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To Study, to Party, or Both? Assessing Risk Factors for Non-prescribed
Stimulant Use Among Middle and High School Students

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ABSTRACT

This study examines the risk factors predicting non-prescribed stimulant use (NPSU) among adolescents, with an emphasis on whether such factors are reflective of instrumental (e.g. studying) and/or recreational (e.g. partying) drug consumption settings. Using data from *Monitoring the Future* (2011), we employed a series of logistic regression models to establish predictors of 12-month self-reported Adderall or Ritalin use without a doctor's note among 8th and 10th graders. Whereas studies of college students have found NPSU to correlate with instrumental motives and productivity-related demands, we find no association between NPSU and indicators of academic strain for this younger sample. Rather, we find that the age of onset and current use of alcohol, tobacco, and marijuana is most predictive of NPSU, which are substances generally associated with social and recreational consumption settings. These findings have potential implications for practitioners concerned with mitigating the harms of general prescription drug misuse, as interventions efforts informed by research conducted among college students may not readily apply to younger populations. Drawing from central tenets of developmental and life course criminology, we call for continued inquiry into the broader socialization and developmental processes that influence NPSU and other prescription drug use patterns *prior* to early adulthood.

Keywords: prescription stimulants; Adderall; Ritalin; adolescent drug use

Attention deficit hyperactivity disorder (ADHD) is a DSM-V recognized neurobehavioral psychiatric disorder that affects the attention, hyperactivity, and impulsiveness of individuals (Centers for Disease Control 2013). The most commonly prescribed drugs to treat this condition are methylphenidates and combinations of amphetamines and dextroamphetamines, often referred to by their brand names: Ritalin and Adderall, respectively (Centers for Disease Control 2013). The use of ADHD stimulants (e.g., Adderall and Ritalin) has become increasingly popular on American college campuses as a result of increased diagnoses and the diversion (e.g. sharing) to non-prescribed users (Centers for Disease Control 2013; McCabe & West 2013).

Researchers have found that NPSU is not viewed as negatively as, for instance, the non-prescribed use of prescription painkillers due to the former being associated with instrumental pursuits of academic or productivity-related goals (Kerley et al., 2015; DeSantis & Hane, 2010; DuPont et al. 2008). This normative acceptance, or at least relative tolerance, of illegal drug use is contrasted by NPSU's punitive regulatory classification; Adderall and Ritalin are listed as Schedule II controlled substances by the U.S. Drug Enforcement Administration, with criminal penalties for possession without a valid prescription, and tougher punishments (and possible felony convictions) for valid prescription-holders who sell to others. Despite such prohibitions under criminal law, undergraduate college students have been found to conceptualize NPSU as both physically harmless and morally acceptable (DeSantis & Hane, 2010). This suggests a contradiction between the seriousness of codified law and the normative understanding of the role of prescription stimulants in the lives of non-prescribed users.

Existing Social Science Literature on NPSU

Whereas ADHD diagnosis rates (and therefore the number of prescription holders) have been steadily increasing, prevalence data for non-prescribed use vary widely. For the general population, lifetime prevalence rate are estimated between 6.9% and 18.6% (Arria et al., 2008; McCabe et al., 2005; Arria et al., 2011). However, one study estimated that nearly one out of three college students have engaged in NPSU within a 12-month period (Low & Gendaszek, 2002). Within college populations, white fraternity and sorority members (Dussault & Weyandt, 2013) and athletes (Bents & Marsh, 2006; DeSantis et al., 2009) are more likely to engage in NPSU relative to other students.

Quantitative studies have found empirical support for theoretical constructs drawn from criminology and sociology—namely General Strain Theory and Control Theory—among both adolescent and college student populations (see Schroeder & Ford, 2012; Ford & Lacerenza, 2011; Ford, 2008). Social learning and subcultural theories have also empirically demonstrated that drug use can be explained by differential exposure to – or membership in – groups in which use is rewarded (Goode, 2008; Akers et al., 1979, p. 638) as well as through social reinforcement supporting favorable conceptions toward the substance (Akers, 1992; Sutherland, 1939; Goode, 2008). Early onset users of one substance are also found to be significantly more likely to experiment with other substances, which in turn would likely take place in social settings (McCabe et al., 2005). Reflecting group-level tendencies or subcultural propensities, individuals who engage in heavy drinking or drug use *prior* to college may self-select into a social group or

organization (e.g. fraternity or sorority) that is known for engaging in these behaviors (Park et al., 2009).

Among *prescribed* college students, those who used the drug for “non-medical” purposes (e.g. consuming through a different route of administration or in a manner for which the drug was not intended) were more likely to report use of alcohol, cigarettes, marijuana, ecstasy, cocaine, and engage in other risky behaviors (McCabe et al., 2005, p. 96). Among non-prescribed college students, those who used the drugs for *recreational* purposes were found to be more likely to, a) misuse a variety of substances; b) combine the use of prescription stimulants with other psychoactive substances; and c) report higher rates of intranasal use of stimulants compared to college students who report using stimulants for the sole purpose of studying (Weyandt et al., 2009). The higher rates of substance use and other risky behaviors identified in these studies may be an indication that NPSU is part of a larger cluster of problem behaviors among college students (McCabe et al., 2005; Woolsey et al. 2014; Giletta et al. 2012), and the possibility that substance use and drug-related behavior *preceded* the non-prescribed or non-medical use of these stimulants¹.

Exploring Instrumental vs. Recreational Correlates of Drug Use

Existing studies have identified substantive differences between prescribed and non-prescribed users, and between “medical” and “non-medical” use among valid prescription-holders. Prescription stimulants and ADHD medication differ from

¹ Within the literature, the choice of “misuse” or “non-prescribed use” is largely a function of the survey data used in secondary analysis. National surveys differ in the wording of questions regarding prescription stimulant use. Whereas *Monitoring the Future* (MTF) asks about non-prescribed use, the *National Survey on Drug Use and Health* (NSDUH) asks respondents if they have ever taken prescription stimulants that were not prescribed to them, *or* if they took the medication only to get high. In research designs using the latter type of survey data, “misuse” and “non-medical” use are used interchangeably. The present study exclusively focuses on non-prescribed use.

substances like alcohol or marijuana in that these drugs can be sought for *both* performance and productivity-related ends, as opposed to the settings and underlying motives driving the use of most other drug types. The possibility of using prescription stimulants (e.g. *Adderall* and its generic counterparts) for the recreational purpose of getting high *and* the instrumental activity of studying or completing an intellectually-demanding task is unique to this drug type (White et al. 2006; DeSantis & Hane 2010; Kerley et al., 2015). Whereas normative acceptance may depend on whether NPSU, for example, takes place in a library during midterm examination season or a nightclub for purposes of staying awake and having more cognitive competence, the legal categorization of NPSU is unwavering. Penalties for unlawful possession are not contingent on the underlying motives or contexts for drug use. Further supporting this distinction between instrumental and recreational use, college students who “use stimulants only as a tool to perform their best” have been found to mentally draw “symbolic boundaries” between themselves and “hedonistic” (or recreational) users (Kerley et al. 2015, p. 589). This can allow occasional instrumental users to rationalize their illegal behaviors while maintaining a non-deviant identity (Kerley et al. 2015).

Theoretical Framework & Research Questions

Much of what researchers know about NPSU has been informed by studies sampling from undergraduate students (see Kerley et al. 2015; Woolsey et al. 2014; Cutler 2014; Bavarian et al. 2014; McCabe et al. 2013; DeSantis & Hane 2010; Weyandt et al. 2009). This invites continued investigation into whether these findings are generalizable to younger populations (e.g., middle and high school students). Developmental and life-course criminology (DLC) is a mode of inquiry concerned with

the origins and developmental processes of antisocial behavior, the risk factors for antisocial behavior among different age groups, and the effects of life events on criminal or deviant trajectories (Farrington 2003). The DLC perspective emphasizes onset, continuation, and desistance from crime as well as the risk factors and life events that affect criminality (Piquero et. al 2003; Farrington 2003). While we prefer to study drug use through a public health and harm-reduction approach, the laws involving the selling and possessing of these drugs allow for the incorporation of this criminological approach. We employ the lifecourse perspective by positing that drug use in late high school (i.e. 11th and 12th grade) and during college are conditioned by socialization, learning, and developmental processes earlier in lifecourse development.

The life course perspective serves as a reminder that the proclivities to use psychoactive drugs or performance enhancers of any kind develop in large part through socialization processes, exposure, learning, and onset *prior* to reaching 18 years of age or entering college (Scalco et al., 2015; Terry-McElrath et al., 2013; Giletta et al., 2012; Goodwin et al., 2012). Using the developmental and life-course criminology (DLC) perspective as a theoretical framework, the research question was: When controlling for several factors, is NPSU among 8th and 10th graders more indicative of instrumentally-motivated settings or recreational settings?

METHODS

Data for this analysis were taken from *Monitoring the Future: A Continuing Study of the Lifestyles and Values of Youth, 2011, Grades 8 and 10*, which is maintained by the University of Michigan's Institute for Social Research (ICPSR 33902) and available for

public use. Because we were interested in NPSU within the *past 12 months*, we drew on and merged the 8th and 10th grade Form 1 data sets (n = 10,639). While Forms 2-4 ask about NSPU, those forms only ask about lifetime use. Although specific response rates for the Form 1 data sets are not available, the aggregate response rates for Forms 1-4 were 91% for 8th graders and 86% for 10th graders (Johnston et al., 2011). All participants were administered an on-site questionnaire, with the individual student constituting the unit of analysis.

Monitoring the Future (MTF) respondents were asked two separate questions regarding how often, if at all, they had used Ritalin or Adderall without a doctor's note within the past 12 months. We collapsed responses to these two questions and dichotomized the variable to capture the variation between any number of NPSU occasions within the past 12 months and non-use, which served as our dependent variable.

Our independent variables (i.e., "Recreational Settings") included alcohol, marijuana, and cigarette use within the past month, riding with a drunk driver in the past two weeks, and access to stimulants. *Alcohol use in the past month* and *marijuana use in the past month* each consisted of a five-item ordinal variable ranging from "none" to "10x or more". *Cigarette use in the past month* consisted of a four-item ordinal variable ranging from "not daily" to "1/2 a pack per day or more". *Riding with a drunk driver in the past two week* was a three-item ordinal variable ranging from "none" to "2x or more". A "drunk driver" was defined as someone who had consumed six or more drinks in one sitting. *Access to stimulants* consisted of a dichotomous variable indicating whether or not the student responded "fairly easy" or "very easy" to the following question: "How

difficult do you think it would be for you to get amphetamines (uppers, speed, Adderall, Ritalin, etc.), if you wanted some?”

We also included several control variables, which were organized into the following conceptual groupings: “Instrumental Settings”, “Early Exposure to Alcohol and Marijuana”, “Academic Engagement”, and “Demographics”. “Instrumental Settings” consisted of four variables: *hours spent on homework per week*, *hours spent working per week*, *competition for grades with peers*, and whether or not the respondent was enrolled in a *college prep program* at the time of the survey. *Hours spent on homework per week* was a four-item ordinal measure ranging from “none” to “20 hours or more”. *Hours spent working per week* was a four-item ordinal measure ranging from “none” to “26 hours or more”. *Competition for grades with peers* consisted of a five-item Likert scale ranging from “None” to “A Great Deal”. We also included a dichotomous control variable for whether or not the respondent was enrolled in a college prep program at the time of the survey (1 = “yes”, 0 = “no”).

The “Early Exposure” variables included two categorical measures, one measuring the grade level when a respondent reported first getting drunk from alcohol (if at all), and the other measuring the grade level when they had first used marijuana (if ever). Rather than consider “Early Exposure” variables as focal independent variables, we treated them as controls because it has been well established in extant literature that age of onset (i.e., early exposure) is predictive of drug use later in life.

“Academic engagement” consisted of three variables: self-reported *grade point average* (on a 4.0 scale), *definitely will attend college* (1 = “yes”, 0 = “no”), and *involved in extracurricular activities* within the past calendar year (1 = “yes”, 0 = “no”).

“Demographics” included *female*, *race*, *tenth grader*, *family composition*, *mother’s educational attainment*, and *region of country*. *Female* was a dichotomous variable noting if the respondent identified as female (1 = “yes”, 0 = “no”). *Race* consisted of four dichotomous variables (1 = “yes”, 0 = “no”) indicating if the respondent self-identified as “non-Hispanic White”, “Black”, “Hispanic”, or “Other”. We also included a measure controlling for whether or not the respondent was a tenth-grader (1 = “yes”, 0 = “no”). *Family composition* consisted of a categorical variable consisting of three family types: “two parent household,” “single female-headed household”, and “single male-headed household.” *Mother’s educational attainment* consisted of three categories: “less than high school”, “high school diploma or General Education Degree”, and “some college or more”. Finally, we included controls for *region of country* of respondents’ schools to account for any national geographical variation in the dependent variable. The *region of country* variable includes four categories: “northeastern”, “northcentral”, “south”, and “west”. All categorical variables used in this study were dichotomized in the analyses.

We used logistic regression to examine the relationships between our independent/control variables and the dichotomized dependent variable (Long, 1997). We employed a step-wise approach to estimate four models to examining student’s NPSU within the past year. Our baseline model (Model I) consisted of variables controlling for “Early Exposure” or age of onset of conventional substance abuse, “Academic Engagement” and “Demographics.” We then added measures consistent only with “Instrumental Settings” (Model II) to the baseline model and then measures consistent only with “Recreational Settings” (Model III). Our final model (Model IV) includes all variables examined in the analyses.

RESULTS

Descriptive Statistics of Variables Used in the Analyses

As noted in table 1, 4% of 8th and 10th graders in our final analytic sample (N = 6,732) reported engaging in NPSU within the past 12 months. Overall, 80% of respondents reported not having used alcohol within the past month. Eleven percent had used once or twice, 5% had used three to five times, 2% had used six to nine times, and 2% ten times or more. Similarly, 88% had not used marijuana in the past 30 days. Five percent had used marijuana once or twice in the past month, while 2%, 2%, and 4% had used three to five times, six to nine times, and ten or more times, respectively. Only 2% reported smoking one to five cigarettes per day, while 1% smoked half-a-pack or more. Ninety-three percent indicated that they had not ridden with a drunk driver in the past two weeks, 4% reported that they had done so once, and 4% two times or more. Twenty-two percent reported having fairly or very easy access to stimulants.

[TABLE 1 ABOUT HERE]

Approximately 6% of respondents indicated they do not spend any time on homework each week, while 72% spent between one and fifteen hours per week. Sixteen percent spent ten to nineteen hours and 6% spent twenty hours or more on homework in a typical week. Most students (76%) did not work at a paid job, while 20% spent between one and fifteen hours working in a typical week. Only 4% spent sixteen hours per week or more working for pay (“16-25 HRS” and “26 HRS or more” combined). Twenty-six reported “quite a bit” (20%) or “a great deal” (7%) of competition for grades with their peers, and 48% were enrolled in a college prep program at the time of the survey.

Seventy-four percent of respondents had never been drunk, 3% first got drunk in elementary school, 11% in junior high, and 12% in high school. In a similar vein, 77% had never used marijuana, 4% first used in elementary school, 10% in junior high, and 10% in high school.

The typical respondent can be described as a student with a 3.2 GPA, who indicated they would definitely attend college (75%), and who had participated in at least one extracurricular activity with the past year (85%). Just over half (52%) of respondents were female, and 62% identified as non-Hispanic White, 9% as Black, and 12% as Hispanic. Fifty-two percent of the sample was in tenth grade. Eighty percent of respondents lived in a two-parent household, 17% lived in a single female-headed household, and 4% lived in a single male-headed household. Nine percent indicated their mother did not finish high school or earn the equivalent of a high school degree, while 21% reported that their mother had finished high school or completed a GED, and 70% noted their mother had at least some college experience. Twenty percent of students were interviewed in a school located in the northeastern part of the country, 26% in the northcentral region, 33% in the south, and 21% in the west.

*Logistic Regression Results for Non-Prescription Stimulant Use within the Past Year:
Instrumental vs. Recreational Exploratory Risk Factors*

Table 2 presents the logistic regression results for Models I-IV. A variance inflation factor (VIF) test suggested collinearity between variables was not a concern, as none of the VIFs exceeded what O'Brien calls the 'rule of five' (O'Brien 2007, p. 688; also see Menard 1995). We found statistically significant positive associations with each

of the “Recreational Setting” variables in Models III and IV. As noted in final model (i.e., Model IV), respondents who reported drinking alcohol six to nine times within the past 30 days had 1.8 times greater odds of reporting NPSU within the past 12 months relative to those who had not consumed alcohol within the past month. Similarly, students who indicated they had used marijuana three to five times within the past month had 1.9 times greater odds of reporting NPSU. Cigarette use was also associated with an increased likelihood of NPSU. Students who smoked between one and five cigarettes per day had 2.1 times greater odds of reporting Ritalin or Adderall use within the past year compared to respondents that did not smoke cigarettes on a daily basis. Respondents who reported riding with a drunk driver during the past two weeks had 1.8 times greater odds of reporting NPSU. Students who reported being able to get stimulants “fairly/very easily” had 4.3 times *greater* odds of reporting NPSU when compared to students without access to these drugs.

[TABLE 2 ABOUT HERE]

The results of the final model did not support the narrative that NPSU among 8th and 10th graders is a function of academic strain or workload. The only exception is that students who were enrolled in a college prep program at the time of the survey had 1.5 times greater odds of having used Ritalin or Adderall without a prescription within the past 12 months relative to respondents not enrolled this type of program.

In terms of “Early Exposure Alcohol and Marijuana,” students who first got drunk in elementary school had 4.7 times greater odds of reporting NPSU than those who had never been drunk. These results are similar when it comes to the *first time marijuana use*

variables: students who first used marijuana in elementary school were significantly more likely to report NPSU. These effects are robust and consistent across all four models.

Consistent with the extant literature, non-Hispanic Whites had 4.7 times *greater* odds of having used Ritalin or Adderall relative to Blacks. Older students (10th graders) were also more likely to have used Ritalin or Adderall without a prescription within the past year relative younger students (8th graders). We also found that family composition matters: respondents in single female-headed households were *more* likely to report NPSU within the past year relative to those from two parent households. Results suggest that students with better educated mothers are *more* likely to report using Ritalin or Adderall in the last 12 months without a doctor's prescription: respondents whose mothers have at least a high school diploma or equivalent or some college experience or beyond had 1.8 and 1.9 times *greater* odds of reporting NPSU within the past year, respectively. We also found that students from the Midwest (i.e., Northcentral) had 2.2 times greater odds of NPSU when compared to those from the northeastern part of the country.

DISCUSSION

In sum, results from Model IV suggest that NPSU within the past 12 months among 8th and 10th graders is positively associated with: alcohol, marijuana, and cigarette use within the past month, riding with a drunk driver within the past two weeks, having easy access to stimulants, being enrolled in a college prep program, age of onset of alcohol, marijuana and tobacco use, being white, being a tenth grader, higher educational attainment of students' mothers, being a child in a single female-headed household, and

living in the northcentral (Midwest) region of the United States. These statistically significant associations remain after controlling for the workload (or productivity-related demand) and control variables. The coefficients associated with “Recreational Settings” show significant support for a non-instrumental interpretation of the context in which NPSU occurs, and an implication of more recreational or socially driven use.

The single most important factor explaining NPSU among 8th and 10th graders is age of onset of alcohol and marijuana use, which is consistent with the existing literature (Haddox et al. 2014; Ford 2009; McCabe et al. 2006). Eighth and tenth graders are not old enough to legally purchase or consume alcohol and tobacco, and marijuana was uniformly prohibited in all states where the MTF surveys were administered. These findings suggest that NPSU is strongly associated with a larger propensity to experiment or habitually use both legal *and* illegal drugs. Marijuana and alcohol are social substances frequently used in social settings among teens. In alcohol studies alone, it is so common for underage drinking to occur in social settings that researchers and public health stakeholders have a separate category and degree of emphasis for adolescents who drink alone (see Cresswell et al. 2015; Engels et al. 1999). This convention is empirically supported by *Monitoring the Future* data, which shows that 94% of high school seniors reported that they never drank alone, or had done so only a few times (Johnston et al. 2013; Cresswell et al. 2015).

Whereas the literature demonstrates that college students can have strong instrumental motives for taking prescription stimulants without a valid prescription, this study finds that among younger teens the motives may not be anchored in the desire to increase productivity. This lack of empirical support for instrumental correlates such as

work or academic-related workload is an important “non-finding”. A simplistic understanding of NPSU as an instrumental “study aide” – which seems intuitive for studies among college students – is not supported by our analyses. NPSU appears to be a behavior that tends to cluster with the use of other substances and in a manner that is *independent* of work and academic-related pressures. This lends tentative support to a recreational or experimental explanation for NPSU among this age group; general adolescent drug use tends to be a social and experimental activity conditioned by the drug-related preferences and propensities of friends and intimate peer networks.

While the methods used in this study cannot speak to causal mechanisms, early onset of marijuana and alcohol may serve as a predictive “risk factor” for using adolescent non-prescribed stimulant use. With this in mind, the DLC paradigm remains useful as a platform for continued research due to its emphases on social structure, environmental, and trait-based developmental processes. As such, future studies that aim to understand NPSU specifically—and adolescent substance use generally—should employ a combination of biological, psychological, and/or sociological theories, all of which contribute to the interdisciplinary utility of the DLC paradigm.

The dichotomous framework of instrumental “versus” recreational motives for NPSU may be erroneous, given that one respondent may have multi-faceted and complex reasons for NPSU, and studies using data from the National Survey on Drug Use and Health (NSDUH) rely on an operationalized variable capturing “misuse” (i.e. medical versus non-medical use), which does not differentiate between prescribed and non-prescribed users. Future studies should continue assessing the extent to which prescribed and non-prescribed users alike report *both* instrumental and recreational justifications for

taking the drug(s), and the social factors guiding prescription stimulant consumption patterns.

Despite these limitations, it is useful to distinguish between instrumentally motivated or strain-based factors for NPSU among non-college populations. Future studies might focus on older high school students (and 11th and 12th graders specifically), as they are more likely to experience heavier academic demands and are within the age range of obtaining legal part-time employment, which could add to increased productivity-related strain. Another opportunity for NPSU research is the examination of family-level healthcare access and group-level differences in parenting knowledge, health insurance coverage, access to primary care physicians who will diagnose and prescribe such medications, and racial, ethnic, or cultural differences regarding the likelihood or perceived appropriateness of seeking ADHD-related treatment. The possibility of NPSU being a form of self-medication or a reflection of under-diagnosis is also largely unexplored, along with other factors related to race and class.

Most importantly, however, we believe that the DLC approach to understanding drug use is valuable in that it emphasizes the K-12 socialization processes that contribute to the drug use patterns that may be later detected in studies of older populations. Prevention strategies and policies informed by samples of older teens and college-aged adults can benefit significantly from more inclusion of younger age groups, particularly when empirical data illustrate how drug habits and high-risk group behaviors are operating long before a person arrives at a college campus.

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REFERENCES

- Agrawal, A. & Lynskey, M.T. 2008. Are there genetic influences on addiction: evidence from family, adoption and twin studies. *Addiction*, 103(7), 1069-1081.
- Akers, R.L. 1992. *Drugs, Alcohol, and Society: Social Structure Process, and Policy*. Belmont, CA: Wadsworth.
- Akers, R.L., Kron, M.D., Lanza-Kaduce, L., & Radosevich, M. 1979. Social Learning and Deviant Behavior: A specific Test of a General Theory. *American Sociological Review* 44: 636-655.
- Arria, A.M., Garnier-Dykstra, L.M., Caldeira, K.M., Vincent, K.B., O'Grady, K.E., & Wish, E.D. 2011. Persistent Nonmedical Use of Prescription Stimulants Among College Students: Possible Association with ADHD Symptoms. *Journal of Attention Disorders*, 15(5), 347-356.
- Arria, A. M., Caldeira, K. M., Vincent, K. B., O'Grady, K. E., & Wish, E. D. 2008. Perceived harmfulness predicts nonmedical use of prescription drugs among college students: Interactions with sensation seeking. *Prevention Science*, 9, 191-201.
- Bavarian, N., Flay, B.R., Smith, & Smith, E. 2014. An exploratory multilevel analysis of nonprescription stimulant use in a sample of college students. *Journal of Drug Issues*, 44(2), 132-149.
- Bents, R. T., & Marsh, E. 2006. Patterns of Ephedra and other stimulant use in collegiate hockey athletes. *International Journal of Sport Nutrition and Exercise Metabolism* 16, 636-643.

- Centers for Disease Control. 2013. "ADHD Throughout the Years." *Attention-Deficit/Hyperactivity Disorder (ADHD)*. Retrieved from (<http://www.cdc.gov/ncbddd/adhd/timeline.html>)
- Cresswell, K. G.; Chung, T.; Wright, A.G.C.; Clark, D.B.; Black, J.J.; Martin, C.S. 2015. Personality, negative affect coping, and drinking alone: a structural equation modeling approach to examine correlates of adolescent solitary drinking. *Addiction* 110: 775-783.
- Cutler, K.A. 2014. Prescription stimulants are "A Okay": Applying neutralization theory to college students' nonmedical prescription stimulant use. *Journal of American College Health*, 62(7), 478-486.
- DeSantis, A. D. & Hane, A. C. 2010. "Adderall is Definitely Not A Drug": Justifications for the Illegal Use of ADHD Stimulants. *Substance Use & Misuse* 45: 31-46.
- DeSantis, A. D., Noar, S. M. & E. Webb. 2009. Non-medical ADHD stimulant use in fraternities. *Journal of Studies on Alcohol and Drugs* 70(6): 952-954.
- Dussault, C. L. & Lisa L. Weyandt. 2013. An examination of prescription stimulant misuse and psychological variables among sorority and fraternity college populations. *Journal of Attention Disorders* 17(2): 87-97.
- DuPont, R. L., Coleman, J. J., Bucher, R. H., & Wilford, B. B. 2008. Characteristics and motives of college students who engage in nonmedical use of methylphenidate. *American Journal on Addictions* 17: 167-171.
- Engels, R.C.M.E.; Knibbe, R.A.; Drop, M.J. 1999. Why do late adolescents drink at home? A study on psychological well-being, social integration and drinking context. *Addict Res Theory* 7: 31-46.

- Farrington, D.P. 2003. Developmental and Life-Course Criminology: Key Theoretical and Empirical Issues – the 2002 Sutherland Award Address. *Criminology* 41(2): 221-256.
- Ford, J. A. 2008. Social Learning Theory and Nonmedical Prescription Drug Use Among Adolescents. *Sociological Spectrum*, 28, 299-316.
- Ford, J.A. 2009. Nonmedical Prescription Drug Use Among Adolescents. *Youth & Society* 40(3): 336-352.
- Ford, J.A. & Lacerenza, C. 2011. The relationship between source of diversion and prescription drug misuse, abuse, and dependence. *Substance Use & Misuse* 46: 819-827.
- Giletta, M., Scholte, R.H.J., Prinstein, M.J., Engels, R.C.M.E, Rabaglietti, E., & Burk, W.J. 2012. Friendship context matters: Examining the domain specificity of alcohol and depression socialization among adolescents. *Journal of Abnormal Child Psychology*, 40(7), 1027-1043.
- Goode, E. 2008. *Drugs in American Society*. 7th ed. McGraw-Hill.
- Goodwin, N.P., Murg, S., Borch, C., & Cillessen, A.H.N. 2012. Peer selection and socialization in adolescent depression: The role of school transitions. *Journal of Youth and Adolescence*, 41(3), 320-332.
- Haddox, J.D., Weiler, R.M, Pealer, L.N. and Barnett, T.E. 2014. Early initiation of alcohol or marijuana use and nonmedical use of prescription drugs. *Drug and Alcohol Dependence* 140: e77.

- Johnston, Lloyd D., J. G. Bachman, P. M. O'Malley, and John E. Schulenberg. 2011. *Monitoring the Future: Questionnaire Responses From the Nation's High School Seniors*. Ann Arbor, MI: University of Michigan, Institute for Social Research; 2013.
- Kerley, K.R., Copes, H., & Griffin III, O.H. 2015. Middle-class motives for non-medical prescription stimulant use among college students. *Deviant Behavior*, 36(7), 589-603.
- Kreek, M.J., Nielsen, D.A., Butelman, E.R., & LaForge, K.S. 2005. Genetic influences on impulsivity, risk taking, stress responsivity and vulnerability to drug abuse and addiction. *Nature neuroscience*, 8(11), 1450-1457.
- Long, Scott J. 1997. *Regression Models for Categorical and Limited Dependent Variables*. Thousand Oaks: Sage Publication.
- Low, K.G., & Gendaszek, A.E. 2002. Illicit use of psychostimulants among college students: a preliminary study. *Psychology, Health and Medicine* 7: 283-287.
- McCabe, S.E.; West, B.T.; Teter, C.J.; Boyd, C.J. 2013. Trends in medical use, diversion, and nonmedical use of prescription medications among college students from 2003 to 2013: Connecting the dots. *Addictive Behaviors* 39(7): 1176-1182.
- McCabe, S. E., Knight, J. R., Teter, C. J., & Wechsler, H. 2005. Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Addiction* 99: 96-106.
- McCabe, S. E., Cranford, J. A., Boyd, C. J. (2006). The relationship between past-year drinking and non-medical use of prescription drugs: prevalence of co-occurrence in a national sample. *Drug and Alcohol Dependence*, 84:281–288.

- Menard S. 1995. *Applied Logistic Regression Analysis: Sage University Series on Quantitative Applications in the Social Sciences*. Thousand Oaks CA, Sage
- O'Brien, R. M. 2007. A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, 41(5), 673-690.
- Park, A., Sher, K. J. & Krull, J. L. 2009. Selection and socialization of risky drinking during the college transition: The importance of microenvironments associated with specific living units. *Psychology of Addictive Behaviors* 23: 404-414.
- Piquero, A., Farrington, D.P. & Blumstein, A. 2003. The criminal career paradigm. In Michael Tonry (ed.), *Crime and Justice Vol. 30*. Chicago: University of Chicago Press.
- Scalco, M.D., Trucco, E.M., Coffman, D.L., & Colder, C.R. 2015. Selection and socialization effects in early adolescent alcohol use: A propensity score analysis. *Journal of Abnormal Child Psychology*, 43(6), 1131-1143.
- 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.
- Sutherland, E.H. 1939. *Principles of Criminology* (3rd ed.). Philadelphia: Lippincott.
- Tarter, R.E. 1988. Are there inherited behavioral traits that predispose to substance abuse? *Journal of Consulting and Clinical Psychology*, 56(2), 189.
- Terry-McElrath, Y.M., O'Malley, P.M., & Johnston, L.D. 2013. Middle and high school drug testing and student illicit drug use: A national study 1998-2011. *Journal of Adolescent Health*, 52(6), 707-715.
- Weyandt, L.L., Janusis, G., Wilson, K.G., Verdi, G., Paquin, G., Lopes, J., Varejao, M., & Dussault, C. 2009. Nonmedical Prescription Stimulant Use Among a Sample of

- College Students: Relationship with Psychological Variables. *Journal of Attention Disorders, 13(3)*, 284-296.
- White, B. P., Becker-Blease, K. A. & Grace-Bishop, K. 2006. Stimulant medication use, misuse, and abuse in an undergraduate and graduate student sample. *Journal of American College Health, 54*, 261-268.
- Woolsey, C.L., Barnes, L.B., Jacobson, B.H., Kensinger, W.S., Barry, A.E., Beck, N.C., Resnik, A.G., & Evans Jr., M.W. 2014. Frequency of energy drink use predicts illicit prescription stimulant use. *Substance Abuse, 35(1)*, 96-103.

Table 1. Proportions for Dependent, Independent, and Control Variables Used in the Analyses (N = 6,732)

	<u>Percent/Mean</u>
Dependent Variable	
Stimulant Use w/o doctor's Orders (Last 12 Months)	4%
Focal Independent Variables	
<i>Recreational Settings</i>	
Alcohol Use in Past Month	
"None"	80%
"1-2x"	11%
"3-5x"	5%
"6-9x"	2%
"10x or more"	2%
Marijuana Use in Past Month	
"None"	88%
"1-2x"	5%
"3-5x"	2%
"6-9x"	2%
"10x or more"	4%
Cigarette Use in Past Month	
"Not Daily"	92%
"Less than one per day"	5%
"1-5 per day"	2%
"1/2 pack per day"	1%
Riding w/ Drunk Driver Past Two Weeks	
"None"	93%
"Once"	4%
"2x or more"	4%
Access to Stimulants	22%
Control Variables	
<i>Instrumental Settings</i>	
Hours Spent On Homework per Week	
"None"	6%
"1-9 HRS"	72%
"10-19 HRS"	16%
"20 HRS or more"	6%
Hours Spent Working per Week	
"None"	76%

<i>"1-15 HRS"</i>	20%
<i>"16-25 HRS"</i>	3%
<i>"26 HRS or more"</i>	1%
Competition for Grades w/ Peers	
<i>"None"</i>	17%
<i>"A Little"</i>	24%
<i>"Some"</i>	32%
<i>"Quite a Bit"</i>	20%
<i>"A Great Deal"</i>	7%
College Prep Program?	48%
<i>Early Exposure</i>	
First Time Drunk?	
<i>"Never Been Drunk"</i>	74%
<i>"Elementary School"</i>	3%
<i>"Junior High School"</i>	11%
<i>"High School"</i>	12%
First Time Marijuana Use?	
<i>"Never Used"</i>	77%
<i>"Elementary School"</i>	4%
<i>"Junior High School"</i>	10%
<i>"High School"</i>	10%
<i>Academic Engagement</i>	
Grade Point Average	3.20
Definitely Will Attend College	75%
Involved In Extracurricular Activities?	85%
<i>Demographics</i>	
Female	52%
Race	
<i>White</i>	62%
<i>Black</i>	9%
<i>Hispanic</i>	12%
<i>Other</i>	17%
Tenth-Grader	52%
Family Composition	
<i>"Two Parent Household"</i>	80%
<i>"Single Female-Headed Household"</i>	17%
<i>"Single Male-Headed Household"</i>	4%
Mother's Educational Attainment	
<i>"Less than High School"</i>	9%

<i>"High School Diploma or GED"</i>	21%
<i>"Some College or More"</i>	70%
Region of Country	
<i>Northeastern</i>	20%
<i>Northcentral</i>	26%
<i>South</i>	33%
<i>West</i>	21%

Source: Monitoring the Future: A Continuing Study of American Youth (8th- and 10th-Grade Surveys), 2011 Form 1.

Note: Percentages may not sum to 100 due to rounding.

Table 2. Odds Ratios and Confidence Intervals For Stimulant Use without Doctor's Order in the Last 12 Months by Conceptual Groupings

	(Non-Prescribed = 1 / No Use = 0) Model I (Baseline)	(Non-Prescribed = 1 / No Use = 0) Model II (Instrumental)	(Non-Prescribed = 1 / No Use = 0) Model III (Recreational)	(Non-Prescribed = 1 / No Use = 0) Model IV (Full Model)
	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Focal Independent Variables				
Recreational Settings				
Alcohol Use in Past Month (Ref = "None")				
"1-2x"	-	-	1.1 (0.7-1.7)	1.0 (0.7-1.6)
"3-5x"	-	-	1.3 (0.8-2.2)	1.2 (0.7-2.0)
"6-9x"	-	-	2.0 (1.1-3.5)*	1.8 (1.0-3.2)*
"10x or more"	-	-	1.2 (0.6-2.3)	1.2 (0.6-2.4)
Marijuana Use in Past Month (Ref = "None")				
"1-2x"	-	-	1.6 (1.0-2.6)*	1.6 (1.0-2.5)
"3-5x"	-	-	1.9 (1.0-3.4)*	1.9 (1.0-3.6)*
"6-9x"	-	-	1.6 (0.9-3.0)	1.7 (0.9-3.1)
"10x or more"	-	-	2.6 (1.6-4.2)***	2.6 (1.6-4.2)***
Cigarette Use in Past Month (Ref = "Not Daily")				
"Less than one per day"	-	-	1.4 (0.9-2.1)	1.3 (0.9-2.1)
"1-5 per day"	-	-	2.1 (1.3-3.4)**	2.1 (1.3-3.4)**

Non-prescribed stimulant Use: To Study, to party, or both?

<i>"1/2 pack per day"</i>	-	-	1.5 (0.8-2.8)	1.6 (0.9-3.0)
Riding w/ Drunk Driver Past Two Weeks (Ref = "None")				
<i>"Once"</i>	-	-	1.8 (1.0-2.9)**	1.8 (1.1-3.1)*
<i>"2x or more"</i>	-	-	1.1 (0.6-1.8)	1.0 (0.6-1.7)
Access to Stimulants?	-	-	4.2 (3.0-5.9)***	4.3 (3.1-6.0)***
Control Variables				
<i>Instrumental Settings</i>				
Hours Spent On Homework per Week (Ref = "None")				
<i>"1-9 HRS"</i>	-	1.0 (0.6-1.6)	-	1.0 (0.6-1.6)
<i>"10-19 HRS"</i>	-	0.9 (0.5-1.7)	-	1.0 (0.5-2.0)
<i>"20 HRS or more"</i>	-	1.0 (0.4-2.3)	-	1.1 (0.4-2.7)
Hours Spent Working per Week (Ref = "None")				
<i>"1-15 HRS"</i>	-	1.2 (0.8-1.7)	-	1.2 (0.8-1.8)
<i>"16-25 HRS"</i>	-	2.0 (1.1-3.6)*	-	1.9 (1.0-3.7)
<i>"26 HRS or more"</i>	-	0.8 (0.3-2.1)	-	0.5 (0.2-1.5)
Competition for Grades w/ Peers (Ref = "None")				
<i>"A Little"</i>	-	0.9 (0.6-1.4)	-	0.9 (0.6-1.4)
<i>"Some"</i>	-	0.7 (0.4-1.0)	-	0.7 (0.4-1.1)
<i>"Quite a Bit"</i>	-	0.5 (0.3-0.9)*	-	0.6 (0.3-1.0)*
<i>"A Great Deal"</i>	-	1.8 (1.0-3.3)	-	1.8 (1.0-3.4)
College Prep Program?	-	1.5 (1.1-2.1)*	-	1.5 (1.0-2.1)*
<i>Academic Engagement</i>				

Non-prescribed stimulant Use: To Study, to party, or both?

Grade Point Average	0.7 (0.6-0.9)**	0.7 (0.6-0.8)***	0.8 (0.7-1.0)	0.8 (0.6-1.0)*
Definitely Will Attend College	0.8 (0.6-1.1)	0.8 (0.5-1.1)	0.9 (0.6-1.2)	0.8 (0.6-1.2)
Involved In Extracurricular Activities?	0.9 (0.6-1.3)	0.9 (0.6-1.3)	1.1 (0.7-1.6)	1.1 (0.7-1.6)
Early Exposure				
First Time Drunk? (Ref = "Never Been Drunk")				
<i>"Elementary School"</i>	8.8 (4.4-17.4)***	8.5 (4.2-16.9)***	4.6 (2.2-9.9)***	4.7 (2.2-10.1)***
<i>"Junior High School"</i>	6.0 (3.4-10.5)***	5.9 (3.4-10.3)***	3.4 (1.8-6.4)***	3.5 (1.9-6.6)***
<i>"High School"</i>	3.6 (2.0-6.3)***	3.6 (2.0-6.4)***	2.2 (1.2-4.1)*	2.3 (1.2-4.3)*
First Time Marijuana Use? (Ref = "Never Used")				
<i>"Elementary School"</i>	18.6 (9.5-36.6)***	20.1 (10.2-39.8)***	6.9 (3.2-14.7)***	7.4 (3.4-16.1)***
<i>"Junior High School"</i>	12.3 (6.9-21.9)***	12.8 (7.2-22.8)***	6.0 (3.1-11.3)***	6.2 (3.3-11.9)***
<i>"High School"</i>	8.7 (4.9-15.5)***	8.8 (4.9-15.6)***	5.3 (2.8-10.1)***	5.4 (2.8-10.5)***
Demographic Controls				
Female	1.1 (0.8-1.5)	1.1 (0.8-1.5)	1.1 (0.8-1.5)	1.1 (0.8-1.5)
Race (Ref = Black)				
<i>White</i>	8.2 (3.2-21.0)***	8.6 (3.4-22.2)***	4.7 (1.8-12.4)**	4.7 (1.8-12.5)**
<i>Hispanic</i>	3.7 (1.3-10.5)*	3.7 (1.3-10.6)*	2.3 (0.8-6.8)	2.3 (0.8-6.7)

Non-prescribed stimulant Use: To Study, to party, or both?

<i>Other</i>	7.0 (2.6-18.8)***	7.1 (2.6-19.1)***	4.3 (1.5-11.8)**	4.1 (1.5-11.6)**
Tenth-Grader	2.1 (1.5-3.1)***	2.1 (1.4-3.1)***	1.6 (1.0-2.4)*	1.5 (1.0-2.3)*
Family Composition (Ref = "Two Parent")				
<i>"Single Female-Headed Household"</i>	1.5 (1.1-2.1)*	1.5 (1.1-2.1)*	1.6 (1.1-2.3)*	1.6 (1.1-2.3)*
<i>"Single Male-Headed Household"</i>	1.3 (0.7-2.4)	1.3 (0.7-2.4)	1.4 (0.7-2.7)	1.4 (0.7-2.8)
Mother's Educational Attainment (Ref = "Less than HS")				
<i>High School Diploma or GED</i>	1.5 (0.9-2.6)	1.6 (0.9-2.8)	1.6 (0.9-2.9)	1.8 (1.0-3.25)*
<i>Some College or More</i>	1.7 (1.0-2.8)*	1.8 (1.1-3.0)*	1.7 (1.0-2.9)*	1.9 (1.1-3.2)*
Region of Country (Ref = "Northeastern")				
<i>Northcentral</i>	1.9 (1.3-3.0)**	2.1 (1.4-3.3)**	2.1 (1.3-3.3)**	2.2 (1.4-3.6)**
<i>South</i>	1.2 (0.8-1.9)	1.4 (0.9-2.1)	1.3 (0.8-2.0)	1.4 (0.9-2.3)
<i>West</i>	0.7 (0.4-1.2)	0.8 (0.5-1.4)	0.9 (0.5-1.6)	1.0 (0.6-1.8)
N = 6,732				6,732
Log likelihood	-673.30	-658.99	-600.48	-588.40
Pseudo R2	0.3601	0.3737	0.4293	0.4408

Note: Log-odds coefficients available on request.

*p < 0.05, **p < 0.01, ***p < 0.001

Source: Monitoring the Future: A Continuing Study of American Youth (8th- and 10th-Grade Surveys), 2011 Form 1.