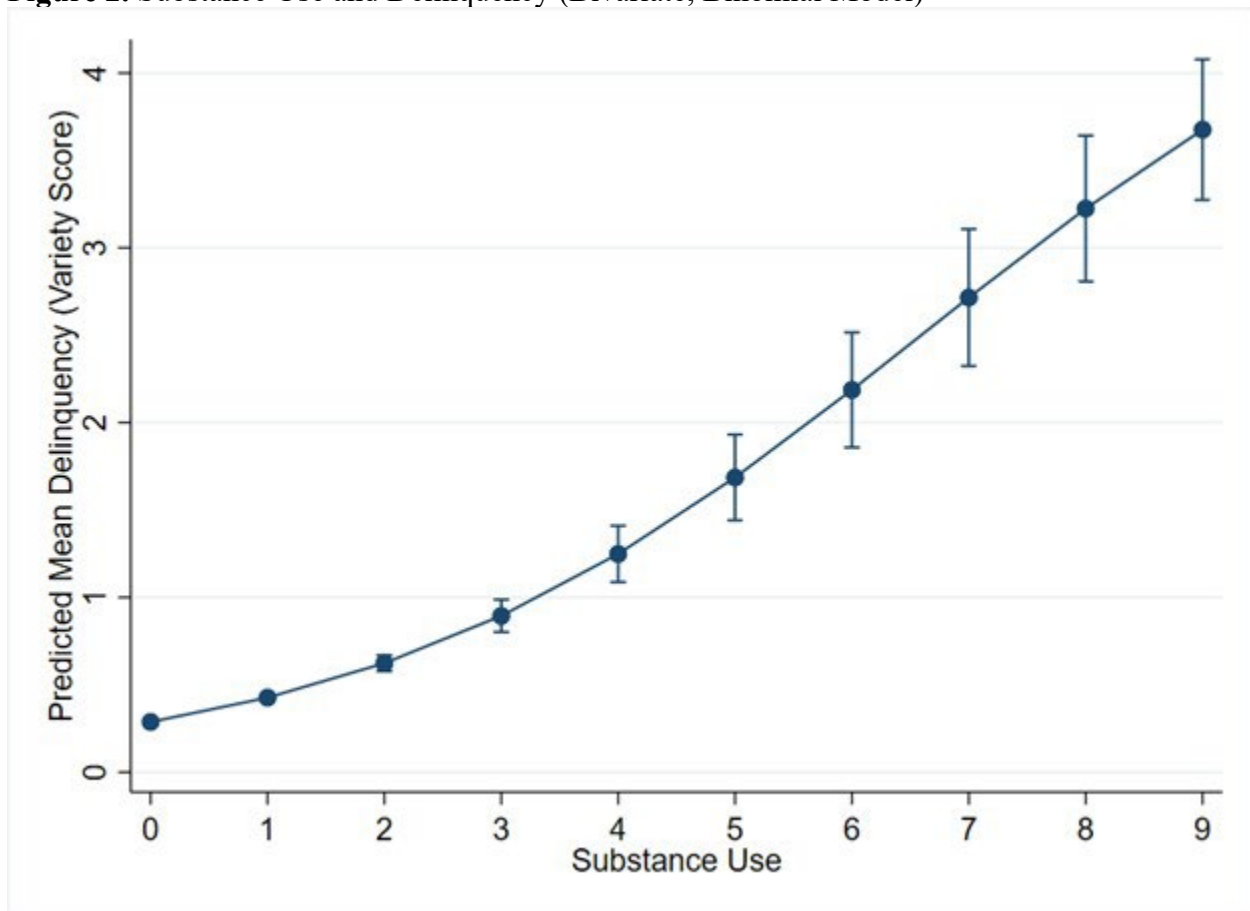
Notes: Reported values include regression coefficients (*b*), robust standard errors (SE), 95% confidence intervals (CI), and average marginal effects (AME).\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

## Figures

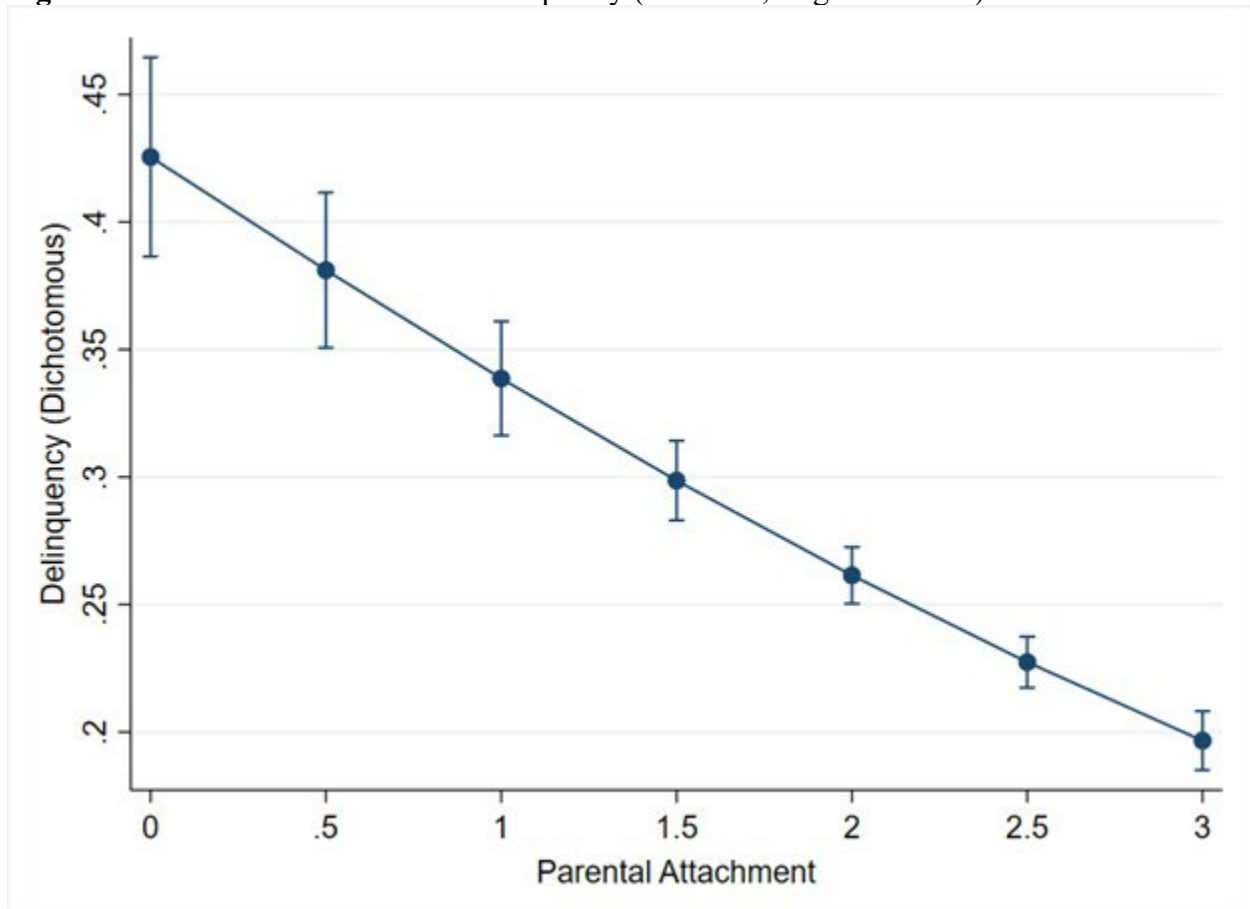
**Figure 1.** Substance Use and Delinquency (Bivariate, Logistic Model)



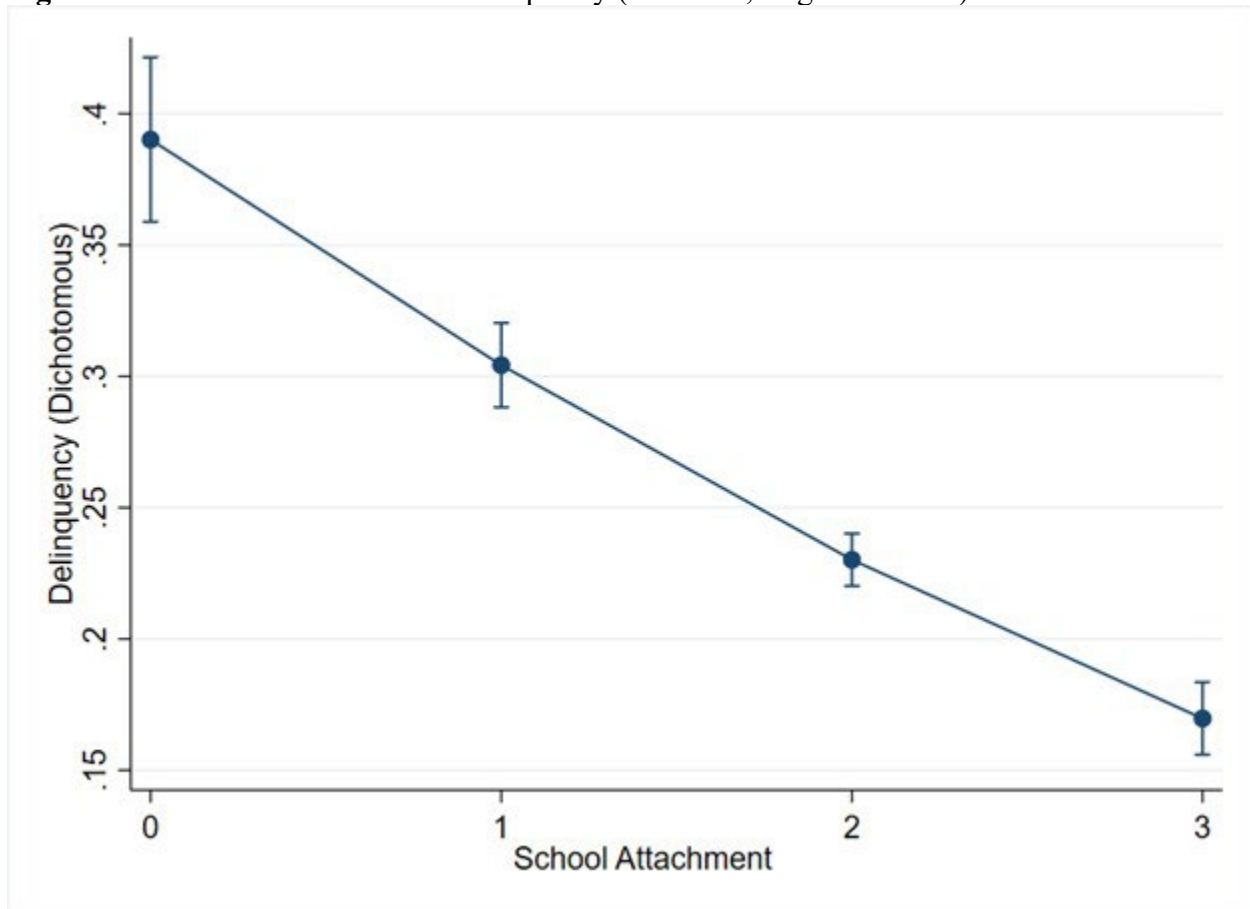
**Figure 2.** Substance Use and Delinquency (Bivariate, Binomial Model)



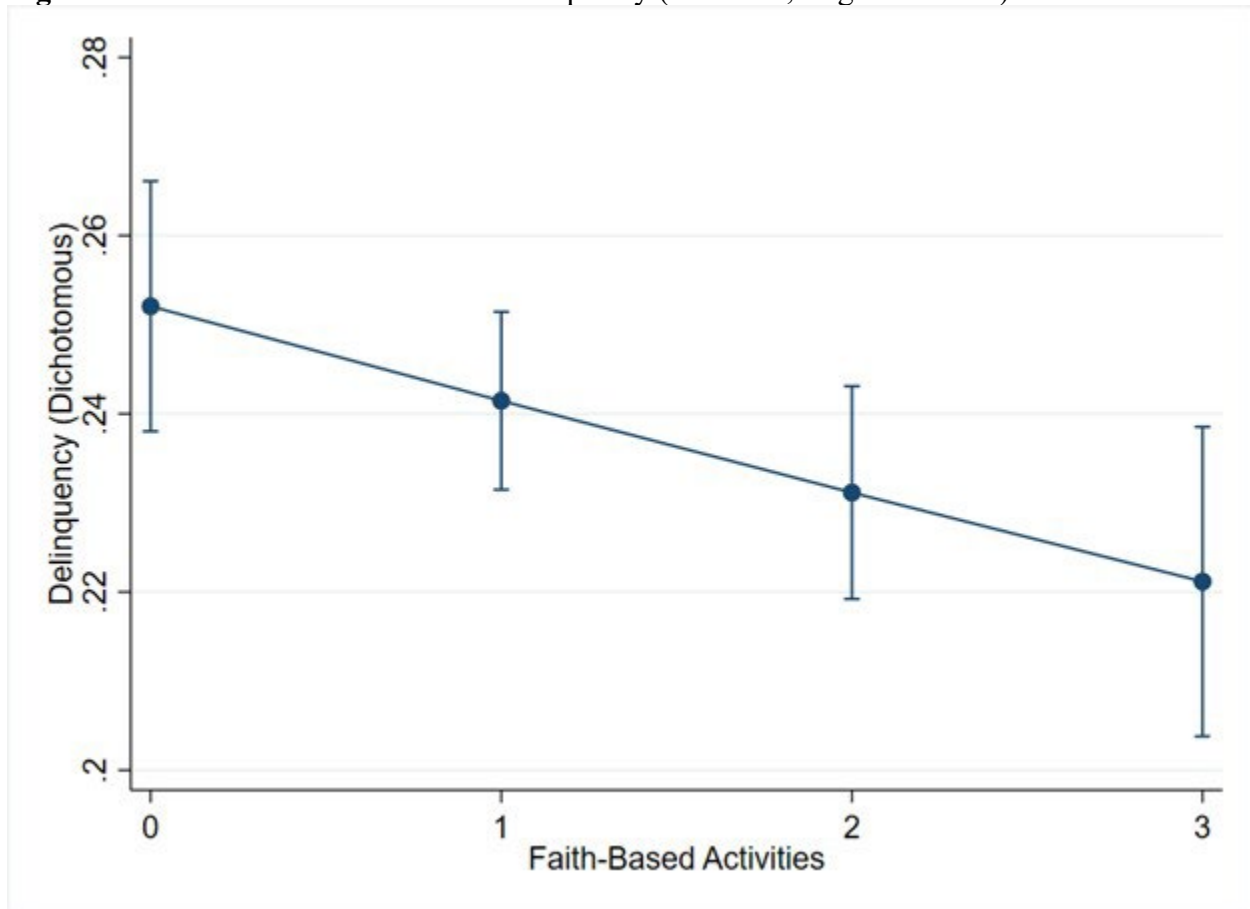
**Figure 3.** Parental Attachment and Delinquency (Bivariate, Logistic Model)



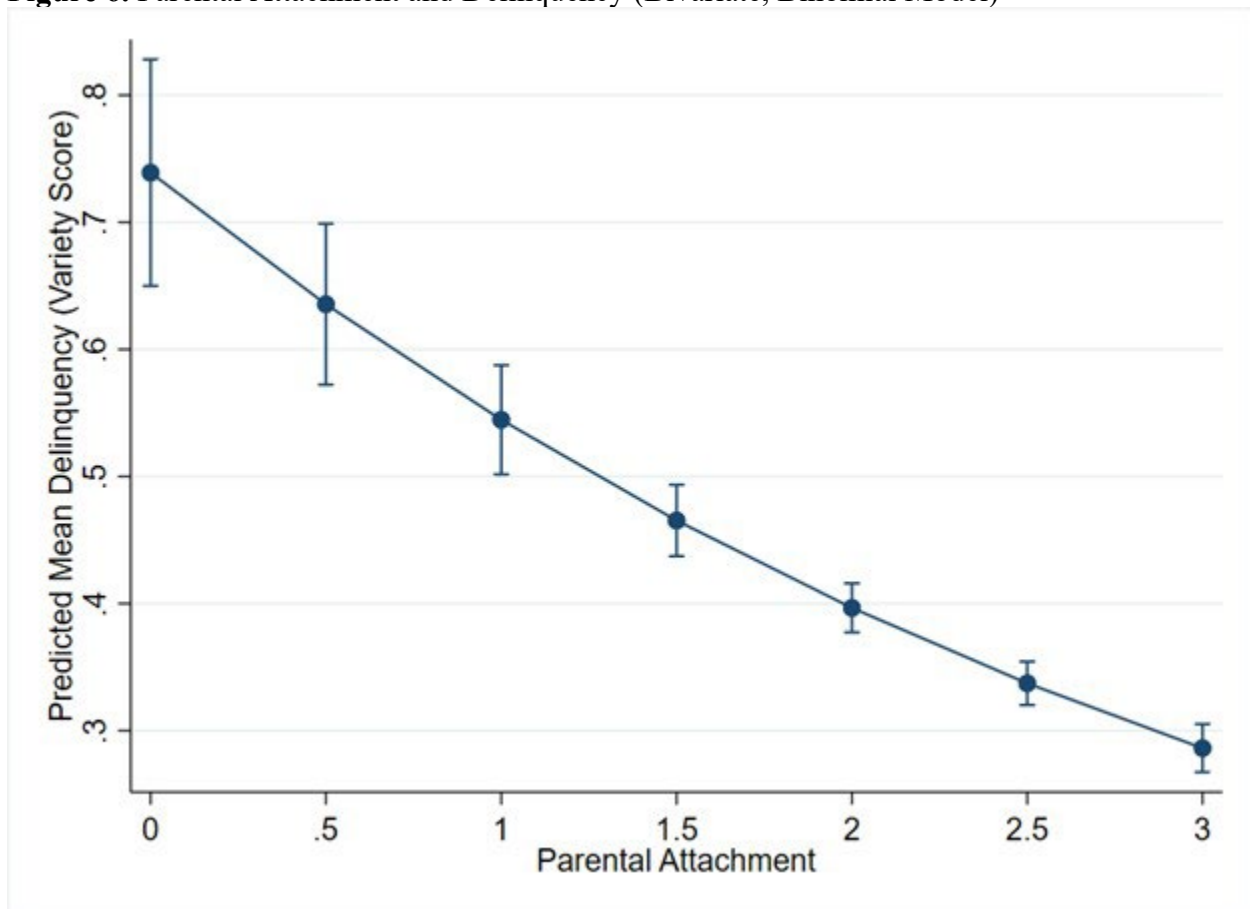
**Figure 4.** School Attachment and Delinquency (Bivariate, Logistic Model)



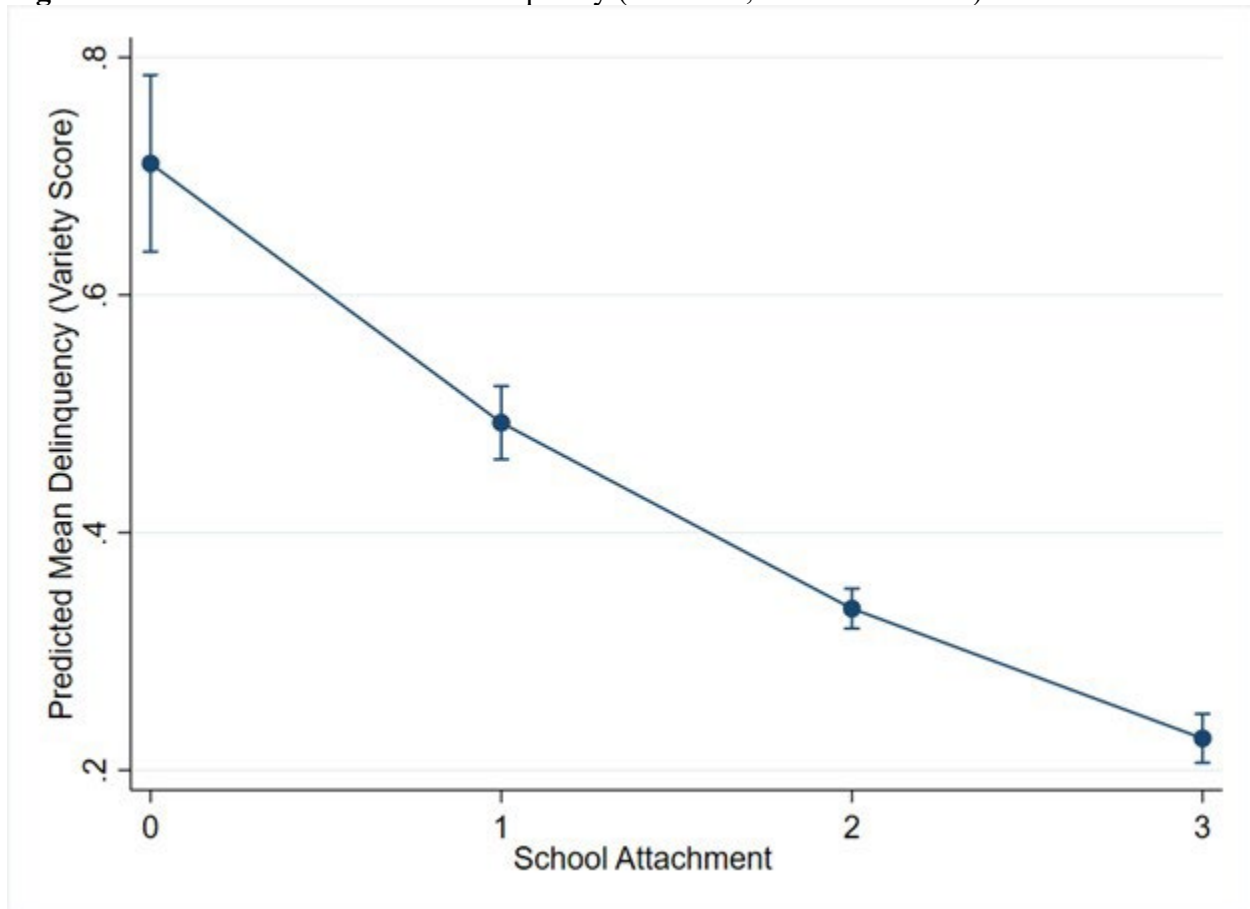
**Figure 5.** Faith-Based Activities and Delinquency (Bivariate, Logistic Model)



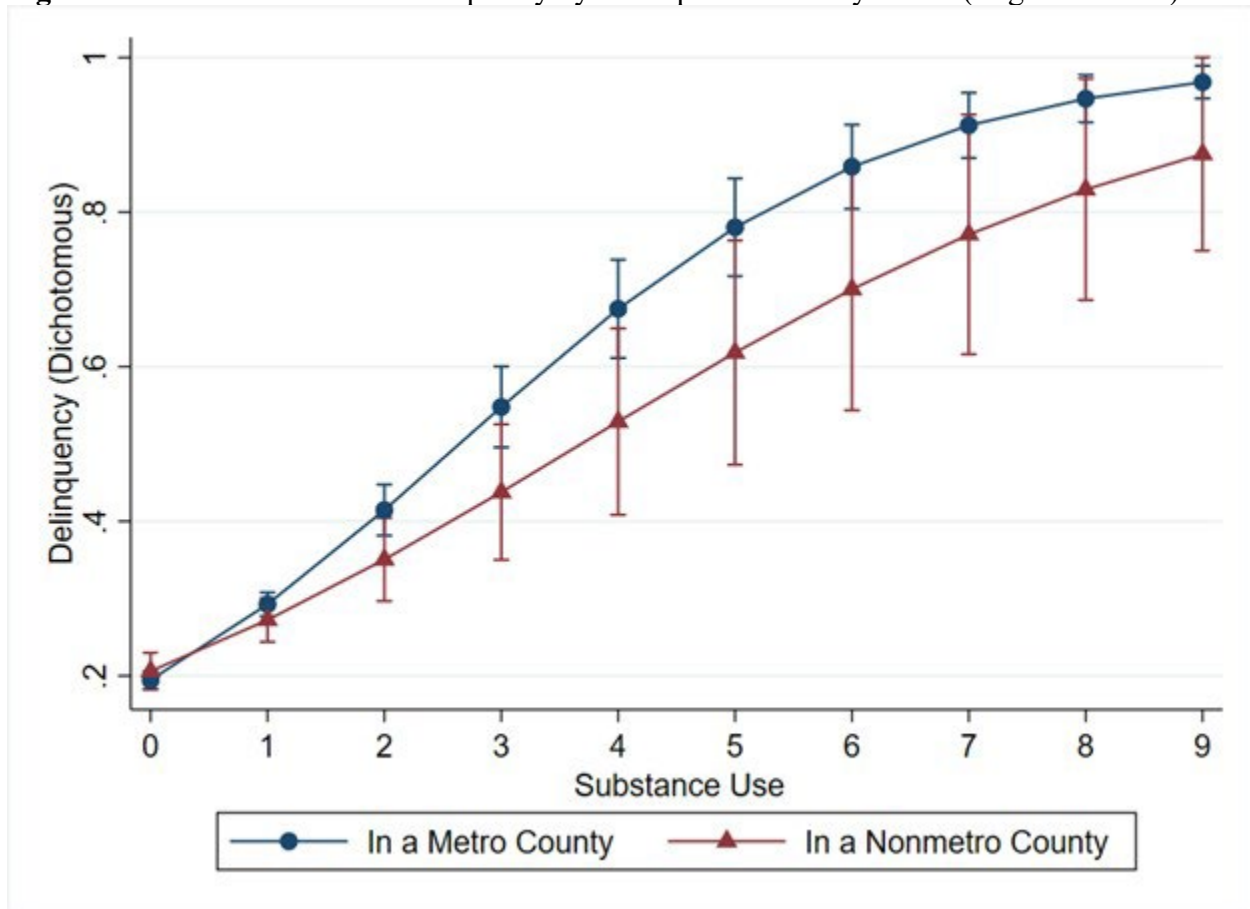
**Figure 6.** Parental Attachment and Delinquency (Bivariate, Binomial Model)



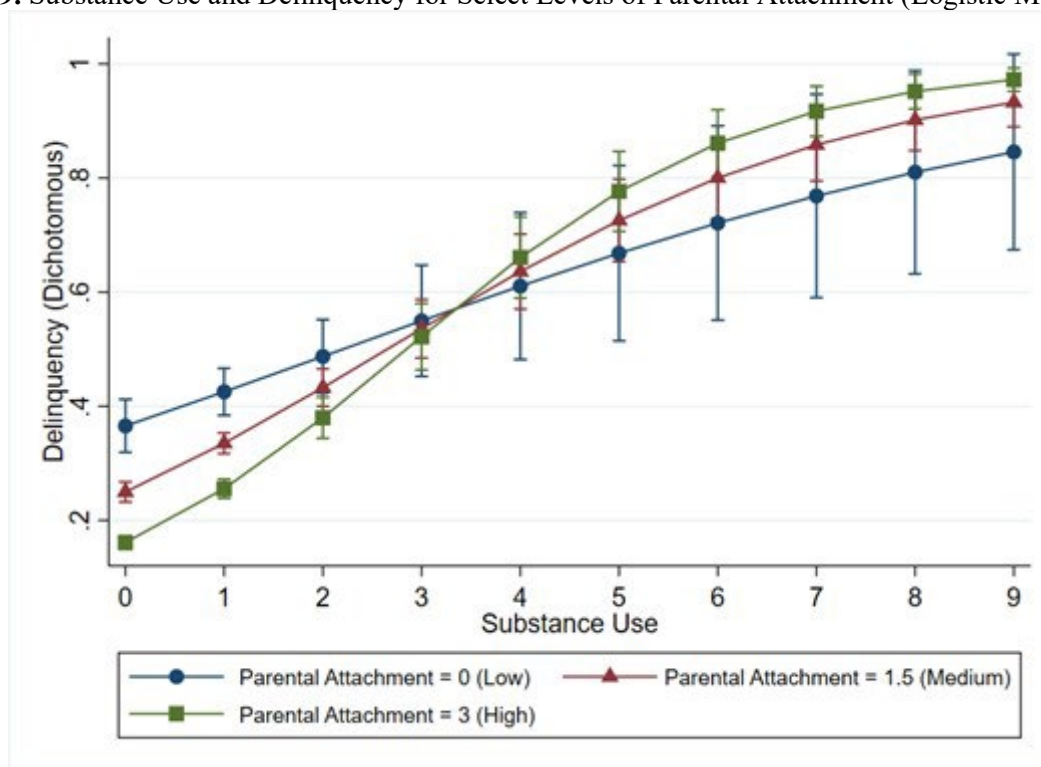
**Figure 7.** School Attachment and Delinquency (Bivariate, Binomial Model)



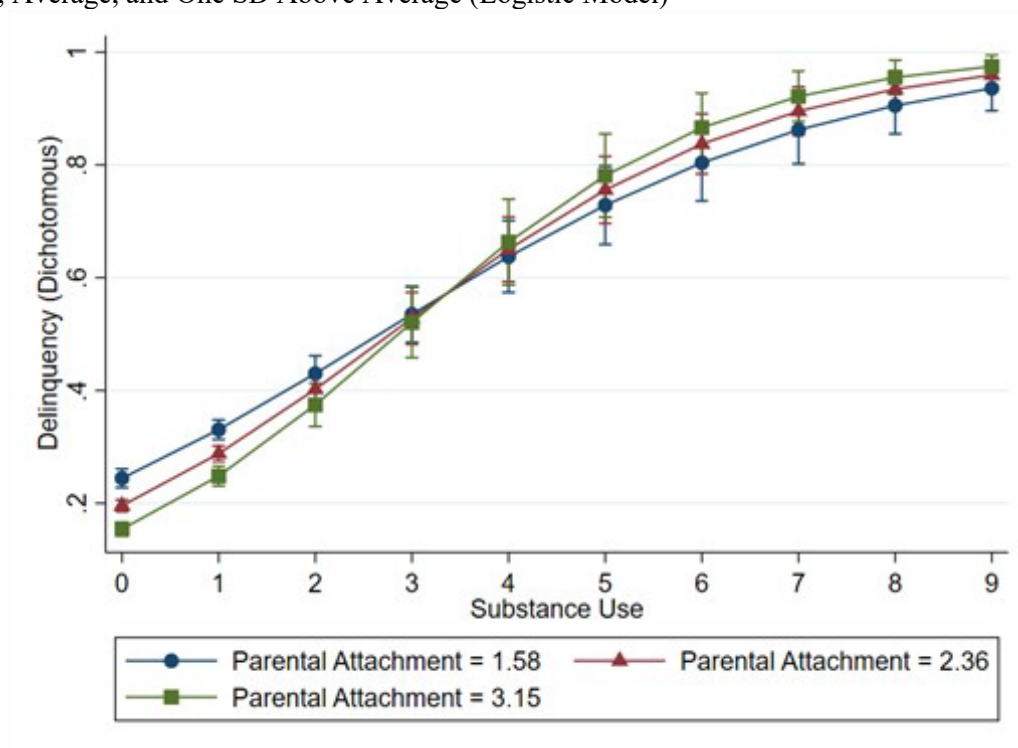
**Figure 8.** Substance Use and Delinquency by Metropolitan County Status (Logistic Model)



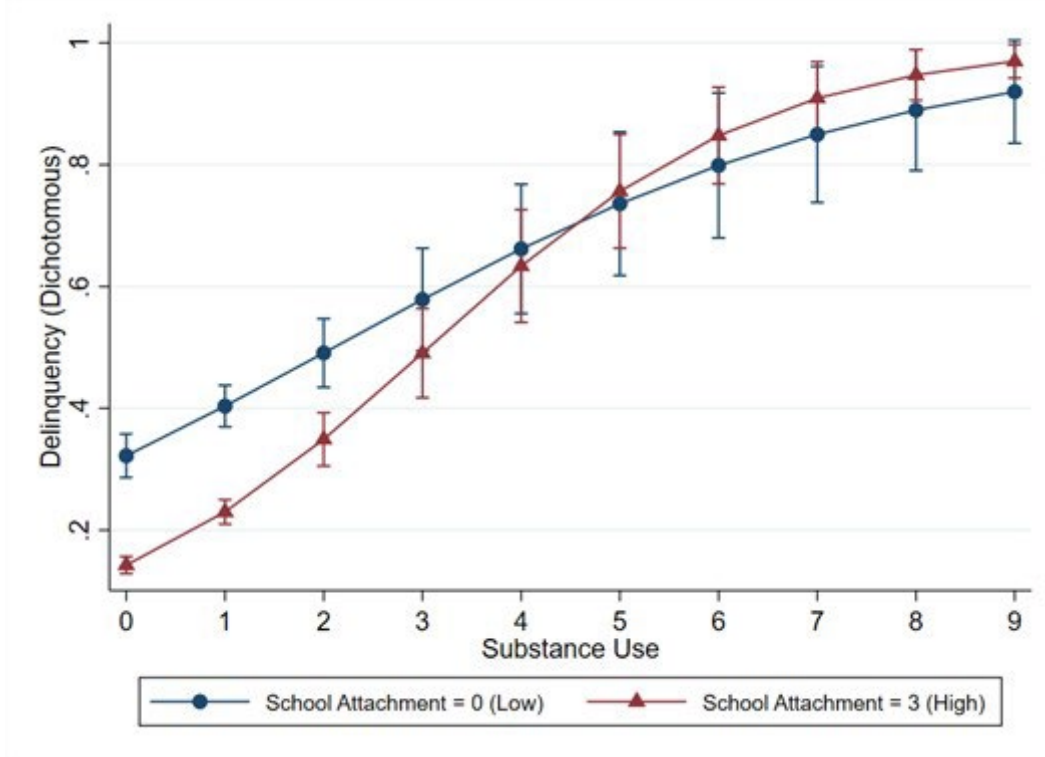
**Figure 9.** Substance Use and Delinquency for Select Levels of Parental Attachment (Logistic Model)



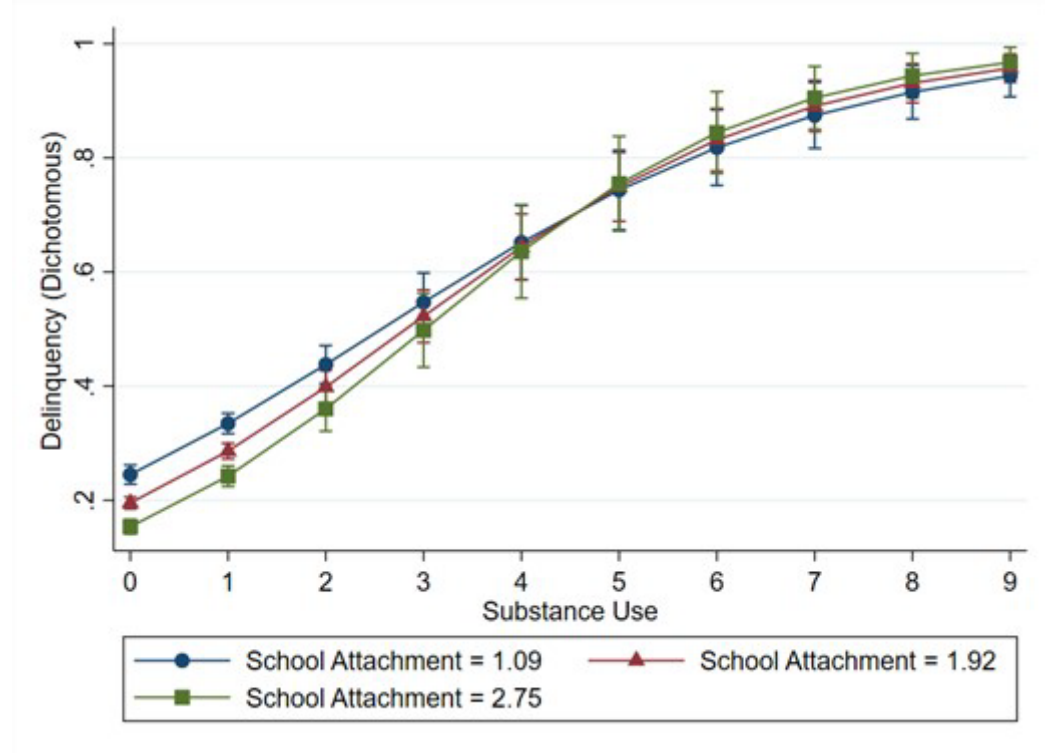
**Figure 10.** Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Logistic Model)



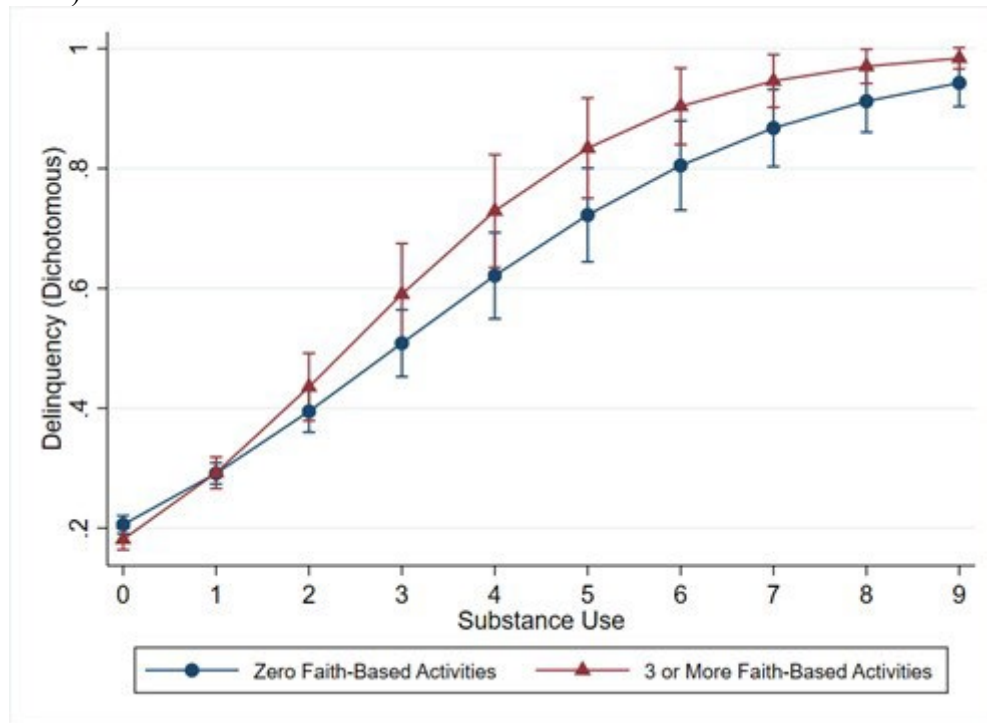
**Figure 11.** Substance Use and Delinquency for Select Levels of School Attachment (Logistic Model)



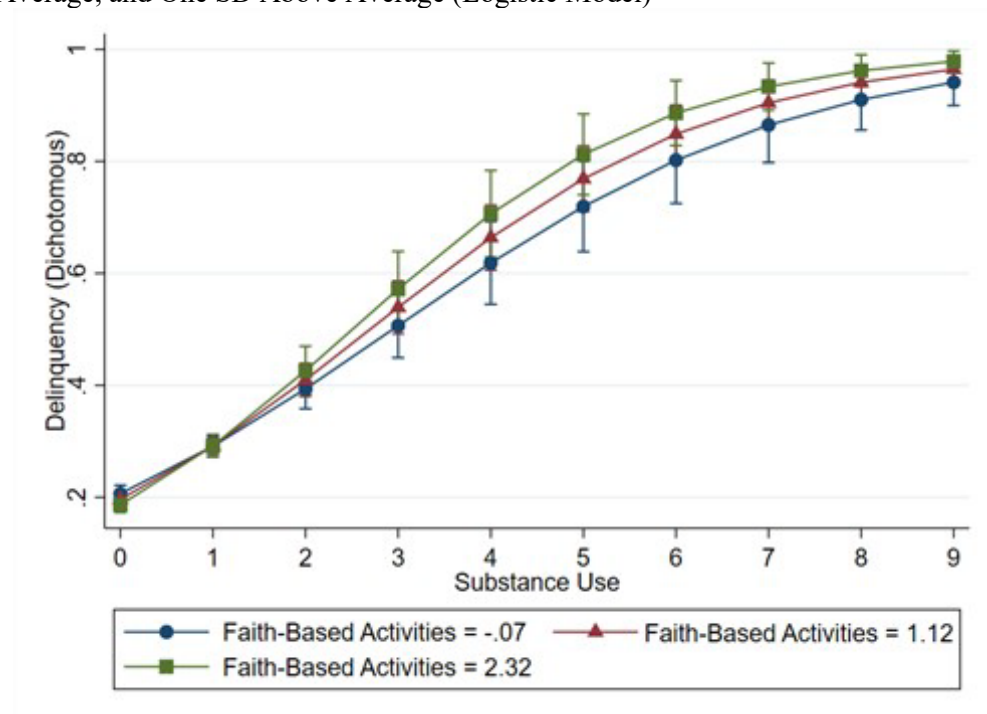
**Figure 12.** Substance Use and Delinquency for Select Levels of School Attachment: One SD Below Average, Average, and One SD Above Average (Logistic Model)



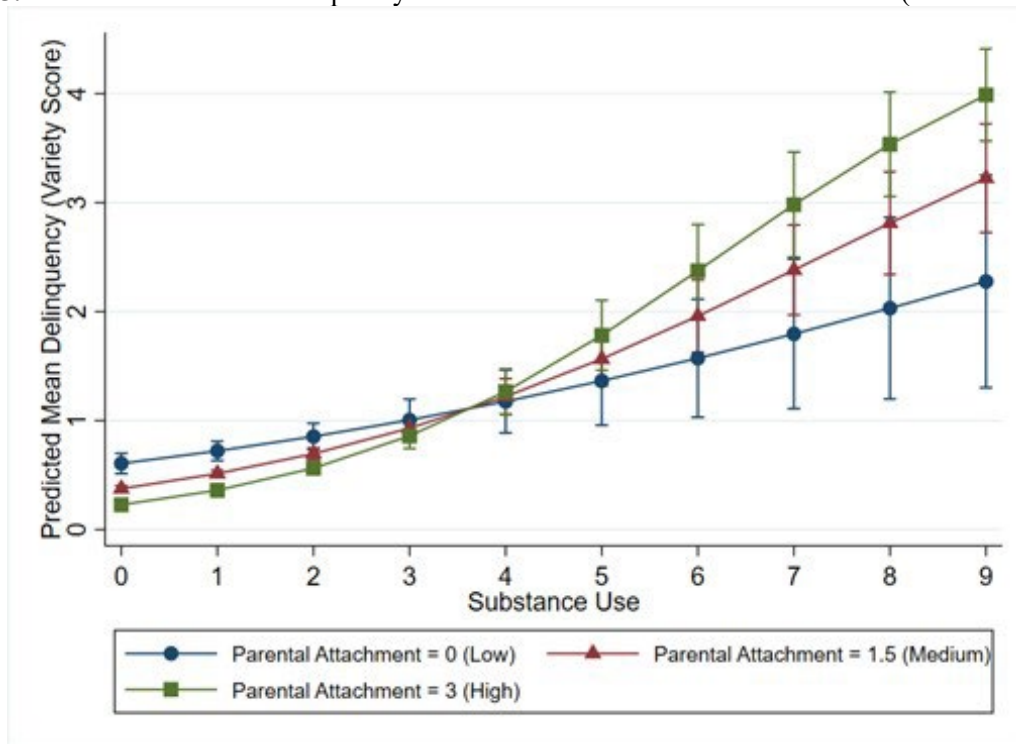
**Figure 13.** Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities (Logistic Model)



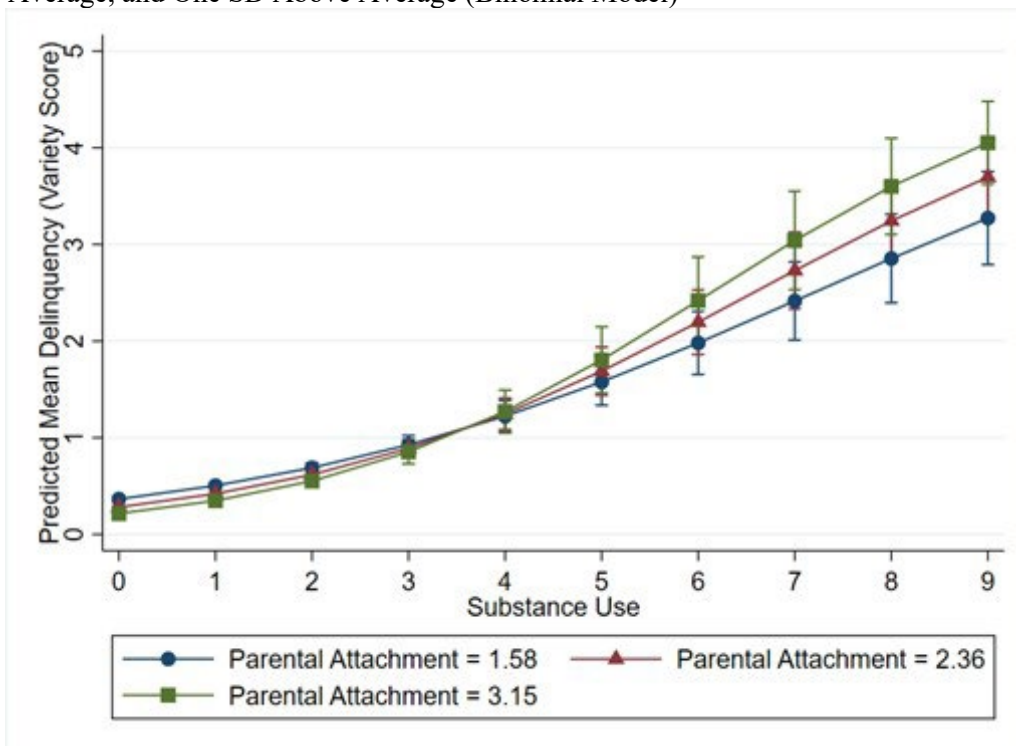
**Figure 14.** Substance Use and Delinquency for Select Levels of Faith-Based Activities: One SD Below Average, Average, and One SD Above Average (Logistic Model)



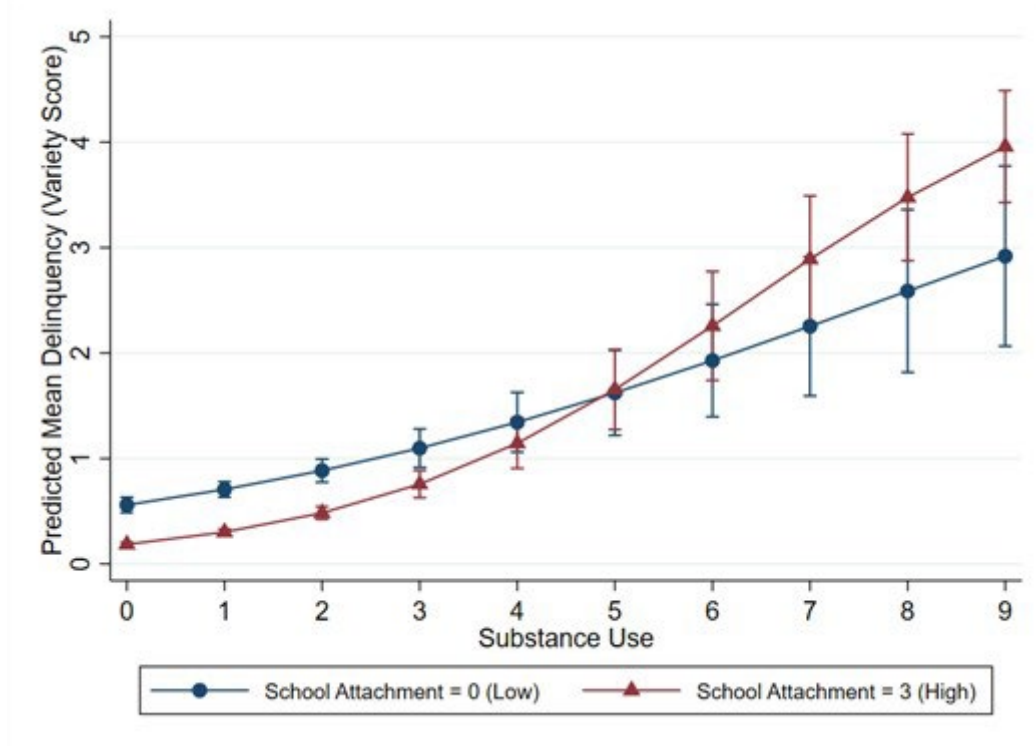
**Figure 15.** Substance Use and Delinquency for Select Levels of Parental Attachment (Binomial Model)



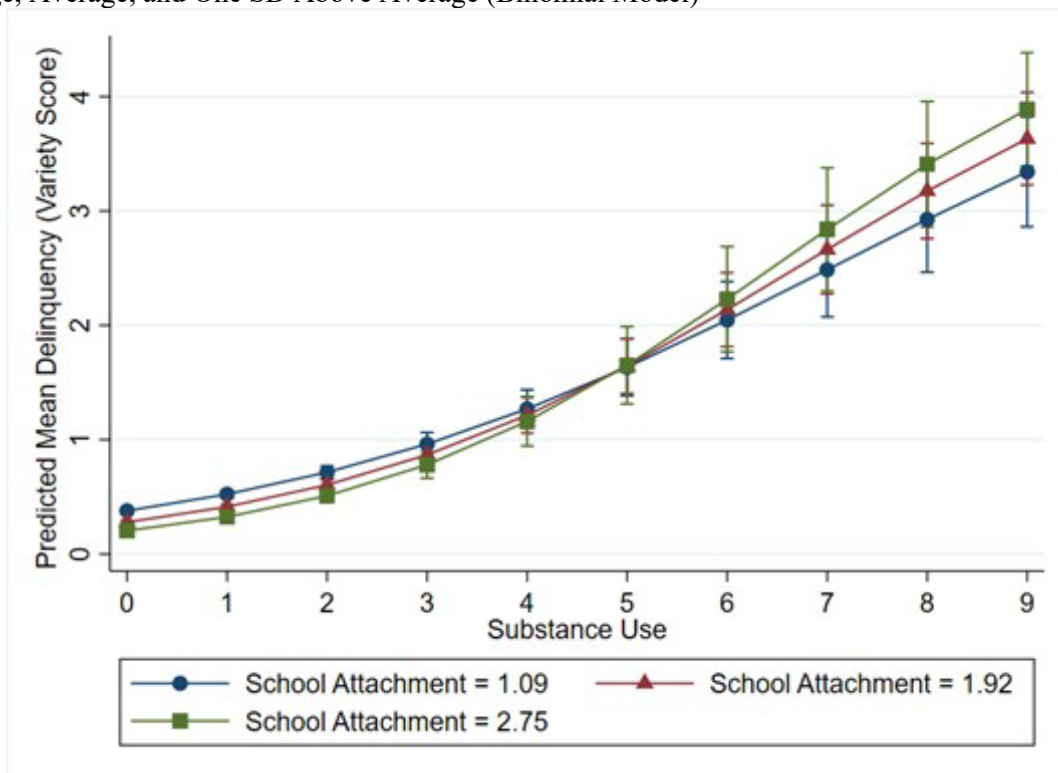
**Figure 16.** Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Binomial Model)



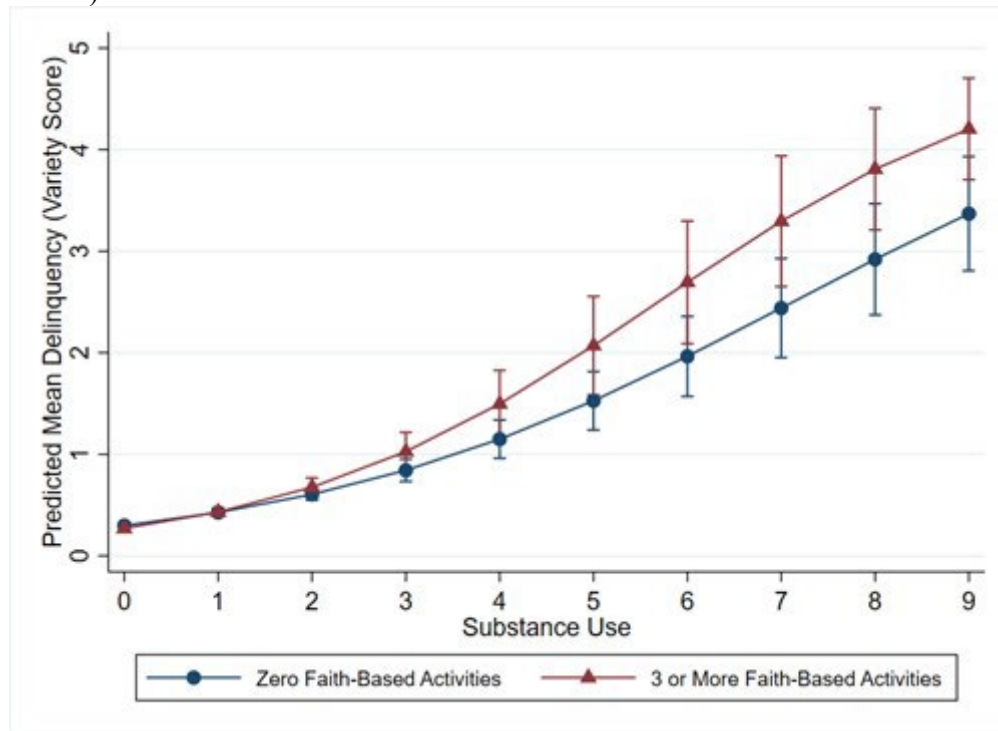
**Figure 17.** Substance Use and Delinquency for Select Levels of School Attachment (Binomial Model)



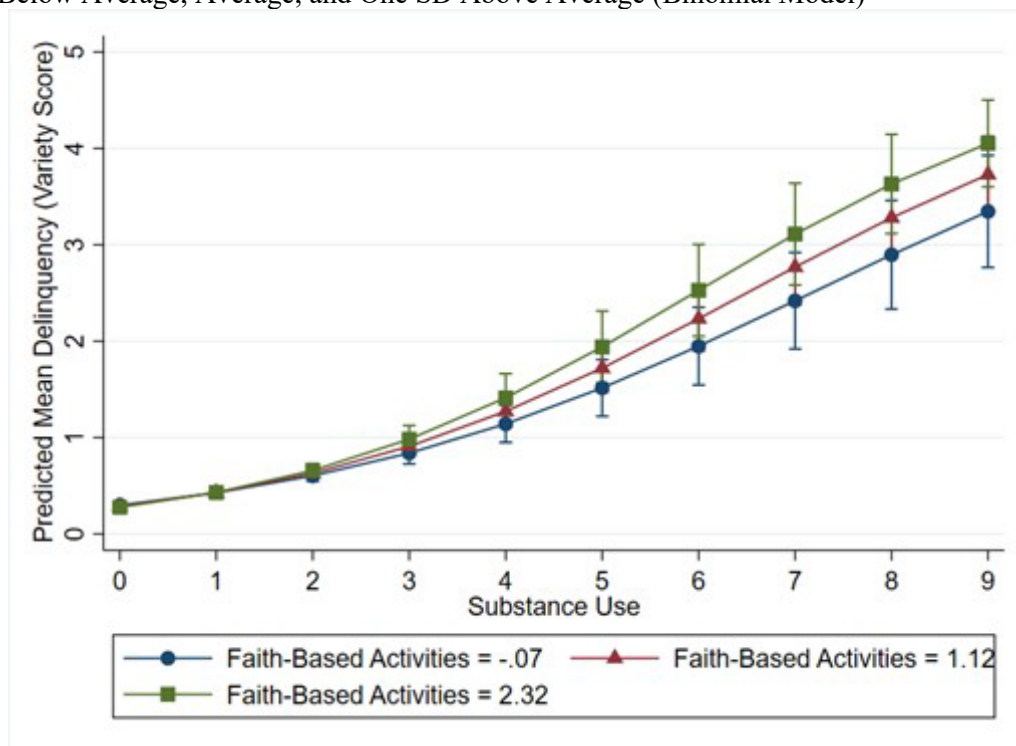
**Figure 18.** Substance Use and Delinquency for Select Levels of School Attachment: One SD Below Average, Average, and One SD Above Average (Binomial Model)



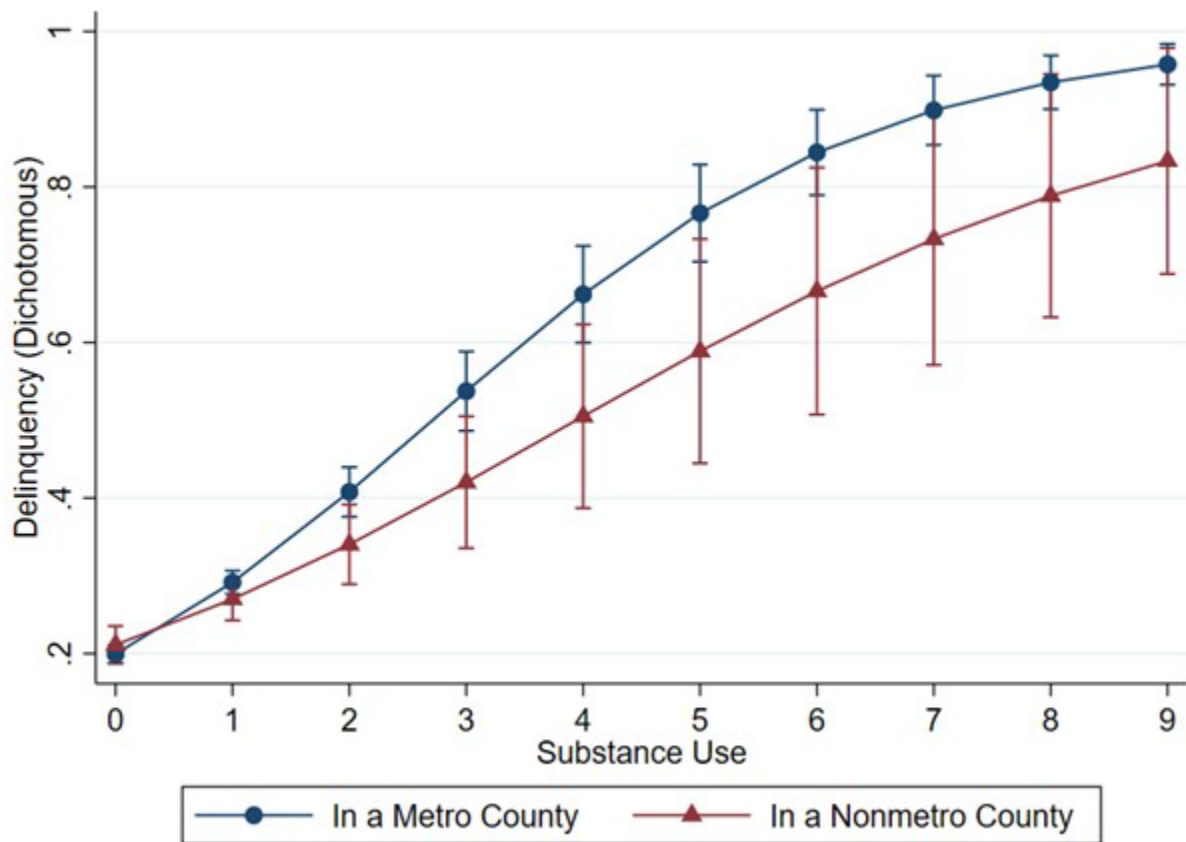
**Figure 19.** Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities (Binomial Model)



**Figure 20.** Substance Use and Delinquency for Select Levels of Participation in Faith-Based Activities: One SD Below Average, Average, and One SD Above Average (Binomial Model)

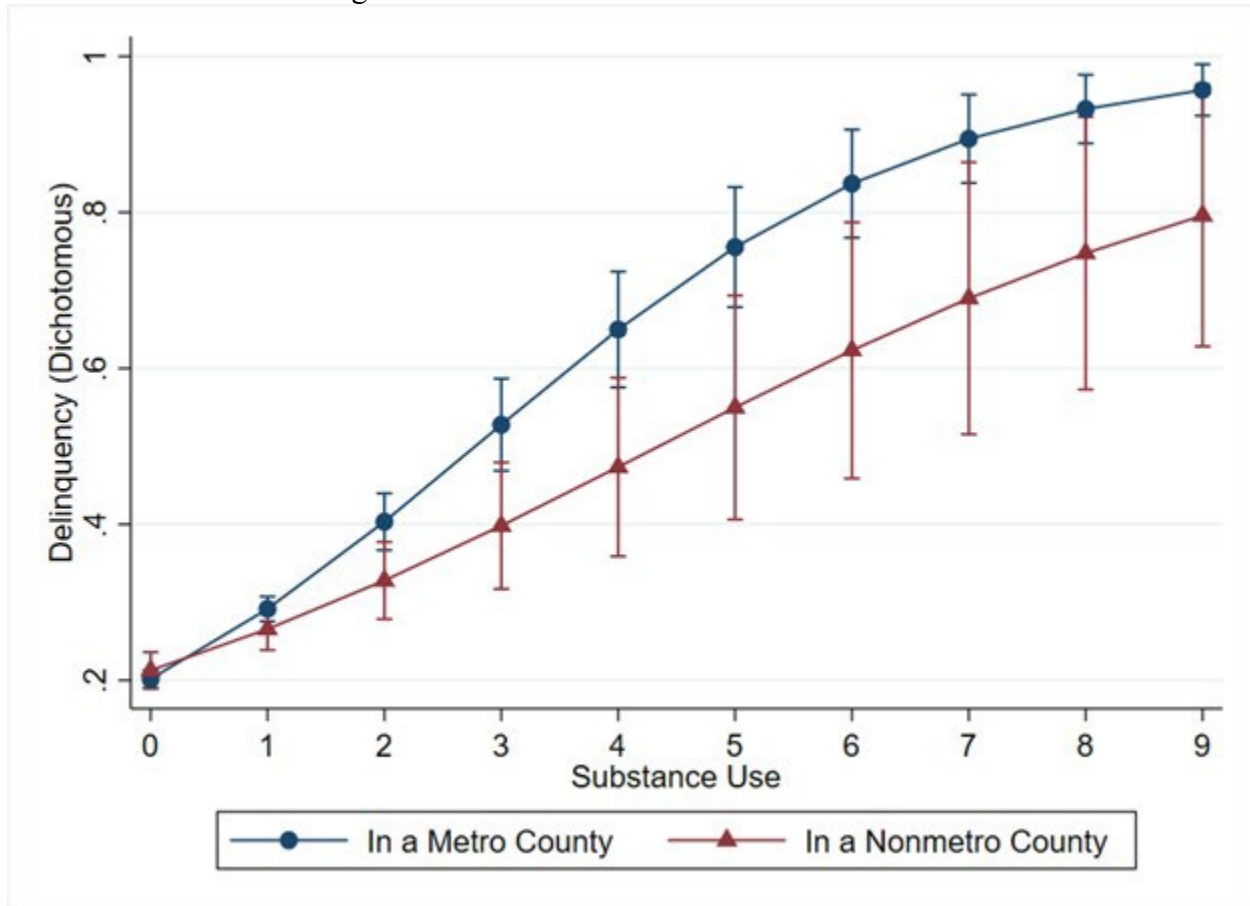


**Figure 21.** Substance Use and Delinquency by Metropolitan County Status (Full Logistic Interaction Model)

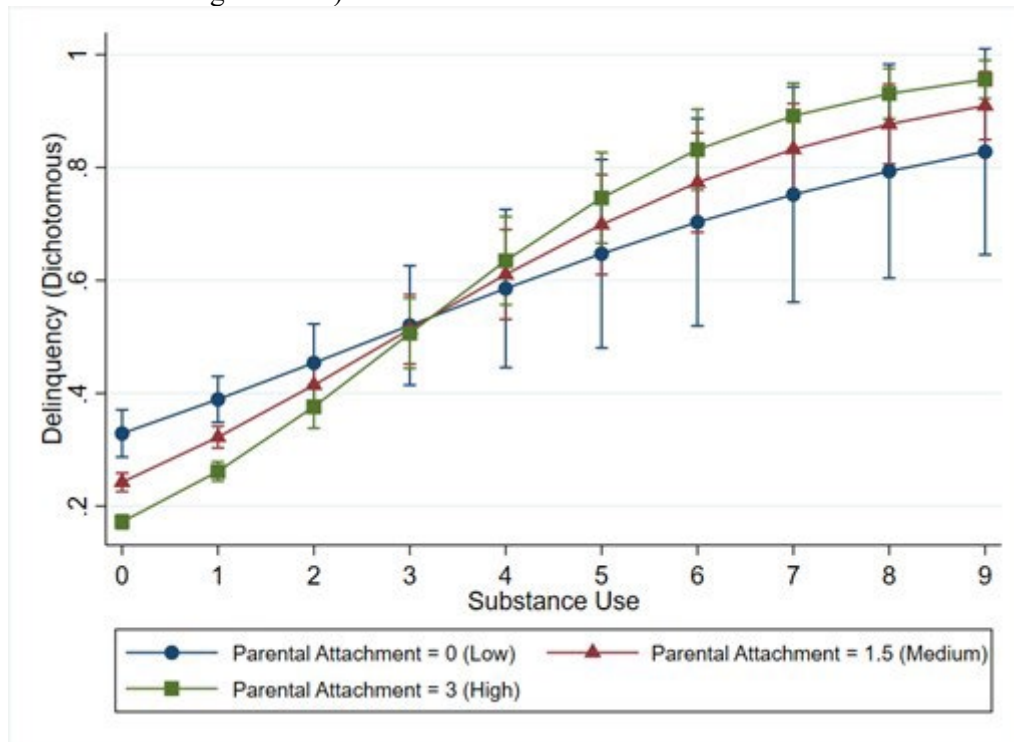


## Appendix

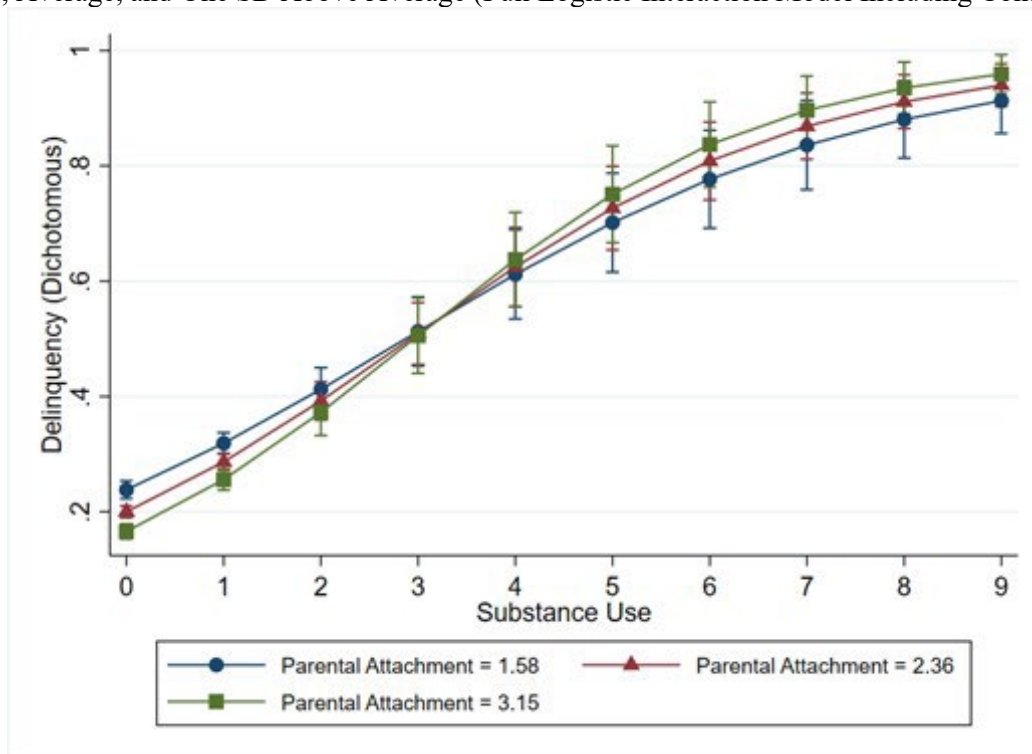
**Figure 22.** Substance Use and Delinquency by Metropolitan County Status (Full Logistic Interaction Model Including Controls)



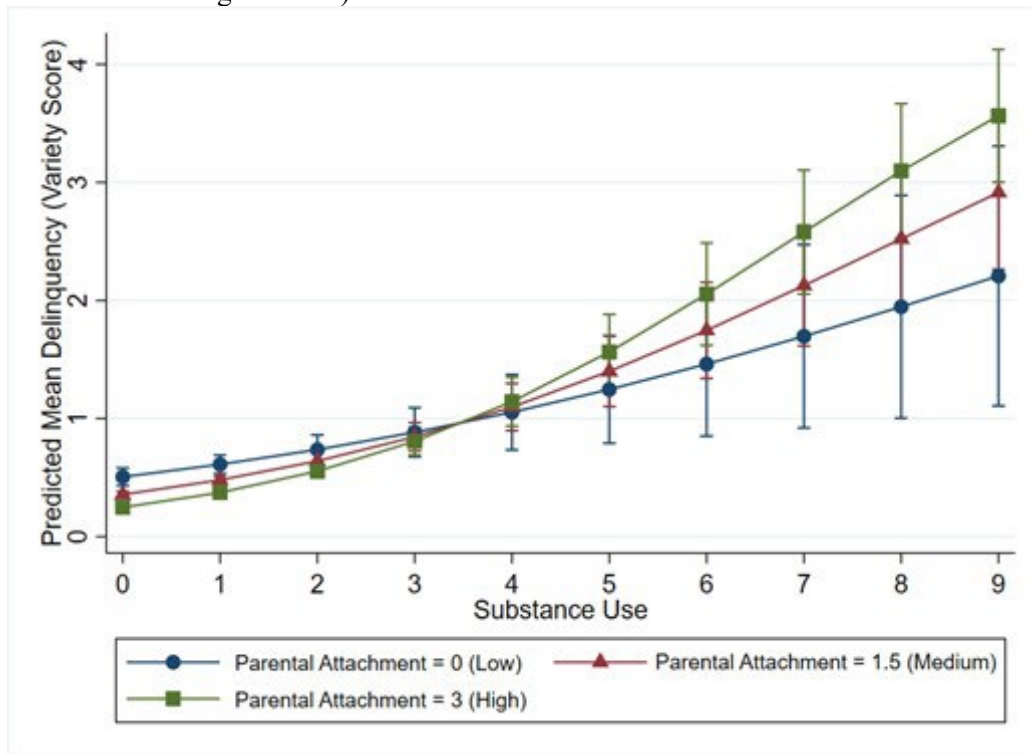
**Figure 23.** Substance Use and Delinquency for Select Levels of Parental Attachment (Full Logistic Interaction Model Including Controls)



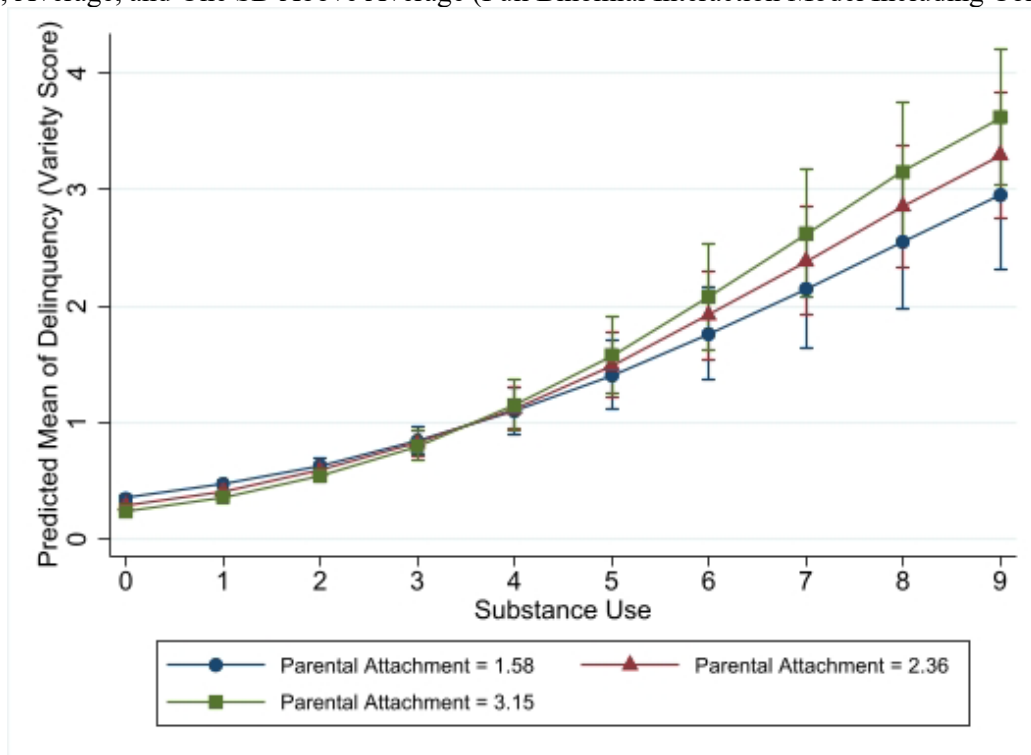
**Figure 24.** Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Full Logistic Interaction Model Including Controls)



**Figure 25.** Substance Use and Delinquency for Select Levels of Parental Attachment (Full Binomial Interaction Model Including Controls)



**Figure 26.** Substance Use and Delinquency for Select Levels of Parental Attachment: One SD Below Average, Average, and One SD Above Average (Full Binomial Interaction Model Including Controls)



## References

- Abraham, J., & Ceccato, V. (2022). Crime and safety in rural areas: A systematic review of the English-language literature 1980–2020. *Journal of Rural Studies*, 94, 250–273.  
<https://doi.org/10.1016/j.jrurstud.2022.05.010>
- American Communities Project. (2022). *Religious Stereotypes vs. Reality in Urban, Suburban, and Rural America*. PRRI and American Communities Project.  
<https://www.americancommunities.org/religious-stereotypes-vs-reality-in-urban-suburban-and-rural-america/>
- Bachman, J. G., & O'Malley, P. M. (1981). When Four Months Equal a Year: Inconsistencies in Student Reports of Drug Use. *The Public Opinion Quarterly*, 45(4), 536–548.
- Bachman, R. (1992). Crime in Nonmetropolitan America: A National Accounting of Trends, Incidence Rates, and Idiosyncratic Vulnerabilities. *Rural Sociology*, 57(4), 546–560.
- Barclay, E., Donnermeyer, J. F., & Jobes, P. C. (2004). The Dark Side of Gemeinschaft: Criminality within Rural Communities. *Crime Prevention and Community Safety*, 6(3), 7–22. <https://doi.org/10.1057/palgrave.cpcs.8140191>
- Barnes, G. M., Hoffman, J. H., Welte, J. W., Farrell, M. P., & Dintcheff, B. A. (2006). Effects of Parental Monitoring and Peer Deviance on Substance Use and Delinquency. *Journal of Marriage and Family*, 68(4), 1084–1104. <https://doi.org/10.1111/j.1741-3737.2006.00315.x>
- Baumer, E. P., Cundiff, K., & Luo, L. (2021). The contemporary transformation of american youth: An analysis of change in the prevalence of delinquency, 1991–2015. *Criminology*, 59(1), 109–136. <https://doi.org/10.1111/1745-9125.12264>
- Beachy, S., & Liang, C. T. H. (2024). Patterns in pro-gun beliefs and weapon carrying behaviors

- in rural White adolescent. *Journal of Research on Adolescence*, 34(1), 21–34.  
<https://doi.org/10.1111/jora.12892>
- Benda, B. B., Pope, S. K., & Kelleher, K. J. (2006). Church Attendance or Religiousness: Their Relationship to Adolescents' Use of Alcohol, Other Drugs, and Delinquency. *Alcoholism Treatment Quarterly*, 24(1–2), 75–87. [https://doi.org/10.1300/J020v24n01\\_05](https://doi.org/10.1300/J020v24n01_05)
- Bennett, T., & Holloway, K. (2009). The Causal Connection Between Drug Misuse and Crime. *The British Journal of Criminology*, 49(4), 513–531. <https://doi.org/10.1093/bjc/azp014>
- Bennett, T., Holloway, K., & Farrington, D. (2008). The statistical association between drug misuse and crime: A meta-analysis. *Aggression and Violent Behavior*, 13(2), 107–118.  
<https://doi.org/10.1016/j.avb.2008.02.001>
- Bernburg, J. G., Krohn, M. D., & Rivera, C. J. (2006). Official Labeling, Criminal Embeddedness, and Subsequent Delinquency: A Longitudinal Test of Labeling Theory. *Journal of Research in Crime and Delinquency*, 43(1), 67–88.  
<https://doi.org/10.1177/0022427805280068>
- Biggar, R. W., Forsyth, C. J., Chen, J., & Richard, T. A. (2016). Protective Factors for Deviance: A Comparison of Rural and Urban Youth. *Deviant Behavior*, 37(12), 1380–1391.  
<https://doi.org/10.1080/01639625.2016.1185861>
- Bishaw, A., & Posey, K.G. (2016). *A Comparison of Rural and Urban America: Household Income and Poverty*. U.S. Census Bureau, Economic and Housing Statistics Division. Retrieved from [https://www.census.gov/newsroom/blogs/random-samplings/2016/12/a\\_comparison\\_of\\_rura.html](https://www.census.gov/newsroom/blogs/random-samplings/2016/12/a_comparison_of_rura.html)
- Boggs, S. L. (1971). Formal and Informal Crime Control: An Exploratory Study of Urban, Suburban, and Rural Orientations. *The Sociological Quarterly*, 12(3), 319–327.

- Boles, S. M., & Miotto, K. (2003). Substance abuse and violence: A review of the literature. *Aggression and Violent Behavior*, 8(2), 155–174. [https://doi.org/10.1016/S1359-1789\(01\)00057-X](https://doi.org/10.1016/S1359-1789(01)00057-X)
- Borders, T. F., & Booth, B. M. (2007). Research on Rural Residence and Access to Drug Abuse Services: Where Are We and Where Do We Go? *The Journal of Rural Health*, 23(s1), 79–83. <https://doi.org/10.1111/j.1748-0361.2007.00128.x>
- Boyum, D.A., Caulkins, J.P., Kleiman, M.A.R. (2011). Drugs, Crime, and Public Policy. In *Crime and Public Policy*, Eds. Wilson, J. Q., & Petersilia, J. Oxford University Press, USA.
- Brame, R., Turner, M.G., Paternoster, R. (2010). Missing Data Problems in Criminological Research. In: Piquero, A., Weisburd, D. (eds) *Handbook of Quantitative Criminology*. Springer, New York, NY. [https://doi-org.proxy-um.researchport.umd.edu/10.1007/978-0-387-77650-7\\_14](https://doi-org.proxy-um.researchport.umd.edu/10.1007/978-0-387-77650-7_14)
- Branas, C. C., Han, S., & Wiebe, D. J. (2016). Alcohol Use and Firearm Violence. *Epidemiologic Reviews*, mxv010. <https://doi.org/10.1093/epirev/mxv010>
- Britt, C. L., Rocque, M., & Zimmerman, G. M. (2018). The Analysis of Bounded Count Data in Criminology. *Journal of Quantitative Criminology*, 34(2), 591–607. <https://doi.org/10.1007/s10940-017-9346-9>
- Bronson, J. (2017). *Drug Use, Dependence, and Abuse Among State Prisoners and Jail Inmates, 2007-2009*. U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. NCJ 250546.
- Brown, B. S., Voskuhl, T. C., & Lehman, P. E. (1977). Comparison of Drug Abuse Clients in

- Urban and Rural Settings. *The American Journal of Drug and Alcohol Abuse*, 4(4), 445–454. <https://doi.org/10.3109/00952997709007002>
- Bureau of Justice Statistics. (2018). *Urban and Rural Victimization*. 2018 National Crime Victims' rights Week Resource Guide: Crime and Victimization Fact Sheets. The National Center for Victims of Crime, Office for Victims of Crime.
- Cebulak, W. (2004). Why rural crime and justice really matter. *Journal of Police and Criminal Psychology*, 19(1), 71–81. <https://doi.org/10.1007/BF02802576>
- Center for Behavioral Health Statistics and Quality. (2020a). *2019 National Survey on Drug Use and Health (NSDUH): Methodological Resource Book, Section 8, Data collection final report*. Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Center for Behavioral Health Statistics and Quality. (2020b). *2019 National Survey on Drug Use and Health Public Use File Codebook*. Substance Abuse and Mental Health Services Administration, Rockville, MD
- Center for Behavioral Health Statistics and Quality. (2023). *2022 National Survey on Drug Use and Health Public Use File Codebook*. Substance Abuse and Mental Health Services Administration, Rockville, MD
- Chaiken, J. M., & Chaiken, M. R. (1990). Drugs and Predatory Crime. *Crime and Justice: A Review of Research*, 13, 203–240.
- Chen, K., & Kandel, D. B. (1995). The natural history of drug use from adolescence to the mid-thirties in a general population sample. *American Journal of Public Health*, 85(1), 41–47. <https://doi.org/10.2105/AJPH.85.1.41>
- Chen, C.-Y., Storr, C. L., & Anthony, J. C. (2009). Early-onset drug use and risk for drug

- dependence problems. *Addictive Behaviors*, 34(3), 319–322.  
<https://doi.org/10.1016/j.addbeh.2008.10.021>
- Chilenski, S. M., & Greenberg, M. T. (2009). The Importance of the Community Context in the Epidemiology of Early Adolescent Substance Use and Delinquency in a Rural Sample. *American Journal of Community Psychology*, 44(3), 287–301.  
<https://doi.org/10.1007/s10464-009-9258-4>
- Coker, A. L., Bush, H. M., Follingstad, D. R., & Brancato, C. J. (2017). Frequency of Guns in the Households of High School Seniors. *Journal of School Health*, 87(3), 153–158.  
<https://doi.org/10.1111/josh.12479>
- Collins, J. J., Hubbard, R. L., & Rachal, J. V. (1985). Expensive Drug Use and Illegal Income: A Test of Explanatory Hypotheses\*. *Criminology*, 23(4), 743–764.  
<https://doi.org/10.1111/j.1745-9125.1985.tb00372.x>
- Contreras, C., & Hipp, J. R. (2020). Drugs, Crime, Space, and Time: A Spatiotemporal Examination of Drug Activity and Crime Rates. *Justice Quarterly*, 37(2), 187–209.  
<https://doi.org/10.1080/07418825.2018.1515318>
- Costello, B. J., & Laub, J. H. (2020). Social Control Theory: The Legacy of Travis Hirschi's Causes of Delinquency. *Annual Review of Criminology*, 3(1), 21–41.  
<https://doi.org/10.1146/annurev-criminol-011419-041527>
- Crockett, L. J., Shanahan, M. J., & Jackson-Newsom, J. (2000). Rural Youth: Ecological and Life Course Perspectives. In R. Montemayor, G. R. Adams, & T. P. Gullotta, *Adolescent Diversity in Ethnic, Economic, and Cultural Contexts* (pp. 43–74). SAGE Publications, Inc. <https://doi.org/10.4135/9781452225647.n3>
- Cunningham, P. B., Henggeler, S. W., Limber, S. P., Melton, G. B., & Nation, M. A. (2000).

- Patterns and Correlates of Gun Ownership Among Nonmetropolitan and Rural Middle School Students. *Journal of Clinical Child Psychology*, 29(3), 432–442.  
[https://doi.org/10.1207/S15374424JCCP2903\\_14](https://doi.org/10.1207/S15374424JCCP2903_14)
- D’Amico, E. J., Edelen, M. O., Miles, J. N. V., & Morral, A. R. (2008). The longitudinal association between substance use and delinquency among high-risk youth. *Drug and Alcohol Dependence*, 93(1), 85–92. <https://doi.org/10.1016/j.drugalcdep.2007.09.006>
- Darke, S. (1998). Self-report among injecting drug users: A review. *Drug and Alcohol Dependence*, 51(3), 253–263. [https://doi.org/10.1016/S0376-8716\(98\)00028-3](https://doi.org/10.1016/S0376-8716(98)00028-3)
- Dawkins, M. P. (1997). Drug use and violent crime among adolescents. *Adolescence*, 32(126), 395–405.
- Deitch, D., Koutsenok, I., & Ruiz, A. (2000). The Relationship Between Crime and Drugs: What We Have Learned in Recent Decades. *Journal of Psychoactive Drugs*, 32, 391–397.  
<https://doi.org/10.1080/02791072.2000.10400241>
- DeLisi, M., Angton, A., Behnken, M. P., & Kusow, A. M. (2015). Do Adolescent Drug Users Fare the Worst? Onset Type, Juvenile Delinquency, and Criminal Careers. *International Journal of Offender Therapy and Comparative Criminology*, 59(2), 180–195.  
<https://doi.org/10.1177/0306624X13505426>
- Dew, B., Elifson, K., & Dozier, M. (2007). Social and Environmental Factors and Their Influence on Drug Use Vulnerability and Resiliency in Rural Populations. *The Journal of Rural Health*, 23(s1), 16–21. <https://doi.org/10.1111/j.1748-0361.2007.00119.x>
- Donnermeyer, J. F. (1992). The Use of Alcohol, Marijuana, and Hard Drugs by Rural Adolescents: A Review of Recent Research. *Drugs & Society*, 7(1–2), 31–75.  
[https://doi.org/10.1300/J023v07n01\\_03](https://doi.org/10.1300/J023v07n01_03)

- Donnermeyer, J. F. (2019). The international emergence of rural criminology: Implications for the development and revision of criminological theory for rural contexts. *International Journal of Rural Criminology*, 5(1), 1–18. <https://doi.org/10.18061/1811/88731>
- Donnermeyer, J. F., & DeKeseredy, W. (2014). *Rural Criminology: New Directions in Critical Criminology*. Routledge. <https://doi.org/10.4324/9780203094518>
- Dornbusch, S. M., Erickson, K. G., Laird, J., & Wong, C. A. (2001). The Relation of Family and School Attachment to Adolescent Deviance in Diverse Groups and Communities. *Journal of Adolescent Research*, 16(4), 396–422. <https://doi.org/10.1177/0743558401164006>
- Duncan, S. C., Duncan, T. E., & Strycker, L. A. (2002). A Multilevel Analysis of Neighborhood Context and Youth Alcohol and Drug Problems. *Prevention Science*.
- Edwards, K. M. (2015). Intimate Partner Violence and the Rural–Urban–Suburban Divide: Myth or Reality? A Critical Review of the Literature. *Trauma, Violence, & Abuse*, 16(3), 359–373. <https://doi.org/10.1177/1524838014557289>
- Elder, G. H., & Conger, R. D. (2000). *Children of the Land: Adversity and Success in Rural America*. University of Chicago Press. <https://press.uchicago.edu/ucp/books/book/chicago/C/bo3613170.html>
- Elliott, D. S., Huizinga, D., & Menard, S. (1989). *Multiple Problem Youth: Delinquency, Substance Use, and Mental Health Problems*. Springer Science & Business Media.
- Fagan, J. (1990). Intoxication and Aggression. *Crime and Justice: A Review of Research*, 13, 241–320.
- Fagan, J. (1993a). Interactions Among Drugs, Alcohol, and Violence. *Health Affairs*, 12(4), 65–79. <https://doi.org/10.1377/hlthaff.12.4.65>

- Fagan, J. (1993b). Set and Setting Revisited: Influences of Alcohol and Illicit Drugs on the Social Context of Violent Events. In Martin, S.E. (Ed.), *Alcohol and Interpersonal Violence: Fostering Multidisciplinary Perspectives*. U.S. Department of Health and Human Services. NIH Publication No. 93-3296.
- Fagan, J., Weis, J. G., & Cheng, Y.-T. (1990). Delinquency and Substance Use among Inner-City Students. *Journal of Drug Issues*, 20(3), 351–402.  
<https://doi.org/10.1177/002204269002000301>
- Fazel, S., Bains, P., & Doll, H. (2006). Substance abuse and dependence in prisoners: A systematic review. *Addiction*, 101(2), 181–191. <https://doi.org/10.1111/j.1360-0443.2006.01316.x>
- Feldstein, S. W., & Miller, W. R. (2006). Substance use and risk-taking among adolescents. *Journal of Mental Health*, 15(6), 633–643. <https://doi.org/10.1080/09638230600998896>
- Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2013). Alcohol misuse and psychosocial outcomes in young adulthood: Results from a longitudinal birth cohort studied to age 30. *Drug and Alcohol Dependence*, 133(2), 513–519.  
<https://doi.org/10.1016/j.drugalcdep.2013.07.015>
- Foran, H. M., & O’Leary, K. D. (2008). Alcohol and intimate partner violence: A meta-analytic review. *Clinical Psychology Review*, 28(7), 1222–1234.  
<https://doi.org/10.1016/j.cpr.2008.05.001>
- Ford, J. A. (2005). Substance Use, the Social Bond, and Delinquency\*. *Sociological Inquiry*, 75(1), 109–128. <https://doi.org/10.1111/j.1475-682X.2005.00114.x>
- Fosco, G. M., Fang, S., Chen, L., Feinberg, M. E., & Spoth, R. (2024). A case study in

- developmental discontinuity: PROSPER Interventions and adolescent substance use trajectories shape young adult substance use and mental health problems. *Journal of Research on Adolescence*, 2024;00, 1–13. <https://doi.org/10.1111/jora.12940>
- Friedman, A. S. (1998). Substance use/abuse as a predictor to illegal and violent behavior: A review of the relevant literature. *Aggression and Violent Behavior*, 3(4), 339–355. [https://doi.org/10.1016/S1359-1789\(97\)00012-8](https://doi.org/10.1016/S1359-1789(97)00012-8)
- Gardner, L., & Shoemaker, D. J. (1989). Social Bonding and Delinquency: A Comparative Analysis. *The Sociological Quarterly*, 30(3), 481–499.
- Gfroerer, J. C., Larson, S. L., & Colliver, J. D. (2007). Drug Use Patterns and Trends in Rural Communities. *The Journal of Rural Health*, 23(s1), 10–15. <https://doi.org/10.1111/j.1748-0361.2007.00118.x>
- Gmel, G., Holmes, J., & Studer, J. (2016). Are alcohol outlet densities strongly associated with alcohol-related outcomes? A critical review of recent evidence. *Drug and Alcohol Review*, 35(1), 40–54. <https://doi.org/10.1111/dar.12304>
- Goldstein, P. J. (1985). The Drugs/Violence Nexus: A Tripartite Conceptual Framework. *Journal of Drug Issues*, 15(4), 493–506. <https://doi.org/10.1177/002204268501500406>
- Gottfredson, M. R., & Hirschi, T. (1990). *A General Theory of Crime*. Stanford University Press. <https://doi.org/10.1515/9781503621794>
- Gorman, D., Speer, P., Gruenewald, P., & Labouvie, E. (2001). Spatial dynamics of alcohol availability, neighborhood structure and violent crime. *Journal of Studies on Alcohol*, 62, 628–636. <https://doi.org/10.15288/jsa.2001.62.628>
- Harrison, L. D. (1995). The Validity of Self-Reported Data on Drug Use. *Journal of Drug Issues*, 25(1), 91–111. <https://doi.org/10.1177/002204269502500107>

- Havens, J. R., Oser, C. B., Leukefeld, C. G., Webster, J. M., Martin, S. S., O'Connell, D. J., Surratt, H. L., & Inciardi, J. A. (2007). Differences in Prevalence of Prescription Opiate Misuse Among Rural and Urban Probationers. *The American Journal of Drug and Alcohol Abuse*, 33(2), 309–317. <https://doi.org/10.1080/00952990601175078>
- Hayes, A. F. (2022). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach* (Third Edition). The Guilford Press.
- Henry, K. L., & Slater, M. D. (2007). The Contextual Effect of School Attachment on Young Adolescents' Alcohol Use. *Journal of School Health*, 77(2), 67–74. <https://doi.org/10.1111/j.1746-1561.2007.00169.x>
- Herz, D. C., & Murray, R. (2003). Exploring Arrestee Drug Use in Rural Nebraska. *Journal of Drug Issues*, 33(1), 99–117. <https://doi.org/10.1177/002204260303300105>
- Hirschi, T. (1969). *Causes of Delinquency*. Routledge. <https://doi.org/10.4324/9781315081649>
- Hirschi, T., & Gottfredson, M. (1983). Age and the Explanation of Crime. *American Journal of Sociology*, 89(3), 552–584. <https://doi.org/10.1086/227905>
- Hofferth, S. L., & Iceland, J. (1998). Social Capital in Rural and Urban Communities. *Rural Sociology*, 63(4), 574–598. <https://doi.org/10.1111/j.1549-0831.1998.tb00693.x>
- Horney, J., Osgood, D. W., & Marshall, I. H. (1995). Criminal Careers in the Short-Term: Intra-Individual Variability in Crime and Its Relation to Local Life Circumstances. *American Sociological Review*, 60(5), 655–673. <https://doi.org/10.2307/2096316>
- Hurst, Y. G. (2007). Juvenile Attitudes Toward the Police: An Examination of Rural Youth. *Criminal Justice Review*, 32(2), 121–141. <https://doi.org/10.1177/0734016807300141>
- Hussong, A. M., Curran, P. J., Moffitt, T. E., Caspi, A., & Carrig, M. M. (2004). Substance

- abuse hinders desistance in young adults' antisocial behavior. *Development and Psychopathology*, 16(04). <https://doi.org/10.1017/S095457940404012X>
- Jimerson, S. R., Campos, E., & Greif, J. L. (2003). Toward an Understanding of Definitions and Measures of School Engagement and Related Terms. *The California School Psychologist*, 8(1), 7–27. <https://doi.org/10.1007/BF03340893>
- Johnson, K., & Lichter, D. (2022). *Growing Racial Diversity in Rural America: Results from the 2020 Census*. University of New Hampshire. <https://carsey.unh.edu/publication/growing-racial-diversity-rural-america-results-2020-census#:~:text=Rural%20America%20remains%20predominately%20non,in%202020%20than%20in%202010>.
- Johnson, K., & Lichter, D. (2019). Rural Depopulation: Growth and Decline Processes over the Past Century: Rural Depopulation. *Rural Sociology*, 84. <https://doi.org/10.1111/ruso.12266>
- Johnson, T. P., & Mott, J. A. (2001). The reliability of self-reported age of onset of tobacco, alcohol and illicit drug use. *Addiction*, 96(8), 1187–1198. <https://doi.org/10.1046/j.1360-0443.2001.968118711.x>
- Kandel, D. B., & Logan, J. A. (1984). Patterns of drug use from adolescence to young adulthood: I. Periods of risk for initiation, continued use, and discontinuation. *American Journal of Public Health*, 74(7), 660–666. <https://doi.org/10.2105/AJPH.74.7.660>
- Kandel, D., Simcha-Fagan, O., & Davies, M. (1986). Risk Factors for Delinquency and Illicit Drug Use from Adolescence to Young Adulthood. *Journal of Drug Issues*, 16(1), 67–90. <https://doi.org/10.1177/002204268601600104>
- Kelly, P. E., Polanin, J. R., Jang, S. J., & Johnson, B. R. (2015). Religion, Delinquency, and

- Drug Use: A Meta-Analysis. *Criminal Justice Review*, 40(4), 505–523.  
<https://doi.org/10.1177/0734016815605151>
- Kirk, D. S. (2020). *Home Free: Prisoner Reentry and Residential Change After Hurricane Katrina*. Oxford University Press.
- Kuhns, J. B., & Clodfelter, T. A. (2009). Illicit drug-related psychopharmacological violence: The current understanding within a causal context. *Aggression and Violent Behavior*, 14(1), 69–78. <https://doi.org/10.1016/j.avb.2008.11.001>
- Kuhns, J. B., Exum, M. L., Clodfelter, T. A., & Bottia, M. C. (2014). The Prevalence of Alcohol-Involved Homicide Offending: A Meta-Analytic Review. *Homicide Studies*, 18(3), 251–270. <https://doi.org/10.1177/1088767913493629>
- Kuypers, K., Verkes, R., van den Brink, W., van Amsterdam, J., & Ramaekers, J. (2020). Intoxicated aggression: Do alcohol and stimulants cause dose-related aggression? A review. *European Neuropsychopharmacology*, 30, 114–147.  
<https://doi.org/10.1016/j.euroneuro.2018.06.001>
- Lanier, C., & Maume, M. O. (2009). Intimate Partner Violence and Social Isolation Across the Rural/Urban Divide. *Violence Against Women*, 15(11), 1311–1330.  
<https://doi.org/10.1177/1077801209346711>
- Lardier, D. T., MacDonnell, M., Barrios, V. R., Garcia-Reid, P., & Reid, R. J. (2018). The moderating effect of neighborhood sense of community on predictors of substance use among Hispanic urban youth. *Journal of Ethnicity in Substance Abuse*, 17(4), 434–459.  
<https://doi.org/10.1080/15332640.2016.1273810>
- Laub, J. H., & Sampson, R. J. (2003). *Shared Beginnings, Divergent Lives: Delinquent Boys to Age 70*. Harvard University Press. <https://doi.org/10.4159/9780674039971>

- Lee, M. R., & Alshalan, A. (2005). Geographic Variation in Property Crime Rates: A Test of Opportunity Theory. *Journal of Crime and Justice*, 28(2), 101–127.  
<https://doi.org/10.1080/0735648X.2005.9721640>
- Lee, M. R., & Bartkowski, J. P. (2003). Love Thy Neighbor—Moral Communities, Civic Engagement, and Juvenile Homicide in Rural Areas. *Social Forces*, 82(3), 1001–1036.
- Lichter, D., & Brown, D. (2011). Rural America in an Urban Society: Changing Spatial and Social Boundaries. *Annual Review of Sociology*, 37. <https://doi.org/10.1146/annurev-soc-081309-150208>
- Lichter, D., & Jensen, L. (2002). Rural America in Transition: Poverty and Welfare at the Turn of the Twenty-First Century. In Weber, B.A., Duncan, G.J., and Whitener, L.A., eds. *Rural Dimensions of Welfare Reform*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. <https://doi.org/10.17848/9781417508884.Ch3>
- Lichter, D. T., & Ziliak, J. P. (2017). The Rural-Urban Interface: New Patterns of Spatial Interdependence and Inequality in America. *The ANNALS of the American Academy of Political and Social Science*, 672(1), 6–25. <https://doi.org/10.1177/0002716217714180>
- Lyerly, R. R., & Skipper, J. K. Jr. (1981). Differential Rates of Rural-Urban Delinquency—A Social Control Approach. *Criminology*, 19(3), 385–399.
- MacCoun, R.J., Klimer, B., and Reuter, P. (2003). Research on Drugs-Crime Linkages: The Next Generation. In *Toward a drugs and crime research agenda for the 21st century*. U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.
- MacCoun, R. J., & Reuter, P. (2001). *Drug War Heresies: Learning from Other Vices, Times, and Places*. Cambridge University Press.
- Marshall, B., & Johnson, S. (2005). *Crime in Rural Areas: A Review of the Literature for the*

*Rural Evidence Research Centre*. Jill Dando Institute of Crime Science, University College London.

Martínez, R., Rosenfeld, R., & Mares, D. (2008). Social Disorganization, Drug Market Activity, and Neighborhood Violent Crime. *Urban Affairs Review*, 43(6), 846–874.

<https://doi.org/10.1177/1078087408314774>

McGinty, E. E., Choksy, S., & Wintemute, G. J. (2016). The Relationship Between Controlled Substances and Violence. *Epidemiologic Reviews*, 38(1), 5–31.

<https://doi.org/10.1093/epirev/mxv008>

Menard, S., Mihalic, S., & Huizinga, D. (2001). Drugs and crime revisited. *Justice Quarterly*, 18(2), 269–299. <https://doi.org/10.1080/07418820100094901>

Nurco, D. N., Hanlon, T. E., & Kinlock, T. W. (1991). Recent research on the relationship between illicit drug use and crime. *Behavioral Sciences & the Law*, 9(3), 221–242.

Office of Management and Budget. (2010). *2010 Standards for Delineating Metropolitan and Micropolitan Statistical Areas*. Federal Register, 75(123), 37246-37252.

<https://www.govinfo.gov/content/pkg/FR-2010-06-28/pdf/2010-15605.pdf>

Osgood, D. W., & Chambers, J. M. (2000). Social Disorganization Outside the Metropolis: An Analysis of Rural Youth Violence\*. *Criminology*, 38(1), 81–116.

<https://doi.org/10.1111/j.1745-9125.2000.tb00884.x>

Otero-Lopez, J. M., Luengo-Martin, A., Miron-Redondo, L., & Carrillo-de-la-Pena, M. T. (1994). An Empirical Study of the Relations between Drug Abuse and Delinquency among Adolescents. *British Journal of Criminology*, 34(4), 459–478.

Paternoster, R., & Brame, R. (1998). The Structural Similarity of Processes Generating Criminal

- and Analogous Behaviors. *Criminology*, 36(3), 633–670. <https://doi.org/10.1111/j.1745-9125.1998.tb01261.x>
- Parker, R. N., & Auerhahn, K. (1998). Alcohol, Drugs, and Violence. *Annual Review of Sociology*, 24(1), 291–311. <https://doi.org/10.1146/annurev.soc.24.1.291>
- Parker, R. N. (1995). Bringing “Booze” Back In: The Relationship Between Alcohol and Homicide. *Journal of Research in Crime and Delinquency*, 32(1), 3–38. <https://doi.org/10.1177/0022427895032001001>
- Peterson, J. R. (2021). *The Policing of Juveniles in Rural Settings: A Qualitative Analysis of Police Decision-Making in a Rural Context* [Ph.D., Indiana University].
- Piquero, A. R., Gibson, C. L., & Tibbetts, S. G. (2002). Does self-control account for the relationship between binge drinking and alcohol-related behaviours? *Criminal Behaviour and Mental Health*, 12(2), 135–154. <https://doi.org/10.1002/cbm.492>
- Pruitt, L. R. (2009). The Forgotten Fifth: Rural Youth and Substance Abuse Symposium. *Stanford Law & Policy Review*, 20(2), 359–404.
- Reeping, P. M., Mak, A., Branas, C. C., Gobaud, A. N., & Nance, M. L. (2023). Firearm Death Rates in Rural vs Urban US Counties. *JAMA Surgery*, 158(7), 771–772. <https://doi.org/10.1001/jamasurg.2023.0265>
- Rennison, C. M., DeKeseredy, W. S., & Dragiewicz, M. (2013). Intimate Relationship Status Variations in Violence Against Women: Urban, Suburban, and Rural Differences. *Violence Against Women*, 19(11), 1312–1330. <https://doi.org/10.1177/1077801213514487>
- Reuter, P., Caulkins, J. P., & Midgette, G. (2021). Heroin use cannot be measured adequately

- with a general population survey. *Addiction*, 116(10), 2600–2609.  
<https://doi.org/10.1111/add.15458>
- Rhew, I. C., David Hawkins, J., & Oesterle, S. (2011). Drug use and risk among youth in different rural contexts. *Health & Place*, 17(3), 775–783.  
<https://doi.org/10.1016/j.healthplace.2011.02.003>
- Ricketts, T. (2000). The Changing Nature of Rural Health Care. *Annual Review of Public Health*, 21, 639–657. <https://doi.org/10.1146/annurev.publhealth.21.1.639>
- Roscigno, V. J., & Crowle, M. L. (2001). Rurality, Institutional Disadvantage, and Achievement/Attainment. *Rural Sociology*, 66(2), 268–292.  
<https://doi.org/10.1111/j.1549-0831.2001.tb00067.x>
- Rowhani-Rahbar, A., Oesterle, S., & Skinner, M. L. (2020). Initiation Age, Cumulative Prevalence, and Longitudinal Patterns of Handgun Carrying Among Rural Adolescents: A Multistate Study. *Journal of Adolescent Health*, 66(4), 416–422.  
<https://doi.org/10.1016/j.jadohealth.2019.11.313>
- Sampson, R. J., & Laub, J. H. (1993). Crime in the Making: Pathways and Turning Points Through Life. *Crime & Delinquency*, 39(3), 396–396.  
<https://doi.org/10.1177/0011128793039003010>
- Sampson, R. J., & Laub, J. (1997). A Life-Course Theory of Cumulative Disadvantage and the Stability of Delinquency. In *Developmental Theories of Crime and Delinquency*. Routledge.
- Schroeder, R. D., Giordano, P. C., & Cernkovich, S. A. (2007). Drug Use and Desistance Processes. *Criminology*, 45(1), 191–222. <https://doi.org/10.1111/j.1745-9125.2007.00076.x>

- Shaw, C. R., & McKay, H. D. (1942). *Juvenile delinquency and urban areas*. University of Chicago Press.
- Sherman, J. (2006). Coping with Rural Poverty: Economic Survival and Moral Capital in Rural America. *Social Forces*, 85(2), 891–913. <https://doi.org/10.1353/sof.2007.0026>
- Simpson, M. (2003). The relationship between drug use and crime: A puzzle inside an enigma. *International Journal of Drug Policy*, 14(4), 307–319. [https://doi.org/10.1016/S0955-3959\(03\)00081-1](https://doi.org/10.1016/S0955-3959(03)00081-1)
- Speer, P. W., Gorman, D. M., Labouvie, E. W., & Ontkush, M. J. (1998). Violent Crime and Alcohol Availability: Relationships in an Urban Community. *Journal of Public Health Policy*, 19(3), 303–318. <https://doi.org/10.2307/3343538>
- Spoth, R., Redmond, C., Shin, C., Greenberg, M., Feinberg, M., & Schainker, L. (2013). PROSPER community–university partnership delivery system effects on substance misuse through 6 1/2 years past baseline from a cluster randomized controlled intervention trial. *Preventive Medicine*, 56(3), 190–196. <https://doi.org/10.1016/j.ypmed.2012.12.013>
- Spoth, R., Redmond, C., Shin, C., Greenberg, M. T., Feinberg, M. E., & Trudeau, L. (2017). PROSPER delivery of universal preventive interventions with young adolescents: Long-term effects on emerging adult substance misuse and associated risk behaviors. *Psychological Medicine*, 47(13), 2246–2259. <https://doi.org/10.1017/S0033291717000691>
- Squeglia, L. M., Jacobus, J., & Tapert, S. F. (2009). The Influence of Substance Use on Adolescent Brain Development. *Clinical EEG and Neuroscience*, 40(1), 31–38. <https://doi.org/10.1177/155005940904000110>

- Substance Abuse and Mental Health Services (SAMHSA). (2023). *Table 1.70B – Illicit Drug Use in Past Year: Among People Aged 12 or Older; by Age Group and Geographic and Socioeconomic Characteristics, Percentages, 2022 and 2023*. 240429.  
<https://www.samhsa.gov/data/report/2023-nsduh-detailed-tables>
- Sudhinaraset, M., Wigglesworth, C., & Takeuchi, D. T. (2016). Social and Cultural Contexts of Alcohol Use. *Alcohol Research: Current Reviews*, 38(1), 35–45.
- Sweeten, G. (2012). Scaling Criminal Offending. *Journal of Quantitative Criminology*, 28(3), 533–557. <https://doi.org/10.1007/s10940-011-9160-8>
- Sweeten, G., Piquero, A. R., & Steinberg, L. (2013). Age and the Explanation of Crime, Revisited. *Journal of Youth and Adolescence*, 42(6), 921–938.  
<https://doi.org/10.1007/s10964-013-9926-4>
- Thompson, A., & Tapp, S.N. (2023). *Criminal Victimization, 2022*. U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. NCJ 307089.
- Uniform Crime Reports [UCR]. (2019a). *Table 2: Crime in the United States by Community Type, 2019*. Federal Bureau of Investigation. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-2/table-2.xls>
- Uniform Crime Reports [UCR]. (2019b). *Table 52: Arrests, Metropolitan Counties by Age, 2019*. Federal Bureau of Investigation. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-52>
- Uniform Crime Reports [UCR]. (2019c). *Table 58: Arrests, Nonmetropolitan Counties by Age, 2019*. Federal Bureau of Investigation. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-58>
- Uniform Crime Reports [UCR]. (2019d). *Table 18: Rate: Number of Crimes per 100,000*

- Inhabitants by Metropolitan and Nonmetropolitan Counties by Population Group, 2019.*  
Federal Bureau of Investigation. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-18>
- United States Census Bureau. (2022). *Nation's Urban and Rural Populations Shift Following 2020 Census*. <https://www.census.gov/newsroom/press-releases/2022/urban-rural-populations.html>
- United States Census Bureau. (n.d.). *Urban and Rural*.  
<https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html>
- United States Department of Agriculture. (2020). *Rural-Urban Continuum Codes*. Economic Research Service. <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/>
- Ward, K. C., Kirchner, E. E., & Thompson, A. J. (2018). Social Disorganization and Rural/Urban Crime Rates: A County Level Comparison of Contributing Factors. *International Journal of Rural Criminology*, 4(1), 43–65.  
<https://doi.org/10.18061/1811/86153>
- Watters, J. K., Reinerman, C., & Fagan, J. (1985). Causality, Context, and Contingency Relationships between Drug Abuse and Delinquency Opiate Dependence as a Psychophysical Event: Users' Reports of Subjective Experiences. *Contemporary Drug Problems*, 12(3), 351–374.
- Weenink, D. (2011). Delinquent Behavior of Dutch Rural Adolescents. *Journal of Youth and Adolescence*, 40(9), 1132–1146. <https://doi.org/10.1007/s10964-011-9650-x>
- Weisheit, R.A., & Brownstein, H. (2016). Drug production in the rural context. In Donnermeyer,

- J. F. (Ed.), *The Routledge International Handbook of Rural Criminology* (pp. 235-243).  
Routledge.
- Weisheit, R., & Donnermeyer, J. (2000). Change and Continuity in Crime in Rural America. *The Nature of Crime: Continuity and Change*, 1.
- Weisheit, R.A., Falcone, D.N., & Wells, L.E. (2006). *Crime and Policing in Rural and Small-Town America* (3rd ed.). Waveland Press, Inc.
- Weisheit, R. A., & Wells, L. E. (2005). Deadly Violence in the Heartland: Comparing Homicide Patterns in Nonmetropolitan and Metropolitan Counties. *Homicide Studies*, 9(1), 55–80.  
<https://doi.org/10.1177/1088767904271434>
- Williams, R. J., & Nowatzki, N. (2005). Validity of Adolescent Self-Report of Substance Use. *Substance Use & Misuse*, 40(3), 299–311. <https://doi.org/10.1081/JA-200049327>
- White, H.R. (1997). Longitudinal Perspective on Alcohol Use and Aggression during Adolescence. In Galanter, M. (Ed.), *Recent developments in alcoholism Volume 13 alcohol and violence*. American Society of Addiction Medicine and the Research Society on Alcoholism, Kluwer Academic, Plenum Publishers, New York.
- White, H. R., Buckman, J., Pardini, D., & Loeber, R. (2015a). The Association of Alcohol and Drug Use with Persistence of Violent Offending in Young Adulthood. *Journal of Developmental and Life-Course Criminology*, 1(3), 289–303.  
<https://doi.org/10.1007/s40865-015-0015-0>
- White, G. F., Gainey, R. R., & Triplett, R. A. (2015b). Alcohol Outlets and Neighborhood Crime: A Longitudinal Analysis. *Crime & Delinquency*, 61(6), 851–872.  
<https://doi.org/10.1177/0011128712466386>
- White, H. R., & Gorman, D. M. (2000). Dynamics of the drug-crime relationship. *Criminal*

- Justice*, 1(15), 1-218.
- White, H. R., Lee, C., Mun, E.-Y., & Loeber, R. (2012). Developmental Patterns of Alcohol Use in Relation to the Persistence and Desistance of Serious Violent Offending Among African American and Caucasian Young Men. *Criminology*, 50(2), 391–426.  
<https://doi.org/10.1111/j.1745-9125.2011.00263.x>
- White, H. R., Tice, P. C., Loeber, R., & Stouthamer-Loeber, M. (2002). Illegal Acts Committed by Adolescents Under the Influence of Alcohol and Drugs. *Journal of Research in Crime and Delinquency*, 39(2), 131–152. <https://doi.org/10.1177/002242780203900201>
- Wuthnow, R. (2018). *The Left Behind: Decline and Rage in Rural America*. Princeton University Press. <https://doi.org/10.23943/9781400889501>
- Yukse, D. A., & Solakoglu, O. (2016). The Relative Influence of Parental Attachment, Peer Attachment, School Attachment, and School Alienation on Delinquency among High School Students in Turkey. *Deviant Behavior*, 37(7), 723–747.  
<https://doi.org/10.1080/01639625.2015.1062683>
- Zhong, S., Yu, R., & Fazel, S. (2020). Drug Use Disorders and Violence: Associations With Individual Drug Categories. *Epidemiologic Reviews*, 42(1), 103–116.  
<https://doi.org/10.1093/epirev/mxaa006>
- Zimmerman, G. M. (2010). Impulsivity, Offending, and the Neighborhood: Investigating the Person–Context Nexus. *Journal of Quantitative Criminology*, 26(3), 301–332.  
<https://doi.org/10.1007/s10940-010-9096-4>
- Zimring, F. E., & Hawkins, G. (1999). *Crime Is Not the Problem: Lethal Violence in America*. Oxford University Press.