



# Birds of a Feather Get High Together: A Reconceptualization of the Social Bond with Latent Class Analysis and a Test with Different Forms of Drug Use

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## Abstract

Social bond theory has received significant empirical support in examinations of drug use for decades. However, research utilizing the theory has often been fragmented and has not incorporated all four dimensions of the social bond. Additionally, much of this research has collapsed drug use into categories rather than examining specific forms of drug use. These concerns confuse the theoretical and practical insights that may be derived from such analyses. I utilize Monitoring the Future (2019) data to examine social bonding wholistically as latent classes in line with the concept of the social bond described by Hirschi (1969) and estimate the effect of the classes on specific forms of drug use. I find there are four distinct classes of social bonding among U.S. seniors most clearly differentiated by levels of attachment and commitment. Logistic regression results indicated different classes of social bonding were associated with different forms of drug use. I discuss the theoretical implications of the results and how they can be applied for criminal justice practitioners.

**Keywords** Social Bond Theory · Cigarettes · Alcohol · Cannabis · Polydrug Use

Drug use among youths is an ongoing national concern and overall illicit drug use is on an upward trend among high school students (SAMSHA, 2020). Principle among these concerns are the use of opiates, synthetic opioids, and other pharmaceutical drugs (Milam, et al., 2021; Miller et al., 2018), new novel forms of drug use (Miller et al., 2019; Stogner & Miller, 2013), a resurging popularity in psychedelics (Khey et al., 2008; Miller et al., 2009; SAMSHA, 2020) and the continued growth in cannabis use and developments in new forms of consumption (SAMSHA, 2020; Stogner & Miller, 2015). Moreover, contemporary social changes brought on by the

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ongoing Covid-19 pandemic have precipitated renewed concerns around drug overdose and increased use of illicit drugs as a product of Covid-19 related social and political change (Boehnke, et al., 2021; Imtiaz et al., 2021; Leatherdale et al., 2021; Linas et al., 2021; Mason et al., 2021). Drug use is associated with numerous negative outcomes including continued use and addiction (Chen et al., 2009), disease and death (Degenhardt & Hall, 2012; Johnston et al., 2021), property and violent crime (Dawkins, 1997), arrest and incarceration (Maden et al., 1990, 1992), lost earnings and societal economic burden (Kasunic & Lee, 2014), as well as a host of mental health related co-morbidities such as anxiety, depression, and suicidality (Choi et al., 2016; Hayatbakhsh et al., 2007; Paton et al., 1977; Sareen et al., 2006).

The fields of sociology, criminology, psychology and public health have produced a wealth of literature on drug use, however, much of it is disconnected and lacking robust theoretical underpinnings from which to make strong recommendations for practice and policy. Within criminology, control theories have seen wide application and empirical support. Indeed, Hirschi's (1969) social bond theory has received significant support in research on delinquency, including various forms of drug use, and the theory appears similarly applicable for boys and girls (for a few examples see, Chapple et al., 2005; Ford, 2005). Yet, common analytic techniques (i.e., classic regression analyses) cannot remain true to Hirschi's conception of the social bond and such simplistic analyses can muddy our understanding of the effect of social bonding on delinquency. Additionally, while many researchers have addressed polydrug use among adolescents and have used advanced analytical techniques like latent class analysis to do so they have often found polydrug use to be driven by the use of alcohol, tobacco, and cannabis (Tomczyk et al., 2016). Yet, there are conceptual and empirical reasons to suggest there are differences in behavioral, attitudinal, and motivational characteristics of those who have used alcohol, tobacco, and cannabis when compared to their counterparts who have added drugs like cocaine, methamphetamine, or heroin to that list (Erickson, *In Press*; Stogner & Miller, 2013; White et al., 2013). This study contributes to the literature on contemporary concerns about drug use and polydrug use through an examination of the effects of social bonding on various forms of drug use by utilizing a method that remains true to the theory. Moreover, this study contributes to the literature on social bonding and delinquency generally as it is the first to empirically examine latent classes of social bonds. Thus, the findings will provide valuable insights into the usefulness of social bond theory as a framework for understanding substance use as well as practical insights for prevention and intervention by identifying and addressing risk factors for specific forms of drug use.

## Social Bond Theory, Latent Classes and Drug Use

Hirschi's (1969) social bond theory is one of the most commonly cited control theories of delinquency and crime and has received support in examinations in various forms of offending. The theory begins with the assumption that deviant behavior among youth is a given unless appropriate bonds are formed that tie the youth to their family, peers, and society. Hirschi (1969) suggested there were four distinct,

but interrelated dimensions of an individual's social bond. *Attachment* related to the youth's connection to prosocial individuals (e.g., family members, teachers). *Commitment* was concerned with the value associated with conventional activities and goals (e.g., educational and professional success). *Involvement* simply referred to engaging in conventional activities that would limit the time to engage in deviant behavior. *Belief* related to a person's acceptance of society's norms, rules, and values. There is significant research that has suggested social bond theory, or at least one or a few dimensions of the social bond, are important for understanding substance use including, alcohol, cannabis, amphetamines, methamphetamine, heroin, opioids, stimulants, tranquilizers, sedatives and cocaine (Akers & Lee, 1999; Asthappan, 2010; Bahr et al., 1998; Ellickson et al., 1999; Ford, 2005, 2009; Ford & Arrastia, 2008; Hill & Pollock, 2015; Hoppe et al., 1998; Marcos & Bahr, 1988; Mowen & Visher, 2015; Reifman et al., 1998; Schroeder & Ford, 2012; Stanley & Lo, 2009).

One concern with the way prior research used social bond theory to examine drug use is the fragmented way in which it has been applied. Namely, much prior research has not included indicators for each of the four dimensions of the social bond and there is no consensus on how such indicators should be operationalized. Another related concern with past work utilizing social bond theory is the methodological constraints inherent in most forms of regression analysis. Common regression techniques fence off the effect of other variables when estimating the effects of individual variables in a model. Thus, if a researcher estimated the effect of attachment on drug use, they have “controlled for” or fenced off the effect of commitment, involvement, and belief. This fragmentation of Hirschi's (1969) theory as a product of variable omission and methodological constraint is common in prior research on drug use (Desmond et al., 2010; Dollar & Ray, 2013; Ford, 2005; Ford & Arrastia, 2008; Hill & Pollock, 2015; Stanley & Lo, 2009). For instance, Hill and Pollock (2015) examined only religion as a social bond for its effect on drug use. In their study of meth use, Stanley and Lo (2009) focused their attention exclusively on school informed dimensions of the social bond related to involvement, commitment, and belief, but excluded attachment. Even studies that use indicators of all sources of the bond often put them in the same model where they usually share some variation and weaken each other's individual variable effects by competing in the model. Certainly, this sort of fragmentation is not how Hirschi (1969) conceived of the social bond he theorized. The social bond was thought to be a composite of its four components. For instance, a youth may be high on attachment and involvement but lower on commitment and belief and the combination of these contributed to the youth's level of social bonding. Some have attempted to address this in their analyses by collapsing the four components of the social bond into a scale (Asthappan, 2010; Schroeder & Ford, 2012). While operationalizing the variable this way is more in line with theory it obfuscates the degree to which one or a few of the elements of the social bond is driving drug use and the fact that all are meant to be discrete indicators that are part of the same underlying construct that may vary in form and degree. More sophisticated and contemporary forms of quantitative analysis such as latent class analysis allow for the most theoretically informed way of testing individual-level criminological theories of offending with multiple dimensions in a construct.

Latent class analysis seeks relationships present in the data and groups cases on the basis of these relationships to create theoretically informed classes of participants. Previous research has used latent class analysis to examine other important criminological theories including the code of the street (Erickson et al., 2020) and low self-control (Vaughn et al., 2009).

Confusing things further is the realization that much of the research on drug use utilizing Hirshi's (1969) theory has looked at only one form of drug use and usually after they have collapsed multiple forms of drug use into dichotomies or broad categories (e.g., use vs non-use; soft vs hard drug; non-use vs prescription drug use, etc.) (Asthappan, 2010; Desmond et al., 2010; Dollar & Ray, 2013; Ford, 2005; Ford & Arrastia, 2008; Hill & Pollock, 2015; Schroeder & Ford, 2012; Stanley & Lo, 2009). For example, Schroeder and Ford (2012) examine the effect of attachment and involvement on marijuana use, but also prescription drugs and illicit drugs. Collapsing forms of drug use into such categories makes it more difficult to infer what types of influences are associated with specific forms of use and could be utilized for drug specific prevention and intervention efforts. Similarly, research that has utilized latent class analysis has tended to do so with little to no thought of theory but simply to find classes of drug users and to test their relationship to various risk factors (Connell et al., 2009; Conway et al., 2013; Cranford et al., 2013; Gilreath et al., 2014; Lamont et al., 2014; Lanza et al., 2010; Maldonado-Molina et al., 2007; Newcomb et al., 2014; Shin, 2012; Shin et al., 2010; Snyder & Smith, 2015; White et al., 2013). While such analysis is more empirically and methodologically sound than arbitrarily collapsing multiple types of drug use into a single category it must be done thoughtfully and with mind to theoretical considerations. For instance, it is hard to develop theoretically informed prevention or intervention efforts aimed at addressing classes of users defined as "predominant polysubstance use" (Conway et al., 2013), "multiple substances" (Cranford et al., 2013), "advanced use" (Graham et al., 1991), or "heavy polysubstance use" (Shin et al., 2010). Moreover, in a systematic review of 23 studies that utilized latent class analysis to look for classes of drug users Tomczyk, Isensee, Hanewinkel (2016) noted in most instances latent classes of polydrug users were made up almost entirely of those engaged in alcohol, tobacco, and cannabis use. White and colleagues (2013) identified a "limited range multidrug" class consisting of those who used tobacco, alcohol, and cannabis which accounted for nearly 20% of their sample. They also found another very small class consisting of 2% of their sample they termed a "extended range multidrug" class consisting of those who used drugs beyond those in the limited range class. This certainly dampens much of the analytic usefulness and "person-centered" focus of a technique like latent class analysis and obfuscates the sort of influences that predict polydrug use (Muthén & Muthén, 2000). If polydrug use classes are made up mostly of those who use only a combination of tobacco, alcohol, and cannabis it is likely that the covariates associated with polydrug use in previous studies do not accurately capture the risk factors related to polydrug use of "hard" drugs or of specific forms of hard drug use. Importantly, this means recommendations for prevention or intervention derived from these analyses may not perform as desired. It seems reasonable to suggest the risk factors associated with those involved in

the consumption of cocaine, heroin, and methamphetamine are different at least in magnitude if not in type than those of polydrug use involving tobacco, alcohol, and even cannabis (White et al., 2013). Rather a theoretically driven analysis of specific forms of drug use are most likely to yield useful insights for researchers and practitioners alike.

## Current Study

In what follows I contribute to the literature on drug use, polydrug use, and the relationship between social bonding and various forms of drug use. Various dimensions of Hirschi's (1969) social bond theory, in various operationalizations, have repeatedly been shown to predict drug use. However, the methods most often used in these analyses (i.e., various forms of regression analysis) do not accurately reflect social bonding as a theoretical construct or an individual's overall level of social bonding. Thus, I utilize latent class analysis to find classes of social bonding. Second, I output these classes and use them in regression analysis predicting various forms of drug use and polydrug use while controlling for other important criminological influences known to inform offending and drug use (Erickson & Burgason, *In Press*; DeLisi, et al., 2019; Telesca et al., 2012). This is contrary to how most researchers have utilized latent class analysis in previous examinations of drug use and polydrug use, however, it is a more theoretically informed and pragmatically driven use of latent class analysis. In doing so, I provide estimates of the effects of empirically existent classes of social bonding on different types of drug use and polydrug use that is true to the theory and provides specific avenues for prevention and intervention.

## Methodology

### Data

I utilize data from the 2019 Monitoring the Future Study (MTF). It is a nationally representative survey of U.S. seniors on their knowledge, attitudes, and behaviors surrounding various drugs of abuse. The aim of the data is to provide descriptive information of drug related concerns each year and over time while also providing analytic potential to explain drug use and drug related attitudes. One of the great advantages of the Monitoring the Future data is its depth of information on drug use attitudes and behaviors among U.S. seniors across multiple decades. However, each survey year represents a cross-sectional dataset without participant follow-up. While these annual snapshots are excellent for analyzing trends and changes in drug use it limits what researchers can do utilizing predictive forms of analysis. Despite this limitation, the data has a wealth of useful information that can be used to understand drug use attitudes and behaviors among those aging into adulthood at a point when they are most at risk of drug use (Telesca et al., 2012).

Data is collected annually in the spring semester from high school seniors across the country with data collection beginning in 1975. As such a breadth of topics are covered, six different surveys are administered in equal proportion with each student completing one survey. This produces six relatively identical nationally representative subsamples. While there are many areas of overlap on each survey some forms focus more or less on certain concerns (interpersonal relationships, work and leisure, etc.). I utilized survey form one associated with dataset two of the MTF data as it included the broadest range of drug use questions, included variables that could adequately proxy each of the elements of Hirschi's (1969) social bond, and included important demographic and control variables. Data is collected via a multistage sampling design (region, school, student) aimed at creating national representativeness. A sample weight is included in the data and used in the following analysis to achieve this aim. Unfortunately, this excludes those who drop out prior to survey administration. While this represents a relatively small number of students such individuals are at increased risk of drug use relative to their peers who graduate (Gasper, 2011). Yet, the goal of the MTF data is to provide the greatest analytic potential possible, in part, by providing data on the broadest cross-section of youth possible. Additionally, while this concern is not altogether unproblematic, a large proportion of drug users earn a high school diploma and Hirschi's (1969) theory was not aimed at explaining extreme and regular offending, on the contrary it was aimed at explaining why the average youth *did not* offend. High school graduates, statistically speaking, represent the "average youth" who is aging into adulthood, a point in their lives when they are at the highest risk for drug use (Telesca et al., 2012). The MTF dataset used here has 2,284 respondents, however, among the variables used in analysis there was a small to moderate amount of missing data among the independent variables (1.9%—28.6%) which if excluded could possibly damage the representativeness of the data and thus its analytic potential. To address this, I used multiple imputation for all cases with missing data on variables used in analysis (excluding dependent variables).

### Social Bonding Variables for Latent Classes

I use one indicator variable for each of Hirschi's (1969) components of the social bond. Each indicator provides a very close fit to some of the indicators Hirschi used to develop his theory. The indicator variable *Attachment* was focused on parental attachment. Participants rated their satisfaction with their parental relationship on a scale from 1–7 and higher scores indicated increased satisfaction. The indicator *Commitment* was measured on a 4 point scale and participants were asked to rate how much they valued future professional success and higher scores indicated increased value. A categorical variable of the hours a week on average participants worked during the school year formed the indicator variable *Involvement* focusing attention on employment as a form of prosocial involvement common to many in the last years of high school. Responses ranged from 1 (did not work) to 8 (worked 30+ hours a week). The indicator variable *Belief* was focused on participants level

of agreement with the suggestion that following the law makes one a good person. Participants were asked to rank their agreement on a scale ranging from 1–5 and higher values indicating stronger agreement. These variables were used to find latent classes of social bonding empirically existent in the data. The resulting classes were then used as independent variables to predict different forms of drug use.

## Dependent Variables

I fit models with a number of dependent variables to test for unique effects of independent variables, specifically social bonding classes, across drugs and types of polydrug use. Due to small cell sizes at the tail end of the distribution all dependent variables are dichotomies of past year use (0=Did Not Use, 1=Did Use). These include *Past Month Tobacco Use*,<sup>1</sup> *Past Year Alcohol Use*, *Past Year Cannabis Use*, *Past Year Psychedelics Use*,<sup>2</sup> *Past Year Cocaine Use*,<sup>3</sup> *Past Year Sedative Use*, *Past Year Polydrug Use* which combines all drug use variables available in MTF except for tobacco and alcohol, and *Past Year Polydrug Use with Alcohol* which adds past year alcohol consumption to the polydrug use variable.<sup>4</sup>

## Control Variables

Several demographic control variables are included in the predictive model. *Black*, *Hispanic*, and “*Other*” (with *White* serving as the reference group) are included in the model. I also account for the association between gender and drug use (1=*Male*). Additionally, I account for the effect of regionality *Northeast*, *South*, and *Midwest* (with *West* serving as the reference group) in the regression model. I also account for other criminological influences including *Number of Parents in Home*, *Neighborhood Satisfaction*, *Past Drug Use* (in the years prior to participants senior year), and *Friends Use Cannabis*. Descriptive statistics of all variables used to create latent classes and in the analytic model are summarized in Table 1.

## Analytic Plan

I imputed data for all variables with missing values that are used in analysis (excluding each of the dependent variables) using 1,000 iterations to produce 10 imputations. Multiple imputation has been rigorously examined and often found to outperform other advanced imputation techniques regardless of the proportion of missing values

<sup>1</sup> This form of the MTF does not include a measure of past year tobacco use. While this is not ideal, it does not damage to the underlying logic of the analysis.

<sup>2</sup> This combines reported past year LSD use and psychedelic use other than LSD as defined by MTF.

<sup>3</sup> Due to small cell sizes past year powdered and crack cocaine required collapsing into a single variable.

<sup>4</sup> Models with past year measures of amphetamines, tranquilizers, narcotics, polypharmaceutical, and heroin use were also estimated. Models could not reach acceptable model fit and no effects were found for classes of social bonding. Thus, tables and text summarizing findings from these analyses have been excluded for parsimony.

**Table 1** Univariate Statistics

	Frequency	% of Sample	Range	Mean	S.D
<i>Social Bond Indicators</i>					
Attachment			1–7	5.37	1.66
Commitment			1–4	3.56	0.67
Involvement			1–8	3.34	2.32
Belief			1–5	2.84	1.20
<i>Social Bond Classes</i>					
Class 1	168	7.4			
Class 2	619	27.3			
Class 2	180	8.0			
Class 4	1297	57.3			
<i>Dependent Variables</i>					
Past Month Cigarette Use	139	6.1			
Past Year Alcohol Use	1188	52.5			
Past Year Cannabis Use	735	32.5			
Past Year Psychedelic Use	84	3.7			
Past Year Cocaine Use	36	1.6			
Past Year Sedative Use	32	1.4			
Past Year Polydrug Use	119	5.3			
Past Year Polydrug Use w/ Alcohol	554	24.5			
<i>Control Variables</i>					
Male	1062	46.9			
Black	237	10.5			
White	1063	47.0			
Hispanic	424	18.7			
"Other"	539	23.8			
Northeast	403	17.7			
South	973	43.0			
Midwest	533	23.6			
West	354	15.7			
# of Parents in Home			0–2	1.57	0.64
Neighborhood Satisfaction	56.5	1279.0			
Past Drug Use (1 = Yes)	54.4	1232.0			
Peer Cannabis Use			0–4	1.50	1.19

Values are representative of social bond indicators as they operationalized when I estimated latent classes prior to standardization in Figure 1.

(Graham, 2009; Lodder, 2013; Rubin, 1976; Tsiriktsis, 2005). Multiple imputation retains the structure of the data to the greatest extent possible while maintaining statistical power and reducing statistical bias (Graham, 2009; Little & Rubin, 1989; Rubin, 1976). Unfortunately, 24 cases had such poor data that values could not be imputed for them. Thus, the final analytic sample was reduced from 2,284 to 2,260 individuals. After the population weight is applied there are 2,263 cases.



**Table 2** Model Fit Statistics for Latent Classes of Social Bond

# of Classes	LL	AIC	BIC	SABIC
2	-15,089.670	30,205.340	30,279.780	30,238.477
3	-13,132.214	26,300.428	26,403.500	26,346.311
4	-13,020.707	26,087.414	26,219.117	26,146.042

Could not reach convergence on a 5 class solution.

After imputation I used the four social bonding indicator variables discussed above to produce latent classes. Latent class analysis assigns cases to a class based on the likelihood that a case belongs in that class which is estimated using *M*-iterations (in this case 1,000) to achieve best fit. Determining the appropriate number of classes is done through the comparison of various fit statistics and statistical diagnostics that indicate class separation (i.e., that the classes are significantly different from each other). I fitted models specifying increasing number of classes until the model could not reach convergence despite increasing the number of iterations from 1,000 to 5,000.

The resulting 4 classes (to be discussed more below) were used as a variable that theoretically approximated each participant's social bond and were used in logistic regression analysis predicting different forms of drug use and polydrug use. I fit two models for each form of drug use, one with only the 4 social bond classes and another with the classes and various control variables. Finally, I utilized a population weight to produce representativeness and correct for over- and under-sampling present in the MTF data.

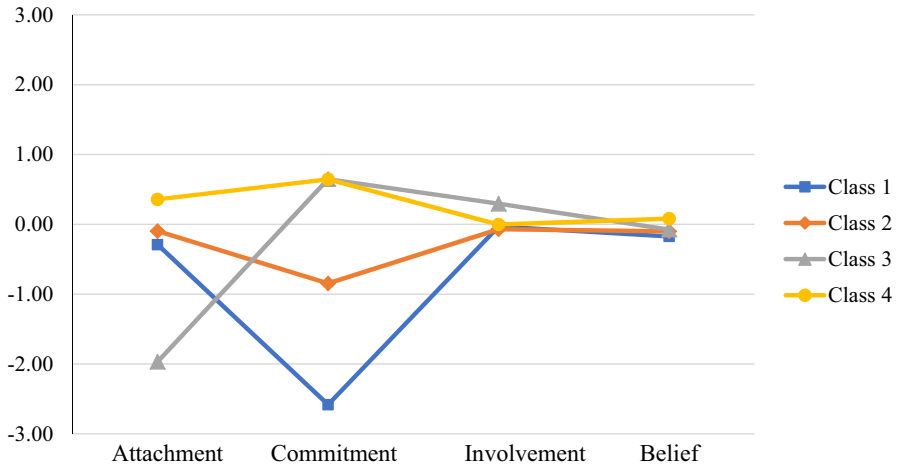
## Results

### Latent Classes of Social Bonding

I constructed latent classes from four indicators, one for each element of Hirschi's (1969) social bond. While there is no single definitive way to determine the appropriate number of classes there is general agreement that researchers doing latent class analysis should compare a variety of fit statistics and diagnostic tests while iteratively increasing the number of classes to determine the appropriate class solution (Weller et al., 2020). I estimated latent classes of social bonding while increasing from 2 to 5 classes and compared fit statistics to determine the appropriate class solution (Table 2). The 5 class solution could not reach convergence despite increasing the number of iterations from 1,000 to 5,000 and was thus deemed an inappropriate number of classes. All fit statistics indicated that the 4 class solution is the best fitting model (Table 2). Probabilities of class membership are very high for the 4 class model ranging from 0.843 to 1, and the entropy value is also very high (0.930). These latter diagnostic tests do not necessarily indicate which class solution fits better but rather indicate that there is an appropriate level of separation between classes, providing further evidence that the 4 class solution best represented

**Table 3** Standardized Means for Social Bond Indicators

	Attachment	Commitment	Involvement	Belief
Class 1	-0.29	-2.58	-0.03	-0.17
Class 2	-0.10	-0.85	-0.07	-0.10
Class 3	-1.97	0.65	0.29	-0.08
Class 4	0.36	0.64	0.00	0.08



**Fig. 1** Standardized Means by Class for Social Bond Indicators

the empirical relationships between the four elements of the social bond present in the data (Muthén & Muthén, 2000).

Each class was output to use as variables as each participant was assigned to a class based on their posterior probabilities, or the likelihood that they would be in that class (Muthén & Muthén, 2000). While variables used to produce latent classes should be used without transformation they are often standardized when variable scales are not the same to ease interpretation, as they are here, when comparing class means on indicator variables (Ferguson, Moore, & Hull, 2020) In Table 3. I report the standardized means for indicators of social bonding for each of the classes and in Fig. 1, I present a visual representation. Latent classes are most differentiated by social bond components attachment and commitment. Specifically, class 3 had a very low standardized mean on the indicator attachment (-1.97), while other class standardized means were more similar. Class 1 is sharply differentiated from other classes by its relatively low standardized mean for commitment (-2.58). Class 3 and 4 have nearly identical standardized means on commitment (0.65; 0.64 respectively). The standardized mean for commitment on class 2 falls between these other classes (-0.85). The standardized means for involvement and belief did not evince the same level of variation between classes present for attachment and commitment. This would suggest that delinquency that is a product of weak or nonexistent social bonds is most driven by differential

levels of attachment and commitment as these are the distinguishing features of typological variation in the bond. Those in class 4 evinced the highest overall levels of social bonding while those in class 1 generally evinced the lowest levels of social bonding (save for levels of attachment).

### Past Month Cigarette Use

Participants in class 1 were 400% more likely to have used cigarettes in the past month relative to class 4 in model 1 ( $O.R. = 4.018, p \leq 0.001$ ). This association held after controls were added in model 2 and the effect was dampened only slightly ( $O.R. = 3.900, p \leq 0.001$ ). Additionally, after controlling for social bond classes Black participants were less likely to use cigarettes ( $O.R. = 0.452, p \leq 0.05$ ) than White participants, while males were more likely to smoke cigarettes than females ( $O.R. = 1.707, p \leq 0.05$ ).<sup>5</sup> Residing in the South was associated with an increased likelihood of cigarette use relative to those from the West, but the effect was only marginally significant ( $O.R. = 1.662, p \leq 0.1$ ). The number of parents that lived at home was negatively related to past month cigarette use ( $O.R. = 0.638, p \leq 0.01$ ). Alternatively, when compared against those who had abstained, those who had used drugs prior to their senior year were more likely to have smoked cigarettes in the past month ( $O.R. = 1.956, p \leq 0.05$ ). Similarly, those who associated with a greater proportion of friends who used cannabis were more likely to have smoke cigarettes in the past month ( $O.R. = 1.322, p \leq 0.01$ ).

### Past Year Alcohol Use

When I fitted models for past year alcohol use (Table 4.) I found class 3 was associated with an increased likelihood of having used alcohol in the past year relative to those in class 4 in model 1 ( $O.R. = 1.524, p \leq 0.05$ ). In model 2 after controls had been included the associations falls from statistical significance. Race was associated with past year alcohol use and Black participants were less likely to report the use of alcohol than White participants ( $O.R. = 0.530, p \leq 0.001$ ). Those who expressed high levels of neighborhood satisfaction were more likely to drink alcohol than those who did not, however the effect was only marginally significant ( $O.R. = 1.221, p \leq 0.1$ ). Participants who had used drugs prior to their senior year were nearly 750% more likely to drink alcohol during their senior year than those who had not used drugs previously ( $O.R. = 7.405, p \leq 0.001$ ). Additionally, having friends who used cannabis was positively associated with past year alcohol use ( $O.R. = 1.274, p \leq 0.001$ ).

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<sup>5</sup> I do not provide interpretations for the “other” racial classification as they are a composite of various racial groups and interpretation would provide little analytic value.

**Table 4** Past Month Cigarette Use & Past Month Alcohol Use

	Past Month Cigarette Use				Past Year Alcohol Use				
	Model 1		Model 2		Model 1		Model 2		
	S.E	O.R	S.E	O.R	S.E	O.R	S.E	O.R	
Class 1	(0.245)	4.018	***	3.900	***	(0.171)	0.830	(0.210)	0.901
Class 2	(0.211)	1.301		1.230		(0.101)	1.020	(0.125)	0.991
Class 3	(0.353)	1.123		0.818		(0.170)	1.524	(0.208)	1.269
Black			*	0.452	*			(0.197)	0.530
Hispanic				0.676				(0.151)	0.880
Other			*	1.724	*			(0.155)	0.882
Male			*	1.707	*			(0.121)	1.022
Northeast				0.550				(0.190)	0.842
Midwest				1.615				(0.181)	1.122
South			^	1.662	^			(0.163)	1.214
# of Parents in Home			**	0.638	**			(0.096)	0.989
Neighborhood Sat				0.840				(0.118)	1.221
Past Drug Use			*	1.956	*			(0.145)	7.405
Friends Use Cannabis			**	1.322	**			(0.051)	1.274
Constant	(0.130)	0.052	***	0.026	*	(0.058)	1.238	***	0.293
X <sup>2</sup>	27.593***	112.334***	8.297***	637.717***					

^p ≤ 0.1, \*p ≤ 0.05, \*\*p ≤ 0.01, \*\*\*p ≤ 0.001.

**Table 5** Past Year Cannabis & Psychedelic Use

	Past Year Cannabis Use			Past Year Psychedelic Use					
	Model 1	Model 2		Model 1	Model 2				
	S.E	O.R	S.E	O.R	S.E	O.R			
Class 1	(0.182)	1.183	(0.225)	1.142	(0.376)	2.112	(0.405)	1.952	^
Class 2	(0.105)	1.289	*	1.388	**	1.478	**	1.408	
Class 3	(0.165)	2.589	***	2.016	***	1.913	^	1.515	
Black			(0.196)	1.744	**		(0.431)	0.941	
Hispanic			(0.158)	1.329	^		(0.365)	0.704	
Other			(0.147)	1.580	**		(0.285)	1.519	
Male			(0.128)	1.238	^		(0.291)	2.886	***
Northeast			(0.192)	0.933			(0.450)	0.359	*
Midwest			(0.182)	1.033			(0.366)	0.842	
South			(0.166)	0.849			(0.318)	0.999	
# of Parents in Home			(0.097)	0.748	**		(0.200)	0.737	
Neighborhood Sat			(0.117)	0.940			(0.242)	0.954	
Past Drug Use			(0.141)	3.780	***		(0.383)	1.732	***
Friends Use Cannabis			(0.059)	1.973	***		(0.131)	1.983	***
Constant	(0.062)	0.447	***	0.082	***	(0.166)	0.033	0.006	***
X <sup>2</sup>	34.506***	588.338***	6.725^	91.686***					

^p ≤ 0.1, \*p ≤ 0.05, \*\*p ≤ 0.01, \*\*\*p ≤ 0.001.

### Past Year Cannabis Use

I present findings for past year cannabis use in Table 5. In model 1, class 2 (O.R. = 1.289,  $p \leq 0.05$ ) and class 3 (O.R. = 2.589,  $p \leq 0.001$ ) were both associated with increased odds of cannabis use compared to class 4. After the inclusion of controls in model 2, class 2 (O.R. = 1.388,  $p \leq 0.01$ ) and class 3 (O.R. = 2.016,  $p \leq 0.001$ ) were still associated with increased odds of past year cannabis use relative to class 4. Being Black (O.R. = 1.744,  $p \leq 0.001$ ), Hispanic (O.R. = 1.329,  $p \leq 0.1$ ), and male (O.R. = 1.238,  $p \leq 0.1$ ) were all associated with increased odds of cannabis use relative to being White or a female after accounting for different classes of social bonding. However, the effects were only marginally significant for Hispanic and male participants. The number of parents residing in the home of the participant was associated with decreased odds of cannabis use (O.R. = 0.748,  $p \leq 0.01$ ). Alternatively, engaging in drug use prior to senior year (O.R. = 3.789,  $p \leq 0.001$ ) and having friends who use cannabis (O.R. = 1.973,  $p \leq 0.001$ ) were both associated with increased odds of past year cannabis use.

### Past Year Psychedelic Use

Findings for past year psychedelic use are presented in Table 5. In model 1, class 1 (O.R. = 2.112,  $p \leq 0.05$ ) and class 3 (O.R. = 1.913,  $p \leq 0.1$ ) were associated with increased odds of past year psychedelic use, however, the effect was only marginally significant for class 3. Moreover, model fit was only marginally significant ( $X^2 = 6.725^{\wedge}$ ) which may suggest an individual's social bond has little to do with psychedelic use. This suggestion is further supported by findings in model 2 after controls have been included which attenuated the effects of class 1 (O.R. = 2.112,  $p \leq 0.1$ ) and class 3. Males were nearly 290% more likely than their female counterparts to report past year psychedelic use (O.R. = 2.886,  $p \leq 0.001$ ) while those in the Northeast were less likely to report psychedelic use than their peers from the West (O.R. = 0.359,  $p \leq 0.05$ ). Finally, having friends who use cannabis was associated with a near 100% increase in the odds of reporting using psychedelics (O.R. = 1.983,  $p \leq 0.0001$ ).

### Past Year Cocaine Use

I present findings for past year cocaine use in Table 6. In model 1, class 1 was associated with significantly increased odds of reporting past year cocaine use relative to class 4 (O.R. = 3.779,  $p \leq 0.01$ ). It is worth noting though that the model fit statistic for model 1 was only marginally significant ( $X^2 = 7.115$ ,  $p \leq 0.1$ ) suggesting social bonding may not be a salient factor in teen cocaine use. Males evinced increased odds of cocaine use relative to females (O.R. = 2.886,  $p \leq 0.001$ ) while participants residing in the Northeast had lower odds of cocaine use compared to those from the West (O.R. = 0.359,  $p \leq 0.05$ ). Finally, having friends who used cannabis was positively associated with past year cocaine use (O.R. = 1.983,  $p \leq 0.001$ ).

**Table 6** Past Year Cocaine and Sedative Use

	Past Year Cocaine Use			Past Year Sedative Use								
	Model 1		Model 2	Model 1		Model 2						
	S.E	O.R	S.E	S.E	O.R	S.E	O.R					
Class 1	(0.480)	3.779	**	(0.405)	1.952	^	(0.464)	2.634	*	(0.494)	2.638	*
Class 2	(0.389)	1.744		(0.273)	1.408		(0.608)	0.314	*	(0.616)	0.313	^
Class 3	(0.707)	1.115		(0.389)	1.515		(0.675)	0.859		(0.696)	0.651	
Black				(0.431)	0.941					(0.532)	1.923	
Hispanic				(0.365)	0.704					(0.667)	0.468	
Other				(0.285)	1.519					(0.474)	1.032	
Male				(0.291)	2.886	***				(0.442)	0.944	
Northeast				(0.450)	0.359	*				(0.598)	1.007	
Midwest				(0.366)	0.842					(0.640)	0.645	
South				(0.318)	0.999					(0.561)	0.885	
# of Parents in Home				(0.200)	0.737					(0.315)	0.921	
Neighborhood Sat				(0.242)	0.954					(0.398)	1.476	
Past Drug Use				(0.383)	1.732					(0.484)	1.025	
Friends Use Cannabis				(0.131)	1.983	***				(0.182)	1.757	**
Constant	(0.262)	0.013	***	(0.665)	0.006	***	(0.224)	0.017	***	(0.981)	0.006	***
X <sup>2</sup>	7.115 <sup>^</sup>			91.686 <sup>***</sup>			10.404 <sup>*</sup>			32.766 <sup>**</sup>		

<sup>^</sup>p ≤ 0.1, \*p ≤ 0.05, \*\*p ≤ 0.01, \*\*\*p ≤ 0.001.

### Past Year Sedative Use

Findings for past year sedative use are reported in Table 6. In model 1, those in class 1 were over 250% more likely to report past year sedative use when compared to those in class 4 (O.R. = 2.634,  $p \leq 0.05$ ). Alternatively, those in class 2 were nearly 70% less likely to have reported past year sedative use than those in class 4 (O.R. = 0.314,  $p \leq 0.05$ ). After controls are included in model 2, the relationship between class 1 and sedative use remains almost unchanged (O.R. = 2.638,  $p \leq 0.05$ ) while for class 2 the effect becomes only marginally significant (O.R. = 0.313,  $p \leq 0.1$ ). The only control variable that was significantly related to past year sedative use was having friends who used cannabis which was associated with increased odds of use (O.R. = 1.757,  $p \leq 0.01$ ).

### Past Year Polydrug Use

I present findings for polydrug use including only “hard” drugs in Table 7. In model 1, each of the three classes was associated with increased odds of polydrug use compared to class 4. Those in class 1 were nearly 85% more likely to report polydrug use compared to their peers in class 4, however the effect was only marginally significant (O.R. = 1.843,  $p \leq 0.1$ ). Those in class 2 (O.R. = 1.956,  $p \leq 0.01$ ) and class 3 (O.R. = 2.969,  $p \leq 0.001$ ) were nearly 100% and 300% more likely to report polydrug use of hard drugs in the past year compared to those in class 4. After including controls in the model the association between class 1 and past year poly drug use of hard drugs became statistically trivial. Alternatively, the associations between class 2 (O.R. = 1.844,  $p \leq 0.01$ ) and class 3 (O.R. = 2.220,  $p \leq 0.01$ ) remained even after controls were included and the magnitude of the effect was only attenuated slightly. Being Hispanic was associated with decreased odds of polydrug use of hard drugs compared to White participants (O.R. = 0.482,  $p \leq 0.05$ ). Participants living in the Northeast were less likely to report past year polydrug use compared to those in the West, but the effect was only marginally significant (O.R. = 0.537,  $p \leq 0.1$ ). Drug use prior to senior year (O.R. = 2.230,  $p \leq 0.05$ ) and having friends who use cannabis (O.R. = 2.254,  $p \leq 0.001$ ) were both associated with an over 200% increase in the likelihood of reporting polydrug use of hard drugs.

### Past Year Polydrug Use including Alcohol

As previous research has indicated that much of polydrug use is driven by combinations of alcohol and tobacco I provide this supplementary analysis of polydrug use that includes alcohol as a means to compare against polydrug use of exclusively “hard” drugs (Table 7). In model 1, only class 3 was associated with an over 230% increased chance of reporting past year polydrug use including possibly alcohol (O.R. = 2.322,  $p \leq 0.001$ ). This is noticeably different from the model of polydrug use that included only hard drugs. In model 2, this associations remains but the magnitude of the effect was reduced by approximately 32% (O.R. = 1.756,  $p \leq 0.01$ ). The number of parents residing in the home was associated with decreased odds



**Table 7** Past Year Polydrug Use & Polydrug Use with Alcohol

	Past Year Polydrug Use			Past Year Polydrug Use with Alcohol				
	Model 1		Model 2	Model 1		Model 2		
	S.E	O.R	S.E	O.R	S.E	O.R		
Class 1	(0.366)	1.843	^ (0.401)	1.640	(0.213)	1.070	(0.265)	1.134
Class 2	(0.216)	1.956	** (0.234)	1.844	** (0.117)	1.186	(0.143)	1.162
Class 3	(0.290)	2.969	*** (0.311)	2.220	** (0.176)	2.322	*** (0.214)	1.756
Black			(0.419)	0.710			(0.238)	0.890
Hispanic			(0.346)	0.482	*		(0.174)	1.019
Other			(0.245)	1.574	^		(0.176)	0.893
Male			(0.235)	1.417			(0.126)	1.128
Northeast			(0.354)	0.537	^		(0.216)	0.839
Midwest			(0.309)	0.936			(0.206)	1.015
South			(0.286)	0.751			(0.184)	0.810
# of Parents in Home			(0.176)	0.992			(0.116)	0.730
Neighborhood Sat			(0.223)	0.805			(0.130)	0.874
Past Drug Use			(0.385)	2.230	*		(0.176)	4.532
Friends Use Cannabis			(0.113)	2.254	***		(0.065)	2.135
Constant	(0.149)	0.046	*** (0.594)	0.007	(0.069)	0.374	*** (0.335)	0.076
X <sup>2</sup>	17.726***		127.194***		22.497***		517.102***	

^p ≤ 0.1, \*p ≤ 0.05, \*\*p ≤ 0.01, \*\*\*p ≤ 0.001.

of polydrug use including alcohol (O.R.=0.730,  $p \leq 0.01$ ). Participants who had used drugs prior to their senior year were over 450% more likely to report past year polydrug use including alcohol than their peers who abstained (O.R.=4.532,  $p \leq 0.001$ ). Similarly, having friends who use cannabis was associated with an over 200% increase in the odds of reporting polydrug including alcohol. Supplementary analysis (available up request) was conducted with each indicator variable in the regression rather than the social bond classes. The results were somewhat different. For instance, when attachment was associated with drug use often class 3 (most distinguished by low levels of attachment) was associated with the same form of drug use. Alternatively, involvement was nearly always associated with increased odds of drug use and belief nearly always associated with decreased odds of drug use. Yet, the latent class analysis presented here would indicate that involvement and belief are likely not driving influences behind different forms of drug use and their effect in regression analysis is likely an artifact of the analytic method used which controls for the effect of attachment and commitment which are much more important when the social bond is considered wholistically.

## Discussion and Conclusion

The findings presented here contribute to the literature on social bond theory and its application to various forms of drug use with implications both theoretically and practically. I have presented the first latent class analysis of the four dimensions of social bond theory and find four empirically existent classes of participants distinguished most clearly by levels of attachment and commitment. Those in class 1 were most clearly differentiated from other classes by their relatively low levels of commitment. Those in class 2 were most defined by low levels of commitment relative to those in class 3 and 4, but evinced higher levels of commitment than those in class 1. Participants in class 3 were most distinguished by their low levels of attachment. Those in class 4 evinced the strongest overall social bond and comprised the majority of the sample. These classes provide evidence that qualitatively distinct classes of social bonds were present among U.S. seniors and further analysis indicated some of these social bonding classes were associated with drug use. Additionally, Hirschi (1969) has suggested that attachment is likely the most important dimension of a person's social bond that discourages possible deviance. The results presented here support this notion, but with a caveat, commitment also seems important, and it seems as if the use of some types of drugs are more informed by commitment rather than attachment, and vice versa. Additional research is required to estimate how well these classes predict other forms of offending. Moreover, future research should interrogate the antecedents of class membership, which may provide clues as why some youths evince strong social bonding in all but their commitment to professional success or attachment to their parents. In subsequent analysis of social bond theory researchers should consider utilizing latent class analysis as it more accurately reflects the theory and can be used to examine social bonding as an independent or dependent variable. Finally, the specification of social bonding used

here is just one parsimonious and conceptually accurate reflection of the dimensions described in the theory. Hirschi (1969) also attended to the influence of attachment to school and peers, commitment to educational successes, involvement in prosocial hobbies which are indicators of various dimensions of social bonding I could not capture in one analysis. However, these ambiguities should not deter criminologists from applying contemporary methods to understand contemporary problems, even if they are framed by classic theories.

The regression analysis utilizing classes as covariates yielded interesting and insightful results. Class 1 was commonly associated with increased odds of reporting various forms of drug use (cigarettes, psychedelics, cocaine, and sedatives). Class 2 was associated with a similar number of forms of drug use (cannabis, polydrug use of hard drugs, and negatively associated with sedative use). Class 3 was associated with its own set of drugs (alcohol, cannabis, psychedelics, polydrug use of hard drugs, and polydrug use with alcohol). Moreover, while social bonding was associated with several forms of drug use, it was not associated with several other forms of drug use (amphetamines, tranquilizers, narcotics, polypharmaceuticals, and heroin). Indeed, regression analyses could not even achieve acceptable model fit in examinations of these latter forms of drug use suggesting a person's social bond has little to do with the likelihood they report having used those drugs. This is especially noteworthy as pharmaceutical narcotics (i.e., opioids) are a significant contemporary concern. Thus, social bonding has real, but oftentimes fairly specific effects on specific forms of drug use. This variation in class associations with different forms of drug use is noteworthy and supports the suggestion that important nuance is lost in analyses that group drugs categorically. Theoretically, this would refute control theorists' assumption that such controls (i.e., social bond, self-control) act uniformly to reduce deviance. In other words, social bonding does not net decreases in a person's propensity to offend generally, nor does lacking a strong social bond net an overall increase in a person's propensity to offend. Rather, the effect of a person's social bond works inconsistently across various domains of drug use, and likely other forms of offending. Perhaps some variation is due to societal perceptions. For instance, cannabis is becoming increasingly normalized and thus its use may not be viewed as a serious infraction by youths who otherwise have a fairly strong social bond (Stringer & Maggard, 2021). Further research on specific forms of offending and their relationship to general theories of crime are warranted. Such research will likely yield theoretical and applied insights as it has here.

The evidence presented here makes a strong case that social bonds are important for understanding some forms of drug use, but not others. Among those forms of drug use that social bonding is salient specific dimension of the social bond seem to be driving specific forms of drug use. Thus, these analyses provide practical insights for prevention, intervention, and rehabilitation. For instance, as sedative use is associated with class 1 which is distinguished by low levels of commitment to future professional success then practitioners have an actionable goal to address with youth engaged in sedative use. Accordingly, programs aimed at improving participant self-worth and develop problem-solving and goal-setting habits would likely have ameliorative effects (Chang et al., 2018; Uzun & Kelleci, 2018). Alternatively, class 3 was differentiated by low levels of attachment to their parents and was associated

with increased odds of cannabis use and polydrug use including alcohol. Thus, programs aimed at developing strong family bonds will likely have positive effects at reducing those forms of substance use. Indeed, it has been long suggested that strong child-parent relationships and parental supervision are integral for preventing or reducing youth drug use (Mounts, 2002; Sokol-Katz et al., 1997; Steinberg, et al., 1994). Importantly though, efforts aimed at improving child-parent relationships for those involved with sedatives will likely have little ameliorative reform as these youths already report relatively high levels of parental attachment. Thus, the results here are useful in that they can help practitioners target specific areas of risk and develop individualized treatment plans for youth engaged in different forms of substance use (Marchand et al., 2019). This type of targeted intervention has greater efficacy and allows for the targeted expenditure of limited resources. Similarly, these insights can be used to develop prevention programs that address specific forms of drug use that may be locally or generationally prevalent. Indeed, improving child-parent relationships or building self-efficacy and long-term goal development are achievable prior to initiating drug use. Despite the costs that may be associated with such efforts they are likely less costly than social, economic, and public safety costs associated with drug use and addiction (Kasunic & Lee, 2014). It is worth noting that peer cannabis use had significant effects for every form of drug use examined and sometimes had a larger effect size. Moreover, prior research has indicated that peers exert an outsized influence on offending patterns, including drug use (Boman et al., 2013; Miller, 2010; Miller et al., 2008, 2011; Rukus et al., 2017). Thus, programs aimed at drug using avoidance or refusal strategies will like also lead to positive effects (Chang et al., 2018; Schwinn et al., 2019).

There are several limitations to this study. First, is the nature of the data which is cross-sectional. This precludes any ability to make causal arguments and it is possible that drug use leads to decreased social bonding, specifically levels of attachment or commitment. Yet, Ford (2005) noted indirect effects of prior drug use on future drug use due to decreased school bonds. In other words, even if drug use did have a dampening effect on social bonds, an individual's social bond would still inform their propensity for later drug use. While there is nothing that can be done about the cross-sectional nature of the data, I have controlled for drug use in the years prior to the survey. Second, while I have provided one specification of social bond theory that is true to its conception, other indicators for the dimensions of the social bond could be explored. For instance, while Hirschi (1969) emphasized attachment to parents he also gave attention to the influence of attachment to school and peers. A fuller examination of the theory and other possible specifications were beyond the scope of the current research. Third, while latent class analysis is an excellent tool for examining criminological theories it necessarily gives up a certain level of variation when cases are subsumed into classes. This is unavoidable but has the advantage of utilizing social bonding in a more theoretically accurate way. Fourth, while I accounted for several other influences that may inform crime I was unable to control for cultural influences germane to drug use and other forms of offending (Burgason et al., 2020; Erickson, In Press). Finally, I was only able to examine one form of drug offending, the results may have been different if I had examined drug

manufacturing or trade as these offenders seem qualitatively different from those that are just users (Erickson et al., 2021).

While Hirschi's (1969) social bond theory has received significant support in examinations of various forms of offending I suggest that it may be best to apply Hirschi's theory with nuance and caution, at least when the offending is in the form of drug use. Qualitatively distinct classes of individuals with similar levels of social bonding are certainly an empirical reality but the differences in bonding between these classes inconsistently effected drug use. Indeed, these distinct groups of individuals evinced distinctly different propensities for different forms of drug use. In these instances, birds of a feather, in the sense of similar social bonds, flocked together. In other instances, model fit statistics suggested that levels of social bonding had little to do with certain forms of drug use. These results are insightful theoretically, but also useful practically. Drug use continues to be an ongoing problem and contemporary concerns brought on by the Covid-19 pandemic have only amplified these issues. Young people have been disproportionately impacted by loss of social connection and the results from this study suggest that for some, damages to their social attachments and commitments may increase the likelihood of certain forms of drugs use. Yet, these results also indicated there were likely fruitful avenues for prevention and intervention to address various forms of substance use among young people in the U.S.

## References

- Akers, R. L., & Lee, G. (1999). Age, social learning, and social bonding in adolescent substance use. *Deviant Behavior, 20*(1), 1–25.
- Asthappan, J. (2010). A Cultural Comparison of Drug Use among American and South Korean College Students: An Application of Hirschi's Social Bond Theory.
- Bahr, S. J., Maughan, S. L., Marcos, A. C., & Li, B. (1998). Family, religiosity, and the risk of adolescent drug use. *Journal of Marriage and the Family, 979–992*.
- Boehnke, K. F., McAfee, J., Ackerman, J. M., & Kruger, D. J. (2021). Medication and substance use increases among people using cannabis medically during the COVID-19 pandemic. *International Journal of Drug Policy, 92*, 103053.
- Boman, J. H., IV., Stogner, J., & Lee Miller, B. (2013). Binge drinking, marijuana use, and friendships: The relationship between similar and dissimilar usage and friendship quality. *Journal of Psychoactive Drugs, 45*(3), 218–226.
- Burgason, K. A., DeLisi, M., Heirigs, M. H., Kusow, A., Erickson, J. H., & Vaughn, M. G. (2020). The code of the street fights back! Significant associations with arrest, delinquency, and violence withstand psychological confounds. *International Journal of Environmental Research and Public Health, 17*(7), 2432.
- Chang, C. C., Liao, J. Y., Huang, C. M., Hsu, H. P., Chen, C. C., & Guo, J. L. (2018). Evaluation of the effects of a designated program on illegal drug cessation among adolescents who experiment with drugs. *Substance Abuse Treatment, Prevention, and Policy, 13*(1), 1–12.
- Chapple, C. L., McQuillan, J. A., & Berdahl, T. A. (2005). Gender, social bonds, and delinquency: A comparison of boys' and girls' models. *Social Science Research, 34*(2), 357–383.
- 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.
- Choi, N. G., DiNitto, D. M., Marti, C. N., & Choi, B. Y. (2016). Relationship between marijuana and other illicit drug use and depression/suicidal thoughts among late middle-aged and older adults. *International Psychogeriatrics, 28*(4), 577–589.

- Connell, C. M., Gilreath, T. D., & Hansen, N. B. (2009). A multiprocess latent class analysis of the co-occurrence of substance use and sexual risk behavior among adolescents. *Journal of Studies on Alcohol and Drugs*, 70(6), 943–951.
- Conway, K. P., Vullo, G. C., Nichter, B., Wang, J., Compton, W. M., Iannotti, R. J., & Simons-Morton, B. (2013). Prevalence and patterns of polysubstance use in a nationally representative sample of 10th graders in the United States. *Journal of Adolescent Health*, 52(6), 716–723.
- Cranford, J. A., McCabe, S. E., & Boyd, C. J. (2013). Adolescents' nonmedical use and excessive medical use of prescription medications and the identification of substance use subgroups. *Addictive Behaviors*, 38(11), 2768–2771.
- Dawkins, M. P. (1997). Drug use and violent crime among adolescents. *Adolescence*, 32(126), 395.
- Degenhardt, L., & Hall, W. (2012). Extent of illicit drug use and dependence, and their contribution to the global burden of disease. *The Lancet*, 379(9810), 55–70.
- DeLisi, M., Bunga, R., Heirigs, M. H., Erickson, J. H., & Hochstetler, A. (2019). The past is prologue: Criminal specialization continuity in the delinquent career. *Youth Violence and Juvenile Justice*, 17(4), 335–353.
- Desmond, S. A., Kikuchi, G., & Budd, K. (2010). Does change in teenage religiosity predict change in Marijuana use over time?. *Interdisciplinary Journal of Research on Religion*, 6.
- Dollar, C. B., & Ray, B. (2013). Adult nonmedical prescription drug use: An examination of bond theory. *Deviant Behavior*, 34(11), 932–949.
- Ellickson, P. L., Collins, R. L., & Bell, R. M. (1999). Adolescent use of illicit drugs other than marijuana: How important is social bonding and for which ethnic groups? *Substance Use & Misuse*, 34(3), 317–346.
- Erickson, J. H. (In Press). “Wild in My Eyes”: An Analysis of Narratives and Narrative Identities among Diverse Drug Users. *Deviant Behavior*, 1–16.
- Erickson, J. H., & Burgason, K. A. (In Press). The influence of structural characteristics and street codes on violent female offenders: A decade after Anderson's initial observations. *Journal of interpersonal violence*.
- Erickson, J. H., Hochstetler, A., & Copes, H. (2021). Meth cooking as a job: Identity and dirty work. *Justice Quarterly*, 38(5), 849–869.
- Erickson, J. H., Hochstetler, A., & Dorius, S. F. (2020). Code in transition? The evolution of code of the street adherence in adolescence. *Deviant Behavior*, 41(3), 329–347.
- Ford, J. A. (2005). Substance use, the social bond, and delinquency. *Sociological Inquiry*, 75(1), 109–128.
- Ford, J. A. (2009). Nonmedical prescription drug use among adolescents: The influence of bonds to family and school. *Youth & Society*, 40(3), 336–352.
- Ford, J. A., & Arrastia, M. C. (2008). Pill-poppers and dopers: A comparison of non-medical prescription drug use and illicit/street drug use among college students. *Addictive Behaviors*, 33(7), 934–941.
- Gasper, J. (2011). Revisiting the relationship between adolescent drug use and high school dropout. *Journal of Drug Issues*, 41(4), 587–618.
- Gilreath, T. D., Astor, R. A., Estrada, J. N., Johnson, R. M., Benbenishty, R., & Unger, J. B. (2014). Substance use among adolescents in California: A latent class analysis. *Substance Use & Misuse*, 49(1–2), 116–123.
- Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology*, 60, 549–576.
- Graham, J. W., Collins, L. M., Wugalter, S. E., Chung, N. K., & Hansen, W. B. (1991). Modeling transitions in latent stage-sequential processes: A substance use prevention example. *Journal of Consulting and Clinical Psychology*, 59(1), 48.
- Hayatbakhsh, M. R., Najman, J. M., Jamrozik, K., Mamun, A. A., Alati, R., & Bor, W. (2007). Cannabis and anxiety and depression in young adults: A large prospective study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 46(3), 408–417.
- Hill, M. C., & Pollock, W. (2015). Was Hirschi right?: A national-level longitudinal examination of religion as a social bond. *Deviant Behavior*, 36(10), 783–806.
- Hirschi, T. (1969). *Cause of Delinquency*. University of California Press.
- Hoppe, M. J., Wells, E. A., Haggerty, K. P., Simpson, E. E., Gainey, R. R., & Catalano, R. F. (1998). Bonding in a high-risk and a general sample of children: Comparison of measures of attachment and their relationship to smoking and drinking. *Journal of Youth and Adolescence*, 27(1), 59–81.

- Imtiaz, S., Wells, S., Rehm, J., Hamilton, H. A., Nigatu, Y. T., Wickens, C. M., ... & Elton-Marshall, T. (2021). Cannabis use during the COVID-19 pandemic in Canada: A repeated cross-sectional study. *Journal of Addiction Medicine, 15*(6), 484.
- Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2021). *Monitoring the Future national survey results on drug use 1975–2020: Overview, key findings on adolescent drug use*. Institute for Social Research, University of Michigan.
- Kasunic, A., & Lee, M. A. (2014). Societal burden of substance abuse. *International Public Health Journal, 6*(3), 269.
- Khey, D. N., Miller, B. L., & Griffin, O. H. (2008). Salvia divinorum use among a college student sample. *Journal of Drug Education, 38*(3), 297–306.
- Lamont, A., Woodlief, D., & Malone, P. (2014). Predicting high-risk versus higher-risk substance use during late adolescence from early adolescent risk factors using latent class analysis. *Addiction Research & Theory, 22*(1), 78–89.
- Lanza, S. T., Patrick, M. E., & Maggs, J. L. (2010). Latent transition analysis: Benefits of a latent variable approach to modeling transitions in substance use. *Journal of Drug Issues, 40*(1), 93–120.
- Leatherdale, S. T., Bélanger, R. E., Gansaonré, R. J., Patte, K. A., deGroh, M., Jiang, Y., & Haddad, S. (2021). Examining the impact of the early stages of the COVID-19 pandemic period on youth cannabis use: Adjusted annual changes between the pre-COVID and initial COVID-lockdown waves of the COMPASS study. *BMC Public Health, 21*(1), 1–10.
- Linas, B. P., Savinkina, A., Barbosa, C., Mueller, P. P., Cerdá, M., Keyes, K., & Chhatwal, J. (2021). A clash of epidemics: Impact of the COVID-19 pandemic response on opioid overdose. *Journal of Substance Abuse Treatment, 120*, 108158.
- Little, R. J., & Rubin, D. B. (1989). The analysis of socialscience data with missing values. *Sociological Methods & Research, 18*(2–3), 292–326.
- Lodder, P. (2013). To impute or not impute: That's the question. *Advising on research methods: Selected topics*, 1–7.
- Maden, A., Swinton, M., & Gunn, J. (1990). Women in prison and use of illicit drugs before arrest. *BMJ: British Medical Journal, 301*(6761), 1133.
- Maden, A., Swinton, M., & Gunn, J. (1992). A survey of pre-arrest drug use in sentenced prisoners. *British Journal of Addiction, 87*(1), 27–33.
- Maldonado-Molina, M. M., Collins, L. M., Lanza, S. T., Prado, G., Ramírez, R., & Canino, G. (2007). Patterns of substance use onset among Hispanics in Puerto Rico and the United States. *Addictive Behaviors, 32*(10), 2432–2437.
- Marcos, A. C., & Bahr, S. J. (1988). Control theory and adolescent drug use. *Youth & Society, 19*(4), 395–425.
- Marchand, K., Beaumont, S., Westfall, J., MacDonald, S., Harrison, S., Marsh, D. C., ... & Oviedo-Joekes, E. (2019). Conceptualizing patient-centered care for substance use disorder treatment: Findings from a systematic scoping review. *Substance Abuse Treatment, Prevention, and Policy, 14*(1), 1–15.
- Mason, M., Arukumar, P., & Feinglass, J. (2021). The pandemic stay-at-home order and opioid-involved overdose fatalities. *JAMA, 325*(24), 2495–2496.
- Milam, A. J., Furr-Holden, D., Wang, L., & Simon, K. M. (2021). Health data disparities in opioid-involved overdose deaths from 1999 to 2018 in the United States. *American Journal of Public Health, 111*(9), 1627–1635.
- Miller, B. L., Griffin, O. H., III., Gibson, C. L., & Khey, D. N. (2009). Trippin' on Sally D: Exploring predictors of Salvia divinorum experimentation. *Journal of Criminal Justice, 37*(4), 396–403.
- Miller, B. L., Stogner, J. M., Khey, D. N., Akers, R. L., Boman, J., & Griffin, O. H., III. (2011). Magic mint, the internet, and peer associations: A test of social learning theory using patterns of Salvia divinorum use. *Journal of Drug Issues, 41*(3), 305–325.
- Miller, H. V. (2010). If your friends jumped off of a bridge, would you do it too? Delinquent peers and susceptibility to peer influence. *Justice Quarterly, 27*(4), 473–491.
- Miller, H. V., Jennings, W. G., Alvarez-Rivera, L. L., & Miller, J. M. (2008). Explaining substance use among Puerto Rican adolescents: A partial test of social learning theory. *Journal of Drug Issues, 38*(1), 261–283.
- Miller, J. M., Stogner, J. M., Miller, B. L., & Blough, S. (2018). Exploring synthetic heroin: Accounts of acetyl fentanyl use from a sample of dually diagnosed drug offenders. *Drug and Alcohol Review, 37*(1), 121–127.
- Miller, J. M., Miller, H. V., & Claxton, T. L. (2019). Theorizing novel and emerging drug use: A motivational typology. *Deviant Behavior, 40*(9), 1105–1118.

- Mounts, N. S. (2002). Parental management of adolescent peer relationships in context: The role of parenting style. *Journal of Family Psychology, 16*(1), 58–69.
- Mowen, T. J., & Visser, C. A. (2015). Drug use and crime after incarceration: The role of family support and family conflict. *Justice Quarterly, 32*(2), 337–359.
- Muthén, B. O., & Muthén, L. K. (2000). Integrating person-centered and variable centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical & Experimental Research, 24*(6), 882–891.
- Newcomb, M. E., Ryan, D. T., Greene, G. J., Garofalo, R., & Mustanski, B. (2014). Prevalence and patterns of smoking, alcohol use, and illicit drug use in young men who have sex with men. *Drug and Alcohol Dependence, 141*, 65–71.
- Paton, S., Kessler, R., & Kandel, D. (1977). Depressive mood and adolescent illicit drug use: A longitudinal analysis. *The Journal of Genetic Psychology, 131*(2), 267–289.
- Reifman, A., Barnes, G. M., Dintcheff, B. A., Farrell, M. P., & Uhteg, L. (1998). Parental and peer influences on the onset of heavier drinking among adolescents. *Journal of Studies on Alcohol, 59*(3), 311–317.
- Rubin, D. B. (1976). Inference and missing data. *Biometrika, 63*(3), 581–592.
- Rukus, J., Stogner, J., & Miller, B. (2017). LGBT novel drug use as contextualized through control, strain, and learning theories. *Social Science Quarterly, 98*(5), 1711–1730.
- Schroeder, R. D., & Ford, J. A. (2012). Prescription drug misuse: A test of three competing criminological theories. *Journal of Drug Issues, 42*(1), 4–27.
- Schwinn, T. M., Schinke, S. P., Keller, B., & Hopkins, J. (2019). Two-and three-year follow-up from a gender-specific, web-based drug abuse prevention program for adolescent girls. *Addictive Behaviors, 93*, 86–92.
- Shin, S. H. (2012). A longitudinal examination of the relationships between childhood maltreatment and patterns of adolescent substance use among high-risk adolescents. *The American Journal on Addictions, 21*(5), 453–461.
- Shin, S. H., Hong, H. G., & Hazen, A. L. (2010). Childhood sexual abuse and adolescent substance use: A latent class analysis. *Drug and Alcohol Dependence, 109*(1–3), 226–235.
- Snyder, S. M., & Smith, R. E. (2015). Do physical abuse, depression, and parental substance use influence patterns of substance use among child welfare involved youth? Substance use misuse. *Substance Use & Misuse, 50*(2), 226–235.
- Sokol-Katz, J., Dunham, R., & Zimmerman, R. (1997). Family structure versus parental attachment in controlling adolescent deviant behavior: A social control model. *Adolescence, 32*(125), 199.
- Stanley, J. M., & Lo, C. C. (2009). School-Related Factors Affecting High School Seniors' Methamphetamine Use. *Journal of Drug Education, 39*(4), 401–418.
- Steinberg, L., Lamborn, S. D., Darling, N., Mounts, N. S., & Dornbusch, S. M. (1994). Over-time changes in adjustment and competence among adolescents from authoritative, authoritarian, indulgent, and neglectful families. *Child development, 65*(3), 754–770.
- Tsikriktsis, N. (2005). A review of techniques for treating missing data in OM survey research. *Journal of operations management, 24*(1), 53–62.
- Stogner, J. M., & Miller, B. L. (2013). Investigating the 'bath salt' panic: The rarity of synthetic cathinone use among students in the United States. *Drug and Alcohol Review, 32*(5), 545–549.
- Stogner, J. M., & Miller, B. L. (2015). Assessing the dangers of "dabbing": Mere marijuana or harmful new trend? *Pediatrics, 136*(1), 1–3.
- Stringer, R. J., & Maggard, S. R. (2021). From "Just Say No" to "I Didn't Inhale" to We Have "Bigger Fish to Fry": The President, The Media, and Attitudes Toward Marijuana Legalization. *Deviant Behavior, 42*(1), 112–129.
- Substance Abuse and Mental Health Services Administration. (2020). Key substance use and mental health indicators in the United States: Results from the 2019 National Survey on Drug Use and Health (HHS Publication No. PEP20–07–01–001, NSDUH Series H-55). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Retrieved from <https://www.samhsa.gov/data/>
- Telesca, D., Eroshova, E. A., Kreager, D. A., & Matsueda, R. L. (2012). Modeling criminal careers as departures from a unimodal population age–crime curve: The case of marijuana use. *Journal of the American Statistical Association, 107*(500), 1427–1440.
- Uzun, S., & Kelleci, M. (2018). Substance Abuse in High School Students: Their Self Efficacy to Avoid Substance Abuse and Related Factors. *Dusunen Adam-Journal of Psychiatry and Neurological Sciences, 31*(4).



- Vaughn, M. G., DeLisi, M., Beaver, K. M., & Wright, J. P. (2009). Identifying latent classes of behavioral risk based on early childhood: Manifestations of self-control. *Youth Violence and Juvenile Justice*, 7(1), 16–31.
- Weller, B. E., Bowen, N. K., & Faubert, S. J. (2020). Latent class analysis: A guide to best practice. *Journal of Black Psychology*, 46(4), 287–311.
- White, A., Chan, G. C., Quek, L. H., Connor, J. P., Saunders, J. B., Baker, P., ... & Kelly, A. B. (2013). The topography of multiple drug use among adolescent Australians: Findings from the National Drug Strategy Household Survey. *Addictive Behaviors*, 38(4), 2068–2073.

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