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SPECIFYING THE LINK BETWEEN ADOLESCENT SUBSTANCE USE AND
TRADITIONAL DELINQUENCY THEORIES: A NEGATIVE BINOMIAL APPROACH

By

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Thesis

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for the degree of

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DEDICATION

This thesis is dedicated to my grandparents, Bob and Jill Feuchter

Specifying the Link Between Adolescent Substance Use and Traditional Delinquency Theories: A Negative Binomial Approach

Chairperson: Dusten Hollist, Ph.D.

The current study applied a cross-sectional sample of 8th, 10th, and 12th grade Montana public school students derived from the Montana Prevention Needs Assessment Survey (n=21,321). Due to the extant literature of adolescent substance use, this study examines hypotheses pertaining to the ability and influence of measures drawn from social bonding, social learning, and social disorganization theories to account for variations in self-reported lifetime use of alcohol, marijuana, and other illicit drugs. Results derived from negative binomial regression equations show significant associations, most notably with variables from the social learning tradition. The findings suggest that existing theories offer a promising framework for understanding the process of adolescent substance use. Limitations along with suggestions for future research are discussed.

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INTRODUCTION

The consumption of alcohol and illicit drugs among adolescents has been a growing concern in sociology and related disciplines (Hayes-Smith and Whaley 2009; Embry, Hankins, Biglan, and Boles 2009; Herman-Stahl, Krebs, Kroutil, Heller 2007). The societal and financial effects of substance use in Montana have been detrimental. For example, methamphetamine use accounted for 33 percent of children in foster care and over 50 percent of children were in foster care for drug-related reasons in 2006 (Methamphetamine in Montana 2008). Also, Bryant, Schulenberg, O'Malley, Bachman, and Johnston (2003) found consistent patterns in the prior literature that high truancy rates and low academic success is strongly related to students who participate in marijuana and alcohol use.

Substance use is prevalent in the adolescent population and can lead to criminal behavior and be highly addictive with severe adverse health effects ranging from increased use of drugs to psychiatric disorders. (Fairbairn, Kerr, Buxton, Li, Montaner, and Wood 2006; Methamphetamine in Montana 2008). This age group was selected because previous research indicates that this is the age at which young people make the initial decision to use alcohol, marijuana, and other illicit drugs (Wilson and Donnermeyer 2006).

Motivators to use substances focus on its ability to make the user feel more concentrated, euphoric, and confident (Embry et al 2009; Herman-Stahl et al 2007). However, many substances have major health and safety consequences. Early initiation of substance use is associated with problem behavior, prolonged use of substances, early sexual behavior, unprotected sex among the teen population, which increases HIV infection rates along with other sexually transmitted diseases, and unexpected teen pregnancies (Embry et al 2009; Fairbairn et al 2007; Methamphetamine Use and Risk for HIV/AIDS 2007; Haynie 2002). The prevention of

substance use could have many health and public safety benefits. Studying the initiation of substance use among adolescents will help contribute to the development of prevention efforts. This study will examine theoretical correlates that have been significantly useful in the research on adolescent substance use to account for variations in alcohol, marijuana, and illicit drug use among a sample of Montana teens.

PRIOR LITERATURE

Adolescent substance use has been a popular topic of research in criminology for decades and it continues to be of great concern in the field. Prior research on youth substance use has primarily focused on family-based social bonding variables and those derived from social learning models which highlight the importance of peer groups (Dekovic, Wissink, and Meijer 2004; Ford 2008; McGillicuddy, Rychtarik, Morsheimer, and Burke-Storer 2007) as well as community, gender, biological, and behavioral factors (Embry et al 2009, Hayes-Smith and Whaley 2009). Research collaborating all of these elements is limited at best. This is a serious void as it is important to understand the numerous influences that affect an adolescent's choice to use substances in order to best understand the connection.

Social Bonding

Social bonding theory (SBT) attempts to explain how an emotional connection to others keeps an individual from delinquent activities when the opportunity for delinquency arises. SBT posits that delinquency results when one's social connections to significant others become weakened or broken (Hirschi 1969). When close relationships exist, youths will be more likely to consider how their decisions impact their connections to others. Acts of delinquency, including substance use, will be avoided to protect the investment that has been put in to the bonds that youths have with others. Alternatively, when connections to others are strained,

become weakened, or broken, there is less to lose and delinquency, like substance use, is projected to more likely to occur. Although a youth's stake in conformity was associated with four interrelated dimensions in Hirschi's original statement of SBT, attachments to parents and schools was regarded as the most consequential social bonds that influence the likelihood of youth substance use. Attachment refers to affective ties to significant others (parents and school) which constrain behavior as deviance would likely harm these important social relationships (Erikson, Crosnoe, and Dornbusch 2000; Ford 2010; Hirschi 1969; Ingram et al. 2007).

Parental Attachment. Prior research finds that parents play a vital role in the outcomes and decision making of their children, including the peers they decide to socialize with (Erickson et al 2000; Parker and Benson 2004; Embry et al 2009, Kim et al 2010; Hirschi 2002; Ford 2010). Parents who communicate with their adolescents and supervise activities with peers decrease the probability of them socializing with delinquent peers and reduce their opportunities for substance use (Erickson et al 2000; Hirschi 2002; Ingram et al 2007). Like the peer group, parents are a source for prosocial and unlawful norms about the use of substances. Parents, in particular, represent individuals to whom youth can talk about smoking, drinking, and other drugs and thereby influence future use through the bond built through communication. The ability to communicate about such issues strengthens familial relationships. Therefore, family cohesion plays an important role in adolescent substance use (Wilson and Donnermeyer 2006). When comparing the quality of parent-adolescent relationships, Dekovic et al (2004) found that youths who maintained positive relations with their parents were less likely to participate in substance use. Time spent during productive family time is a protective factor against the development of problem behaviors. Ackard, Neumark-Sztainer, Story, and Perry (2006) documented how the impact of parent-child interaction on substance use and other problem

behavior increased family closeness, the value parent opinion, and felt comfortable talking to their parents. This family closeness resulted in the children developing better self-control skills, which are related to less substance use and increased academic success. In a study focusing on youth time use and its correlates to delinquency, youth who spend more time during the week with parents tends to be warmer and more loving (Crouter, Head, Mchale, and Tucker 2004). The youth in these families were less involved in drinking and delinquency than youth from families who spent little time together. This was constant in both males and females, regardless of social class (Crouter, Head, Mchale, and Tucker 2004). Furthermore, studying youth in treatment for substance abuse, low parental monitoring and weaker relationships between parents and youth predicted severe substance use and socialization with antisocial peers.

School Commitment. Connections that youths develop in the context of school have been found to influence the likelihood of delinquency and substance use (Ford 2010; Hawkins, Graham, Maguin, Abbott, Hill, and Catalano 1997; Haynie and Saylor 1999; Hirschi 2002; Maddox and Prinz 2003; Seek Moon and Ando 2009). Most schools offer the ability to excel in academics, extracurricular activities, prosocial peer groups, and in relationships with positive role models such as faculty and staff. However, failure to take interest in these opportunities puts youth at a risk for substance use (Ford 2009). Youths spend an abundance of their time interacting with peers and adults in the context of schools. When a youth's connection to school is strong, there is a higher premium placed on conforming to existing laws and rules (Haynie and Saylor 1999; Ford 2010; Seek Moon and Ando 2009).

In a study to determine the effect of school bonding on nonmedical prescription drug use, Ford (2009) concluded that a strong school bond makes substance use less likely by establishing a stake in conformity. Participation in substance use would place such aspirations at risk in the

present and future. Other research has indicated that White males are more at risk for substance use during adolescence when experiencing low academic achievement, school bonding, school interest, school effort, and parental help. However, females experiencing low academic achievement are more at risk than males because their perceived self-concept, suggesting that school failure may put females at a higher risk for problem behaviors than males (Bryant, Schulenberg, O'Malley, Bachman, and Johnston 2003). Wang, Matthew, Bellamy, and James (2005) stated that school was found to be the sole, significant pathway to substance use among adolescents. Wang, Matthew, Bellamy, and James (2005) noted that social skills and social support, especially from teachers, are major determinants of social closeness and less substance use. A student feeling safe in the school environment is also imperative for developing a close connection to school (Whitlock 2006).

Social Learning

Social learning theory (SLT) states that individuals learn to participate in criminal behavior, such as substance use, in the same way that they learn other types of behavior. Youths acquire definitions of criminal behavior as favorable or unfavorable through a social learning process involving social interaction and socialization with intimate others (Sutherland 1940). The youth's actions are differentially reinforced, whereby their behaviors are shaped by rewards and punishments (Burgess and Akers 1966). With regard to substance use, SLT predicts that youths are more likely to participate in substance use when they interact with peers who express definitions favorable to it. Conversely, youths are more likely to resist participating in substance use when the groups that they interact with express definitions against it. Although SLT is not limited to the peer group, previous research indicates that association with delinquent peers is the strongest correlate to delinquent behavior (Warr 2002).

Prior literature has consistently found that youths whose interaction with intimate others contain an excess of favorable definitions toward substance use is a leading cause of youth substance use (Ventura Miller, Jennings, Alvarez-Rivera, and Mitchell Miller 2008, Embry et al 2009, Kim, Kwak, and Yun 2010; Akers, Krohn, Lanza-Kaduce, and Radosevich 1979; Lee, Akers, and Borg 2004). In an Oregon study that specifically focused on methamphetamine use, youths were more likely to use if their peers engaged in substance use or in antisocial behavior (Embry et al 2009). Embry, Hankins, Biglan, and Boles (2009) also reported that there was a robust relationship between parents' favorable attitudes toward drug use and methamphetamine use among adolescents. Hartjen and Priyadarsini (2003) found that youth who reside in rural towns are strongly influenced to participate in delinquent behavior when they associate with antisocial peers who show positive attitudes toward problem behavior.

After examining the effects of a youth having all delinquent friends compared to a combination of delinquent and non-delinquent friends, Haynie (2002) concluded that youth who had all delinquent friends were twice as likely to participate in delinquency as those who had delinquent and non-delinquent friends. Early onset of substance use was found to occur from association with more delinquent peers. As a result, youths who socialized with more delinquent peers and begin substance use earlier than the other participants in the study were more likely to engage in delinquent activities. Also, youth who socialize with academically high-achieving peers show improvement in their grades over time (Dishion and Owen 2002) which has been shown to serve as a protective factor against substance use (Ford 2009; Bryant et al 2003). Moreover, youth who spend time with drug using peers are less likely to engage in school and show an increase in their own drug use (Dishion and Owen 2002). Lonardo, Giordano, Longmore, and Manning (2009) discovered that although youth are more likely to be involved in

substance use when they associate with delinquent peers, the probability of delinquent behavior and substance use increases when youth are in a romantic relationship with a delinquent partner. Neff and Waite (2007) noted that, regardless of gender, peer substance use is significantly connected to early onset of substance use and more frequent present substance use. In addition, youth who are more peer-oriented than parent-oriented are more likely to take part in substance use (Neff and Waite 2007), thus, confirming that negative peer association consistently plays a significant role in youth substance use.

Social Disorganization

Social disorganization theory (SDT) is founded on the prediction that disruption and breakdown in social relations and values at the community level result in the loss of the social control of group and individual behavior. Communities with high rates of delinquency are overwhelmed with low paying jobs, high levels of residential turnover and ethnic variation (Shaw and McKay 1942, 1969). These structural-level factors influence youth in involvement in delinquency indirectly by influencing educational and occupational opportunities and making it difficult for residents to develop and maintain informal control mechanisms. As a result, socially disorganized communities face challenges pertaining to the lack of common value systems, ability to supervise youth groups, and prevent delinquency. Characteristics of social disorganization include low social capital, the inability to offer community activities, abandoned buildings and other broken down social structures, residential instability, and racial/ethnic heterogeneity (Hayes-Smith and Whaley 2009). Pratt and Cullen (2005) noted that there are numerous theoretical perspectives that overlap predictions connecting structural factors and crime. However, they concluded that there is substantial support for social disorganization theory.

The demographic composition of Montana is vastly rural and the bulk of the population is comprised of White youths (82.8%). Native American youths represent the second largest demographic at 8.6%. As such, ethnic heterogeneity, while an important part of SDT, is less likely to be as consequential to this study as residential mobility and collective efficacy. When residents frequently move in and out of the community, they are less likely to involve themselves in informal social networks that provide control over its members. In a study conducted by Hayes-Smith and Whaley (2009), it was noted that social ties with a neighborhood and the desire to remain in a neighborhood created social efficacy and mediated the effect of structural constraints and was a protective factor against community disorder and crime. In addition, rural areas often experience higher poverty rates than most urban areas (Hayes-Smith and Whaley 2009). The problem creating rural poverty is a lack of employment, training, education, and community resources within rural communities. The unavailability of these resources leads community members to resort to substance use as a means to overcome their substandard lifestyles (Bernbug and Thorlindsson 2007). Youths who live in rural poverty often witness adults abuse substances and this frequently validates substance use as an appropriate behavior accepted within the community.

In communities that were characterized to have low socioeconomic status, transient populations, and be predominantly White, Hayes-Smith and Whaley (2009) found a higher use of methamphetamines compared to other communities. Bernbug and Thorlindsson (2007) found that close social cohesion in a social network that ties community parents and their adolescents mediate part of the effect of neighborhood structure on youth problem behavior. Residential mobility has been shown to alter a families' social network and ties. Although it is possible for families to develop a strong bond to other families in the community that was not available to

them at their previous residence, it is more likely to have previous bonds disrupted or broken than it is to develop new bonds (Faulth, Leventhal, and Brooks-Gunn 2007). Faulth Leventhal, and Brooks-Gunn (2007) also found that it is more beneficial for young, low-income children to move into poor neighborhoods than when adolescents make this same transition, they tend to show more resiliencies to parental ideals.

CURRENT STUDY

The purpose of the current study is to examine the link between substance use and variables derived from traditional delinquency theories. Based on the prior literature and the availability of data to measure them, parental attachment, school commitment, peers who favor drug use, pro-delinquent attitudes, community norms favoring drug use, community disorder, residential mobility, and community attachment were selected to represent the theories outlined in the previous section. The analysis that follows examines the following three hypotheses: First, theoretically derived variables will be significantly associated with self-reported substance use. The relationship between alcohol, marijuana, illicit drug, and variables from social learning theory, community disorder, and residential mobility will be positive. The association with variables from the social bonding perspective and community attachment will be negative because SBT attempts to explain conformity. Second, when examined individually, theoretically derived variables will be significantly associated with self reported use of LSD, Cocaine, Inhalant, Methamphetamine, Stimulant, Sedative, Heroin, and Ecstasy. Third, it is expected that there will be differences in the relative contribution of the variables in the models, but the pattern of findings will be similar across all models.

DATA

The data used for this study are taken from the 2006 Montana Prevention Needs Assessment Survey (MPNAS). The MPNAS is given to students in the Montana public school system by qualified staff from the Department of Public Health and Human Services. The survey has been administered every two years in Montana since 1998. The data collected from the MPNAS consist of students in the sixth, eighth, tenth, and twelfth grades. In 2006, according to the Department of Public Health and Human Services (DPHHS), this level of surveying is necessary because program planning often requires knowledge of subpopulations, such as youth in a specific community or a specific grade. The public use of the data is only accessible in aggregate form to protect the identity of the participants in the study.

The survey was administered in the spring of 2006 to all the schools that agreed to participate. A total of 21,321 (53.4%) students from Montana public schools participated in the 2006 wave of the data collection which is a sufficient participation rate for the results to be representative of the students in grades eight, ten, and twelve in Montana.

Teachers were given a script to read so that all students would receive a standardized set of questions. To ensure confidentiality, the questionnaires were placed in an envelope that was taken to the main office by a student and the teacher where it was mailed to the conductor of the survey (Montana DPHHS 2006). The MPNAS survey required about 45 minutes of in-class time to complete and was comprised of 227 questions. The items in the MPNAS are divided into identified risk factors for substance use in important areas of daily life focusing on community, family, school, individual, and peer domains. The information pertaining to youth attitudes toward peers, family, school, community, and substance use makes this a valuable set of data for this study.

To ensure validity, 873 surveys were eliminated because respondents were determined to be dishonest. These surveys were eliminated because of five dishonesty indicators: 1) the student indicated that they were “Not Honest At All” (243); 2) the students indicated that they had used the non-existent drug phenoxydine (616); 3) the students reported an impossibly high level of multiple drug use (292); 4) the students indicated past-month use rates that were higher than lifetime use rates (136); 5) the students reported an age that was inconsistent with their grade or their school (79).

MEASURES

Independent Variables

Social Bonding Variables. Two variables represent social bonding theory. *Parental Attachment* ($\alpha=.90$) was made up of eleven items measuring how close the respondents felt to their parents, could consult their parents about personal problems, and had opportunities for prosocial involvement in the family. *School Commitment* ($\alpha=.78$) was measured as a seven item scale dealing with the respondent’s school experiences including their level of safety and comfort in school, and their commitment to school success. These items correspond to the same items used by Maddox and Prinz (2003) in defining school commitment. The responses are coded so that the higher scores are those respondents who reported having close relationships with their parents and enjoying the connections that they have with others in the context of the school environment.

Social Learning Variables. Three social learning variables are included in the analysis. *Peers Who Favor Drug Use* ($\alpha=.73$) was based upon two items asking respondents about their four best friends and how many have used illicit drugs (other than marijuana) and have sold illicit drugs. The responses are coded so that the higher scores are those respondents who

reported having best friends who participated in and/or promoted drug use. *Pro-Delinquency Attitudes* (alpha=.77) was comprised of five items asking the respondents about how wrong they felt it was to participate in delinquency (very wrong to not wrong at all). Higher scores represent adolescents who felt it was not wrong at all to steal something worth more than five dollars, to pick a fight, attack someone to hurt them, to miss school, and to use LSD, cocaine, and other illegal drugs. *Community Norms Favoring Drug Use* (alpha=.77) was made up of six items that ask respondents how wrong adults in their neighborhood would think it would be if kids used substances and the likelihood that kids in their neighborhood would get caught by the police for substance use. This variable incorporates the societal or group norms conducive to conformity or deviance (Akers 1998).

Social Disorganization Variables. There are three variables representing respondent perceptions of social disorganization at the community level. *Community Disorder* (alpha=.83) was measured as a five item scale. The scale consists of indicators of informal social control, community violence, and feelings of safety within the community. The responses are coded so that the higher scores are those respondents who reported living in communities with higher levels of violence, lower levels of safety, and lower levels of social control. The second social disorganization variable is *Community Attachment* (alpha=.86), was made up of six items identifying if the respondents felt they were encouraged to do their best from community members, if the respondent would like to leave their neighborhood, and if they like the neighborhood. *Residential Mobility* is a single item measuring how often the respondent has moved since kindergarten.

Dependent Variables

The data allowed for very specific indications of the respondent's long term substance use. Respondents were asked to report how many times in their lifetime they had used alcohol, marijuana, methamphetamines, LSD, inhalants, stimulants, sedatives, heroine, ecstasy, cocaine, and overall illicit drug use ($\alpha=.77$). Response categories were: 0 occasions, 1-2 occasions, 3-5 occasions, 6-9 occasions, 10-19 occasions, 20-39 occasions, and 40 or more occasions. Higher scores from the respondents indicate a higher frequency of lifetime use of substances. Lifetime use is seen as a good measure of youth experimentation and experience with substances whereas thirty day use is generally applied when examining the rate of use of a particular substance (DPHHS 2006). Lifetime use is more beneficial when testing theories whose causal mechanism are seen as developing over an extended period of time (e.g. parental attachment) than would be expected in the shorter past thirty days questions used to collect data on substance use in the MPNAS.

Control Variables

Social domains in an individual's life may only explain a portion of the variance in rates of self-reported substance use. Individual characteristics also play a role in a respondent's choice to participate in substance use. In an attempt to control for spuriousness in the association between theoretically derived variables and substance use, individual, demographic, and family characteristics were held as covariates in the analysis. The controls used to address these demographic characteristics consisted of *Age* (an ordinal variable measured in years) and *Male* (a dichotomous variable with males coded as the high category). Prior research generally focuses on shared characteristics of male and female adolescents, rather than what is unique about each gender. However, it is argued that adolescent gender may be among the most primary individual

characteristics that should be addressed in studies (Gavazzi, Lim, Yarcheck, Bostic, and Sheer 2008). *Mother's/Father's Education* was a categorical variable measuring the combined level of education for a respondent's mother and father. Mother's/father's education level was selected because parent education may influence parental effectiveness. This has been important in mediating exposure to other risk factors such as educational attainment, peer drug use, and access to drugs (Toumbourou, Rowland, Lee, Hemphill, Marshall, and Dimovshi 2003). *Non-White* is an ethnicity variable with non-whites coded as the high category.

A single variable was used to measure differences in levels of sensation seeking. Characteristics pertaining to individual temperament were measured by a three item scaled variable, *Impulsivity* ($\alpha=.71$). Impulsivity measured how often the respondent had done what feels good no matter what, had done something dangerous because someone dared them to do it, and had done crazy things even if they were a little dangerous. The answers ranged from "never" to "once a week or more." Moeller and Dougherty (2002) have shown that impulsivity is an important variable to measure because individuals who use substances tend to be more impulsive than non-substance-using populations. Impulsivity has also been found to be strongly related to overall delinquency (White, Moffitt, Caspi, Bartusch, Needles, and Stouthamer-Loeber 1994) especially in the adolescent years (Moffitt 1993)

ANALYSIS

Logic of the Analysis

In determining the appropriate multivariate estimation technique, the models were initially fitted as ordinary least squares estimates (OLS). Upon examination of the residuals based on this model, it became clear that there were problems with non-normally distributed prediction errors. When examining the models through Poisson distribution, the dispersion

statistics showed the amount of overdispersion to be large enough to bias the predictions (Deviance >1; Hilbe 2008). Therefore, the models were specified as negative binomial regression estimates (NBR) in the analysis that follows. NBR models are advantageous to their OLS and Poisson counterparts as they can account for overdispersion in the scores (instance where the standard deviation are higher than the associated averages) and non-normality in terms of the excess likelihood of reporting no substance use on the outcome variables. Before proceeding to the presentation of the findings, a couple of issues pertaining to the test of significance in the NBR models need to be mentioned. First, there is a concern with regard to the influence that a sample of 21,321 respondents has on the magnitude of the association needed to rule out the null claim of no association in the population. The observed effect size needed is very small to do so with at least 95% confidence in the decision. In addition, it is important to recognize that the effects sizes reported in Tables 6 and 7 are unstandardized slopes therefore there will be no relative comparisons between the variables. As a result it is difficult to determine the thresholds as they pertain to effects sizes that are needed to conclude that the findings are non-random. Part of the estimation of the tests of significance is a comparison of the effects size with the standard errors for each of the independent variables. Although the standard errors are uniformly low, they do vary between the variables and so too will the strength of the association needed to achieve statistical significance.

Table 1. Descriptive Statistics (n=21,321)

Variable	Mean	Standard Deviation	Minimum	Maximum
Controls				
Age	15.37	1.74	11	19
Male	1.50	.50	1	2
Non-White	.17	.38	0	1
Mother's/Father's Education	4.53	1.45	1	8
Impulsivity	9.34	4.11	1	18
Social Bonding Variables				
Parental Attachment	30.56	8.65	1	44
School Commitment	25.65	5.24	1	37
Social Learning Variables				
Peers Who Favor Drug Use	2.57	1.48	1	10
Pro-Delinquent Attitudes	8.19	2.97	1	20
Community Norms Favoring Drug Use	13.14	3.92	1	24
Social Disorganization Variables				
Community Disorder	7.40	2.92	1	20
Community Attachment	15.27	4.54	1	24
Residential Mobility	2.36	1.29	1	5
Substance Use Variables				
Lifetime Alcohol Use	2.38	2.30	0	6
Lifetime Marijuana Use	1.17	2.03	0	6
Lifetime LSD Use	.09	.533	0	6
Lifetime Cocaine Use	.10	.57	0	6
Lifetime Inhalant Use	.29	.88	0	6
Lifetime Methamphetamine Use	0.08	0.56	0	6
Lifetime Stimulant Use	0.16	0.75	0	6
Lifetime Sedative Use	0.32	1.01	0	6
Lifetime Heroin Use	0.05	0.41	0	6
Lifetime Ecstasy Use	0.07	0.45	0	6
Lifetime Illicit Drug Use	1.11	3.34	0	47

The descriptive statistics for the variables that were used in the analysis are presented in Table 1. As shown, all of the substance use variables, with the exception of lifetime alcohol and illicit drug use, had standard deviations larger than the associated arithmetic averages. Although some overdispersion of scores is to be expected (see Hilbe 2008, p.45 for an extended discussion of how common slight overdispersion is in statistical data), the magnitude of the disparity was in

most cases stronger than could be expected under the assumptions for OLS and Poisson estimation.

Average age of the respondents in the data was 15.37. There was near equal split between males (49.9%) and females (51.1%) and most of the respondents were White (82.6%). Respondents resided in households where the mean parental education level (4.53) was between “some college” and “graduated college.” Roughly 16% of the respondents reported the use of any illicit drug in their lifetime.

Table 2. Frequency Distributions of Lifetime Substance Use

Variable	0-Occasions	1-2 Occasions	3-5 Occasions	6-9 Occasions	10-19 Occasions	20-39 Occasions	40+ Occasions
Alcohol	6858 (33.1%)	3067 (14.8%)	2089 (10.1%)	1543 (7.4%)	1881 (9.1%)	1749 (8.4%)	3531 (17%)
Marijuana	14015 (69.5%)	1353 (6.7%)	833 (4.1%)	605 (3.0%)	802 (4.0%)	580 (2.9%)	1970 (9.8%)
LSD	19099 (95.7%)	395 (2.0%)	187 (0.9%)	104 (0.5%)	91 (0.5%)	32 (0.2%)	42 (0.2%)
Cocaine	18951 (95.8%)	424 (2.1%)	432 (0.7%)	89 (0.4%)	72 (0.4%)	47 (0.2%)	72 (.4%)
Inhalant	17052 (85.3%)	1660 (8.3%)	559 (2.8%)	306 (1.5%)	186 (0.9%)	91 (0.5%)	141 (0.7%)
Meth	18750 (96.6%)	303 (1.6%)	108 (0.6%)	62 (0.3%)	65 (0.3%)	42 (0.2%)	79 (0.4%)
Stimulant	18297 (93.3%)	527 (2.7%)	274 (1.4%)	182 (0.9%)	122 (0.6%)	79 (0.4%)	121 (0.6%)
Sedative	17035 (86.6%)	1099 (5.6%)	545 (2.8%)	350 (1.8%)	284 (1.4%)	148 (0.8%)	206 (1.0%)
Heroin	19002 (98.0%)	182 (0.9%)	59 (0.3%)	43 (0.2%)	37 (0.2%)	20 (0.1%)	40 (0.2%)
Ecstasy	18517 (96.5%)	383 (2.0%)	118 (0.6%)	62 (0.3%)	51 (0.3%)	23 (0.1%)	32 (0.2%)

Concerns with the distribution assumptions continue when considering the pattern in the frequency of zero, “never used in their lifetime,” versus non-zero scores pertaining to self reported substance use. These patterns are presented in Table 2. The distributions clearly show that with the exception of alcohol use, most respondents did not report substance use in their lifetime.

When examining combined illicit drug use, 75 percent of the respondents reported to never having used an illicit drug. This issue is most pronounced in the distributions for methamphetamine use (96.6%) and heroin use (98%). However, when examining the frequency

of each substance use, respondents reported more “40+ Occasions” in each category than the previous “20-39 Occasions.”

Table 3 presents the percentage of substance use by grade level measured in the MPNAS. This table indicates that Alcohol is the most frequently used substance. Also, there is a consistent pattern of an increase in substance use with the age of the respondent, except for Inhalant use which peaks in the eighth grade. The percentage of respondents who reported using Marijuana, LSD, Cocaine, Methamphetamine, Heroin, and Ecstasy tripled from the eighth grade to the twelfth grade.

Table 3. Percentage of MT Respondents Who Use Substances during Their Lifetime by Grade

Montana School Grade	Grade 8	Grade 10	Grade 12
Substance Used			
Alcohol	52.90%	72%	81.50%
Marijuana	13.90%	35.90%	47.30%
LSD	1.60%	4.50%	7.50%
Cocaine	1.50%	4%	7.90%
Inhalant	16.50%	15.40%	11.20%
Methamphetamine	1.50%	3.50%	5.80%
Stimulant	3.60%	7.70%	9.20%
Sedative	10%	14.20%	16.70%
Heroin	0.90%	2%	3.20%
Ecstasy	1.90%	3.60%	5.70%

Bivariate Results

Tables 4 and 5 contain the zero order inter-correlations for each of the variables in the analysis. The associations between the theoretical variables and self reported substance use are consistent with findings from the prior literature and the pattern of the associations are in the expected direction. At the bivariate level, the associations between the theoretical and substance use variables consistently have a weak association except for those representing SLT. Having peers who favor the use of drugs was the strongest bivariate predictor of substance use at the bivariate level. This finding is consistent with prior literature (Ventura Miller, Jennings,

Alvarez-Rivera, and Mitchell Miller 2008, Embry et al 2009, Kim, Kwak, and Yun 2010; Akers, Krohn, Lanza-Kaduce, and Radosevich 1979; Lee, Akers, and Borg 2004). This variable was most closely associated with engaging in LSD use when the types of illicit drug use were examined individually in Table 5. The findings in Table 4 show that school commitment served more as a protective factor than parental attachment for each form of substance use. School commitment was the only theoretical variable, except for SLT variables, which has more than a weak correlate of alcohol use.

Table 4. Zero Order Intercorrelations for Alcohol, Marijuana, and Illicit Drug Use (n=21,321)

Variables	Alcohol Use	Marijuana Use	Illicit Use
Controls			
Male	-.037**	-.044**	.006
Age	.395**	.293**	.135**
Non-White	.039**	.138**	.054**
Mother's/Father's Education	-.134**	-.109**	-.066**
Impulsivity	.393**	.276**	.238**
Social Control Variables			
Parental Attachment	-.158**	-.155**	-.036**
School Commitment	-.308**	-.28**	-.166**
Social Learning Variables			
Peers Who Favor Drug Use	.335**	.476**	.453**
Pro-Delinquent Attitudes	.392**	.367**	.375**
Community Norms Favoring Drug Use	.399**	.317**	.26**
Social Disorganization Variables			
Community Disorder	.143**	.164**	.185**
Residential Mobility	.117**	.146**	.111**
Community Attachment	-.15**	-.178**	-.083**

**Correlation is significant at the .01 level

*Correlation is significant at the .05 level

Females were shown to be more likely than males to participate in substance use except for sedative, inhalant, and overall illicit drug use. However, the magnitude of these differences was minor and did not surpass +/- 0.1. In nearly every instance, older adolescents were more

likely to report substance use. The only exception to this pattern was found for inhalant use which was most strongly associated with community disorder. Impulsivity was the strongest control correlate of substance use; it was most closely associated with alcohol use. Non-whites were found to be more likely than whites to reports substance use regardless of the type with marijuana use being the only substance use variable where the association exceeded 0.1. Residential mobility corresponded with previous research findings that transient populations increases the likelihood of adolescent substance use and low parental education was also associated with adolescent substance use.

Table 5. Zero Order Correlations For Illicit Drug Use Type (n=21,321)

Lifetime Substance Use	LSD	Cocaine	Inhalant	Meth	Stimulant	Sedative	Heroin	Ecstasy
Controls								
Male	-.056**	-.024**	.015*	-.002	-.007	.03**	-.04**	-.033**
Age	.116**	.12**	-.024**	.099**	.1**	.109**	.07**	.083**
Non-White	.035**	.025**	.075**	.059**	.047**	.037	.022**	.043**
Mother's/Father's Education	-.045**	-.037**	-.052**	-.057**	-.056**	-.06**	-.012	-.032**
Impulsivity	.137**	.12**	.209**	.1**	.168**	.192**	.095**	.138**
Social Control Variables								
Parental Attachment	-.088**	-.08**	-.16**	-.07**	-.108**	-.145**	-.07**	-.076**
School Commitment	-.156**	-.137**	-.173**	-.111**	-.169**	-.194**	-.104**	-.138**
Social Learning Variables								
Peers Who Favor Drug Use	.401**	.393**	.224**	.324**	.369**	.329**	.278**	.328**
Pro-Delinquent Attitudes	.218**	.208**	.276**	.175**	.249**	.262**	.15**	.208**
Community Norms Favoring Drug Use	.149**	.139**	.172**	.134**	.169**	.191**	.088**	.13**
Social Disorganization Variables								
Community Disorder	.081**	.067**	.166**	.094**	.116**	.117**	.067**	.085**
Community Attachment	-.072**	.065**	-.139**	-.06**	-.105**	-.126**	-.039**	-.068**
Residential Mobility	.068**	.062**	.11**	.097**	.09**	.096**	.048**	.074**

**Correlation is significant at the .01 level

*Correlation is significant at the .05 level

Multivariate Results

Hypothesis One. The results in Table 6 provided partial support for the first hypothesis; that theoretically derived variables would be significantly associated with self-reported substance use. With the exception of the negative effects of community disorder on alcohol and marijuana use, which were hypothesized to be positive and the effect of parental attachment on illicit drug use which were hypothesized to be negative, all remaining relationships were in the expected direction. In each of these instances where the association between variables was in the opposite direction, the magnitude of the effects was weak.

The strongest support for hypothesis one were the findings pertaining to the SLT variables. Peers who favor drug use was the strongest predictor of marijuana use ($\beta = .206$; $p < .01$) and was significantly associated with variations in alcohol ($\beta = .041$; $p < .01$) and illicit drug use ($\beta = .073$; $p < .01$). Respondents who held pro-delinquent attitudes was closely associated with marijuana use ($\beta = .085$; $p < .01$), but in addition was associated with both alcohol ($\beta = .048$; $p < .01$) and illicit drug use ($\beta = .025$; $p < .01$). Alcohol ($\beta = .052$; $p < .01$) and marijuana ($\beta = .055$; $p < .01$) use were more likely to be reported in communities where respondents perceived favorable norms toward drug use. The effect of community norms favoring drug use is less closely associated with variations in illicit drug use ($\beta = .006$; $p < .05$).

The patterns of associations for the social bonding variables are for the most part consistent with past research indicating a negative association with substance use. School commitment was found to be the strongest negative correlate of substance use in the models and was most closely associated with variations in marijuana ($\beta = -.032$; $p < .01$) and alcohol use ($\beta = -.032$; $p < .01$). The effects of parental attachment were negatively correlated with alcohol ($\beta = -.008$; $p < .01$) and marijuana use ($\beta = -.009$; $p < .01$). In contrast to the hypothesized results, the

magnitude of the effects sizes for both variables derived from the social control tradition was weaker than expected and specifically for variations in illicit drug use, not statistically different than would have been expected if there were no association at all.

The results for hypothesis one derived from the pattern of findings for social disorganization variables were mixed. As hypothesized the more often respondents reported residential mobility was positively correlated with marijuana ($\beta = .109$; $p < .01$) and alcohol use ($\beta = .043$; $p < .01$); and to a lesser extent illicit drug use ($\beta = .014$; $p < .05$). The analysis found a weak negative association between community attachment and marijuana use ($\beta = -.022$; $p < .01$) and no association between community attachment and lifetime alcohol and illicit drug use. To further add to the mixed evidence in the findings pertaining to SDT variables, community disorder was weakly associated with lower levels of illicit drug use ($\beta = .003$; $p > .05$) and negatively associated with both alcohol ($\beta = -.013$; $p < .01$) and marijuana ($\beta = -.014$; $p < .01$) use.

The results pertaining to the influence of the control variables showed males were more likely than females to engage in alcohol, marijuana, and overall illicit drug use. Except for inhalant use, substance use occurred more often among older adolescents. Substance use was more prevalent among non-Whites, those residing in households where combined parental education was low, and for those with higher levels of impulsivity.

Table 6. Negative Binomial Regressions of the Effects Statistical Controls and Theoretical Variables on Substance Use (n=21,321)

	Lifetime Alcohol Use	Lifetime Marijuana Use	Lifetime Illicit Drug Use
Intercept	-3.485** (.141)	-6.822** (.189)	1.205** (.119)
Control Variables			
Male	.158** (.020)	.187** (.025)	.054** (.017)
Age	.198** (.006)	.317** (.008)	.007* (.005)
Non-White	.054* (.026)	.508** (.031)	.002 (.023)
Mother's/Father's Education	-.031** (.007)	-.049** (.008)	-.004 (.006)
Impulsivity	.066** (.003)	.068** (.003)	.007** (.002)
Social Bonding Variables			
Parental Attachment	-.008** (.001)	-.009** (.002)	.002 (.001)
School Commitment	-.023** (.002)	-.032** (.003)	-.001 (.002)
Social Learning Variables			
Peers Who Favor Drug Use	.041** (.007)	.206** (.008)	.073** (.006)
Pro-Delinquent Attitudes	.048** (.004)	.085** (.005)	.025** (.003)
Community Norms Favoring Drug Use	.052** (.003)	.055** (.004)	.006* (.003)
Social Disorganization Variable			
Community Disorder	-.013** (.004)	-.014** (.005)	.003 (.003)
Community Attachment	.000 (.003)	-.022** (.003)	.000 (.002)
Residential Mobility	.043** (.008)	.109** (.009)	.014* (.007)
Deviance	.787	1.006	.063

Note: Standard errors in parentheses; * p< .05; ** p< .01 (two-tailed tests)

Hypothesis Two. The results in Table 7 offer partial support for the second hypothesis that, when examined individually, theoretically derived variables will be significantly associated with specific types of illicit drug use. An examination of the patterns shows Heroin and Ecstasy were the only two substances that were not significantly associated with any theoretical variable.

Findings for the SLT variables show the most support for the second hypothesis. Peers who favor drug use was the strongest predictor and was significantly associated with marijuana ($\beta=.440$; $p<.01$), alcohol ($\beta=.406$; $p<.01$), methamphetamine ($\beta=.394$; $p<.01$), and stimulant ($\beta=.294$; $p<.01$) use. Pro-delinquent attitudes were also significantly associated with types of illicit drug use. The effects were most pronounced for inhalant use ($\beta=.127$; $p<.01$) and least pronounced for sedative use ($\beta=.08$; $p<.01$). Community norms favoring drug use were not as consequential for illicit drug use as the other SLT variables but were positively associated with all types except stimulant use ($\beta=-.053$; $p<.01$). Methamphetamine use ($\beta=.06$; $p<.01$) was most positively correlated with community norms favoring drug use.

Similar to the findings presented for hypothesis one, the association between variables from the SBT perspective and forms of illicit drug use is weaker than found for SLT variables. Parental attachment was significantly associated with LSD ($\beta=-.021$; $p<.01$), cocaine ($\beta=-.018$; $p<.01$), inhalant ($\beta=-.024$; $p<.01$), methamphetamine ($\beta=-.018$; $p<.01$), stimulant ($\beta=-.02$; $p<.01$), and sedative use ($\beta=-.02$; $p<.01$). However, cocaine ($\beta=-.014$; $p<.05$) and inhalant ($\beta=-.009$; $p<.05$) use did not acquire a significance of $<.01$ when associated with the school commitment variable. The analysis found no support for the correlation between methamphetamine use and school commitment. Stimulant ($\beta=-.019$; $p<.01$), LSD ($\beta=-.025$; $p<.01$), and sedative ($\beta=-.029$; $p<.01$) use all show negative correlations with school commitment and maintain a significance of $<.01$.

Residential mobility was shown to support the second hypothesis the most from the SDT variables. Each substance use variable, excluding heroin and ecstasy, was significantly associated with residential mobility. Residential mobility was most strongly correlated with methamphetamine use ($\beta=.293$; $p<.01$) while maintaining a significant association. The findings

from the analysis indicated that community attachment was significantly associated with inhalant ($\beta=-.009$; $p<.01$), stimulant ($\beta=-.029$; $p<.01$), and sedative use ($\beta=-.021$; $p<.01$) whereas the other substance use variables did not attain a significant association. Community disorder was significantly associated with LSD ($\beta=-.025$; $p<.05$), cocaine ($\beta=-.048$; $p<.01$) and inhalant use ($\beta=.022$; $p<.01$) and was negatively correlated with other substance use variables without significant associations.

Results concerning the control variables indicate impulsivity and age having a significant association with each substance use variable at the $<.01$ level except for heroin and ecstasy which have no significant associations with the control variables. Impulsivity is also positively correlated with each substance use variable while age is only negatively associated with inhalant use ($\beta=-.131$; $p<.01$). Non-White respondents were most significantly associated and most positively correlated with methamphetamine ($\beta=.290$; $p<.01$) and inhalant use ($\beta=.223$; $p<.01$). Inhalant, methamphetamine, stimulant, and sedative use had a $<.01$ association with the gender and combined parental education variables. Gender was also significantly associated with cocaine use ($\beta=.457$; $p<.01$).

Table 7. Negative Binomial Regression of Statistical Controls and Theoretical Variables On Substance Use (n=21,321)

Lifetime Substance Use	LSD	Cocaine	Inhalant	Meth	Stimulant	Sedative	Heroin	Ecstasy
Intercept	-9.89** (.525)	-11.86** (.539)	-2.122** (.268)	-13.022** (.559)	-8.402** (-.389)	-5.407** (-0.271)	-9.839 (-.673)	-10.236 (-.592)
Control Variables								
Male	-.07 (.069)	.457** (.068)	.358** (.038)	.553** (.071)	.48** (-.052)	.639** (-0.038)	-.163 (-.092)	.221 (-.078)
Age	.303** (.023)	.357** (.023)	-.131** (.012)	.356** (.024)	.2** (-.017)	.115** (-.011)	.257 (-.03)	.219 (.025)
Non-White	.048 (.081)	-.038 (.083)	.223** (.045)	.290** (.079)	.079 (-.061)	-.007 (-.047)	.04 (-.105)	.221 (.088)
Mother's/Father's Education	-.024 (.022)	-.012 (.022)	-.043** (.012)	-.077** (.022)	-.045** (-.016)	-.037** (.012)	.065 (-.029)	-.025 (.024)
Impulsivity	.052** (.010)	.046** (.009)	.097** (.005)	.044** (.010)	.095** (-.007)	.089** (.005)	.067 (-.012)	.099 (.011)
Social Bonding Variables								
Parental Attachment	-.021** (.005)	-.018** (.005)	-.024** (.003)	-.018** (.005)	-.02** (-.003)	-.02** (.003)	-.037 (.006)	-.011 (.005)
School Commitment	-.025** (.007)	-.014* (.007)	-.009* (.004)	.000 (.008)	-.019** (-.006)	-.029** (.004)	-.018 (.009)	-.012 (.008)
Social Learning Variables								
Peers Who Favor Drug Use	.406** (.013)	.440** (.013)	.091** (.010)	.394** (.014)	.294** (-.011)	.202** (.009)	.416 (.017)	.337 (.015)
Pro-Delinquent Attitudes	.105** (.011)	.119** (.011)	.127** (.007)	.103** (.012)	.12** (-.009)	.08** (.007)	.103 (.014)	.136 (.012)
Community Norms Favoring Drug Use	.058** (.010)	.053** (.010)	.050** (.006)	.060** (.010)	-.053** (-.008)	.05** (.006)	.006 (.013)	.046 (.011)
Social Disorganization Variables								
Community Disorder	-.025* (.011)	-.048** (.011)	.022** (.006)	-.002 (.011)	-.008 (.008)	-.01 (.006)	-.004 (.014)	-.02 (.012)
Residential Mobility	.118** (.024)	.111** (.024)	.111** (.014)	.293** (.024)	.132** (-.018)	.085** (.014)	.1 (-.032)	.166 (.027)
Community Attachment	-.009 (.008)	-.007 (.008)	-.021** (.005)	.007 (.009)	-.029** (-0.006)	-.021** (.005)	.029 (.011)	-.022 (.009)
Deviance	.258	.268	.625	.271	.429	.69	-.188	.225

Note: Standard errors in parentheses; * p< .05; ** p< .01 (two-tailed tests)

When examining the control variables on the specified substances, males predominantly responded to using more of these illicit drugs than females. LSD ($\beta=-.163$) and heroin ($\beta=-.07$) use were the only two substances in which females were more likely use than males. Except for cocaine and sedative use, Whites responded to using fewer substances than non-Whites.

Respondent's self-reported substance use is more likely when their parent's education scores were low. Those respondents who reported being more impulsive was more apt to engaging in each specific substance use.

Hypothesis Three. The results from the negative binomial regression models in Table 7 provide support the third hypothesis that there will be differences in the contribution of the variables and the pattern of findings will be similar across the bivariate and multivariate models. When examining bivariate models, the SLT variables took precedence in explaining the causes of self-reported substance use while the SBT variables suggested being deterrents of substance use. SDT variables suggested less consistency with the causes of adolescent substance use. Results were similar in multivariate models.

Respondents who had peers who favored drug use served as the strongest correlate in both models. Although variables representing SLT were as a group the strongest predictor of substance use, residential mobility was a stronger predictor than the other theoretical variables. This holds true in both models. In both models, respondents with pro-delinquent attitudes and residing in communities with norms favoring drug use had relatively equal influence on substance use. Community disorder was hypothesized to positively influence substance use but the analysis found that community disorder was mostly negatively associated with the substance use variables in tables 6 and 7. Community attachment showed a negative association with marijuana use ($\beta=-.022$) and no association with alcohol and illicit drug use in Table 6. These results were similar in Table 7 in which community attachment was negatively association with each substance except for methamphetamine ($\beta=.007$) and heroin ($\beta=.029$) use. The SBT variables, parental attachment and school commitment, were negatively associated with the substance use variables confirming past research. Parental attachment was positively correlated

with illicit drug use ($\beta=.002$) in Table 6 but the effect size is too small to make any significant contradictions to the similarities in the models.

The control variables were consistent in both models confirming more support for hypothesis three. Tables 6 and 7 both suggest that impulsive respondents, males, non-Whites, and respondents with low combined parental education are more likely to report substance use. Substance use is also more probable among older adolescents.

DISCUSSION AND CONCLUSION

The current research provides an understanding of adolescent substance use in Montana and the ability to account for variations in adolescent substance use using variables derived from traditional delinquency theories. The purpose of this study was to examine how theoretically derived variables would be associated with self-reported substance use. The results from negative binomial regression models show mixed support for the research hypotheses pertaining to alcohol, marijuana, illicit drug use, and types of illicit drug use. Social bonding, social learning, and social disorganization theories were used to guide the construction of the variables and the analyses that were performed. These theories are among the most widely employed frameworks that were used in the review of the analysis and offer a series of lenses through which adolescent substance use can be examined and understood.

Consistent with the prediction, variables derived from social learning theories were shown to be the most influential predictors of adolescent substance use. The findings suggested that peers who favor drug use is largely associated with adolescent substance use. This is not surprising considering patterns in the prior research that show interaction with intimate others who favor substance use is a leading cause of youth substance use (Ventura Miller, Jennings, Alvarez-Rivera, and Mitchell Miller 2008, Hankins, Biglan, and Boles 2009, Kim, Kwak, and

Yun 2010; Akers, Krohn, Lanza-Kaduce, and Radosevich 1979; Lee, Akers, and Borg 2004). To sum up, the social learning variables suggest that substance use develops more through interaction with others who show definitions favorable to it than residing in disorganized communities and individuals who have weak relationships with conforming entities. Parental attachment and school commitment had similar effect sizes indicating that both variables served as almost equal protective factors which is consistent with the literature (Ackard et al 2006; Ford 2009; Whitlock 2006) However, it was hypothesized that community attachment would be negatively associated with self-reported substance. This holds true except for lifetime methamphetamine and heroin use. Yet the effect size is close enough to zero to draw any significant conclusions as to why community attachment is positively associated to methamphetamine and heroin use. The relationship between the residential mobility variable is positive as stated in the first hypothesis confirming prior research that changing residences can disrupt social ties leading to substance use (Faulth et al 2007; Hayes-Smith and Whaley 2009). Though hypothesized that community disorder would have a positive relationship with the substance use variables, this only holds true for inhalant use. The theoretically derived variables vary in the effect sizes with the substance use variables but they do show a similar pattern throughout the different types of illicit drugs.

In addition to the main findings, the results indicate that certain groups are at greater risk for substance use. First, the likelihood of self-reported substance use increases with age with the exception of lifetime inhalant use. Self-reported substance use among older adolescents is consistent with past research (Ford 2009; Bryant et al 2003; Ingram et al 2007; McCurley and Snyder 2008). The vast availability to obtain inhalants may be associated with younger adolescents since most inhalant products can be purchased over the counter or are available as

household items. Second, perception of community disorder is most strongly associated with inhalant use. Third, the non-White populations of the respondents, which mainly consist of Native Americans, tend to be more involved with substance use. Previous studies have found similar results pertaining to Native American youth and substance use (Spear, Longshore, McCaffrey and Ellickson 2005; Steinman and Hu 2007). The bivariate results in Tables 4 and 5 suggest that females engaged in substance use more than males. Yet the results were close enough to zero indicating that either gender was not more strongly associated with any substance than the other. This parallel pattern in gender substance use is consistent in previous studies. Ford (2009) found that females were more likely than males to use prescription drugs. In a study focusing on alcohol and illicit drug use, Barnes, Welte, and Hoffman (2002) reported males slightly being at higher risk.

Before moving to the implications of the research findings, there are limitations with the work presented here that must be identified. First, using secondary data rarely compliments a research study perfectly. When data from MPNAS was collected, it was not gathered with the intention of covering all aspects of different criminological theories. It was designed to measure the need for prevention services among youth in the areas of substance abuse, delinquency, antisocial behavior, and violence. The questions ask youth about the factors that place them at risk for or protect them from problem behaviors. Items chosen from the data were selected to best fit the delinquency theories from the prior research. In some cases, there were no items to measure key theoretical concepts; for others the items were less comprehensive than can be found in some previous test. An example of this is the measure used to represent the community disorder variable. Combining census level social disorganization indicators may have made for a more efficient variable. Unfortunately for this study, it was not possible to merge the MPNAS

data with census data matched at the zip code level. This would have allowed the study to account for the influence of community level effects in the estimates of family and peer influences. Instead, perceptions of community disorder were used rather than objective measures. An additional limitation is the ordinal response category for the frequency use of each substance. When answering “On how many occasions (if any) have you...,” the respondent had the option of choosing 0, 1-2, 3-5, 6-9, 10-19, 20-39, 40+ times. This is a limitation when studying youth experimentation and experience with substances because those who used a particular substance on 40 occasions are categorized in the same group as an individual who reported using that same substance on 200 occasions. Also, while using NBR, there are no multicollinearity diagnostics to determine if there is too much shared variance in the variables. NBR reports unstandardized scores therefore no comparisons of the effect can be made.

The findings from this research suggest some important areas for future research. First, although community disorder was negative in contrast to the hypothesized association, this variable should not be dismissed from studying delinquent behavior. This variable was comprised of items pertaining to informal social control, community violence, and feelings of safety within the community which have been shown to be linked to adolescent substance use (Hayes-Smith and Whaley 2009; Bernbug and Thorlindsson 2007; Faulth et al 2007). Second, it is important to note that through the research of this study, the vast majority of the prior literature is conducted quantitatively. While quantitative research is helpful in capturing the importance of a statistical relationship, it is not well adapted to interpretative or social constructionist principals that aid in the development of an in-depth understanding of the research. A qualitative approach may provide better meaning and understanding and therefore provide the contextual data needed to explain the underlying process of adolescent substance use. Whereas quantitative research is

useful for determining what factors influence adolescent substance use; qualitative research is better suited to determine why adolescents participate in substance use. For example, when studying the reasons for younger adolescent's participation in inhalant use, a qualitative study could give meaning of being a younger adolescent residing in a disorganized community and develop an enriched understanding of the pressures to use inhalants. Also, qualitative research could shed more light on gender differences and problem behavior. Third, females and males show little differences in substance use/abuse but delinquent behavior is most common among males. Theory offers great explanations of male delinquent behavior and substance use but only explains female substance use. It is important to determine what mediates female delinquent behavior that is apparently absent in determining male delinquent behavior. This shows that there is a distinct difference in gender indicating the need to differentiate gender roles and how these roles influence substance use and different problem behaviors. A qualitative, or mixed, approach may help in deciphering these inconsistencies and lead to more beneficial intervention/prevention programs.

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