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Exploring Relationships Between Delinquent Peer Groups, Participation in Delinquency, Substance Abuse, and Injecting Drug Use Among the Incarcerated: Findings From a National Sample of State and Federal Inmates in the United States

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Abstract

The following study assesses the relationship between affiliating with delinquent peer groups, participation in delinquency, and several substance misuse and injecting drug use outcomes in a nationally representative sample of inmates in state and federal facilities in the United States. After controlling for potential confounders, affiliating with peers who engaged in deviant behaviors and participation in delinquency was associated with onset of alcohol and illicit drug use, substance dependence, alcohol dependence, types of substances used, and injecting drug use outcomes. Inmates who began engaging in delinquency at older ages reported initiating drug and alcohol use at older ages, and were less likely to meet the criteria for drug abuse or dependence, less likely to use substances daily or near daily, and less likely to report having ever injected or shared syringes. The implications of these findings for substance abuse, HIV, and crime prevention interventions are discussed.

Keywords

peer effects; substance use; adolescent

Introduction

The influences of peer groups are among the most widely supported predictors of increased risk of substance abuse in social science and public health literature (Barnow, Schultz, Lucht, Ulrich, Preuss, & Freyberger, 2004; Bauman & Ennett, 1996; Beman, 1995; Ennett, Bauman, Hussong, Faris, & Foshee, 2006; Gardner & Steinberg, 2005; Hamil-Luker, Land, & Blau, 2004; Lundborg, 2006; Simons-Morton & Chen, 2006; Sussman, Skara, & Ames, 2008; Fazel, Bains, & Doll, 2006). In 2013, nearly 10% (24.6 million) of Americans above the age of 12 reported recent use of an illicit drug (National Institute of Drug Abuse, 2015) compared with approximately 56% of state prisoners (Mumola & Karberg, 2006). In

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addition, research has reported that individuals who affiliate with deviant peer groups are more likely to participate in crime themselves (Akers, Krohn, Lanza-Kaduce & Radosevich, 1979, 2011; Carrington, 2009; Haynie & Osgood, 2005; Thornberry, Lizotte, Krohn, Farnworth, & Jang, 1994) and are disproportionally represented in incarcerated populations (Neff & Waite, 2007; Winfree, Mays, & Vigil-Bäckström, 1994). Compared with the general community, incarcerated populations have higher rates of people who inject drugs and rates of HIV infection (Cooper et al., 2016; Dolan et al., 2015). Despite mounting studies, little is known surrounding how deviant peer groups affect the types of substances used, onset of substance use, alcohol dependence, and injecting drug use. To address these gaps, the following study assesses the relationship between affiliating with delinquent peer groups, co-offending and several substance misuse, and injecting drug use outcomes in a nationally representative sample of inmates in state and federal facilities in the United States. Findings from this study will inform substance abuse prevention interventions for a social group that is disproportionately affected by the burden of substance abuse in the United States.

Background

Literature Review

Co-offending—Broad empirical evidence suggests that individual delinquent behaviors and substance use occur within the context of other peers (Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2006; Reiss, 1988; Reiss & Farrington, 1991; Rice, Milburn, Rotheram-Borus, Mallett, & Rosen-thal, 2005; Van Mastrigt & Farrington, 2009, 2011), and that participation in delinquency is a significant predictor of substance abuse (Huizinga, Loeber, & Thornberry, 1994; McCord & Conway, 2002; McGloin & Piquero, 2009a, 2009b; McGloin & Stickle, 2011; McGloin, Sullivan, Piquero, & Bacon, 2008). Moreover, research suggests that individuals tend to engage in similar crimes as their peers and have similar levels of criminal experience (Agnew, 1991; Elliott, Huizinga, & Ageton, 1985; Fagan, Piper, & Moore, 1986). McCord and Conway (2002) found that nonviolent first-time offenders who engage in violence with peers are more likely to engage in subsequent acts of violent crime following participation in violence with their peers. Moreover, studies have found that affiliating with deviant peers predicts earlier onset of individual experimentation with drugs and alcohol use (Garnier & Stein, 2002) as well as progression to chronic patterns of substance misuse (Brook et al., 2013).

Developmental and social learning theories—Empirical inquiry into the effects of peer groups during adolescence on substance misuse in adulthood is supported by developmental and social learning theoretical frameworks. Developmental theories of human behavior hypothesize that adolescence is a window of vulnerability through which associating with deviant peer groups confers the greatest risk of substance misuse and other behavioral problems (Carrington, 2009; Duan, Chou, Andreeva, & Pentz, 2009; Elliott & Menard, 1996; Ferguson & Meehan, 2011; Kandel, 1985; Keenan, Loeber, Zhang, Stouthamer-Loeber, & van Kammen, 1995; Sampson & Laub, 2005b; Thornberry et al., 1994). Specifically, most studies find that the effects of deviant peer groups are greatest in early- to mid-adolescence between the ages of 12 and 18 in which youth are most likely to participate in delinquency with other peers (Fergusson, Swain-Campbell, & Horwood, 2002;

Sampson & Laub, 2003), and engage in risky and reckless behaviors (Doremus-Fitzwater, Varlinskaya, & Spear, 2010; Gardner & Steinberg, 2005; Steinberg, 2008).

For instance, Fergusson et al. (2002) observed the strongest relationship between delinquent peer group affiliation and marijuana and alcohol abuse for participants between the ages of 14 and 15 compared with participants who were 20 to 21 years of age. Moreover at earlier developmental stages, Monahan, Steinberg, and Cauffman (2009) found no effect of affiliating with delinquent peers on substance abuse during adulthood for participants who were younger than 12. These studies converge with extant literature suggesting that the progression of peer group influence on substance abuse and delinquency follows a normative social developmental temporal process from antisocial behavior to conformity closely resembling the age–crime curve (Elliott, Huizinga, & Menard, 1989; Elliott & Menard, 1996; Moffitt, 1993, 1997; Sampson & Laub, 2005a; Steinberg, 2008; Stolzenberg & D'Alessio, 2008; Warr, 1993). In addition, Monahan (2014) found that delinquency most often preceded the onset of illicit drug use and youth progress from single acts to co-occurring problem behaviors.

In addition to developmental perspectives, social learning theories are supported by extant literature as an empirically validated theoretical framework for explaining the underlying mechanisms through which peer groups affect deviant behaviors and substance abuse (Akers & Jensen, 2006; Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979; Bandura, 1977; Duan et al., 2009; Neff & Waite, 2007; Simons, Conger, & Whitbeck, 1988). The fundamental proposition of social learning theory is that associating and interacting with peers facilitate the acquisition of attitudes, norms, and values conducive to deviance and substance abuse (Akers & Lee, 1996, 1999; Burgess & Akers, 1966). Affiliating with delinquent peers increases the risk of activating positive outcome expectancies associated with illicit drug and alcohol use (Bandura, 1977). If an individual expects the potential rewards of a behavior to exceed the potential negative consequences, then the likelihood of the behavior increases (Akers & Jensen, 2006, 2011). In addition, social learning theory presumes that the amount of time spent with delinquent peers and the number of peer group delinquent activities increase the likelihood of substance abuse similar to a dose–response relationship. In a study of more than 1.4 million Swedish probationers, Kendler, Ohlsson, Sundquist, and Sundquist (2014) identified a strong dose–response relationship between exposure to peer deviance and drug abuse in which each percentage increase in peer deviance increased the hazard ratio for drug abuse 1.32-fold after adjusting for family factors, genetic vulnerability, and demographic factors.

Deviant peers and alcohol—In addition to illicit drug use, empirical studies support a relationship between affiliating with delinquent peers during adolescence and alcohol use (Bahr et al, 1995; Dishion & Loeber, 1985; Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010; Kremer & Levy, 2008; Real & Rimal, 2007). For instance, Barnow et al. (2004) found that peer group delinquency and alcohol expectancies predicted alcohol problems above and beyond the effects of age, sex, individual aggressive/delinquent behaviors, and family history of alcohol use. In mediational models, the effects of individual alcohol expectancies and aggression on drinking behaviors were primarily mediated through peer delinquency and substance abuse.

Deviant peers and injecting drug use—Beyond the consumption of drugs, extant literature suggests that the social contexts of peer groups and networks are influential determinants of injecting drug use and syringe sharing (De, Cox, Boivin, Platt, & Jolly, 2007; Fuller et al., 2005; Latkin, For-man, Knowlton, & Sherman, 2003; Latkin, Kuramoto, Davey-Rothwell, & Tobin, 2010; Latkin et al., 1995; Neaigus et al., 2006). The transition from other routes of administration to injecting is influenced by social learning processes facilitated through affiliating with peer groups that confer the skills necessary to prepare injecting equipment for consumption (Bandura, 1994; Friedman et al., 1988). Bailey et al. (2007) found that peer norms surrounding injection drug use increased risk of receptive syringe sharing in a large urban sample of young people who inject drugs. Despite a growing interest in social network analysis among delinquent youth, the inclusion of delinquent peer groups and participation in delinquency have remained largely absent from studies examining early predictors of injecting drug use.

Criminal justice settings deviant peer groups and substance abuse outcomes—Incarceration provides a fertile setting for the concentration of many social problems, including criminal behaviors, substance abuse, and injection drug use (Fazel et al., 2006). The prevalence of substance abuse among inmates is significantly higher compared with general populations. It is estimated that more than half of all inmates in state and federal facilities in the United States meet the criteria for substance dependence disorders (Karberg & James, 2005). In addition to high rates of substance abuse, incarcerated settings provide opportunities for inmates to fortify social ties and networks with peer groups that are engaged in delinquency and high rates of criminal behaviors (Dunham & Lobos, 2015; Lambie & Randell, 2013; Walters, 2015). The social bonds afforded by peer groups in prison can offer opportunities to engage in substance misuse and injection drug use behaviors (Cusick, Havlicek, & Courtney, 2012; Fazel et al., 2006).

Gaps in the literature—Although the body of literature elucidating the impact of deviant peers, participation in delinquency, and substance misuse among inmates is expanding and insightful, there are several important gaps that are addressed by this study. First, there is a dearth of literature examining which types of peer delinquent activities are associated with substance misuse outcomes in adulthood. Second, extant literature traditionally focuses on broad categories of substance misuse outcomes or a single illicit drug rather than including several different types of illicit drugs. Third, few studies have examined the impact of deviant peer groups on the age of onset of illicit drugs and alcohol. Fourth, there is a lack of research on delinquent peer group influences on substance use outcomes in incarcerated populations. Fifth, few studies have tested hypotheses surrounding the impact of peer group deviance, participation in delinquency, and alcohol dependence. Finally, no studies to date have focused on the impact of affiliating with delinquent peers, participation in delinquency, and injecting drug use.

A deeper understanding of the correlates of substance misuse problems among the incarcerated could inform and enrich social interventions to prevent the onset and progression of substance use as well as injecting drug use in a population that is disproportionately affected by substance use problems. In the United States and

internationally, incarcerated populations are at a heightened risk of HIV based upon a myriad of intersecting risk factors, including substance misuse, injecting drug use, structural disadvantage, sexual risk, and other factors (Flanigan & Beckwith, 2011; Jürgens, Nowak, & Day, 2011; Stephenson, Wohl, Golin, & Tien, 2005; Wohl, Rosen, & Kaplan, 2006). Therefore, there is a critical need for additional research to inform HIV and substance abuse prevention interventions for inmates with substance use problems in the United States. To address these gaps in the literature, this study aims to investigate the effects of growing up with deviant peer groups and participation in delinquency on substance abuse and injecting drug use outcomes.

Method

Using a large nationally representative sample of inmates in the United States, this study examines the association between affiliating with deviant peer groups, participation in delinquency, and the following outcomes: (a) age of first illicit drug use, (b) age of first alcohol use, (c) meeting the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) criteria for substance dependence or abuse in the year prior to arrest, (d) meeting the *DSM-IV* criteria for alcohol dependence in the year prior to arrest, (e) daily or near daily use of substances (marijuana, cocaine, crack, heroin, and methamphetamines) in the month prior to arrest, and (f) lifetime injecting drug use (heroin, cocaine, or methamphetamines, and sharing syringes).

Study Design and Sample

Data consist of the cross-sectional nationally representative 2004, Survey of Inmates in State and Federal Facilities in the United States (The Interuniversity Consortium for Political and Social Research [ICPSR], 2004). Data collection entailed computer-assisted interviews involving questions on prior criminal history, demographic characteristics, gun possession, participation in delinquent activities while growing up, peer group delinquency, incident characteristics, prior substance abuse, mental health, and many other criminological variables. In the first stage, the design used a randomized stratified systematic sampling design that involved 287 state and 29 federal facilities. The second stage drew a random sample from these facilities of 14,499 state and 3,686 federal inmates. Dropping inmates based on missing data and prespecified exclusion criteria resulted in a final sample size of 16,046 inmates.

Variables

Onset of illicit drug and alcohol use—Inmates were asked how old they were when they first started using any illicit drugs or alcohol.

Substance use disorders and alcohol dependence—Respondents were assessed for substance abuse disorders and alcohol dependence using two batteries of questions that mirrored the diagnostic criteria set forth by the *DSM-IV* (APA, 2000). Using these question items, two dichotomous variables were created measuring (a) *substance dependence* if three or more items were endorsed on the substance abuse subset of questions, and (b) *alcohol dependence* if three or more items were endorsed on the alcohol abuse questionnaire.

Daily use of types of substances—Ordinal response measures of substance use asked inmates during the year prior to incarceration how often they had used marijuana, heroin, methamphetamine, crack, and powder cocaine. These variables were dichotomized to reflect daily or near daily use of each substance. Inmates who reported using less than almost daily or not at all were coded with a “0.”

Injection drug use—Inmates indicated if they had ever injected methamphetamines, cocaine, or heroin as well as having ever used a syringe that they suspected had been used by someone else.

Peer delinquency and participation—Respondents were asked if while growing up they had friends who (a) destroyed or damaged property; (b) used drugs; (c) sold stolen property; (d) stole motor parts or parts from motor vehicles; (e) broke into homes or other buildings; (f) mugged, robbed, or extorted; (g) destroyed or damaged property; (h) shoplifted; and (i) any other illegal activity. Inmates were also asked if while growing up they engaged in any delinquent acts with their peers and at which age they first engaged in delinquency with their peers.

Socioeconomic variables—Covariates included unemployment at arrest (including part-time, occasional work, and no work), a dichotomous variable measuring less than a high school degree, a continuous variable for age, male sex, race, and ethnicity.

Analyses

The data file was converted from SAS to STATA SE Version 13 for statistical analysis using StatTransfer. In preliminary analyses, no multicollinearity between study variables was identified using variance inflation factor (VIF; 1.25) and tolerance methods (.10; results are available upon request). The VIF and tolerance methods are widely regarded as the standard for statistical evaluation of multicollinearity (Graham, 2003; Liao & Valliant, 2012; Lin, 2008). When performing descriptive and multivariable analyses, it is necessary to correct for the stratified probability sampling strategy used in this dataset otherwise *p* values and standard error terms will be inflated; thus, increasing the likelihood of a Type I error (Lee & Forthofer, 2005; Rabe-Hesketh & Skrondal, 2008).

In this study, sampling weights provided by the publically available dataset were applied to take into account the stratified sampling design, and corrected estimates were retrieved for all descriptive results, bivariate tests, parameter estimates, confidence intervals (CIs), and standard errors (DOJ, 2004). Descriptive statistics included weighted proportions and means as well as bivariate regressions to test for statistically significant differences between primary peer delinquency and participation predictor variables and substance abuse outcomes. The first set of multivariable models examined the impact of different types of peer group delinquency, and participation on substance abuse outcomes and injecting drug use and controlled for age, employment status, sex, race, and education. The second set of models used the number of different types of delinquent peer group activities as the primary predictor variable and controlled for participation in delinquency, age, employment status, sex, race, and education. The third set of models examined age of first engaging delinquent

behaviors as the primary predictor variable and controlled for age, employment status, sex, race, and education. This set of models restricted the sample to only inmates who reported having peers who engaged in delinquency and having participated in delinquency (8,667). In the set of models corresponding to age of participation in delinquency and age of drug use, the sample was restricted to participants who reported having friends who engaged in delinquency, ever engaging in peer group delinquency, and ever using drugs ($n = 7,752$). In the set of models corresponding to age of participation in delinquency and age of alcohol use, the sample was restricted to participants who reported having friends who engaged in delinquency, ever engaging in peer group delinquency, and ever using drugs ($n = 8,241$). Wald F -test statistics and when appropriate r^2 values (for ordinary least squares [OLS] regressions) are provided to illustrate design-adjusted statistical significance and the amount of variance explained by predictor variables for each of the overall models.

Results

Descriptive Statistics

Table 1 provides a description of overall frequencies, means, and bivariate tests of statistical significance for peer group delinquency and participation, and substance use outcomes of age of first substance use, age of first alcohol use, substance abuse, alcohol dependency, and types of substances used.

Delinquent behaviors and participation—More than two thirds of inmates reported having friends who used drugs (67.02%; 10,004), and more than a third of the sample reported friends who shoplifted (33.09%; 4,655), destroyed or damaged property (33.09%; 4,655), sold stolen property (33.78%; 4,885), and sold imported or manufactured drugs (38.01%; 5,635). Less common types of peer delinquent behaviors consisted of breaking into homes or other buildings (30.59%; 4,317), engaging in muggings, robbery, or extortion (16.93%; 2,434), and other delinquency (2.70%; 393). The mean number of different types of delinquent peer behaviors was 2.98 ($SD = 0.02$). More than a half of inmates reported participating in delinquency with their peers (58.06%; 8,667), and the average age of first engaging in delinquent behaviors was 13.36 ($SD = 0.05$).

Age of onset of illicit drug and alcohol use—Among inmates who ever used illicit drugs ($n = 12,968$), the average age of first using illicit drugs was 16.88 ($SD = 0.05$), and among inmates who ever used alcohol (13,345), the average age of first use of alcohol was 15.88 ($SD = 0.03$).

Substance use disorders and alcohol dependence—More than a third of the sample met the *DSM-IV* criteria for substance dependence (35.66%; 5,774), and more than a quarter met the criteria for alcohol dependence (25.71%; 3,863).

Types of substances used—Table 2 presents design-adjusted summary statistics and bivariate analyses for peer group delinquency and types of substances used. Marijuana was the most commonly consumed drug on a daily or near daily basis (29.22%; 4,310), followed by crack cocaine (8.36%; 1,471), powder cocaine (8.04%; 1,310), methamphetamines (7.63%; 1,287), and heroin (4.82%; 793).

Injection drug use—Table 3 presents design-adjusted summary statistics and bivariate analyses for peer group delinquency and injection drug use. Prevalence estimates were similar for inmates who reported having ever injected cocaine (10.11%; 1,641), methamphetamine (8.36%; 1,471), and heroin (10.93%; 1,743). Finally, the prevalence of having ever shared syringes (7.53%; 1,248) was less than the prevalence of the injecting drug use outcomes.

Multivariable Statistics

Table 4 reports adjusted odds ratios (AOR) from logistic and beta coefficients from OLS regression analyses examining the association between deviant peer groups, participation in peer group delinquency, and age of first use of substances and alcohol, substance dependence and alcohol dependence.

Age of first use of drugs and alcohol—Growing up with peers who used drugs ($B = -2.08$; $CI = [-2.04, -1.74]$; $p < .001$) and participation in any delinquent activities ($B = -1.42$; $CI = [-1.67, -1.17]$; $p < .001$) were significantly associated with a younger age of first using illicit drugs. Regarding alcohol use, growing up with friends who used drugs ($B = -0.84$; $CI = [-1.06, -0.62]$; $p < .001$); destroyed or damaged property ($B = -0.43$; $CI = [-0.62, -0.23]$; $p < .001$); shoplifted ($B = -0.53$; $CI = [-0.72, -0.34]$; $p < .001$); broke into homes or other buildings ($B = -0.31$; $CI = [-0.52, -0.11]$; $p < .01$); sold, imported, or manufactured drugs ($B = -0.26$; $CI = [-0.43, -0.08]$; $p < .01$); engaged in mugging, robbing, or extortion ($B = -0.39$; $CI = [-0.59, -0.18]$; $p < .001$); and other delinquency ($B = -0.56$; $CI = [-0.98, -0.14]$; $p < .05$) were significantly associated with younger age of first alcohol use. In addition, inmates who started engaging in delinquent behaviors later in adolescence began using illicit drugs ($B = 0.34$; $CI = [0.31, 0.36]$; $p < .001$) and alcohol ($B = 0.25$; $CI = [0.23, 0.27]$; $p < .001$) at older ages. Inmates with peer groups that engaged in a greater number of types of delinquent behaviors started using illicit drugs ($B = -0.48$; $CI = [-0.52, -0.45]$; $p < .001$) and alcohol ($B = -0.41$; $CI = [-0.44, -0.38]$; $p < .001$) at younger ages than inmates who grew up with peer groups engaged in fewer types of delinquent behaviors.

Substance and alcohol dependence—Growing up with a peer group that used drugs (AOR = 2.47; $CI = [2.19, 2.80]$; $p < .001$); destroyed or damaged property (AOR = 1.15; $CI = [1.03, 1.28]$; $p < .05$); shoplifted (AOR = 1.28; $CI = [1.15, 1.41]$; $p < .01$); sold stolen property (AOR = 1.42; $CI = [1.26, 1.61]$; $p < .001$); broke into homes or other buildings (AOR = 1.24; $CI = [1.11, 1.39]$; $p < .001$); sold, imported, or manufactured drugs (AOR = 1.49; $CI = [1.35, 1.64]$; $p < .001$); and participated in delinquency (AOR = 1.81; $CI = [1.63, 2.00]$; $p < .001$) significantly increased the odds of meeting the criteria for substance abuse. For alcohol dependence, inmates were at increased odds if they grew up with friends who used drugs (AOR = 1.66; $CI = [1.46, 1.88]$; $p < .001$), destroyed or damaged property (AOR = 1.54; $CI = [1.38, 1.72]$; $p < .001$), broke into homes or other buildings (AOR = 1.22; $CI = [1.08, 1.38]$; $p < .001$), and participated in delinquency (AOR = 1.43; $CI = [1.28, 1.59]$; $p < .001$). Inmates who grew up with peers who stole motor vehicles or parts from motor vehicles were less likely to meet the criteria for dependence (AOR = 0.81; $CI = [0.72, 0.91]$, $p < .001$) and alcohol dependence (AOR = 0.85; $CI = [0.76, 0.96]$; $p < .05$). The greater number of types of delinquent peer group behaviors was significantly associated with

increased odds of substance dependence (AOR = 1.32; CI = [1.30, 1.34]; $p < .001$) and alcohol dependence (AOR = 1.19; CI = [1.18, 1.22]; $p < .001$). In addition, later age of first engaging in delinquent activities was associated with a decreased odds of substance dependence (AOR = 0.99; CI = [0.98, 0.99]; $p < .05$).

Table 5 reports results from adjusted logistic and OLS regression analyses examining the association between deviant peer groups, participation in peer group delinquency, and types of substances and injection drug use.

Types of substances—After adjusting for other variables, growing up with peers who used drugs was significantly associated with daily use of marijuana (AOR = 1.87; CI = [1.64, 2.13]; $p < .001$), crack cocaine (AOR = 2.28; CI = [1.86, 2.79]; $p < .05$), powder cocaine (AOR = 1.68; CI = [1.36, 2.07]; $p < .001$), heroin (AOR = 2.28; CI = [1.71, 3.06]; $p < .001$), and methamphet-amines (AOR = 1.93; CI = [1.52, 2.44]; $p < .001$). Furthermore, growing up with peers who engaged in shoplifting was at an increased odds of using crack cocaine (AOR = 1.28; CI = [1.09, 1.52]; $p < .01$), powder cocaine (AOR = 1.24; CI = [1.04, 1.48]; $p < .05$), and heroin (AOR = 1.38; CI = [1.11, 1.72]; $p < .05$). Growing up with peers who mugged, robbed, and extorted predicted a lower odds of using methamphetamines (AOR = 0.78; CI = [0.63, 0.96]; $p < .01$). Affiliating with peer groups that stole motor vehicles or parts from motor vehicles was associated with an increased odds of daily marijuana use (AOR = 1.16; CI = [1.03, 1.30]; $p < .05$) and metham-phetamine use (AOR = 1.24; CI = [1.03, 1.49]; $p < .05$) but decreased the odds of crack cocaine use (AOR = 0.80; CI = [0.68, 0.97]; $p < .05$). An increased odds of daily use of marijuana (AOR = 1.62; CI = [1.32, 1.67]; $p < .001$), powder cocaine (AOR = 1.45; CI = [1.23, 1.71]; $p < .001$), and methamphetamine (AOR = 1.52; CI = [1.28, 1.80]; $p < .05$) was observed for inmates who reported growing up with peers who sold, imported, or manufactured drugs.

Participation in any delinquent activities significantly predicted daily use of marijuana (AOR = 1.92; CI = [1.72, 2.15]; $p < .001$), crack cocaine (AOR = 1.47; CI = [1.24, 1.74]; $p < .001$), powder cocaine (AOR = 1.43; CI = [1.20, 1.71]; $p < .001$), heroin (AOR = 1.81; CI = [1.43, 2.30]; $p < .001$), and methamphetamines (AOR = 1.62; CI = [1.32, 1.67]; $p < .001$). The greater number of different types of delinquent peer behaviors was associated with increased odds of marijuana use (AOR = 1.22; CI = [1.20, 1.23]; $p < .001$), crack cocaine (AOR = 1.23; CI = [1.19, 1.25]; $p < .001$), powder cocaine (AOR = 1.24; CI = [1.21, 1.27]; $p < .001$), heroin (AOR = 1.26; CI = [1.22, 1.29]; $p < .001$), and methamphetamines (AOR = 1.17; CI = [1.14, 1.20]; $p < .001$). Finally, engaging in delinquency at older ages was associated with decreased odds of daily use of marijuana (AOR = .98; CI = [0.97, 0.99]; $p < .001$), crack cocaine (AOR = .97; CI = [0.96, 0.99]; $p < .001$), powder cocaine (AOR = 0.97; CI = [0.96, 0.99]; $p < .001$), and heroin (AOR = 0.98; CI = [0.96, 0.99]; $p < .05$).

Injecting drug use and syringe sharing—Inmates who reported growing up with peers who used illicit drugs were more likely to report ever having injected cocaine (AOR = 1.98; CI = [1.59, 2.46]; $p < .001$), heroin (AOR = 2.19; CI = [1.75, 2.74]; $p < .001$), methamphetamines (AOR = 1.93; CI = [1.52, 2.44]; $p < .001$), and ever shared syringes (AOR = 2.03; CI = [1.56, 2.64]; $p < .001$). Growing up with peers who shoplifted was associated with increased odds of injecting cocaine (AOR = 1.34; CI = [1.14, 1.58]; $p < .$

001), heroin (AOR = 1.38; CI = [1.11, 1.72]; $p < .001$), and having ever shared syringes (AOR = 1.55; CI = [1.28, 1.87]; $p < .001$). Inmates who grew up with peers who destroyed or damaged property were less likely to inject methamphet-amine (AOR = 0.80; CI = [0.68, 0.97]; $p < .05$) and heroin (AOR = 0.75; CI = [0.64, 0.87]; $p < .001$). Conversely, an increased likelihood of injecting heroin (AOR = 1.51; CI = [1.26, 1.81]; $p < .001$), cocaine (AOR = 1.39; CI = [1.16, 1.66]; $p < .001$), and sharing needles (AOR = 1.25; CI = [1.01, 1.55]; $p < .05$) was observed for inmates who grew up with peers who sold stolen property. Inmates who reported growing up with peers who broke into homes or other buildings were at an increased risk of injecting methamphetamines (AOR = 1.87; CI = [1.55, 2.26]; $p < .05$), heroin (AOR = 1.46; CI = [1.23, 1.71]; $p < .001$), cocaine (AOR = 1.45; CI = [1.23, 1.71]; $p < .001$), and sharing needles (AOR = 1.69; CI = [1.40, 2.04]; $p < .001$). A more modest effect was observed for the impact of selling, importing, or manufacturing drugs with significant associations observed for injecting methamphetamines (AOR = 1.31; CI = [1.11, 1.55]; $p < .01$), heroin (AOR = 1.19; CI = [1.02, 1.40]; $p < .05$), and cocaine (AOR = 1.37; CI = [1.17, 1.59]; $p < .001$). Growing up with peers who mugged, robbed, or extorted significantly predicted not only an increase in the odds of injecting heroin (AOR = 1.19; CI = [1.01, 1.40]; $p < .05$) but also a lower odds of injecting methamphetamine (AOR = 0.71; CI = [0.57, 0.87]; $p < .01$). Other delinquency predicted an increased odds of injecting methamphetamines (AOR = 1.68; CI = [1.20, 2.34]; $p < .001$).

Inmates who reported participating in delinquency with deviant peer groups were associated with increased odds of injecting cocaine (AOR = 2.10; CI = [1.76, 2.49]; $p < .001$), heroin (AOR = 2.28; CI = [1.90, 2.72]; $p < .001$), methamphetamines (AOR = 1.92; CI = [1.58, 2.33]; $p < .001$), and having ever shared needles (AOR = 2.79; CI = [2.25, 3.44]; $p < .001$). Peer groups that engaged in greater number of different types of delinquency were associated with an increased odds of injecting cocaine (AOR = 1.30; CI = [1.27, 1.33]; $p < .001$), heroin (AOR = 1.35; CI = [1.32, 1.28]; $p < .001$), and methamphetamines. Participating in delinquency at older ages was associated with a significantly lower likelihood of having ever injected cocaine (AOR = 0.95; CI = [0.94, 0.96]; $p < .001$), heroin (AOR = 0.94; CI = [0.93, 0.96]; $p < .001$), methamphetamine (AOR = 0.96; CI = [0.95, 0.98]; $p < .001$), and having ever shared syringes (AOR = 0.96; CI = [0.94, 0.97]; $p < .001$).

Discussion

Mounting empirical studies suggest that peer groups are influential in shaping the development of substance abuse problems and are important considerations in designing substance abuse prevention interventions (Burrow-Sanchez, 2006; Doremus-Fitzwater et al., 2010; Huizinga et al., 1994; Kaminer, 2013; Oetting & Lynch, 2006). Moreover, findings from this study contribute new insights to this topic by documenting that affiliating with peers engaged in different types of deviant behaviors and participation in delinquency are associated with several substance misuse outcomes (onset of alcohol and illicit drug use, substance use disorders, alcohol dependence, types of substances used, and injecting drug use) in a nationally representative sample of inmates in state and federal facilities in the United States. Major study findings provide insight into interventions and future research with incarcerated and other justice-involved populations in the United States.

A significant relationship was found between drug-related peer group delinquency and all of the substance abuse outcomes. Specifically, more than 80% of participants in all substance abuse outcomes reported growing up with peers who used illicit drugs. In addition, inmates who grew up with peers who sold imported or manufactured drugs, and broke into homes began using drugs at younger ages. Significant relationships were found between several additional types of peer group delinquency (destroying or damaging property, shoplifting, engaging in mugging, robbing, or extorting and other delinquency) and age of first alcohol use. Inmates who first engaged in delinquent activities with peers at older ages were more likely to begin using illicit drugs and alcohol at older ages, and less likely to meet the criteria for dependence and meet the criteria for alcohol dependence, report daily or near daily use of substances, and ever have injected drugs and shared syringes. Inmates who grew up with peers engaged in a greater number of different types of delinquent behaviors began using illicit drugs and alcohol at younger ages, and were at an increased odds of all substance abuse and injecting drug use outcomes. In addition to the behaviors of peers, participation in delinquency was one of the most influential predictors of all of the substance abuse and injecting drug use outcomes. Nearly three quarters of inmates participated in some form of delinquency, and participation in delinquency was significantly related to increased odds of all of the substance use outcomes.

Notwithstanding the important findings reported by this study, there are several limitations that warrant explication and provide fruitful avenues for future research. Overall, findings from this study are only generalizable to incarcerated populations and other justice-involved groups with similar backgrounds. In addition, the retrospective, cross-sectional design excludes causal or temporal inference for the parameter estimates presented in this study. As with all cross-sectional and retrospective research, there exists the potential for recall bias and underreporting particularly when measuring stigmatized behaviors such as deviant peer groups, participation in delinquency, and substance abuse. Nonetheless, the findings from this study present a compelling justification for community-based longitudinal studies to elaborate upon a temporal relationship between deviant peer groups, participation in delinquency, and substance abuse outcomes that is generalizable to the entire population of the United States as well as subpopulations of inmates in jails and prisons. Finally, this study relies upon a dataset that is rather old. The 2004 Survey of Inmates in State and Federal Facilities is the most recent wave of a nationally representative sample of imprisoned persons in the United States. However, in the years since completion of the original study, the population of inmates with substance use problems has continued to expand at unprecedented rates (Substance Abuse Mental Health Services Administration, 2015), thereby underscoring the importance and continued relevance of translating findings from this study and others using large inmate populations into behavioral substance abuse prevention interventions.

In addition to study design, limitations in the measurement of key predictor and outcome variables call for additional research. Specifically, the study questionnaire did not measure which types of delinquency inmates engaged in with their peers, thus precluding analysis of the effects of participating in specific types of delinquency with peers on substance misuse outcomes. Another limitation pertains to measuring injecting drug use as the questionnaire did not collect data on quantity of peer groups' delinquent behaviors, rather data were

collected on how many different *types* of delinquent behaviors were perpetrated by inmates' peer groups while growing up. Future research must examine both the number of types and individual acts of delinquency to gauge which behaviors are the strongest determinants of substance abuse outcomes later in life. Finally, the study questionnaire only measured lifetime injecting drug use and syringe sharing at the expense of including a measure of most recent injection and the quantity of injecting behaviors. In addition, given the fact that the question measured only lifetime injecting drug use, it is possible that a greater number of inmates ever injected than the prevalence of inmates using the illicit drug on a daily or near daily basis. This was the case for heroin in this study where a greater number of inmates reported ever injecting heroin than reported daily or near daily use.

Nonetheless, findings from this study give rise to important implications for designing substance abuse and HIV prevention interventions for incarcerated and other justice-involved populations. Data presented in this study suggest that targeting types of peer group delinquency, age of onset, and participation in delinquency may be beneficial to substance abuse and injection drug use prevention. Actuarial risk assessment instruments with youth should go deeper than simply asking questions about individual delinquency and delve into the types and quantity of peer group delinquency as well as age of onset of delinquent behaviors in the pursuit of identifying at-risk groups in need of additional services and resources. Moreover, targeting interventions focused on desistance from deviance and disengagement from delinquent peer groups to youth who engage in delinquency at younger ages may be protective and delay the progression of serious substance use problems. Finally, data on the genetic composition of inmates were not collected which prevented investigation into the complex interaction between genetic factors and the intervening effects of socioenvironmental stressors throughout the life course. Addiction is a chronic brain disorder that becomes exacerbated by social influences in the environment, and thus future research on this topic must include predisposing genetic factors alongside measures of individual and peer delinquency.

This study is among very few studies to examine the intersection between peer deviance, participation in delinquency, and injecting drug use. Moreover, this study is aligned with a trend in public health research to situate empirical research within the substance abuse–HIV nexus (O'Leary, 2001). Incarcerated populations bear a disproportionate burden of HIV infection, injecting drug use, and substance use problems compared with the general population (CDC, 2015; Fazel, 2006). Findings from this study suggest that peer group deviance and participation in delinquency are associated with HIV risk behaviors among the incarcerated in the United States. Therefore, future empirical inquiry is necessary that brings together sociobehavioral predictors such as delinquency with substance abuse and HIV risk behaviors. Specifically, findings from this study should prompt additional research examining if interventions to help justice-involved youth disengage from deviant peers and delinquency could promote HIV prevention by virtue of targeting early developmental precursors of injecting drug use.

Conclusion

Incarceration is one of the most serious contemporary social problems in the United States, and its intersection with substance abuse and HIV infection cannot be ignored. Giving data regarding rising injection and noninjection substance use among incarcerated and other justice-involved populations, there is a compelling need for empirical inquiry focusing on early developmental predictors of substance use problems. This is the first study to examine the association between deviant peer groups, delinquency, and injecting drug behaviors among incarcerated inmates in the United States. After controlling for potential confounders, findings from this study provide preliminary evidence that delinquent peer groups and participation in delinquency are significant risk factors for the onset of substance and alcohol use, development of substance use disorders, and injecting drug use.

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Biography

Phillip Marotta researches the impact of criminal justice involvement and delinquency on HIV drug and sexual risk factors, rates of infectious diseases, retention in care and engagement in behavioral HIV prevention interventions. Phillip's research focuses on how the intersection between individual level factors (trauma and injection drug use) and environmental factors (criminal justice involvement, drug laws and stigma) shape the social production of HIV infection, sexual risk behaviors and drug use. His populations of interest include people who inject drugs, labor migrants, and adolescents in the United States and globally.

Table 1

Weighted Design-Adjusted Descriptive Estimates and Bivariate Unadjusted Tests of Significance Between Peer Group Delinquency, Co-Offending, and Substance and Alcohol Misuse Among Inmates in the United States.

	Overall		Age first used drugs ($n = 12,968$) ^a		Age first used alcohol (13,345) ^b		Substance dependence ^c		Alcohol dependence ^c	
	% (n)	M (SD)	$B_{unadjusted}$	M (SD)	$B_{unadjusted}$	% (n)	OR	% (n)	OR	
Overall	NA	16.88 (0.05)	NA	15.88 (0.03)	NA	35.66 (5,774)	NA	25.71 (3,863)	NA	
While growing up had friends who...										
Used drugs	67.92 (10,004)	15.34 (0.05)	-4.36 *** [-4.64, -4.08]	15.16 (0.04)	-2.56 *** [-2.73, -2.39]	87.31 (4,880)	5.15 *** [4.69, 5.66]	82.29 (67,92)	2.74 *** [2.47, 3.02]	
Shoplifted	43.17 (6,558)	15.14 (0.06)	-2.53 *** [-2.71, -2.34]	14.75 (0.05)	-2.13 *** [-2.27, -1.98]	56.21 (4,530)	3.08 *** [2.90, 3.32]	57.15 (2,142)	2.41 *** [2.22, 2.62]	
Destroyed or damaged property	33.09 (4,655)	14.75 (0.06)	-2.31 *** [-2.51, -2.12]	14.51 (0.06)	-2.09 *** [-2.23, -1.94]	47.57 (2,425)	2.71 *** [2.51, 2.93]	48.22 (1,704)	2.15 *** [1.98, 2.33]	
Sold stolen property	33.78 (4,885)	14.83 (0.07)	-2.48 *** [-2.67, -2.29]	14.63 (0.06)	-1.81 *** [-1.96, -1.66]	50.47 (2,649)	3.13 *** [2.90, 3.38]	46.10 (1,663)	1.75 *** [1.61, 1.90]	
Stole motor vehicles or parts	31.95 (4,583)	14.74 (0.07)	-2.44 *** [-2.62, -2.25]	14.68 (0.06)	-1.94 *** [-2.09, -1.79]	43.98 (2,288)	2.32 *** [2.15, 2.51]	41.30 (1,494)	2.04 *** [1.88, 2.22]	
Broke into homes or other buildings	30.59 (4,317)	14.72 (0.07)	-2.46 *** [-2.65, -2.27]	14.50 (0.06)	-2.06 *** [-2.21, -1.91]	45.54 (2,327)	2.91 *** [2.69, 3.15]	43.72 (1,542)	2.21 *** [2.03, 2.40]	
Sold, imported, or manufactured drugs	38.01 (5,635)	14.71 (0.06)	-2.88 *** [-3.07, -2.70]	14.76 (0.05)	-1.88 *** [-2.03, -1.74]	54.82 (2,969)	3.02 *** [2.80, 3.25]	48.84 (1,819)	1.83 *** [1.68, 1.99]	
Engaged in mugging, robbing, or extorting	16.93 (2,434)	14.39 (0.08)	-2.41 *** [-2.60, -2.20]	14.32 (0.08)	-1.90 *** [-2.08, -1.73]	24.85 (1,296)	2.31 *** [2.10, 2.54]	23.42 (845)	1.78 *** [1.61, 1.96]	
Engaged in other delinquency	2.70 (393)	14.76 (0.26)	-1.63 *** [-2.15, -1.10]	14.20 (0.23)	-1.73 *** [-2.18, -1.28]	3.884 (203)	1.93 *** [1.55, 2.40]	3.40 (123)	1.39 *** [1.10, 1.76]	
Participate in delinquency	58.06 (8,744)	15.11 (0.05)	-3.67 *** [-3.90, -3.45]	14.95 (0.04)	-2.45 *** [-2.60, -2.30]	77.74 (4,287)	3.91 *** [3.60, 4.24]	72.96 (2,725)	2.40 *** [2.20, 2.62]	
Mean number of delinquent acts (SD)	2.98 (0.02)	NA	-0.65 *** [-0.69, -0.62]	NA	-0.48 *** [-0.51, 0.45]	4.19 (0.04)	1.29 *** [1.28, 1.31]	3.94 (0.05)	1.18 *** [1.17, 1.20]	
Age started engaging in these activities (SD ; $n = 8,667$) <i>d,e,f</i>	13.36 (0.05)	NA	0.38 *** [0.35, 0.40]	NA	0.26 *** [0.25, 0.29]	13.20 (0.08)	0.98 *** [0.97, 0.99]	13.16 (0.09)	0.99 [0.97, 1.00]	

Note: OR = odds ratio.

^a Sample is restricted to only inmates who ever reported using any illicit drug.

^b Inmates who reported ever drinking alcohol.

^c In year prior to arrest.

Participants who ever engaged in peer group delinquency.
 $n = 7,752$ for age first engaged in delinquency and age first used drugs.
 $n = 8,241$ for age first engaged in delinquency and age first used drugs.
 $p < .05$.
 $p < .01$.
 $p < .001$.

Weighted Design-Adjusted Descriptive Estimates and Bivariate Unadjusted Tests of Significance Between Peer Group Delinquency, Co-Offending, and Types of Substances Misuse Outcomes Among Inmates in the United States.

Table 2

	Marijuana ^a		Crack ^a		Cocaine ^a		Heroin ^a		Methamphetamine ^a	
	% (n)	OR	% (n)	OR	% (n)	OR	% (n)	OR	% (n)	OR
Overall	29.22 (4,310)	NA	8.36 (1,471)	NA	8.04 (1,310)	NA	4.82 (793)	NA	7.63 (1,287)	NA
While growing up had friends who...										
Used drugs	87.88 (3,733)	4.90 *** [4.40, 5.44]	84.57 (1,186)	2.81 *** [2.40, 3.29]	85.84 (1,091)	3.13 *** [2.64, 3.72]	87.08 (670)	3.32 *** [2.65, 4.18]	87.10 (1,085)	3.43 *** [2.85, 4.12]
Shoplifted	55.39 (4,992)	2.41 *** [2.23, 2.61]	61.00 (857)	1.62 *** [1.43, 1.83]	63.60 (797)	2.05 *** [1.80, 2.32]	63.63 (488)	1.62 *** [1.32, 1.90]	58.93 (714)	1.78 *** [1.57, 2.04]
Destroyed or damaged property	47.76 (1,911)	2.47 *** [2.28, 2.67]	43.36 (547)	2.19 *** [1.94, 2.48]	48.87 (561)	2.42 *** [2.13, 2.75]	43.82 (311)	2.40 *** [2.03, 2.83]	45.72 (516)	1.99 *** [1.75, 2.27]
Sold stolen property	46.31 (1,268)	2.64 *** [2.44, 2.86]	50.08 (651)	1.53 *** [1.34, 1.73]	54.89 (649)	2.12 *** [1.86, 2.40]	55.46 (412)	2.48 *** [1.79, 3.47]	47.83 (554)	1.77 *** [1.55, 2.01]
Stole motor vehicles or parts	48.02 (1,950)	2.72 *** [2.72, 2.51]	41.02 (527)	2.07 *** [1.83, 2.34]	48.53 (577)	2.54 *** [2.24, 2.88]	47.78 (350)	2.12 *** [1.52, 2.97]	44.24 (512)	1.89 *** [1.66, 2.16]
Broke into homes or other buildings	44.76 (1,799)	2.46 *** [2.27, 2.67]	43.88 (555)	1.86 *** [1.65, 2.11]	48.92 (572)	2.28 *** [2.01, 2.59]	46.18 (338)	2.02 *** [1.71, 2.37]	43.65 (493)	1.85 *** [1.62, 2.11]
Sold, imported, or manufactured drugs	59.67 (2,477)	3.61 *** [3.33, 3.91]	50.48 (675)	1.74 *** [1.54, 1.97]	58.44 (709)	2.46 *** [2.16, 2.79]	53.96 (411)	1.97 *** [1.68, 2.32]	53.44 (657)	1.98 *** [1.73, 2.25]
Engaged in mugging, robbing, or extorting	27.76 (1,132)	2.70 *** [2.45, 2.97]	25.50 (335)	1.77 *** [1.53, 2.04]	29.09 (342)	2.14 *** [1.86, 2.48]	28.67 (209)	2.05 *** [1.71, 2.47]	17.76 (208)	1.06 [0.90, 1.26]
Engaged in other delinquency	38.62 (145)	1.54 *** [1.24, 1.93]	9.89 (47)	1.23 [0.87, 1.74]	12.17 (49)	1.57 ** [1.13, 2.18]	6.48 (28)	1.38 [0.89, 2.14]	14.91 (56)	2.18 *** [1.61, 2.97]
Participate in delinquency	79.88 (3,362)	4.12 *** [3.77, 4.51]	74.04 (1,025)	2.18 *** [1.91, 2.50]	76.71 (962)	2.57 *** [2.23, 2.97]	78.69 (598)	2.78 *** [2.30, 3.37]	79.12 (969)	2.94 *** [2.52, 3.42]
Mean number of delinquent acts (SD)	4.28 (0.04)	1.27 *** [1.26, 1.29]	4.04 (0.08)	1.16 *** [1.13, 1.18]	4.42 (0.09)	2.54 *** [2.20, 2.94]	4.30 (0.11)	1.19 *** [1.16, 1.22]	4.04 (0.09)	1.15 *** [1.13, 1.18]
Age started engaging in these activities (SD, n = 8,667)	12.87 (0.08)	0.96 *** [0.95, 0.98]	13.29 (0.17)	0.99 [0.98, 1.01]	12.88 (0.17)	0.98 ** [0.96, 0.99]	13.22 (0.21)	0.99 [0.97, 1.01]	13.01 (0.17)	0.98 * [0.97, 0.99]

Note. OR = odds ratio.

^aDaily or near daily illicit drug use.

^bParticipants who ever engaged in peer group delinquency.

^cn = 7,752 for age first engaged in delinquency and age first used drugs.

^dn = 8,241 for age first engaged in delinquency and age first used drugs.

* p < .05.

** p < .01.

*** p < .001

Table 3

Weighted Design-Adjusted Descriptive Estimates and Bivariate Test of Significance Between Peer Group Delinquency, Co-Offending, and Injecting Drug Use Outcomes.

	Inject cocaine ^d			Inject meth ^d			Inject heroin ^d			Shared needles ^d		
	% (n)	OR	% (n)	OR	% (n)	OR	% (n)	OR	% (n)	OR	% (n)	OR
Overall	10.11 (1,641)	NA	7.85 (1,282)	NA	10.93 (1,743)	NA	7.53 (1,248)	NA	7.53 (1,248)	NA	7.53 (1,248)	NA
While growing up had friends who...												
Used drugs	86.82 (1,394)	3.39 *** [2.89, 3.97]	87.07 (1,093)	3.58 *** [3.06, 4.19]	87.20 (1,489)	3.39 *** [2.89, 3.97]	88.60 (1,084)	3.96 *** [3.25, 4.82]	88.60 (1,084)	3.96 *** [3.25, 4.82]	88.60 (1,084)	3.96 *** [3.25, 4.82]
Shoplifted	64.35 (1,012)	1.86 *** [1.64, 2.12]	61.62 (7,533)	1.89 [1.69, 2.12]	66.32 (1,116)	1.93 *** [1.73, 2.17]	68.96 (830)	2.16 *** [1.90, 2.47]	68.96 (830)	2.16 *** [1.90, 2.47]	68.96 (830)	2.16 *** [1.90, 2.47]
Destroyed or damaged property	46.87 (676)	2.25 *** [1.97, 2.57]	46.46 (537)	2.91 *** [2.59, 3.27]	46.51 (721)	2.59 *** [2.30, 2.90]	50.13 (551)	3.19 *** [2.77, 3.66]	50.13 (551)	3.19 *** [2.77, 3.66]	50.13 (551)	3.19 *** [2.77, 3.66]
Sold stolen property	53.26 (795)	1.78 *** [1.56, 2.02]	48.56 (571)	2.28 *** [2.04, 2.55]	56.31 (908)	1.89 *** [1.69, 2.13]	56.46 (648)	2.30 *** [2.02, 2.62]	56.46 (648)	2.30 *** [2.02, 2.62]	56.46 (648)	2.30 *** [2.02, 2.62]
Stole motor vehicles or parts from motor vehicles	45.47 (676)	1.96 *** [1.72, 2.23]	44.14 (524)	2.87 *** [2.56, 3.21]	49.24 (787)	2.44 *** [2.18, 2.74]	50.20 (576)	2.76 *** [2.42, 3.15]	50.20 (576)	2.76 *** [2.42, 3.15]	50.20 (576)	2.76 *** [2.42, 3.15]
Broke into homes or other buildings	50.77 (757)	2.65 *** [2.32, 3.00]	51.52 (593)	2.78 *** [2.48, 3.11]	51.91 (832)	2.57 *** [2.29, 2.88]	55.13 (615)	3.06 *** [2.69, 3.50]	55.13 (615)	3.06 *** [2.69, 3.50]	55.13 (615)	3.06 *** [2.69, 3.50]
Sold, imported, or manufactured drugs	53.83 (843)	1.81 *** [1.59, 2.05]	51.51 (644)	2.03 *** [1.81, 2.27]	53.41 (897)	2.03 *** [1.81, 2.27]	53.66 (647)	1.99 *** [1.75, 2.27]	53.66 (647)	1.99 *** [1.75, 2.27]	53.66 (647)	1.99 *** [1.75, 2.27]
Engaged in mugging, robbing, or extorting	23.02 (356)	1.02 [0.86, 1.22]	17.28 (210)	1.95 *** [1.71, 2.22]	25.33 (300)	1.55 *** [1.35, 1.77]	25.33 (300)	1.75 *** [1.50, 2.04]	25.33 (300)	1.75 *** [1.50, 2.04]	25.33 (300)	1.75 *** [1.50, 2.04]
Engaged in other delinquency	14.31 (63)	2.10 *** [1.55, 2.85]	14.93 (59)	1.74 *** [1.31, 2.30]	17.31 (74)	1.47 * [1.08, 2.00]	11.27 (55)	1.58 *** [1.14, 2.21]	11.27 (55)	1.58 *** [1.14, 2.21]	11.27 (55)	1.58 *** [1.14, 2.21]
Participate in delinquency	80.45 (1,274)	3.30 *** [2.83, 3.86]	80.81 (1,000)	3.48 *** [3.04, 3.99]	81.12 (1,366)	3.29 *** [2.87, 3.77]	84.66 (1,009)	4.35 *** [3.67, 5.16]	84.66 (1,009)	4.35 *** [3.67, 5.16]	84.66 (1,009)	4.35 *** [3.67, 5.16]
Mean number of delinquent acts	4.28 (0.07)	1.20 *** [1.18, 1.22]	4.13 (0.08)	1.17 *** [1.15, 1.19]	4.41 (0.07)	1.22 *** [1.20, 1.25]	4.53 (0.08)	1.23 *** [1.21, 1.26]	4.53 (0.08)	1.23 *** [1.21, 1.26]	4.53 (0.08)	1.23 *** [1.21, 1.26]
Age started engaging in these activities (<i>SD</i> : <i>n</i> = 8,667) ^b	12.52 (0.15)	.96 *** [0.94, 0.97]	12.42 (0.17)	0.95 *** [0.94, 0.97]	12.56 (0.15)	0.96 *** [0.95, 0.97]	12.42 (0.17)	0.96 *** [0.95, 0.98]	12.42 (0.17)	0.96 *** [0.95, 0.98]	12.42 (0.17)	0.96 *** [0.95, 0.98]

Note. OR = odds ratio.

^aParticipants who ever engaged in peer group delinquency.

^bEver in lifetime.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

Table 4

Design-Adjusted Multivariable Parameter Estimates of Adjusted Odds Ratios (AOR) for Peer Group Delinquency Variables, Participation in Delinquency, and Substance and Alcohol Misuse Outcomes.

	Age first used substances (<i>n</i> = 12,968) ^a	Age first started drinking (<i>n</i> = 13,345) ^b	Substance dependence ^c	Alcohol dependence ^c
	<i>B</i> _{adjusted}	<i>B</i> _{adjusted}	AOR	AOR
While growing up did you have friends who... (<i>n</i> = 16,042) ^d				
Used drugs	-2.08*** [-2.04, -1.74]	-0.84*** [-1.06, -0.62]	2.47*** [2.19, 2.80]	1.66*** [1.46, 1.88]
Destroyed or damaged properties	-0.08 [-0.41, 0.04]	-0.43*** [-0.62, -0.23]	1.15* [1.03, 1.28]	1.54*** [1.38, 1.72]
Shoplifted	-0.19 [-0.42, 0.04]	-0.53*** [-0.72, -0.34]	1.28*** [1.15, 1.41]	1.11 [0.99, 1.24]
Stole motor vehicles or parts from motor vehicles	-0.17 [-0.39, 0.05]	0.01 [-0.20, 0.22]	0.81*** [0.72, 0.91]	0.85* [0.76, 0.96]
Sold stolen property	0.02 [-0.23, 0.27]	0.01 [-0.20, 0.23]	1.42*** [1.26, 1.61]	1.08 [0.95, 1.23]
Broke into homes or other buildings	-0.33** [-0.57, -0.09]	-0.31** [-0.52, -0.11]	1.24*** [1.11, 1.39]	1.22*** [1.08, 1.38]
Sold, imported, or manufactured drugs	-0.54*** [-0.74, -0.34]	-0.26** [-0.43, -0.08]	1.49*** [1.35, 1.64]	1.09 [0.98, 1.21]
Engaged in mugging, robbing, or extorting	-0.21 [0.43, 0.019]	-0.39*** [-0.59, -0.18]	0.81*** [0.72, 0.91]	1.12 [0.98, 1.27]
Engaged in other delinquency	-0.16 [-0.64, 0.33]	-0.56* [-0.98, -0.14]	1.10 [0.86, 1.39]	0.95 [0.74, 1.21]
Participate in any delinquent activities	-1.42*** [-1.67, -1.17]	-0.98*** [-1.17, -0.79]	1.81*** [1.63, 2.00]	1.43*** [1.28, 1.59]
<i>F</i> test	153.31***	124***	105.14***	51.58***
<i>R</i> ²	.25	.16	NA	NA
Mean number of types of peer group delinquent acts (<i>n</i> = 16,042) ^e	-0.48*** [-0.52, -0.45]	-0.41*** [-0.44, -0.38]	1.32*** [1.30, 1.34]	1.19*** [1.18, 1.22]
<i>F</i> test	282.93***	237.63***	203.72***	95.22***
<i>R</i> ²	.21	.14	NA	NA
Age when first engaged in these activities (<i>n</i> = 8,667) ^{d,f,g,h}	0.34*** [0.31, 0.36]	0.25*** [0.23, 0.27]	0.99* [0.98, 0.99]	0.99 [0.98, 1.00]
<i>F</i> test	154.99***	89.75***	42.89***	17.02***
<i>R</i> ²	.21	.13	NA	NA

^a *n* = 12,968 inmates who ever reported using any illicit drug.

^b *n* = 13,345 inmates who reported ever drinking alcohol.

^c Year prior to arrest.

^d Adjusted for full-time employment race, less than high school degree, age, male sex, and education.

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Adjusted for participation in delinquency, full-time employment race, unemployment, less than high school degree, age, male sex, education.
 e
 f $n = 8,667$ participants who ever engaged in peer group delinquency.
 g $n = 7,752$ participants who ever used drugs and ever engaged in delinquent activities with peers.
 h $n = 8,241$ participants who ever used drugs and ever engaged in delinquent activities with peers.

Design-Adjusted Multivariable Parameter Estimates of Adjusted Odds Ratios (AOR) for Peer Group Delinquency Variables, Participation in Delinquency, and Types of Substances Used and Injection Drug Use Outcomes.

	Marijuana ^d			Cocaine ^d			Inject cocaine ^b			Heroin ^d			Inject heroin ^b			Methamphetamine ^a			Inject meth ^b			Shared needles ^b		
	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR	AOR
While growing up did you have friends who... ^c																								
Used drugs	1.87***	1.64, 2.13]	2.28***	1.86, 2.79]	1.68***	1.36, 2.07]	1.98***	1.59, 2.46]	2.28***	1.71, 3.06]	2.19***	1.75, 2.74]	1.93***	1.52, 2.44]	1.89***	1.50, 2.40]	2.03***	1.56, 2.64]						
Destroyed or damaged properties	0.97	[0.87, 1.08]	1.11	[0.94, 1.31]	1.04	[0.96, 1.36]	0.89	[0.76, 1.05]	0.80*	[0.64, 0.97]	0.75***	[0.64, 0.87]	0.85	[0.72, 1.03]	0.80*	[0.68, 0.97]	0.91	[0.76, 1.09]						
Shoplifted	1.07	[0.96, 1.19]	1.28**	[1.09, 1.52]	1.24*	[1.04, 1.48]	1.34***	[1.14, 1.58]	1.38**	[1.11, 1.72]	1.54***	[1.31, 1.81]	1.10	[0.91, 1.33]	1.18	[0.98, 1.41]	1.55***	[1.28, 1.87]						
Stole motor vehicles or parts from motor vehicles	1.16*	[1.03, 1.30]	0.80*	[0.66, 0.95]	0.99	[0.83, 1.19]	0.96	[0.81, 1.12]	1.01	[0.80, 1.28]	1.11	[0.94, 1.32]	1.24*	[1.03, 1.49]	1.09	[0.90, 1.33]	1.10	[0.91, 1.34]						
Sold stolen property	0.99	[0.87, 1.08]	1.36**	[1.01, 2.01]	1.30**	[1.08, 1.71]	1.39***	[1.16, 1.66]	1.54***	[1.20, 1.98]	1.51***	[1.26, 1.81]	1.15	[0.94, 1.41]	1.02	[0.83, 1.25]	1.25*	[1.01, 1.55]						
Broke into homes or other building	1.03	[0.96, 1.16]	1.10	[0.93, 1.29]	1.14	[0.96, 1.35]	1.45***	[1.23, 1.71]	1.02	[0.81, 1.26]	1.46***	[1.23, 1.71]	0.92	[0.76, 1.12]	1.87***	[1.55, 2.26]	1.69***	[1.40, 2.04]						
Sold, imported or manufactured drugs	1.62***	[1.47, 1.80]	1.09	[0.93, 1.29]	1.45***	[1.23, 1.71]	1.37***	[1.17, 1.59]	1.20	[0.97, 1.50]	1.19*	[1.02, 1.39]	1.52***	[1.28, 1.80]	1.31***	[1.11, 1.55]	1.12	[0.94, 1.33]						
Engaged in mugging, robbing, or extorting	1.10	[0.97, 1.24]	1.07	[0.89, 1.28]	1.09	[0.92, 1.31]	0.99	[0.84, 1.17]	1.24	[0.98, 1.57]	1.19*	[1.01, 1.40]	0.78*	[0.63, 0.96]	0.71**	[0.57, 0.87]	1.01	[0.83, 1.22]						
Engaged in other delinquency	0.82	[0.64, 1.04]	0.93	[0.65, 1.34]	1.02	[0.908, 1.23]	1.01	[0.73, 1.38]	0.93	[0.59, 1.47]	1.12	[0.82, 1.51]	1.70**	[1.21, 2.39]	1.68**	[1.20, 2.34]	1.03	[0.73, 1.47]						
Participate in any delinquent activities	1.92***	[1.72, 2.15]	1.47***	[1.24, 1.74]	1.43***	[1.20, 1.71]	2.10***	[1.76, 2.49]	1.81***	[1.43, 2.30]	2.28***	[1.90, 2.72]	1.62***	[1.32, 1.67]	1.92***	[1.58, 2.33]	2.79***	[2.25, 3.44]						
F _{test}	104.98***		46.69***		22.52***		54.58***		31.50***		62.43***		43.65***		52.51***		50.99***							
R ²	NA		NA		NA		NA		NA		NA		NA		NA		NA							
Mean number of types of peer group delinquent acts ^d	1.22***	[1.20, 1.23]	1.23***	[1.19, 1.25]	1.24***	[1.21, 1.27]	1.30***	[1.27, 1.33]	1.26***	[1.22, 1.29]	1.35***	[1.32, 1.28]	1.17***	[1.14, 1.20]	1.23***	[1.19, 1.26]	1.34***	[1.30, 1.37]						
F _{test}	209.19***		93.42***		48.54***		115.89***		61.66***		131.72***		85.80***		104.84***		107.30***							
R ²	NA		NA		NA		NA		NA		NA		NA		NA		NA							
Age when first engaged in these activities (<i>n</i> = 8,667) ^{c,e,f,g}	0.98***	[0.97, 0.99]		0.97**	[0.96, 0.99]		0.97***	[0.96, 0.99]	0.98*	[0.96, 0.99]	0.94***	[0.93, 0.96]	0.99	[0.98, 1.02]	0.96***	[0.95, 0.98]	0.96***	[0.94, 0.97]						
F _{test}	70.35***		56.96***		11.12***		83.99***		36.35***		88.39***		40.11***		65.87***		68.21***							
R ²	NA		NA		NA		NA		NA		NA		NA		NA		NA							

^a Daily or near daily illicit drug use.

^b Ever in lifetime.

^c Models adjusted for full-time employment race, less than high school degree, age, male sex, and education.

^d Models adjusted for participation in delinquency, full-time employment race, unemployment, less than high school degree, age, male sex, and education.

^e *n* = 8,667 for age started engaging in these activities, sample is restricted to participants who ever engaged in peer group delinquency.

^f *n* = 7,752 for cell corresponding to age first engaged in delinquency and age first used drugs, sample is restricted to participants who ever used drugs and ever engaged in delinquent activities with peers.

^g *n* = 8,241 for cell corresponding to age first engaged in delinquency and age first used drugs, sample is restricted to participants who ever used drugs and ever engaged in delinquent activities with peers.