PREVALENCE OF AND RISK FACTORS FOR NON-MEDICAL USE OF PRESCRIPTION STIMULANTS: A NATIONAL STUDY OF YOUTH

By

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“To Amla, Pala and Aila’s”

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As a two year old, I moved or rather my father relocated my entire family to a neighboring state just so I could have a better education and continue to have the warmth of home at the same time. I learned early on that the ship is safest when it's in port, but that's not what ships were meant for and that roots and responsibilities are just as important, if not more. Since then, I moved on to several states and a country in pursuit of the best education, and although my family did not move every place with me, they have been there in all possible ways-- fanning my wings and giving me rootedness. I am what I am and all that I have achieved because of the gracious and unconditional support from my parents, sisters, brothers-in-law, nieces and nephew. I am truly blessed in this regard and want to acknowledge their wonderful impact in my life.

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Lastly, I gratefully acknowledge the NIH Fogarty grants (D#43-TW09120 & D#43-TW05811; PI Cottler) that have supported my pre doctoral period at both the Washington University in St Louis and University of Florida. This experience has brought me immense learning, research knowledge and growth over the course of the last five years. I hope to justify this opportunity to the fullest extent possible.

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LIST OF ABBREVIATIONS

ABIC	Adjusted Bayes information criterion
ADHD	Attention deficit hyperactivity disorder
AIC	Aikake information criterion
AOR	Adjusted odds ratio
ATM+	Alcohol, tobacco, marijuana and other drugs
BLRT	Bootstrapped likelihood ratio test
CD	Conduct disorder
CI	Confidence interval
LCA	Latent class analysis
LMR-LRT	Lo-Mendell-Rubin-adjusted likelihood ratio test
MI	Multiple imputation
MTF	Monitoring The Future
MU	Medical use
N-MAPSS	National Monitoring of Adolescents Prescription Stimulants Study
NMU	Non-medical use
NSDUH	National Survey on Drug Use in Households
OTC	Over the counter
SAM	Substance Abuse Module
VIF	Variance inflation factor

Abstract of Dissertation Presented to the Graduate School
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The non-medical use (NMU) of prescription stimulants among youth is of public health concern due to its dependence potential and deleterious physical health consequences. Increased understanding of what risk factors influence the use of stimulants for non-medical purposes among youth is of great need to adequately deal with the prescription drug epidemic in the United States. The present study aimed to examine the: 1) prevalence of and risk factors in terms of externalizing and internalizing problem behaviors for past 30-day NMU of stimulants among youth 10 to 18 years; 2) period of highest hazard for initiation into non-medical use of stimulants and factors that influence the onset, and 3) empirically determined subtypes of substance use among youth.

Data comes from the National Monitoring of Prescription Stimulant Study (N-MAPSS) which recruited 11,048 youth between 10 to 18 years of age using an entertainment venue intercept method. The cross-sectional study was carried out in ten cities across the United States from 2008 to 2011. Assessments included lifetime and past 30 day use of prescription stimulants, the quantity, routes and reasons for stimulants use, use of cigarettes, alcohol, marijuana and other illicit substance use,

mental health and behavioral factors, peer use of stimulants and demographic information. The main outcome measure in the study is the non-medical use of prescription stimulants defined as use of stimulant medication without a prescription, in greater amounts, more often, or longer than prescribed, or for a reason other than a doctor said one should take them. Youth with a history of NMU of stimulants were compared to youth with a history of medical use only and non-users.

The study is an in-depth investigation into the risk factors of non-medical use of prescription stimulants with a focus on gender-specific characteristics. Findings will indicate when youth are at highest risk of initiating stimulant use non-medically and inform the field of the subtypes of youth most likely to misuse. The work will have important implications in the design of targeted prevention and intervention programs to reduce non-medical use of prescription stimulants among youth in the United States.

CHAPTER 1
INTRODUCTION

Prescription stimulant medications such as methylphenidate, dextroamphetamine and amphetamine salts are used in the treatment of Attention Deficit Hyperactivity Disorder (ADHD), narcolepsy, obesity and occasionally depression (Bogle and Smith, 2009; Challman and Lipsky, 2000; Visser et al., 2007). These medications are listed as Schedule II drugs because of their potential for non-medical use and dependence. Non-medical use (NMU) refers to the use of stimulants that deviates from a doctor's recommended dose, route or use without a prescription (Cottler et al., 2013). Following NMU, tolerance for stimulants can develop along with the risk of addiction. Additionally, the use of stimulants for non-medical purposes has been shown to cause several medical issues such as cardiovascular problems (rapid or irregular heartbeat, increase in blood pressure, stroke), increased body temperature, convulsions and even death (Lakhan and Kirchgessner, 2012).

Prevalence

The past two decades in the United States have been marked with a significant growth in the rates of prescription stimulant medications paralleled by increased rates of non-medical use (Garfield et al., 2012; Johansen et al., 2015; Visser et al., 2007). Young adults and adolescents have been consistently shown to be at highest risk for NMU; approximately a third of the 2.4 million new initiators of NMU of prescription drugs including stimulants within the past year were between the ages of 12 and 17 years (Substance Abuse and Mental Health Services Administration, 2011; Teter et al., 2005). Several national and regional studies have reported the pervasiveness of NMU leading to its designation as a public health problem of grave concern among youth.

Overall, among youth between 10 to 18 years of age, the prevalence of past year non-medical use of stimulants ranges from 5-10% with past 30 day use up to 5% (Cottler et al., 2013; Johnston et al., 2012; McCabe et al., 2007; McCabe et al., 2004; Nakawaki and Crano, 2012; Schepis and Krishnan-Sarin, 2008; Simoni-Wastila et al., 2008a; Substance Abuse and Mental Health Services Administration, 2014; Viana et al., 2012). For instance, Monitoring the Future (2012) which is a national student based study indicated a growing trend in the NMU of stimulants among 12th grade students; past year rates of amphetamine abuse increased from 6.8% to 8.7% over the last five years from 2008 to 2013. A slight decline was observed for those in the 8th (0.3%) and 10th grade (0.6%). During the same period, an increase in the rates of current NMU for 12th grade students was also observed (from 2.9 to 4.1%) while rates remained stable for 8th and 10th graders at around 1.4% and 2.8% respectively. Using combined data from an annual cross sectional household survey for the years 2002-2009, Sweeney and others (2013) found lifetime NMU of stimulants to be 3.4% for those aged 12 years and older.

Other smaller or regional samples report higher rates NMU of stimulants compared to those in national samples (McCabe et al., 2015, 2012; McCabe and West, 2013). For instance, a study found the lifetime rate of all non-medical use of prescription drugs to be 6.5% among 6th to 12th graders in public schools at Mississippi. Stimulants (e.g., Ritalin, Concerta, Focalin, Dexedrine; 37%), were the third most common drug of misuse after pain medications (57%) and benzodiazepines (44%) (Viana et al., 2012a). Also, indications of diversion--the selling and sharing of prescription drugs to individuals without prescriptions have been reported; with friends or family being most commonly

reported as the main source for their NMU (Clemow and Walker, 2014; Cottler et al., 2013; Fischer et al., 2010; Kaye and Darke, 2012). For example, one in seven adolescent students reported having received or exchanged prescribed medications from their friends for non-medical purposes (West et al., 2011). It is clear that there is significant supply of and access to ADHD medication available to youth in the US indicating potential for NMU and its adverse effects (Setlik et al., 2009; Valdez, 2014).

A cause of added concern is the significant rise in emergency department (ED) visits related to stimulant non-medical use. In the years 2004 to 2009, ED visits increased by 102% for methylphenidate and by 276% for amphetamines (Substance Abuse and Mental Health Services Administration, 2011). Furthermore, the Drug Abuse and Warning Network (DAWN) surveillance system developed to monitor morbidity and mortality associated with drug use indicates that stimulant related ED visit rates have steadily risen over both the long term (307%) and short term (85%) while rates for other medications such as opioids and benzodiazepines have remained stable (Substance Abuse and Mental Health Services Administration, 2013). Because of the risk of NMU and its deleterious consequences, there have been attempts to control the availability and accessibility of prescription drugs with measures (such as prescription monitoring systems) which relate to limiting the supply of prescription medications for NMU (Fischer et al., 2010; Zosel et al., 2013). What is less known is the demand aspect of NMU among youth—the identification of youth at risk for non-medical use of stimulants.

Risk Factors of Non-Medical Use of Prescription Stimulants

Developmentally, youth differ from adults in maturation and behavior reflected in part as differential patterns and correlates of substance use (Cotto et al., 2010). While the majority of NMU of stimulants literature has focused on the college going population,

prior studies do suggest that developmental life stage specific risks exist and risk factors vary depending on the population and setting which necessitates the characterization of youth with NMU (Clark et al., 2013; DeLisi et al., 2015; Moss et al., 2014; Piehler et al., 2012; Herman-Stahl et al., 2008). Some important risk factors shown important in prior substance use literature have been disproportionately understudied in NMU of stimulants focused studies (such as mental health) while a few others have been well researched (such as sociodemographic variables, other substance use, perceived risk or harm from use) (McCabe and West, 2013; Nargiso et al., 2015; Sweeney et al., 2013; Teter et al., 2005). A brief review of risk factors is presented in the following sections.

Sociodemographic Factors

The majority of previous studies on NMU of stimulants among youth have focused on sociodemographic risk factors such as gender, race, family characteristics and academic performance (Chen et al., 2014; Collins et al., 2011; King and Chassin, 2007; McCabe et al., 2012; McCabe and West, 2013; Nakawaki and Crano, 2012). Specifically, being of White race has been consistently found to be associated with higher rates of NMU of stimulants in youth while those of other races, such as African Americans and Asians are at lower risk (Conn and Marks, 2014; McCabe et al., 2004; McCabe and West, 2013). With regard to the role of gender, the evidence so far is largely inconclusive; some studies have found increased rates among females, others report higher rates in males while others indicate non-differential risk by gender (Fleary et al., 2011; McCabe and West, 2013; Nakawaki and Crano, 2012; Sweeney et al., 2013). There is considerable evidence to suggest that NMU of stimulants among youth is associated with negative consequences such as school dropout, low academic performance and low educational attainment (Arria et al., 2011; Collins et al., 2011;

Garnier-Dykstra et al., 2012; McCabe et al., 2012; Nargiso et al., 2015; Schepis and Krishnan-Sarin, 2008; Young et al., 2012a). Additionally, parental characteristics are also important; in particular, poor monitoring and involvement by parents is positively related to NMU of stimulants in youth in the majority of the studies (Ford and McCutcheon, 2012; Schinke et al., 2008; Vaughn et al., 2012). Also, youth from dual parent households have been consistently found to be at decreased risk for NMU of stimulants compared to youth from a single parent or absent parent households (Kaye and Darke, 2012; Young et al., 2012).

Externalizing and Internalizing Problem Behaviors

To better understand childhood mental health and behavior and its implications, a large body of research distinguishes between externalizing and internalizing behavior problems (Achenbach and Edelbrock, 1978). Externalizing behavior problems denote behaviors characterized by a child's negative acting out on the external environment and include key problems of disruptive behavior, hyperactivity, aggression and delinquency (Campbell et al., 2000; Eisenberg et al., 2001). Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD) fall in the scope of externalizing behavior problems. In contrast, internalizing behavior problems affect the internal psychological environment of an individual and are characterized by behaviors such as social withdrawal, negativity, anxiety, inhibition and depression (Achenbach and Edelbrock, 1978; McCulloch et al., 2000). Internalizing disorders encompass the diagnoses of Anxiety Disorder and Major Depressive Disorder (Campbell et al., 2000; Eisenberg et al., 2001; Hinshaw, 1987). Although the dichotomy of externalizing and internalizing behaviors has been proposed, there is evidence that these behaviors can occur concomitantly (Kirisci et al., 2015;

Miettunen et al., 2014; Scalco et al., 2014; Weiland et al., 2014). More importantly, both externalizing and internalizing behavior problems have been significantly associated with substance abuse. For example, long-term associations exist between childhood externalizing behavior problems and abuse of substance such as alcohol, tobacco and other illegal drugs (Helstrom et al., 2004; King et al., 2004). Internalizing behavior problems in childhood have been shown to increase the risk of initiating use of illegal substances in young adolescents (King et al., 2004).

The association of externalizing and internalizing behavior problems and NMU of stimulants has not yet been fully examined; a lack of nationally representative data that investigates mental health correlates of NMU of stimulants among youth has been suggested as an area of need (Sung et al., 2005). In terms of externalizing problem behaviors, a few studies have found that antisocial behavior and delinquent activities are linked to increased rates of NMU of stimulants (Chen et al., 2014; Gilson and Kreis, 2009; Harrell and Broman, 2009; McCauley et al., 2010; Nargiso et al., 2015; Vaughn et al., 2012; Viana et al., 2012).

Among the internalizing problems, only depression has been studied as a correlate of NMU of stimulants in youth. A national study by Goldstein (2008) found that among youth between the ages of 12 and 17 with NMU of stimulants, at least 20% reported having experienced an episode of major depression in the past 12 months. A recent study also reports a positive association between the NMU of prescription medications and major depressive disorders (MDD); an excess risk of up to 35% for MDD was found among users relative to non-using youth (Ali et al., 2015). Most of the

other internalizing problems (such as anxiety) have not been subjected to investigation in the context of NMU of stimulants in youth.

Peer Influence

A number of studies have demonstrated a significant relationship between peer or friend approval of substance use and NMU of medication among youth (Ford et al., 2014; Ford and Lacerenza, 2011). Peer disapproval of substance use seems to be a protective factor that decreases the likelihood of NMU of stimulants while youth with friends that have increasingly tolerant attitudes towards the use of substances seem to be at greater risk of having engaged in non-medical use of stimulants in the past 12 months (Ford and Lacerenza, 2011; Young et al., 2012). Moreover, the use of substances by a close friend has been consistently seen as an important risk factor for NMU of stimulants in line with most other substance use research. For example, Schinke and colleagues (2008) found females who had best friends who used substances were over five times at increased risk for NMU of stimulants than their counterparts.

Age of Onset and Non-medical Use of Prescription Stimulants

Adolescence is a critical developmental stage for the structural and functional maturation of the human brain; this period is marked by significant changes in cognition and behavior such as risk-taking, and the emergence of substance use and psychological pathologies. The majority of the substance use literature has shown that the most vulnerable years for initiating substance use are between the ages of 12 and 20 (Substance Abuse and Mental Health Services Administration, 2011). Detrimental effects of substance use are greater on the developing adolescent brain than they are among adults. Moreover, among those who use, the risk of developing substance

dependence is two to three times higher when onset is in adolescence than when youth begin use later (Brook et al., 2007; Gil et al., 2004; King and Chassin, 2007). While there are several studies that have examined the onset and consequences of substance use such as alcohol, tobacco, marijuana, few have focused on prescription stimulants (Moss et al., 2014; Seedall and Anthony, 2013). An earlier age of initiation of substance use is linked to a progression into long term substance use patterns, especially stimulants.

Previous studies on the onset of NMU of stimulants have focused on reporting the mean age of first stimulant use as an important factor. However, information regarding the critical period of risk for onset of NMU of stimulants based on general population youth samples are lacking; this knowledge would be of importance for prevention or for messages that focus on delaying initiation of stimulant non-medical use. While longitudinal studies are more appropriate to examine predictive relations, cost and logistic considerations make such studies difficult and unfeasible to conduct.

Non-medical Use of Prescription Stimulants and the Use of Other Substances

Youth who engage in NMU of stimulants also report increased use of other drugs compared to those who use stimulants medically or abstain. Several studies have revealed associations between NMU of stimulants and increased rates of use of cigarettes; heavy episodic drinking; marijuana, and other illicit drug use among youth in the United States (Arria et al., 2011; Collins et al., 2011; Garnier-Dykstra et al., 2012; McCabe et al., 2012; Nargiso et al., 2015; Schepis and Krishnan-Sarin, 2008; Young et al., 2012). There are indications that characteristics of youth who engage primarily in NMU of stimulants significantly differ from youth who engage in comorbid or poly-substance use. A handful of studies have empirically classified youth into distinct groups

determined by their patterns of substance use or by motives and routes of use (McCabe et al., 2009; McCabe and Cranford, 2012). Findings from young adult and college going age populations and those focused on other drug classes besides stimulants suggest that there may be important but unrecognized differences between substance use subtypes; the possible variation in risk correlates for different groups of youth stimulant users is still unknown (Hall et al., 2010; McCabe et al., 2009; Lamont et al., 2014; Moss et al., 2014; Roth et al., 2015). Knowledge of NMU of stimulants related taxonomies among youth and their associated characteristics can contextualize NMU of stimulants within the larger public health scope of substance use and abuse behaviors.

Limitations of Prior Non-medical Prescription Stimulant Use Literature

A lack of representativeness limits the existing studies to date in our understanding of the association of risk factors and NMU of stimulants. The majority of studies have focused on students and restricted geographical locations or are web based (Boyd et al., 2009, 2007; Viana et al., 2012; Webb et al., 2013). Two national studies--the National Study on Drug Use and Health (NSDUH) and the Monitoring the Future (MTF) have assessed NMU among youth; however, variable definitions of NMU, inclusion of only a few stimulant medications and varying methodology make comparisons with other studies difficult. The MTF although large is school-based and does not include youth who are school drop outs or students who missed school the day of the survey, this may be a significant proportion of the very youth who are at increased risk for substance use (Bracken et al., 2013; Cottler et al., 2013). Additionally, these large samples are not suited to examine characteristics of NMU of stimulants among youth because they are not detailed in their assessment of factors that can influence the non-medical use of stimulants.

Because of these reasons such as the variable definitions of non-medical use and lack of generalizability of study findings, there is a gap in the understanding of what factors influence prescription stimulant use among youth. NMU of stimulants continues to be a problem among youth, with about 5%-10% reporting past 12-month of stimulant misuse (McCabe et al., 2014; Weyandt et al., 2014; Wang et al., 2015).

The present study will provide a comprehensive and in-depth investigation into the non-medical use of stimulants among youth across ten US cities in order to narrow the knowledge gap on risk factors for NMU of stimulants. One unique aspect of the study is the sample; data comes from the National Monitoring of Adolescent Prescription Stimulant Study (N-MAPSS) which is the only study to focus primarily on stimulant use patterns among youth 10-18 years of age. In fact, youth as young as 10 to 12 years of age were assessed for patterns of stimulant use and the field currently lacks data for this age group. Further, the present study uses a sample that is large, assesses use of the majority of commonly prescribed stimulants among respondents recruited from across the contiguous US along with a number of important potential correlates based on extant substance use literature. Therefore, the study is ideally suited to add to the current prescription stimulant misuse literature among youth.

Additionally, the emphasis of the present study is placed on a holistic understanding of NMU of stimulants and focuses on the period from when youth are at highest risk to the most current past 30 day non-medical use and the identification of factors that place youth at increased risk for NMU of stimulants. An important component is the attention on the role of gender in the NMU of stimulants in youth. The empirical identification of subtypes of youth based on their substance use patterns is

also a highlight of this work because it aims to contextualize the NMU of stimulants within the larger concept of substance use and misuse. The proposed work will be important in the comprehensive and overall understanding of non-medical use of stimulants among youth which has value in the design of strategic prevention and intervention programs. The ultimate aim is to utilize the study findings to reduce substance abuse among youth.

CHAPTER 2
DATA SOURCE

The National Monitoring of Adolescents Prescription Stimulants Study

Data for the present study comes from the National Monitoring of Adolescent Prescription Stimulants Study (N-MAPSS) which surveyed youth 10 to 18 years of age. An entertainment venue intercept methodology was used to recruit youth across ten US cities. The state with the highest volume of stimulant prescriptions within one of ten federal regions (OMB Circular A105) was first selected; within each state the city with highest volume (shown in Figure 2-1) was then selected from which recruitment was carried out (Boston, New York, Philadelphia, Tampa, St Louis, Cincinnati, Houston, Denver, Los Angeles and Seattle). Eligibility criteria included: being 10 –18 years of age, residing in an urban, suburban or rural ZIP code from one of the ten cities. Youth unaware of their ZIP code, non-English readers, cognitively impaired, or college going were excluded. Recruiter interviewers (RI) visited entertainment venues such as malls, parks and other recreational places that are youth friendly, identified potential respondents (based on the study eligibility criteria) and introduced the study. Consent for participation in the N-MAPSS was verbally obtained. Because data were anonymous parental permission/informed consent was deemed to be not required by the Institutional Review Board (IRB) at Washington University where the study commenced.

Recruiter interviewers approached 21,444 youth for study participation. Among those approached, 25% did not stop to hear about the study, an additional 21% were not eligible and 10% refused to participate. Among those who participated (11,468), 420 were excluded because the surveys were duplicates, incomplete, ineligible or questionable with regard to quality or veracity of responses. The final sample consisted

of 11,048 youth that represented an 86.7% participation rate and a 68% overall response rate. The N-MAPSS survey assessed for recognition and patterns of use of prescription stimulant medication along with other substance use (cigarettes, alcohol, marijuana and other illegal drugs). Data collection was carried out over four cross sections between Fall 2008 and Spring 2011. Recruitment goals sought at adequate representation of all ages of interest as well as urban, suburban and rural areas. Demographic characteristics of the N-MAPSS sample were comparable to those of the US 2010 census across the same age range (Cottler et al., 2013). Participants were each remunerated with a gift card worth $10 from a national electronics store. The study approval was obtained from the IRB at Washington University in St Louis for all four cross sections of the study and University of Florida IRB for the fourth cross section. All analyses for the present study used data from all cross sections except for one component that examined age of onset of stimulant use that was assessed only in the latter three cross sections.

N-MAPSS Assessment

The N-MAPPS survey was adapted from the 1) Substance Abuse Module (SAM) (Horton et al, 2000) found to be reliable for quantity and frequency of stimulant and other substance use and 2) the Washington University Risk Behavior Assessment (RBA) for risk factors for non-medical use (Shacham and Cottler, 2010). The assessment consisted of two parts. Part I of the survey assessed for demographics along with mental and behavioral variables (described in detail below). Then, youth were presented with pictures of 5 dosages of commonly prescribed amphetamines, 2 pictures of other common stimulant medication and a common over-the-counter (OTC) pain medication and a decongestant. Youth were asked if they had ever seen the

medication; if they answered positively, they were asked to identify the stimulant by brand name and formulation.

Part II started with a presentation of pictures of five stimulants-- Adderall® or Adderall XR®, Concerta®, Ritalin®, Daytrana®, and Vyvanse® individually, by dose and formulation. Specific questions asked for: a) lifetime and past 30-day use of each stimulant; b) use of stimulants more than prescribed; c) use that belonged to someone else (parents, brother or sister, different family member, someone from school or from work, someone unknown and other); d) route of ingestion of stimulant (by mouth, snorted or sniffed, smoked and other); e) reasons for prescription stimulant use and f) age of first use of each stimulant contingent on whether youth responded to using the stimulant. Questions also assessed if each stimulant endorsed for use had been prescribed by a psychiatrist or a doctor.

Demographics

The N-MAPSS assessed for age, gender, race and ethnicity. Zip code level information was used to determine eligibility and to categorize area of residence as urban, suburban or rural. The survey also included items that elicited whether youth lived in a dual parent household, grades in school, sleep timings during the week, number of meals in a week youth ate with family and self-rated general level of health (excellent, good, fair and poor).

Mental and Behavioral Health Indicators

A number of mental and behavioral health problems were measured. 1) self – reported ADHD diagnosis; 2) conduct disorder symptoms: getting into a lot of trouble at home or school, running away from home overnight, being arrested, using or threatening someone with a weapon, suspension from school for any reason; 3) weight

issues: ever been very afraid of gaining weight, ever tried to lose weight by making yourself vomit, taking pills, not eating for a day or two and exercising too much; 4) depressive symptoms: past 12 month loss of interest for at least 2 weeks, and feeling sad or depressed in the past 12 months for at least 2 weeks; 5) anxiety: lifetime worry or stress lasting 6 months or more; 6) substance use*:* individual questions for both lifetime and past 30 day use of cigarettes, alcohol, marijuana and lifetime use of other illegal drugs that included cocaine, heroin, ecstasy, LSD, steroids, inhalants and methamphetamine. Further, youth were asked if they had ever used the prescription medication Xanax®, Vicodin®, Vyvanse ® or Oxycodone® individually. Additionally, age of first use of each of the substances was assessed contingent on whether youth reported having used the substance.

Peer Influence

In order to asses for peer influence on stimulant use, youth were asked for the number of close friends who had used the stimulant Adderall® at least once.

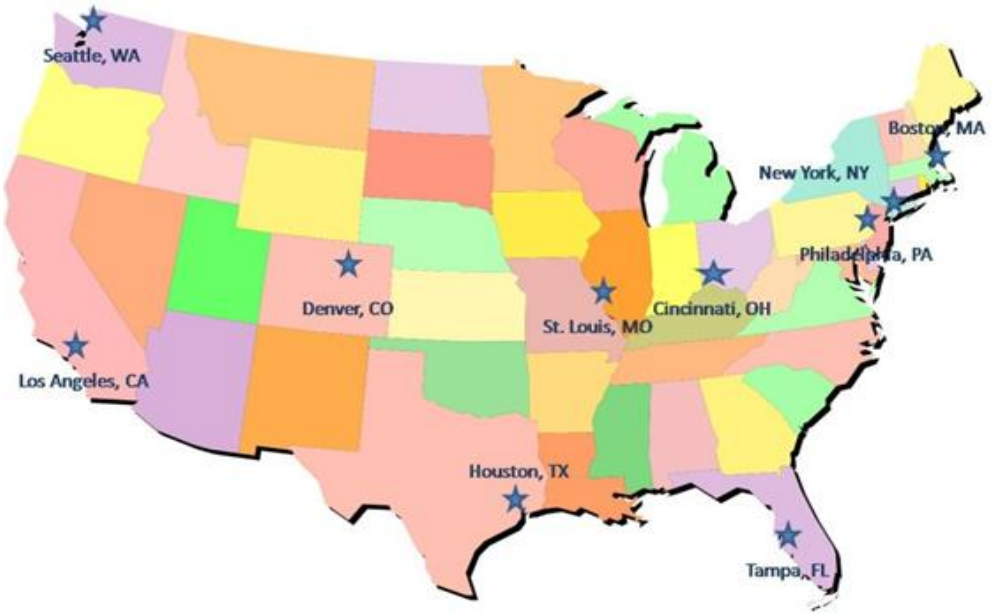


Figure 2-1. Recruitment Sites of the N-MAPSS

Stimulant Use in the N-MAPSS

For the purposes of this study, past 30-day stimulant use was categorized into a three level variable: NMU of stimulants, medical use (MU) of stimulants and no use. Past 30-day NMU of stimulants was defined as the use of any of the five stimulants by non oral routes (except Daytrana®), use that belonged to someone else, use of any stimulant more than prescribed, or use for the reasons 'to get high', 'just because' or 'out of curiosity'. The medical use (MU) of stimulants was defined as the use of any of the five stimulants with a prescription within the prescribed dosage, use only by oral routes (except Daytrana® which comes in a patch) and no use of stimulant that belonged to someone else. Medical use was cross tabulated with NMU and those youth who endorsed both (118) were considered NMU. Youth who did not report past 30 day use of any stimulants were categorized as non-users of prescription stimulant medications. Using these definitions, 6.8% of youth reported some form of stimulant use in the past 30 days; as shown in Figure 2-2, 3.6% (398) reported NMU and 3.2% (334) were MU.

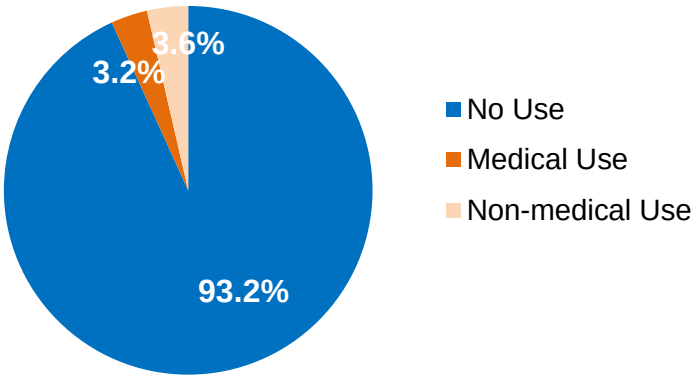


Figure 2-2. Past 30 day Stimulant Use among Youth in the N-MAPSS

CHAPTER 3
EXTERNALIZING AND INTERNALIZING RISK FACTORS OF NON-MEDICAL USE OF PRESCRIPTION STIMULANTS: A NATIONAL STUDY OF YOUTH

Background

Prescription stimulant medication such as methylphenidate, dextroamphetamine and amphetamine salts have been highly effective in the treatment of Attention Deficit Hyperactivity Disorder (ADHD), however, the abuse potential of these medications and reports of misuse of prescription stimulants by youth in the United States has generated much public health concern in the past decade (Chen et al., 2014; Clemow and Walker, 2014; Johnston et al., 2014, 2012; McCabe et al., 2011; Miech et al., 2015; Schepis and Krishnan-Sarin, 2008; Simoni-Wastila et al., 2008; Substance Abuse and Mental Health Services Administration, 2014; Sweeney et al., 2013; Viana et al., 2012; Young et al., 2012). Approximately 5-10% of youth aged 10 to 18 years in the US engage in the misuse or non-medical use of prescription stimulant medications (NMU) defined as the use of medications by non-oral routes, use of medication that belongs to someone else, overuse of one's own medication, or use motivated by getting high or experimentation of the stimulant medication (Cottler et al., 2013; Lasopa et al., 2015; Wang et al., 2015).

Because the patterns and correlates of substance use, abuse and dependence in youth differ from the adult population, it is important to understand developmental specific risks of NMU (Cotto et al., 2010). While some efforts to deepen our understanding of what risk factors are linked to NMU of stimulants among youth have been conducted, the efforts have disproportionately focused on socio-demographic factors, illicit drug use, perceived risk or harm from stimulant use; other individual level factors such as mental health characteristics that have been shown to be important in other substance use among youth have been understudied (McCabe and West, 2013;

Nakawaki and Crano, 2012; Nargiso et al., 2015; Sweeney et al., 2013). It has been suggested that distinct factors place some youth at increased likelihood for non-medical use and these factors vary by medication, population and setting (Herman-Stahl et al., 2007). While mental health problems have played an important role in comorbidity of other substance use (tobacco, alcohol and other drugs) they have not been the focus of research among youth in the context of stimulant use and misuse (Barkley et al., 2004; Brook et al., 2007; Flory et al., 2003; Gil et al., 2004; Marmorstein, 2009; Marmorstein et al., 2010). In conceptualizing child and adolescent mental health, a distinction has been made between two types of problem behaviors termed as externalizing and internalizing behaviors (Achenbach, 1966). Externalizing problems are behaviors manifest overtly and associated with problems in controlling unwanted or disruptive behaviors, aggressive behaviors and hyperactivity (Liu, 2004). These are disorders of Attention Deficit Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). In contrast, internalizing problems are related to the internal psychological processes characterized by an inability to effectively regulate emotions and they include social withdrawal, somatic complaints, sadness, anxiety and depression (Liu, 2003). In general, externalizing problems find increased representation among males while the prevalence of internalizing problems is high among females. Although substance use has been conceptualized as a form of externalizing behavior, there is evidence to suggest it is related to internalizing problems as well.

Externalizing Problem Behaviors and Non-medical Use of Prescription Stimulants

Externalizing problems such as CD problems and antisocial traits among youth have been linked to NMU; prevalence rates are elevated among those with antisocial and delinquent activities (Gilson and Kreis, 2009; Harrell and Broman, 2009; McCauley

et al., 2010; Nargiso et al., 2015; Vaughn et al., 2012; Viana et al., 2012a). For instance, Viana and others (2012) reported that youth were 1.5 times more likely to have engaged in NMU of prescription medication if they had been involved in physical fights. Several studies indicate the role of ADHD in contributing to the risk of substance use across varied samples and methodological differences (Charach et al., 2011; Lee, 2011; Molina et al., 2007; Riggs, 2014). A recent study by Harstad and Levy (2014) showed that children with ADHD were two times more likely to develop substance use disorders as compared to those without ADHD. Additionally, ADHD is known to pose increased risks for academic, social and psychological difficulties among youth relative to their non ADHD peers. Further, students diagnosed with ADHD have indicated having to read material over and over to understand. Although a large majority of youth report NMU of stimulants to improve their academic or cognitive performance, youth are as likely to endorse using stimulants to get high (Boyd et al., 2006).

Internalizing Problem Behaviors and Non-medical Use of Prescription Stimulants

Internalizing problems such as anxiety and depression have been implicated in the development of NMU of prescription medications. For example, more than one in five youth aged 12 to 17 years in a national study who met criteria for NMU of stimulants had experienced an episode of major depression in the past 12 months (Goldstein, 2008). Further, a known side effect of prescription stimulants is weight loss and there are reports that a proportion of youth misuse these medications to control weight often citing weight loss as a motive. Youth have also indicated the use stimulants to deal with negative emotion and stress related eating behaviors (Jeffers and Koester, 2013; Terry-McElrath et al., 2009).

Overall, the literature suggests that youth with externalizing (attention difficulties, hyperactive behaviors, conduct or antisocial traits) or internalizing problems (emotional problems) may be at increased risk of NMU of stimulants.

Gender and Non-medical Use of Prescription Stimulants

Patterns of substance use, abuse and dependence are known to vary by gender and several studies have examined gender distribution in the prevalence of NMU of stimulants. The majority of analyses from NSDUH report increased rates of NMU of stimulants among females compared to males in the age range of 12 to 17 years (Herman-Stahl et al., 2008; Nakawaki and Crano, 2012). Other studies have found greater NMU of stimulants among males, still others indicate no difference by gender suggesting that the role of gender in NMU of stimulants is still not clear (Chen et al., 2014; King et al., 2013; McCabe et al., 2014; Sweeney et al., 2013; Teter et al., 2005). Females have been shown to be more likely than males to abuse substances when they are concerned about peer approval (Rohrbach and Milam, 2002). Although some efforts to understand risk factors for NMU of stimulants among youth in general are underway, the intersection between mental health and the NMU of stimulants, and the role of gender in this relationship still needs to be addressed. A conceptual model illustrating the relationship between externalizing and internalizing behaviors with the NMU of stimulants among youth along with the possible moderating role of gender is presented in Figure 3-1.

The majority of prior research on mental health and NMU of stimulants among youth have not included the general population or out of treatment populations; studies that do focus on general populations have assessed non-medical use of stimulants but only within a broader category of non-medical use of prescription medications. In order

to address important gaps in the literature for NMU of stimulants literature and to extend previous work, the present study aims to examine a broad range of mental and behavioral risk factors of NMU of stimulants in terms of externalizing and internalizing problem indicators with a specific focus on the role of gender with a large national sample of youth.

First, we aim to: 1) assess the prevalence and association of externalizing (ADHD and CD symptoms, and past 30 day use of cigarettes, alcohol, marijuana and lifetime other illegal drug use) and internalizing problems (depressive and anxiety symptoms, and weight concerns) by stimulants use status. The hypotheses for this aim are: 1a) ADHD symptoms will increase the risk of NMU of stimulants among youth; 1b) youth with CD symptoms will have increased risk of NMU of stimulants; 1c) past 30 day use of cigarettes, alcohol, marijuana and lifetime other illegal drug use will be positively associated with NMU of stimulants in youth; 1d) depressive symptoms will increase the risk of NMU of stimulants among youth; 1e) youth with anxiety symptoms will have increased risk of NMU of stimulants and 1f) weight concerns will be positively associated with NMU of stimulants among youth.

Additionally, the dissertation focuses on two externalizing problem behaviors and aims to: 2) examine the role of gender in the associations between ADHD and CD, and the NMU of stimulants in youth. For this aim we hypothesize that 1) male gender will increase the association between ADHD and NMU of stimulants than when youth are female; 2) male gender will increase the association between CD and NMU of stimulants CD symptoms than when youth are female.

Methods

Data came from a cross-sectional survey known as the National Monitoring of Prescription Stimulants Study (N-MAPSS). The N-MAPPS was conducted in the years 2008 to 2011, and recruited a sample of 11,048 youth aged 10 to 18 years from entertainment venues in ten cities across the United States. The sample was found to be highly representative of the US population (Cottler et al., 2013). Interviewers surveyed youth anonymously on patterns of prescription stimulant and other substance use along with a number of socio-demographic information.

Measures

Prescription stimulant use

The N-MAPSS survey assessed use of prescription stimulants--Adderall® or Adderall XR®, Concerta®, Ritalin®, Daytrana®, and Vyvanse® individually. Pictures of each stimulant medication were presented and youth were asked to identify the stimulant by brand name and formulation. Specific questions asked for: a) lifetime and past 30-day use of each stimulant; b) use of stimulants more than prescribed; c) use that belonged to someone else (parents, brother or sister, different family member, someone from school or from work, someone unknown and other); d) route of ingestion of stimulant (by mouth, snorted or sniffed, smoked and other), and e) reasons for prescription stimulant use. Questions also assessed if each stimulant endorsed for use had been prescribed by a psychiatrist or a doctor.

For this study, past 30-day NMU of stimulants was defined as the use of any of the five aforementioned stimulants for use other than by mouth (except Daytrana®), use of any stimulant that belonged to someone else, use of any stimulant more than prescribed, or use for the reasons ‘to get high’, ‘just because’ or ‘out of curiosity’.

Medical use (MU) was defined as the use of any of the five stimulants with a prescription within the prescribed dosage, use only by oral routes (except Daytrana® which comes in a patch) with no use of any prescription stimulant that belonged to someone else. Medical use was cross tabulated with NMU and those youth who endorsed both (118) were consistently considered NMU as has been done in prior analyses (McCabe and West, 2013; Cottler et al., 2013). Youth who did not report any of the five stimulants assessed were categorized as non-users of prescription stimulant medications. Using these definitions, the final sample includes a three level past 30 day stimulant use variable with 398 youth reporting any non-medical use (NMU), 334 youth reporting use of prescription stimulants for medical purposes only (MU) and 10,252 youth reporting no use (non-user).

Externalizing problem behaviors

For the purposes of this study, symptoms of ADHD and CD, and substance use were considered externalizing problem behaviors.

Attention deficit hyperactivity disorder (ADHD)

ADHD was assessed with the question: “Has a doctor ever told you or your parents that you have Attention Deficit Disorder (ADD) or ADHD? Youth responded positively were considered to have ADHD while those who responded “no” or “don’t know” were considered no ADHD.

Conduct disorder (CD) symptoms

Five items measured CD symptoms among youth: a) “Have you ever gotten into a lot of trouble at home or at school or ran away from home overnight?” b) “Have you ever used or threatened someone with a weapon?” c) “How many tickets or warnings have you received from the police?” d) How many times have you been arrested?” The

first three items were categorical and coded either yes or no; the last two variables were coded yes when youth responded having at least one episode of having received tickets or warnings, or being arrested at least once. They were coded no when there were none. Based on these items, a variable to represent conduct problems was created when youth positively responded to a minimum of three of the items.

Substance use

Questions assessed for both lifetime and past 30 day use of use of cigarette, alcohol, marijuana and other illegal drugs (cocaine, heroin, ecstasy, LSD, steroids, inhalants or methamphetamine). Dichotomous variables for the past 30 days were created with 1 representing ‘use’ and 0 as ‘no use’ for each individual substance (cigarette, alcohol, marijuana) except for other illegal drug use which was only measured as a lifetime question.

Internalizing problem behaviors

For the purposes of this study, anxiety and depression symptoms and weight issues were considered internalizing problem behaviors.

Depressive symptoms

Depressive symptoms were elicited with two items that asked: “In the past 12 months have you had two weeks or more when you felt down or depressed” and “in the past 12 months have you had two weeks or more when you lost interest in things”. Responses to either of the two questions were considered as having depressive symptoms and coded yes; not responding positively was coded no.

Anxiety symptoms

A positive response to “ever having worry or stress for 6 months or more” was considered as having anxiety symptoms and coded 1 while a negative response was taken to indicate having no anxiety and was coded 0.

Weight issues

Weight issues were measured with five questions: 1) “Have you ever been very afraid of gaining weight?” 2) “Have you ever tried to lose weight by… a) Making yourself vomit? b) Taking pills? c) Not eating for a day or two; d) exercising too much? “Positive responses to any three of the five questions were considered to indicate having weight issues and coded 1 while two positive responses or less were coded as 0.

Peer influence

Peer stimulant use influence was assessed with the question “How many of your close friends have tried Adderall®, even once?” Youth reporting at least one close friend were coded as yes and those who reported having no friends were coded as no.

Demographics

N-MAPSS assessed for a number of demographic characteristics that include age, gender, race and Zip code of residence. Zip code level information was used to categorize area of residence into urban, suburban and rural. The survey also included items that elicited characteristics within the home such as whether youth lived with both parents, sleep timings during the week (youth were dichotomized into those who regularly went to bed at 12 am or later and those who went to bed before 12 am) and number of times in a week youth ate meals with family (binary variable created with youth eating with family ate at least 5 times in a week coded as yes and those not

coded no). Grades in school were also assessed and dichotomized into A's, B's and C's vs. D's and F's.

Statistical Analyses

First, prevalence estimates for NMU of stimulants, MU only of stimulants and no use by gender were computed. Chi square analyses were conducted to examine differences in sociodemographic, stimulant use status, externalizing and internalizing disorders and peer influence by gender. Stratified chi square analyses were carried out to explore the effects of gender on past 30 day prescription stimulant use (NMU of stimulants, MU only of stimulants and no use) by sociodemographic characteristics, externalizing and internalizing disorders and peer stimulant use influence.

Next, bivariate logistic regression models were conducted to calculate unadjusted odds ratios between each individual risk factor and covariates and the outcome variable of NMU of stimulants described earlier. Then, multivariate logistic regression models were conducted to explore factors associated with increased risk of non-medical prescription stimulant use with non-users as the referent group for both NMU and MU only groups. A standard approach to model building was applied (Hosmer et al., 2013); only those variables in univariate models which were statistically associated (at p value <0.05) with the outcome variable were retained in the model building process. In the multivariate model, variables were entered in the following order: socio-demographics, mental and behavioral health factors, other substance use measures, peer stimulant use and interaction terms of gender with ADHD, and gender with CD.

The assessment of multi-collinearity was conducted to identify highly associated independent variables before their insertion into the models; this was conducted with a

regression model with all variables to estimate the tolerance and Variance Inflation Factor (VIF). Generally a tolerance below .40 is suggestive of multi-collinearity; VIF coefficient above 10 is indicative of a variable that is correlated with other variables in the model (Davis et al., 1986). High tolerance and low VIF was observed indicating no evidence of multi-collinearity of variables in the model. Following the inclusion of each variable, the decision to either drop or retain a variable was based on whether its coefficient differed significantly from 0 (adjusting for the effects of the other variables), whether removal of the variable altered the remaining coefficients of other terms in the model by more than 20%. Also, it was considered whether change in the overall fit of the model was improved by its addition. In some cases, a variable was retained in a model for statistical significance but later became insignificant when other variables were dropped. In these few cases, the variable that became insignificant was retained in the model.

Further, two way interaction terms were created to test the hypothesis of the moderating role of gender on the relationship between ADHD and CD variables and NMU in the model. In general, a moderator is a variable (in this case gender) that affects the direction and strength of the relationship between a predictor X and an outcome Y; the causal relationship between X and Y changes as a function of the moderator (Baron and Kenny, 1986). In these analyses, the expected moderation model is shown in Figure 3-1 where gender is a moderator (M), and two externalizing behaviors (ADHD, CD) are the predictors when NMU is the outcome. Based on a conceptual model (Hayes, 2013), the moderation model for the present study was conceptualized to test whether females were more likely to experience NMU of

stimulants compared to males when they are experiencing the same level of externalizing symptoms (ADHD and CD). A diagrammatic representation of the expected mechanism involved in the relationship between the predictor X (ADHD as an illustration) on outcome Y (NMU of stimulants) and influenced by the moderator M (gender) is shown in Figure 3-2. It is displayed by the arrow from the moderator M to the line linking predictor X to outcome Y. Only those interaction terms that were statistically associated (at p value <0.05) with the outcome variable indicating moderating effects were retained in the final moderation model. A less conservative stepdown Bonferroni correction was used to account for multiple testing.

About 5% of the sample had missing data for one or more externalizing or internalizing behaviors, peer stimulant use variables and the covariates of grades, sleep timings and household structure. Multiple imputation procedures were used to impute values for the missing scores using the proc mianalyse command in SAS 9.4. The final model was assessed for goodness of fit in terms of the AIC, deviance scores and lackfit test. The final model showed lower AIC values compared to prior models; deviance scores were non-significant at 0.05 level of significance and lackfit values were high indicating adequate model fit. Adjusted odds ratios with 95% confidence intervals are reported and all analyses were carried out using SAS 9.4.

Results

Shown in Table 3-1 are characteristics of youth in the total sample and by stimulant use status. Compared to MU only and youth with no use of stimulants, those who reported NMU of stimulants were more likely to be male, Caucasian, had poorer grades (D’s and F’s), live in rural areas and less likely to live in a dual parent household.

Prevalence of Externalizing and Internalizing Problem Behaviors and Non-medical Use of Stimulants

Also shown in Table 3-1 are the rates of externalizing problems in youth by stimulant use status, using a three level variable. Overall, 3.2% of youth reported only medical use of stimulants in the past 30 days prior to the N-MAPSS survey; 3.6% reported non-medical use of stimulants, while 93.2% reported no use of any of the five stimulants assessed. About 13% of youth reported having been diagnosed with ADHD; a similar rate of CD symptoms was reported by youth (12.7%). While ADHD was highest among those with MU only (83.8%), 41% of youth with NMU of stimulants also reported ADHD. A significantly higher rate of CD was observed among youth with NMU of stimulants (42.8%) compared to both MU only (18.9%) and no use (11.4%). Past 30 day use of cigarettes, alcohol or marijuana ranged from 9.9% to 27.0% and lifetime other illegal drug use was reported by 11.7% of youth. Substance use among youth with NMU of stimulants was two to three times higher relative to MU only and up to six times higher than youth with no use.

In terms of the prevalence of internalizing behaviors, high rates of depressive symptoms (21.8%) were observed. About one fourth of youth reported anxiety symptoms (25.8%) and weight concerns were reported by 3.8%. The rates of all three internalizing behaviors were higher among youth with NMU of stimulants as compared to MU only while those with no use had the lowest rates. About one third of youth reported having at least one friend with stimulant use and the rate was significantly increased among youth with NMU of stimulants at 83% and more than half with MU only reported having friends who used stimulants.

Further, we examined whether the socio demographic characteristics and prevalence of externalizing and internalizing behaviors among youth differed by gender within each stimulant use category. As shown in Table 3-2, there was no gender difference in race or area of residence among youth with NMU of stimulants or MU only; however, a higher representation of Caucasian race was seen among females with no stimulant use compared to males. Males were more likely to report poor grades (D's & F's) compared to females in all three levels of stimulant use. In the NMU of stimulants group and those with no use, a higher proportion of males reported going to bed at 12 am or later most days of the week compared to females while no gender difference was observed in youth with MU only.

We found that there were significantly higher rates of externalizing conduct problems among males compared to females among all stimulant use groups. The prevalence of ADHD was higher among males compared to females among youth with NMU of stimulants and among those with no use, while there was no gender difference in the ADHD rate for youth with MU only. Further, more females were likely to report cigarettes use relative to males in the NMU of stimulants group; alcohol, marijuana and other illegal drug use was comparable across gender. Among the no use group, males were more likely to report marijuana and other illegal drug use compared to females. No gender difference was observed in substance use in the MU only group.

With regard to internalizing behaviors, among youth with NMU of stimulants and no use both depressive and anxiety symptoms and weight concerns were overrepresented in females relative to males. It is seen that more than half of females with NMU of stimulants report depressive (53.6%) and anxiety (56.8%) symptoms while

about 30% females reported weight concerns; these are considerably high rates of internalizing behaviors. Weight concerns were higher among females compared to males in the MU only and no use groups.

Gender difference in peer stimulant use rates was observed only among the no use group where slightly more males reported having a friend who used stimulants (26% vs. 23.6%). Although, no gender based difference in peer stimulant use were seen among youth with NMU of stimulants, the majority of males and females with NMU of stimulants have at least one friend who used stimulants (84.7 and 81.1% respectively).

Association between Externalizing and Internalizing Behaviors and Non-medical Use of Stimulants

As shown in Table 3-3, controlling for all other variables in the model, the strongest risk factor for non-medical use of prescription stimulants was a close friend's use of stimulant which increased the odds of NMU of stimulants by more than five times (AOR 5.68, CI 4.12-7.68) compared to not having a close friend who used stimulants. This was followed by the externalizing behaviors of ADHD that increased the risk of NMU of stimulants by over three times compared to not having ADHD (AOR 3.17, CI 2.45-4.09). Further, lifetime use of other illegal drugs increased the likelihood of NMU of stimulants by almost three times (AOR 2.94, CI 2.23-3.88) compared to no use of other illegal drugs. The only internalizing problem that increased the risk of NMU of stimulants was having weight concerns compared to no weight concerns (AOR 2.28; CI 1.57-3.30). Additionally, past 30 day use of alcohol (AOR 1.70; CI 1.27-2.26), cigarettes (AOR 1.59; CI 1.09-2.32) and marijuana (AOR 1.81; CI 1.37-2.40) were also positively associated with increased odds of NMU of stimulants relative to their counterparts. We did not find any gender based association between the externalizing behaviors of ADHD or CD and

the NMU of stimulants; interaction terms were not statistically significant using the Bonferroni correction for multiple tests.

Among the socio-demographic characteristics assessed, the likelihood of NMU of stimulants increased with Caucasian race (AOR 1.65) compared to non-Caucasians while being male increased the odds of NMU of stimulants by 1.39 times relative to females.

When results for MU only were examined with no use serving as the referent group, ADHD symptoms had the strongest association with MU only with an AOR of 50.79 (CI 36.93-69.84) relative to those without ADHD which was as expected. Peer stimulant use (AOR 2.35; CI 1.78-3.11) emerged as another important correlate of MU only among youth. Further, being of Caucasian race, and living in suburban or rural areas compared to urban areas were positively associated with MU only while older age was negatively associated. Each year increase in age was associated with about 17% decrease in MU only.

Discussion

In this nationally representative sample of over 11,000 youth, analyses resulted in some important findings. First, we found high rates of externalizing behaviors of ADHD and CD symptoms, substance use, as well as the internalizing behaviors of depressive and anxiety symptoms, and weight concerns among non-medical users of stimulants. Overall rates were largely comparable to those reported by prior studies. Second, consistent with our hypothesis, the externalizing behaviors of ADHD and use of the substances – cigarettes, alcohol, marijuana and other illegal drugs, and only internalizing behaviors of weight concern had a significant main effect on the non-medical use of stimulants. However, the strongest association was between peer

stimulant use and non-medical use of stimulants. Third, we did not find evidence to support the moderating role of gender in the relationship between the externalizing behaviors of ADHD and CD symptoms, and the non-medical use of stimulants.

Prevalence of Externalizing and Internalizing Behaviors and Non-medical Use of Stimulants

We found rates of self-reported ADHD in our sample (12.5 vs. 10%) to be comparable to the reported ADHD rates in the general population (Castle et al., 2007; Merikangas et al., 2010; Vande Voort et al., 2014; Visser et al., 2007). However, youths' rates of self-reported conduct disorder symptoms (12.7 vs. 7%) were high compared to youth in other community studies (Merikangas et al., 2010). On the other hand, rates of CD up to 13.5% among boys and 5.4% among girls have been reported (Bloom et al., 2013). One reason our study found high rates of CD symptoms may be explained by the manner in which CD symptoms were measured. First, the measures we used were self-reported and second, it is possible that our measures most likely captured subclinical and subjective symptoms of CD compared to other studies that are clinical or diagnostic.

Further, we found high rates of ADHD symptoms among youth with medical use only (83.8%), as well as non-medical use (40.9%). Although, it is expected that medical users would report having been diagnosed with ADHD, we are concerned with a fairly high proportion of non-medical users who also reported ADHD who were either overusing their medications or were using medications without prescriptions. It is known that less than half of children in the community with ADHD receive mental health care over the past one year (Merikangas et al., 2010). A national study showed that even when most youth with ADHD received some form of treatment (behavioral or medication

or both), the quality of care was not in compliance with best practices for ADHD treatment (Visser et al., 2014). Poor access or inadequate care of those with ADHD, directs us to the self-medication hypothesis which suggests that youth may be using stimulants non-medically to self-treat their ADHD symptoms (such as inattention) that they experience as distressing.

Prior work has demonstrated that youth misuse stimulants in their quest for academic and cognitive improvement and it is possible that academic achievement motives are related in part to the problematic symptoms of ADHD (Boyd et al., 2006; Rabiner et al., 2009). While the self-medication of undiagnosed ADHD symptoms has not been commonly cited as a primary motive for non-medical use of stimulants, there have been reports of stimulant misuse among those who perceive that they had ADHD (Boyd et al., 2009). This explanation may also be linked to our finding of higher rates of CD symptoms among youth with non-medical use of stimulants. An estimated 60% of those with CD are likely to have at least one mental health disorder or academic and learning problem (Bernstein, 2015). Despite the lack of clear causal etiology, academic problems have been associated with conduct problems which may in turn influence the non-medical use of prescription stimulants.

In terms of substance use, our past 30 day marijuana rate of 17.2% and alcohol use of 27% corresponds to those reported in national studies (up to 21% for marijuana and up to 37% for alcohol) (Miech et al., 2015). However, youth in our study reported higher rates of cigarette use (10 vs. 3%) and lower rates of other illegal drug use (11.7 vs. 27.4%) than other studies. Other substance use (such as alcohol, marijuana, other prescription medication misuse and illicit drugs) has been commonly reported among

non-medical users of stimulants. For instance, McCabe and West (2013) reported that the majority of students with non-medical use of prescription stimulants also had increased rates of non-medical use of opioids, sedatives, or tranquilizers. One reason for the lower rates of other illegal drug use could be related to our sample which included youth at younger ages while youth in other samples were slightly older.

For internalizing problems, our lifetime rates correspond to those of other studies. Rates of anxiety (25.8%) and depressive symptoms (21.8%), and weight concerns (3.8%) were comparable at around 31.9%, 30% and 3% respectively (Centers for Disease Control and Prevention, 2014; Merikangas et al., 2010). However, rates of internalizing problems were high among those with non-medical use of stimulants.

Association of Externalizing and Internalizing Behaviors and Non-medical Use of Prescription Stimulants

While youth with externalizing behaviors of ADHD and use of cigarettes, alcohol, marijuana and other illegal drugs were more likely to use stimulants non-medically; ADHD and illegal drug use were the more important factors that increased the risk of non-medical use of stimulants by about three times. Several investigations have demonstrated positive relationships between ADHD symptoms and non-medical use of stimulants as well as other substance use (Arria et al., 2012; Bright, 2008; Cassidy et al., 2013; Dussault and Weyandt, 2013; Kollins, 2008; McCabe et al., 2007; Poulin, 2007). Further, evidence from NSDUH (Substance Abuse and Mental Health Services Administration, 2008) suggests that those who use stimulants non-medically have higher rates of alcohol or drug use disorders, increased use of illicit drugs or greater participation in mental health treatment compared to non-users. Increased poly-substance use (cigarettes, alcohol, marijuana) among youth with non-medical use of

stimulants has been shown across the general and student population, and among residential care settings (Chen et al., 2014; Hall et al., 2010; Rhoades et al., 2014). Although a large proportion of youth in our study reported CD symptoms, when controlling for other substance use (other illegal drugs, cigarettes, alcohol, marijuana), the association of CD symptoms with non-medical stimulant use did not hold true. While several studies suggest that conduct problems may concomitantly occur with substance use, substance use may also precede conduct problems which may be a more important factor for the non-medical use of stimulants in youth. For instance, one study indicated that the use of tobacco, marijuana and cocaine prior to conduct problems such as theft, drug dealing or arrest (Morihisa et al, 2007). However, the association of conduct problems, other substance use and non-medical use of stimulants in youth may require further exploration. It is noted that youth who only used stimulants medically only had similar rates of substance use as the non-users; this suggests that youth in the general population who appropriately use their prescribed medications for ADHD are not at higher risk for substance misuse than non-users of stimulants.

Although the reasons for the link between ADHD and substance use and nonmedical use of prescription stimulants is not clear, a common factor model suggests that the relationship is the result of shared risk factors (Hawkins, 2009). Both ADHD and substance use have been characterized as disorders of impaired control that are influenced by similar neurobiological deficits that are associated with impulsivity and sensation seeking (Arcos-Burgos et al., 2012; Duka, 2011). Neuroimaging studies indicate abnormalities in the activation of anterior cingulate and fronto-subcortical systems along with dopaminergic and striatal involvement (Casey and Jones, 2010;

Frodl, 2010). Although it is beyond the scope of this paper, future studies may examine this suggested association of ADHD and non-medical use of stimulants among youth.

It is of note that risk of non-medical stimulant use increased by fivefold for youth with a friend with stimulant use compared to those without a friend stimulant use. This finding is consistent with a substantial body of research indicating that peer use and approval or disapproval of use, have a profound influence on the non-medical use of stimulants and other substance abuse (Collins et al., 2011; McCabe and West, 2013; Schinke et al., 2008). Sung and colleagues (2005) have shown that even the mere perception of drug use by peers is linked to actual drug abuse by youth. Further, King and others (2013) found that both peer stimulant non-medical use and use of other substances such as alcohol or marijuana also had similar positive effects on non-medical use.

In terms of internalizing problems, we found that only weight concerns elevated the risk of stimulants non-medical use. Stimulants are known to have the side effects of appetite suppression and consequent weight loss and youth may be motivated to use stimulants non-medically in order to lose weight (Kent et al., 1995; Zachor et al., 2006; Jeffers and Benotsch, 2014; Jeffers and Koester, 2013; Teter et al., 2005). One of the few studies that examined motives for prescription drugs among students found about 4.5% of youth indicated amphetamine use to reduce weight. Further, the risk was stronger among regular non-medical users of stimulants (AOR 3.3) compared with occasional users (AOR 1.6). Females were also significantly more likely to report weight reduction motives than males (Terry-McElrath et al., 2009).

Although a large proportion of youth in our study reported symptoms of depression or anxiety, when controlling for other factors, the association with non-medical stimulant use did not hold true. Similar to our findings, the non-medical use of prescription medication was not related to depressive symptoms among adolescents in grades 7 to 12 (Harrell and Broman, 2009). However, in other studies of youth, major depressive disorder (MDD) has been linked to the non-medical use of prescription drugs. One example is the NSDUH study wherein, almost one in four youth who used stimulants in the past 12 months had a major depressive episode in the past year compared with less than 10% of youth who did not use stimulants (Goldstein, 2008) The available measure for depression and anxiety in our study was based on only one or two items which may not adequately capture the emotional constructs and this could be related to the discrepant findings.

The Role of Gender in the Association between Externalizing Behaviors and Non-medical Use Of Stimulants

Results of earlier studies, particularly those using NSDUH data, have found increased risk of non-medical use of stimulants among females. Thus, we were motivated to examine whether gender specific mental health risk factors for non-medical use of stimulants would emerge in a representative national sample of youth. Unlike some prior studies, we found that boys aged 10 to 18 years of age, were more likely to report the non-medical use of prescription stimulants compared to females (Nakawaki and Crano, 2012). However, there are also studies that similarly reported increased rates of non-medical use of stimulants among males (Fleary et al., 2011; King et al., 2013; McCabe et al., 2014).

In this study, we did not find evidence to support our hypotheses that gender plays a moderating role in the associations between ADHD and non-medical use of stimulants, and CD and the non-medical use of stimulants. However, two prior studies have shown greater association between tobacco use and risk of non-medical use of prescription drugs (including stimulants) for females compared with males (Back et al., 2010; Berenson and Rahman, 2011). One possible reason we did not find differential risk in the association of ADHD or CD and non-medical use of prescription stimulants by gender could be related to our measure of non-medical use which only examined the rates but not the patterns of non-medical use by gender.

The study findings may be viewed in light of some limitations. First, our measures are based on self-reports, there may be concerns related to social desirability issues and errors in recall using self-reported measures. However, self-reports of substance use have been shown to be reliable and used by a large number of studies to assess the non-medical use of prescription drugs (Harrington and Newman, 2007). Our study also used pictures of the medications assessed to aid in brand recognition of the stimulants which may have minimized youths' errors in accuracy. However, we used a screener for the diagnosis of ADHD, CD, and depression and anxiety symptoms and this may have contributed to higher or lower rates compared to those of other studies. Moreover, we only assessed anxiety symptoms in the last six months. Another limitation is related to the cross sectional nature of the study which limits our ability to make temporal associations.

Our study also has some important strengths. We had a large sample of over 11,000 that were representative of youth in the US population (Cottler et al., 2013).

Compared to other national studies, an entertainment recruitment venue method enabled the study sample to include non-in residence student populations (such as school drop outs and home schooled) as well. Further, the study also assessed for a broad range of mental and behavioral risk factors which has increased our overall understanding of non-medical use of stimulants in youth.

Despite the limitations noted, the study identified a number of important risk factors of non-medical use of stimulants. Knowledge of risk factors is relevant for prevention, intervention and public health aspects of stimulant use and misuse. Programs to prevent non-medical use of stimulants from developing into stimulant dependence must be developed and the outcomes evaluated.

Table 3-1. Socio-demographic, mental and behavioral characteristics by stimulant use among youth 10 to 18 years of age in the N-MAPSS

Characteristic	No use (n=10252)	MU only (n=334)	NMU (n=398)	p value	Total
Socio-demographics					
Age (Mean)	15.1	14.7	16.2	<.0001***	15.1
Male gender	47.3%	52.4%	54.0%	0.0077**	47.7%
Caucasian	41.6%	60.5%	63.9%	<.0001***	43.0%
Residence					
Urban	94.5%	2.2%	3.3%		47.6%
Suburban	92. 8%	3.6%	3.7%	<.0001***	37.3%
Rural	91.1%	4.4%	4.5%		15.1%
Grades in school (Ds & Fs)	23.1%	30.2%	40.9%	<.0001***	24.0%
Meals with family (≤ 5 per week)	50.7%	52.2%	31.1%	<.0001***	50.1%
Sleep timings later than 12 am	21.9%	22.7%	39.2%	<.0001***	22.6%
Dual parent household	56.2%	49.4%	46.2%	<.0001***	55.7%
Externalizing behaviors					
CD symptoms	11.4%	18.9%	42.8%	<.0001***	12.7%
ADHD	9.0%	83.8%	40.9%	<.0001***	12.5%
Cigarette use past 30 days	8.5%	15.1%	43.6%	<.0001***	9.9%
Alcohol use past 30 days	25.3%	28.7%	69.7%	<.0001***	27.0%
Marijuana use past 30 days	15.5%	20.4%	60.9%	<.0001***	17.2%
Other illegal drugs lifetime use	9.7%	17.7%	58.3%	<.0001***	11.7%
Internalizing behaviors					
Depressive symptoms	20.7%	30.6%	43.0%	<.0001***	21.8%
Anxiety symptoms	24.8%	33.2%	45.7%	<.0001***	25.8%
Weight concerns	3.3%	5.4%	16.6%	<.0001***	3.8%
Peer influence					
Stimulant use by friend	24.7%	53.9%	83.0%	<.0001***	27.7%

$^{*}p$ <.05, $^{**}p$ <.001, $^{***}p$ <.0001

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder

Table 3-2. Socio-demographic, mental and behavioral health problems by gender and stimulant use among youth 10 to 18 years of age in the N-MAPSS

Characteristic	No use (n=10252)			MU only (n=334)			NMU (n=398)		
	Female	Male	p value	Female	Male	p value	Female	Male	p value
Socio-demographics									
Caucasian	44.0%	38.8%	<.0001***	59.5%	61.5%	0.7095	65.4%	62.6%	0.5677
Residence									
Urban	47.5%	48.9%		34.6%	34.3%		38.8%	47.4%	
Suburban	37.5%	36.6%	0.3988	43.4%	44.0%	0.9937	40.4%	35.3%	0.2185
Rural	15.0%	14.5%		22.0%	21.7%		20.8%	17.2%	
Grades in school (Ds & Fs)	17.9%	28.2%	<.0001***	20.7%	38.9%	0.0003**	35.5%	45.6%	0.0419*
Meals with family (≤ 5 per week)	49.7%	51.9%	0.0234*	50.9%	53.4%	0.6476	29.7%	32.2%	0.5814
Sleep timings later than 12 am	18.0%	26.2%	<.0001***	20.7%	24.6%	0.4060	32.8%	44.6%	0.0157*
Dual parent household	57.0%	55.3%	0.0867	50.3%	48.6%	0.7503	44.8%	47.4%	0.5995
Externalizing behaviors									
CD symptoms	7.11%	16.1%	<.0001***	13.2%	24.1%	0.0110*	32.4%	51.6%	0.0001***
ADHD diagnosis	6.9%	11.5%	<.0001***	83.0%	84.6%	0.7003	33.8%	47.0%	0.0081*
Cigarette use past 30 days	8.1%	8.8%	0.1952	15.2%	14.9%	0.9498	49.7%	38.4%	0.0241*
Alcohol use past 30 days	25.7%	24.9%	0.3649	32.5%	25.3%	0.1484	71.1%	68.6%	0.5862
Marijuana use past 30 days	12.5%	18.7%	<.0001***	18.9%	21.8%	0.5017	57.8%	63.5%	0.2473
Other illegal drugs lifetime use	8.3%	11.3%	<.0001***	15.7%	19.5%	0.3622	54.4%	61.6%	0.1520
Internalizing behaviors									
Depressive symptoms	24.5%	16.6%	<.0001***	33.5%	28.0%	0.2731	53.6%	33.9%	<.0001***
Anxiety symptoms	29.1%	20.0%	<.0001***	32.1%	34.3%	0.6685	56.8%	36.3%	<.0001***
Weight concerns	5.2%	1.07%	<.0001***	10.1%	1.1%	0.0003**	29.5%	5.6%	<.0001***
Peer influence									
Stimulant use by friend	23.6%	26.0%	0.0046*	51.3%	56.3%	0.3560	81.1%	84.7%	0.3485

* p <.05, ** p <.001, *** p <.0001

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder

Table 3-3. Logistic regression models of externalizing and internalizing problem behaviors as risk factors for stimulant use among youth 10 to 18 years of age in the N-MAPSS (n=10984)

Characteristic		No use	Medical use only AOR (95% CI)	Non-medical use AOR (95% CI)
Socio-demographics				
	Mean age (SD)	ref	0.83 (0.78-0.89)	0.98 (0.91-1.05)
	Male gender	ref	0.99 (0.74-1.31)	1.39 (1.03-1.90)
	Caucasian	ref	1.26 (0.97-1.64)	1.53 (1.20-1.96)
	Residence	ref		
	Suburban vs. urban	ref	1.39 (1.05-1.84)*	0.90 (0.70-1.17)
	Rural vs. urban	ref	1.47 (1.03-2.08)*	1.00 (0.73-1.39)
	Grades in school (D's &F's)	ref	0.78 (0.59-1.00)	1.01 (0.78-1.31)
	Meals with family (<=5 per week)	ref	0.88 (0.67-1.15)	1.16 (0.89-1.49)
	Sleep timings later than 12 am	ref	0.86 (0.63-1.17)	0.99 (0.77-1.28)
	Lives in a dual parent household	ref	1.08 (1.84-1.40)	0.95 (0.74-1.20)
Externalizing behaviors				
	CD symptoms	ref	0.80 (0.56-1.14)	1.26 (0.95-1.67)
	ADHD diagnosis	ref	50.79 (36.93-69.84)	3.17 (2.45-4.09)
	Cigarette use past 30 days	ref	1.18 (0.67-2.07)	1.59 (1.09-2.32)
	Alcohol use past 30 days	ref	0.94 (0.68-1.30)	1.70 (1.27-2.26)
	Marijuana use past 30 days	ref	0.85 (0.59-1.23)	1.81 (1.37-2.40)
	Other illegal drugs lifetime use	ref	1.33 (0.90-1.96)	2.94 (2.23-3.88)
Internalizing behaviors				
	Depression symptoms	ref	1.08 (0.81-1.44)	1.22 (0.94-1.58)
	Anxiety symptoms	ref	0.97 (0.74-1.29)	1.16 (0.90-1.49)
	Weight concerns	ref	1.09 (0.60-2.00)	2.28 (1.57-3.30)
Peer influence				
	Stimulant use by friend	ref	2.35 (1.78-3.11)	5.63 (4.12-7.68)

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder

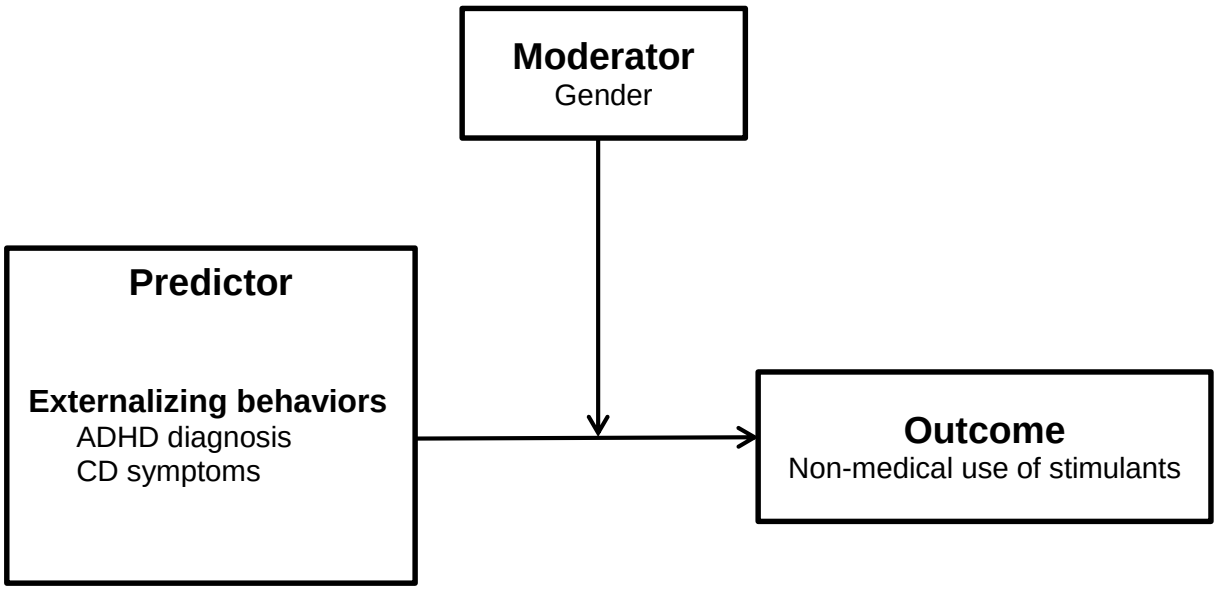


Figure 3-1. Conceptual diagram of the association between externalizing behaviors and the non-medical use of prescription stimulants among youth.

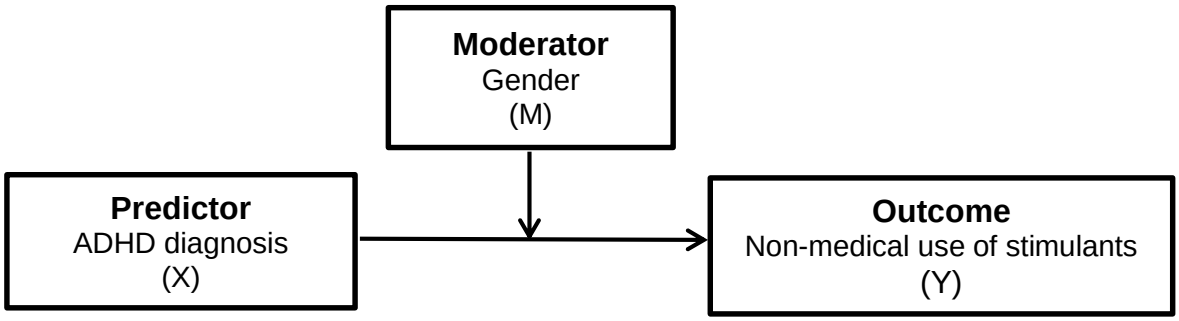


Figure 3-2. Conceptual diagram of the moderation model with ADHD as an example

CHAPTER 4
AGE OF INITIATION AND RISK FACTORS OF NON-MEDICAL USE OF PRESCRIPTION STIMULANTS

Background

Substance use by youth continues to be a national public health problem; the rate of use of illicit drugs including the non-medical use of prescription medications (such as stimulants, sedatives, benzodiazepines) does not seem to show any signs of decline (Johnston et al., 2014). About 5-10% of youth in the general population report the non-medical use of prescription stimulants (Conn and Marks, 2014; Cottler et al., 2013; King et al., 2013; Nargiso et al., 2015; Wang et al., 2015). However, the non-medical use of prescription stimulants and other medications have rarely been included when examining the development of substance use initiation and progression.

Substance Use Initiation and Progression Theories

Many studies on substance use among youth indicate the progression of use from licit substances to illicit in a sequential manner known as the Gateway Hypothesis and that the progression to a drug stage is unlikely without first having used a drug that was lower in the drug stage (Kandel, 2002). Although the universality of the theory has been questioned by some researchers (Golub and Johnson, 2004; Patton et al., 2005), several studies that focused on youth in the United States have shown the progression of substance use that begins with alcohol or tobacco not legal among teens and advances to the regular use of the substance and use of other substances such as marijuana, cocaine and methamphetamine (Bracken et al., 2013; Choo et al., 2008; Chung and Martin, 2001; Degenhardt et al., 2009; Kandel and Yamaguchi, 1993; Kirby and Barry, 2012; Sartor et al., 2013; Tarter et al., 2012). Some studies suggest that the type of substance misused can differ by the existing opportunities to access the

substance such that drug use laws or socio-cultural practices and norms may increase or decrease the availability of certain substances (Wagner and Anthony, 2002). When considering access and obtainability, the last two decades in the US has witnessed increased recognition of Attention Deficit Hyperactivity Disorder (ADHD) and its treatment with pharmaceutical stimulants which has played a major role in the environmental availability of these medications (Gillespie et al., 2013). Also, the majority of the youth indicate that their non-medical use of prescription stimulants is largely supplied by friends or family with prescriptions (Conn and Marks, 2014; Cottler et al., 2013; Lasopa et al., 2015; Nargiso et al., 2015).

Another body of research has demonstrated that not all youth progress through the substance use sequence from licit to illicit drugs. Such deviations occur specifically with marijuana use being reported more than alcohol use (Johnston et al., 2012). Diverting from the “gateway” paradigm, researchers such as Jessor et al (1977) posit the Problem Behavior Theory which suggests that substance use and abuse are symptoms of a common vulnerability to co-varying problem behaviors (such as substance use, behavior problems, delinquency and high risk sexual activity among others) which are associated with a common set of risk factors. In accordance with the Problem Behavior Theory, prior research has shown that early use of licit substances (tobacco and alcohol) increases the risk of illegal substance use including the non-medical use of stimulant medications as well as related psychosocial problems such as violent behaviors and drunkenness, (Gruber et al., 1996; McCabe and West, 2013; Moss et al., 2014; Olthuis et al., 2013), self-harm (Zha, 2009), traffic accidents (Heeren et al., 2002), and loss of social relationships (Gruber et al., 1996).

Whether substance use occurs in a sequential progression or with other problem behaviors, the risk of adverse physical and mental health consequences is seen with early substance use (Behrendt et al., 2009; Brook et al., 2007; Gil et al., 2004; Henry et al., 2012; King and Chassin, 2007; Peleg-Oren et al., 2009). The early onset of non-medical use of prescription stimulants has been linked to the development of later dependence (McCabe and West, 2013). Even though for some youth, non-medical use of prescription stimulants may last for only a brief period of experimentation, use of these substances in youth do have serious adverse consequences as demonstrated by a dramatic rise in emergency department visits related to the misuse of stimulants (Substance Abuse and Mental Health Services Administration, 2014).

Externalizing Problem Behaviors and Risk of Initiating the Non-medical Use of Stimulants

Several factors associated with the initiation of substances such as alcohol, tobacco and other drugs have been studied that includes as family history of substance use, genetics, inconsistent parental practices, different opportunities for access to substances and peer influence. Externalizing problem behaviors such as inattention, hyperactivity and aggression have been found to be particularly important in substance use initiation (Grant and Dawson, 1998; Levy, 2014; Molina et al., 2013, 2007; Mrug et al., 2010; Nelson et al., 2015; Pagan et al., 2006; Palmer et al., 2010; Prescott and Kendler, 1999; Wagner and Anthony, 2002). Consistent with other substance use literature, a small number of studies suggest a positive relationship between externalizing behavior problems such as CD and ADHD symptoms and the onset of NMU of stimulants (Arria et al., 2011; Cassidy et al., 2013; Dussault and Weyandt, 2013). While using stimulants for ADHD treatment itself does not increase the risk of

NMU, many studies have found an increased risk of substance use among those diagnosed with ADHD or having symptoms of ADHD (Pittsburg et al 2013). Having both ADHD and CD seems to confer greater risk of substance use at younger ages among adolescents (Brinkman et al., 2015). Two studies investigated the role of conduct problems in the association between early ADHD and later NMU of stimulants (Brook et al., 2014; Van Eck et al., 2013). Both studies found that ADHD and CD were independently and directly associated with the NMU of stimulants. Further, Brook and colleagues (2014) in their 22 year longitudinal study of 14 year old youths found that in addition to the direct path between ADHD and NMU of stimulants, ADHD was also indirectly linked to NMU of stimulants through CD problems and other substance use disorders. In another study, CD symptoms increased the risk of initiation across all substance types at the age of 15 years; moreover, continued risk of initiating till 21 years of age was observed for stimulants but not for all other substance types (Hopfer et al., 2013). In other studies on substance use among youth not specific to stimulants, there are some indications of the role of gender in early substance use involvement, specifically the use of tobacco increased illegal drug use among boys (Baumeister and Tossmann, 2005; Guxens et al., 2006) Another study showed that girls transitioned from experimental tobacco use to regular use faster than boys (Galanti et al., 2001).

While there has been increased research interest on the epidemiology of NMU of stimulants among youth, less attention has been given to the initiation of the non-medical use or on factors that influence the initiation and consequences of early non-medical use. Given the potential adverse effects associated with the NMU of stimulants, knowledge regarding the age of initiation into non-medical use of prescription stimulants

will be particularly important for efforts that intervene with the purpose of prevention or delay of initiation and long term use. Further, the ascertainment of modifiable risk factors such as externalizing problem behaviors of ADHD and CD symptoms that may influence onset of non-medical use is important with a view to specialized planning of prevention strategies and design of early-detection programs based on the risk factors.

Current Study

There have been a number of cross-sectional studies that report on the epidemiology of NMU of stimulants among youth that have identified a number of associated potential factors; however, a dearth of prospective studies that examine the trajectory of NMU of stimulants in youth is observed. Ideally, prospective studies in the general population can be used to examine the initiation into NMU of stimulants and factors that increase the risk of onset. However, these approaches are costly, prone to attrition and take long to follow up. An alternate approach is to use cross-sectional survey data and construct pseudo-longitudinal observations drawing on the retrospective age of onset of NMU of stimulants assessed. Survival analysis can then be used to model time to NMU of stimulants, allowing the examination of factors associated with the transition from a non-use state to one of NMU of stimulants. This method has been used previously to assess the age of onset of other substances such as cigarettes, alcohol and marijuana (Butterworth et al., 2014; Kalaydjian et al., 2009). Here again, majority of empirical studies on the initiation and development of substance use including NMU of stimulants have focused on the sequencing of drug use and ages of onset as the parameters of importance with comparatively less focus on factors that influence onset.

In the present study, survival analysis of a data from a nationally representative sample of youth aged 10 to 18 years in the US was used to examine: 1) the period (in terms of age) when youth are at highest risk for initiation of non-medical use of prescription stimulants; 2) the role of externalizing problem behaviors of ADHD and CD symptoms in the initiation of non-medical use of prescription stimulants; and 3) whether gender differences in the initiation of non-medical use of prescription stimulants in youth exist. Additionally, we ascertained the impact of prior use of other substances (such as cigarettes, alcohol and marijuana) on the initiation of NMU of stimulants. The aims of the study were addressed with the following hypotheses: 1) self-reported ADHD diagnosis in youth will increase the hazards of initiation of NMU of stimulants; 2) hazards of NMU of stimulants initiation will be higher among youth with self-reported CD symptoms; 3) there will be gender differences in the initiation of NMU of stimulants with males showing increased hazards of initiation; and 4) among non-medical users of stimulants, the use of alcohol, cigarette, and marijuana prior to non-medical stimulant use will be associated with increased risk of NMU initiation compared to later users of other substances.

Methods

The paper reports on analyses conducted on data from the National Monitoring of Prescription Stimulants Study (N-MAPSS). The N-MAPSS is a cross sectional study of 11,048 youth between the ages of 10 and 18 years who were interviewed about their knowledge, use and misuse of prescription stimulants from ten cities across the United States. Data collection was carried out in four cross sections from fall 2008 to spring 2011. Other details of the study are reported elsewhere (Cottler et al., 2013). The study

was approved by the Institutional Review Boards of Washington University in St Louis for the first three cross sections and the University of Florida for the fourth cross section.

Sample

The present analysis is restricted to youth in the second, third and fourth cross sections (n=8330); the first cross section of the N-MAPSS did not assess the age of first use of stimulants among youth and was therefore excluded from this study. Further, we excluded youth on certain criteria specific to this study described below.

Inclusion criteria

Youth who were recruited in the third and fourth cross section of the study with lifetime non-medical use of stimulants and reported their first age of stimulant use were included in the present analyses.

Exclusion criteria

Youth with reported stimulant use but with missing age of onset were excluded from the analysis. Those youth who met the criteria for medical use only (MU) of prescription stimulants defined as use of stimulants that were prescribed by a psychiatrist or doctor were not included in the analyses. Additionally, youth who met criteria for NMU but who also endorsed having a doctor's prescription (MU) was excluded.

Based on the exclusion criteria, we did not include 434 youth who met the definition of MU only because we aimed to assess risk of first non-medical use into prescription stimulants relative to non-users. Additionally, 201 youth who met criteria for MU only but also responded positively to any of the questions that indicated NMU were not included in the present study. This was because youth were only asked their age of first stimulant use and were not specifically asked when they started either NMU or MU

only; distinguishing whether NMU was prior or later to MU only was not possible. Further, four youths who did not report their age of first stimulant use, and one reporting first use of NMU at two years of age, were excluded from further analyses. Following removal of youth based on the exclusion criteria, the final sample for this study consisted of 7691 youth.

Measures

Event measure

The change from non-user to NMU of stimulants was the main outcome or event measure coded as 1 for ‘yes’ and 0 for ‘no’. NMU of stimulants was defined as the use of any of the 5 stimulants: Adderall® or Adderall XR®, Concerta®, Ritalin®, Daytrana®, and Vyvanse® which belonged to someone else (parents, brother or sister, different family member, someone from school or from work, someone unknown and other) or ingested via non-oral routes (such as snorted or sniffed, smoked), or were used for reasons such as ‘to get high’, ‘out of curiosity’ or ‘just because’. Youth who met the definition of NMU of stimulants were censored at the age of interview.

Age of non-medical stimulant use initiation

The N-MAPSS assessed youth for lifetime and past 30-day use of prescription stimulants; youth who had ever used any of the five stimulants were asked to report on their age at first use for each individual drug. The dependent variable of interest in this analysis was the age of NMU of stimulants initiation defined as the self-reported age in years at which youth had first used any of the five stimulant medications assessed for in the N-MAPSS.

Length of follow-up

Because cross-sectional data was used, we constructed pseudo-longitudinal observations drawing on the retrospective age of onset assessed to model time to NMU of stimulants. The difference in reported first age of onset of prescription stimulant use from the current age was used to ascertain time taken to develop NMU of stimulants across the length of follow up time. The length of follow up was the age at survey for those who had not initiated NMU of stimulants. This allowed the tracking of age of NMU of stimulants initiation over time and was assessed as an increase of 1 point for 18 years (maximum year possible) thereby creating pseudo-longitudinal data necessary for survival analysis.

ADHD

ADHD was measured with the question: “Has a doctor ever told you or your parents that you have Attention Deficit Disorder (ADD) or ADHD? Youth who responded “yes” were considered to have ADHD while those who responded “no” or “don’t know” were considered no ADHD.

CD symptoms

Five items measured conduct problems among youth: a) “Have you ever gotten into a lot of trouble at home or at school or ran away from home overnight?” b) “Have you ever used or threatened someone with a weapon?” c) “How many tickets or warnings have you received from the police?” d) How many times have you been arrested?” The first three items were categorical and coded either 1 or 0; the latter two variables were coded 1 when youth responded having at least one episode having received tickets or warnings, or being arrested at least once, and coded 0 when there

were none. Based on these items, a variable to represent conduct problems was created when youth positively responded to a minimum of three of the items.

Other substance use initiation

To assess the effects for prior use of other substances on NMU of stimulants, measures of cigarette, alcohol and marijuana initiation were included. Age of initiation of cigarette, alcohol and marijuana use was assessed among youth who positively responded to having used the three substances in individual questions. We defined age (in years) of initiation of cigarette use as the age a participant reported they first engaged in cigarette use. Age of initiation of alcohol use was defined as the age (in years) a respondent reported they first had a full alcoholic drink. Age (in years) of initiation of marijuana use as the age a respondent reported they first used marijuana. Because we were interested in assessing the impact of substance use on NMU of stimulants, we created a three level variables for cigarettes, alcohol and marijuana use to represent: 1) use of each of the substances prior to NMU of stimulants among those with NMU of stimulants; 2) use of each of the substances later than NMU of stimulants among youth with NMU of stimulants and 3) a third level to indicate no NMU of stimulants (which also included youth who used any of the three substances but did not engage in NMU of stimulants).

Covariates

Gender and Caucasian race coded as dichotomous variables were included as covariates in all models. Area of residence was included as a three level variable with urban, suburban and rural designations based on zipcode level information from youth.

Statistical Analyses

Descriptive analyses were conducted to present cumulative incidence proportions of non-medical use of prescription stimulant medication. Given that an individual X years of age cannot report the NMU of stimulants initiation greater than X, the survival model offers a fairly robust alternative to analyze such data (Chen and Unger, 1999).The analyses tested the hypothesis that: 1) hazards of NMU of stimulants initiation would differ by externalizing behavior problems mainly ADHD status and CD status; and 2) prior use of alcohol, tobacco or marijuana would increase hazards of NMU of stimulants initiation compared to later use.

Discrete time survival analysis was used to model the age in years at first use which models the conditional probability that a particular youth will experience an event (NMU of stimulants) in a given period of time (age). The hazards in this analysis represent the risk that a youth who has not yet initiated NMU of stimulants at the beginning of a given age will initiate NMU of stimulants at any given time within the given age period. This is a robust technique to investigate the time taken to develop NMU of stimulants across the length of follow up time. The Hazard X time or H(t) therefore estimates the probability of initiating NMU of stimulants by age. The SAS Proc Lifetest was used to estimate the hazards of NMU of stimulants initiation. Hypothesis 2 tested whether the estimated hazards H(t) of NMU of stimulants initiation differed by ADHD and CD status and prior to NMU of stimulants onset of cigarette, alcohol and marijuana using the Strata option and log-rank tests. Thereafter, the Cox proportional hazards survival models assessed the influence of ADHD, CD, prior to NMU of stimulants use of substance (cigarette, alcohol, marijuana) and other covariates (gender, race, residence) on the hazards of NMU of stimulants onset. The Cox model

does not make assumptions about the form of the baseline model akin to being non-parametric. However, two important issues were considered prior to the application of the model results. First, the N-MAPSS design ensures that the mechanisms used to censor youth were not associated with the probability of occurrence of NMU of stimulants (event); the follow up period is in fact dependent on the age of interview. Therefore, the assumption of *non-informative censoring* is satisfied. An important second assumption in the Cox model is that of *proportional hazards* wherein survival curves for two strata (in this analyses values for ADHD, CD and gender variables) are required to have a constant relative hazard function (i.e. the hazard functions are proportional over time). This constant relative hazard comparison by ADHD and CD status and gender were evaluated graphically using the "log-log" plots which indicated that the proportional hazards assumption was met. The SAS Proc Phreg assessed the hazards of first non-medical use of prescription stimulant medication initiation as a function of ADHD and CD status while adjusting for covariates of gender, race and area of residence. The model also tested hypothesis 2 whether the use of other substances (cigarette, alcohol, marijuana) prior to NMU of stimulants, would increase hazards of NMU initiation. Bivariate and adjusted hazard ratios (HR) with 95% confidence intervals (CI) are reported.

Results

Characteristics of Youth with Non-medical Use of Prescription Stimulants

Table 4-1 displays the characteristics of youth in the current analyses. Of the entire sample (n=7691), 6.07% of youth reported the NMU of stimulants. The prevalence of the self-reported externalizing problem behaviors of ADHD and CD symptoms were similar at 10.6% and 10.3% respectively. However, the rate of ADHD

was more than 11 times higher among those with NMU of stimulants compared to non-users of stimulants. The rate of CD symptoms was about two times higher among youth with NMU of stimulants relative to youth who did not use stimulants. Youth with NMU of stimulants were more likely to be male, Caucasian and less likely to live in rural areas.

As shown in Table 4-2, almost half of youth with NMU of stimulants had ever used alcohol (48.2%) with about 15% reporting the initiation of alcohol use before the NMU of stimulants. Approximately one third of youth with NMU of stimulants had ever used cigarettes or marijuana with almost 12% reporting initiating either of the two substances prior to NMU of stimulants. Overall, higher proportions of youth reported use of alcohol, cigarettes and marijuana after the non-medical use of stimulants.

Hazard of Initiating Non-medical Use of Stimulants

The hazard estimates for non-medical use of prescription stimulants are presented in Table 4-3 as a life-table. Overall, the estimated hazard of NMU of stimulants was low (2% or less) prior to age 10 and increased to about 3.5% at age 11 years. From 12 years of age, the hazard of NMU of stimulants initiation steadily increased by about 0.6-0.8% with each year increase in age till age 18 years when the hazard estimate reached the highest at 7.6% (also presented graphically in Figure 4-3).

The hazard estimates of initiation into non-medical use of stimulants differed by the externalizing behaviors of ADHD, CD symptoms and also by gender. As shown in Figure 4-2, at every age, the hazards of NMU of stimulants initiation is markedly higher among youth with ADHD compared to those without ADHD (Log-rank γ^2 (1) = 241.2838, $p < .0001$). Similarly, Figure 4-3 indicates that youth with CD had significantly increased hazards of initiating NMU of stimulants relative to non-CD youth (Log-rank γ^2 (1) =

31.4410, p < .0001). A gender difference in the hazards of NMU of stimulants initiation was also observed, males had higher hazards of initiating NMU of stimulants at every age assessed compared to females (Figure 4-4; Log-rank γ^2 (1) = 7.9608, p < .0048).

Effect of Externalizing Problem Behaviors on the Initiation of Non-medical Use of Prescription Stimulants

As shown in Table 4-4, in multivariable analysis, the externalizing behaviors of ADHD and prior use of cigarettes, alcohol and marijuana increased the hazard risk of NMU of stimulant initiation. In the initial unadjusted model, youth with history of ADHD showed about 4 times the risk of initiating NMU of stimulants compared to those without a history of ADHD ((hazards ratio (HR): 4.02, 95% confidence interval (CI): 3.32-4.86)). When controlling for gender, race, area of residence, CD symptoms, and prior use of alcohol, cigarettes and marijuana use, the hazard of initiating NMU of stimulants among youth with ADHD decreased only slightly with HR at 3.82. However, reporting CD symptoms did not increase the hazard of initiating NMU of stimulants when adjusting for other variables in the model.

The hazards of NMU of stimulants were markedly high in the unadjusted models comparing risk from prior alcohol, cigarette and marijuana use to later use. When adjusting for other variables, the risk of NMU of stimulants was higher among youth with prior use of cigarettes (HR 3.13), marijuana (HR 2.22) and alcohol (HR 1.39) compared to youth with non-use of the substances although the hazard estimates were lower compared to the unadjusted models.

Effect of Covariates on the Initiation of Non-medical Use of Prescription Stimulants

When adjusted for all other variables, the hazards of initiating non-medical use of prescription stimulants did not differ by gender, race or residence. Interaction terms

between ADHD and gender on the risk of NMU of stimulants onset were tested, however, it was not significant suggesting that ADHD only independently influences the initiation into NMU of stimulants.

Sensitivity Analysis

To ascertain the impact of not including medical users only and both medical users with non-medical use in the final model presented in the results, sensitivity analysis were conducted. First, a model with MU only considered as non-users was compared to the final model that excluded the group of youth. Second, results for a model with both MU and NMU considered as non-users was compared to the final model that excluded the group of youth. Third, results for the model with both NMU and MU considered as NMU and MU only considered as non-users were compared to the final model. Results indicate no significant differences in the parameter estimates (HR) for the exposures of interest i.e. ADHD and gender on the hazards of NMU of stimulants initiation in the final model when compared to the other models used in the sensitivity analysis. The results of the sensitivity analysis are presented as a table in Appendix B.

Discussion

Using survival analysis methods, we sought to examine the ages of highest risk for first non-medical use of prescription stimulants and factors that influence the initiation among youth aged 10 to 18 years in the US. In this study, we found that the hazard of non-medical use of stimulants initiation amplified with each year increase in age. Although, the hazard of non-medical use of stimulants was fairly low before 10 years of age, it increased each successive year after age 11 and peaked at 18 years of age when our study period ended. This finding suggests that the period of 11 to 18 years of age is a critical period for NMU of stimulant prevention among youth in the US.

As hypothesized, the hazard of initiating non-medical use of stimulants differed by whether youth reported externalizing behaviors of ADHD symptoms but this was not true for CD symptoms. Prior use of alcohol and marijuana use also increased the hazards of initiating non-medical use of stimulants; this association was not observed for prior cigarette use.

Our findings are consistent with the few studies that examine the age of onset of non-medical use of prescription stimulant medication. For example, Austic (2015) used data from a national household survey and reported on incidence rates of non-medical stimulant use for the years 2004 to 2012. The study found the peak ages for non-medical stimulant use were between the 16 and 19 years of age and the risk for initiating stimulant non-medical use was marginally lower in the age ranges 12 to 15 years and 20 to 21 years. Further, youth differed in the risk of non-medical use of stimulants initiation by race; Whites or Native Americans showed higher incident non-medical use of prescription stimulants at each individual year of the study. In another study by Austic and others (2015), the highest incidence of initiation of non-medical use of prescription medication (analgesics, stimulants, sedatives and anxiolytics) was at age 16 among youth in the Detroit area. Although the methodology used in our study differs from those of the Austic studies, overall results seem to indicate that preventive efforts for non-medical use of prescription stimulants should begin by the early teen years. In related work, McCabe and others (2007) found approximately one fourth of the 13% prescription stimulant dependent youth began use before 13 years as compared to less than 10% of those who began use after age 21. Moreover, the association of early non-medical use with increased risk for later dependence was more likely to occur among

prescription stimulant non-medical users as compared to any other type of prescription drug class. These findings suggest that different patterns and risk factors may exist depending on the type of drug abused which further justifies our attention to prescription stimulant non-medical use and its onset among youth.

Our findings suggest that a factor that influences the initiation into non-medical use of prescription stimulants is the externalizing behavior of ADHD which seems to independently increase the risk (Hopfer et al., 2013). There are some possible explanations for an association between ADHD and non-medical use of prescription stimulants. It has been suggested that early initiators of substance use self-select and may already be different from their peers at the time of substance initiation. Among non-medical users of prescription stimulants, ADHD could be involved as a self-selection factor. Previous work has shown that compared to non-users, higher likelihood of attention problems were reported by students who used stimulants non-medically (Rabiner et al., 2009). Although conducted on college students, related to our findings is the study by Arria and others (2012) which found that self-reported ADHD symptoms were predictive of continued non-medical stimulant use over a period of four years. These and prior findings suggest that some youth may engage in the non-medical use of stimulants as a way to self-treat their perceived or untreated ADHD symptoms (Rabiner et al., 2013). On the other hand, non-medical use of stimulants may be used to achieve academic success even when youth do not have symptoms of ADHD. Available evidence does indicate that youths reasons for substance use differs based on the class of medications and their perceived effects and stimulants are known to improve attention and concentration among those with ADHD (Boyd et al., 2006; Bogle and

Smith, 2009). Further, ADHD has been linked with increased impulsivity which is associated with impairments in executive functioning and these in turn are associated with poor decision making that result in the use of substances (Dom et al., 2006).

Although we expected that CD symptoms would be important in the initiation of non-medical stimulant use, our findings did not support this hypothesis. Other studies have found an association between CD and elevated risk of initiation for non-medical stimulant use (Brook et al., 2014; Hopfer et al., 2013). One possible reason for the non-significant findings in the present study could be related to the stronger effects of prior use of other substances (such as cigarettes, marijuana and alcohol) on the initiation of NMU of stimulants compared to CD.

Overall, our study findings are in accordance with the Problem Behavior Theory and a large body of research that suggests that non-medical use of stimulants is part of a generalized problem behavior that exposes youth to a variety of co-varying risk behaviors of other substance use (such as alcohol and marijuana) and externalizing behaviors of ADHD (Jessor and Jessor, 1987; Lerner et al., 2013; Molina and Pelham, 2003; Morral et al., 2002). The risk of non-medical use of prescription stimulants has been shown to be highly associated with other substance use (cigarette, binge drinking, marijuana, other illicit drugs and non-medical use of other prescription drugs) among a national sample of youth (McCabe and West, 2013). To some extent, our findings are also in line with the Gateway Hypothesis (Kandel, 2002), we found the prior use of cigarettes, alcohol and marijuana served akin to gateway substances and increased the hazards of initiation into non-medical use of prescription stimulant medication.

Collectively, there is indication that the onset of non-medical use of prescription stimulants among youth seems to occur quite early in the developmental period and that prior use of alcohol and marijuana use appears to increase the risk, it may be worthwhile to include prevention efforts for non-medical use of stimulants when those for other substance use are carried out. The delay of initiation of overall substance use may have beneficial effects by reducing the time in a formative period of the life span when an individual experiences the deleterious effects of drugs. While our findings reinforce the importance of preventive efforts to delay the age of onset of prescription stimulants or prevent use entirely as part of substance use prevention programs in general, it is noted that several drug education and prevention programs in school both at the middle and high school levels have not been very successful when the salient risk factors have not been taken into account (Griffin and Botvin, 2010). Specific screening programs for poorly controlled ADHD symptoms may be incorporated as measures to identify those at risk for non-medical use of stimulants.

Though the present study offers important insights into the understudied area of initiation into non-medical use of prescription stimulants among youth, it is not without limitations. The cross-sectional nature of the design did not allow the inclusion of some important variables that could have allowed us to infer causality based on actual temporality. However, care was taken to include in the analyses only variables for which the independent variables preceded the onset of non-medical use with a reasonable degree of certainty, strengthening the inferences made. We focused our analysis on non-medical use of stimulants even if youth only used stimulants once, and diagnostic criteria for abuse or dependence on stimulants were not used. There may be important

differences in youth who non-medically use stimulants once and those who go on to develop disorders. Further, we used retrospective reports of age at first use which may be prone to the 'telescoping effect', wherein youth may erroneously perceive a recent substance use onset as being more earlier or remote than that of another substance (Johnson and Schultz, 2005). Lifetime use measures of substance use may be biased by recall errors due to fading of memory over time and particularly when age of onset is farther apart in time from the current age.

Despite the limitations noted, this study provides important insights into the nature of initiation into non-medical use of prescription stimulants in a representative national sample of youth. The study was also able to identify some of the important factors involved in increasing risk of first non-medical use such as ADHD symptoms. Given that longitudinal studies are not always feasible, we were able to model the hazards of initiation into non-medical use of prescription stimulants using cross sectional data. Findings of the study with respect to the period of highest risk for onset has important implications for the design of programs that aim to either prevent or delay the age of first non-medical use of prescription stimulants.

Table 4-1. Characteristics of youth aged 10 to 18 years by lifetime prescription stimulants use status.

Characteristic	No use (n=7228)	Non-medical use (n=467)	p value	Total (n=7691)
Male gender	45.6%	53.1%	0.0017*	46.1%
Caucasian	40.1%	60.6%	<.0001***	41.3%
Residence				
Urban	48.6%	38.1%		47.9%
Suburban	36.8%	40.9%	<.0001***	37.0%
Rural	14.7%	21.0%		15.1%
ADHD	6.6%	73.7%	<.0001***	10.6%
CD symptoms	9.7%	18.9%	<.0001***	10.3%

* p <.05, ** p <.001, *** p <.0001

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder

Table 4-2. Life time substance use among youth with non-medical prescription stimulants use (n=467).

Substance type	Non-medical use of stimulants
Alcohol use	
No use	51.0%
Onset before NMU	15.2%
Onset ≤ NMU	33.0%
Cigarette use	
No use	64.5%
Onset before NMU	11.6%
Onset ≤ NMU	22.7%
Marijuana use	
No use	61.0%
Onset before NMU	11.8%
Onset ≤ NMU	26.3%

Table 4-3. Life-table estimates of hazard probabilities of initiation into non-medical use of stimulants among youth (N=7691) aged 5 to 18 years from 2009 to 2011.

Age	Number entering interval	Number censored	Number of terminal events	Hazard	Standard error	Cumulative Hazard	Standard error
5 years	7691	0	0	0		0	0
6 years	7691	52	52	0.00676	0.000934	0.00676	0.000938
7 years	7639	88	36	0.0114	0.00121	0.0115	0.00122
8-years	7603	125	37	0.0163	0.00144	0.0163	0.00146
9 years	7566	158	33	0.0205	0.00162	0.0207	0.00165
10 years	7533	225	67	0.0293	0.00192	0.0296	0.00197
11 years	7259	266	41	0.0347	0.00209	0.0352	0.00216
12 years	6920	324	58	0.0428	0.00233	0.0436	0.00243
13 years	6427	397	43	0.0492	0.00251	0.0503	0.00263
14 years	5584	427	30	0.0543	0.00266	0.0266	0.0557
15 years	4586	448	30	0.0605	0.00287	0.0622	0.00305
16 years	3387	456	21	0.0663	0.00313	0.0684	0.00334
17 years	2156	463	8	0.0698	0.00335	0.0721	0.00359
18 years	1044	463	7	0.0760	0.00407	0.0788	0.00439

Table 4-4. Estimated hazards of non-medical prescription stimulant use initiation among youth 10 to 18 years of age in the N-MAPPS

Characteristic	Unadjusted HR (95% CI)	Adjusted HR (95% CI)
Gender		
Female	ref	ref
Male	1.28 (1.07-1.54)	1.11 (0.92-1.34)
Race		
Non Caucasian	ref	ref
Caucasian	2.24 (1.85-2.70)	1.18 (0.97-1.43)
Residence		
Suburban vs. urban	1.42 (1.16-1.75)	1.21 (0.98-1.49)
Rural vs. urban	1.77 (1.38-2.28)	1.08 (0.89-1.49)
ADHD diagnosis		
No	ref	ref
Yes	4.02 (3.32-4.86)	3.82 (3.00-4.85)
CD symptoms		
No	ref	ref
Yes	1.94 (1.53-2.44)	0.93 (0.73-1.18)
Cigarette use		
Onset after NMU	ref	ref
Onset ≤ NMU	13.98 (12.50-15.29)	3.13 (.2.21-4.43)
Alcohol use		
Onset after NMU	ref	ref
Onset ≤ NMU	12.94 (11.72-14.29)	1.39 (1.06-3.09)
Marijuana use		
Onset after NMU	ref	ref
Onset ≤ NMU	13.51 (12.23-14.92)	2.22 (1.59-4.85)

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder; NMU – Non-medical Use of Prescription Stimulants

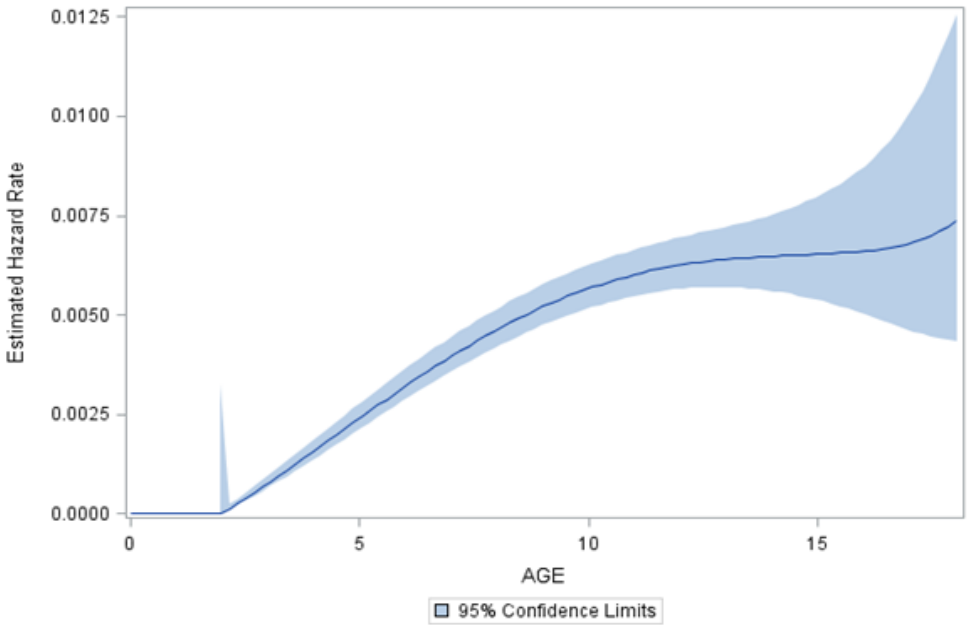


Figure 4-1. Hazard estimates of age of initiation into non-medical use of prescription stimulants among youth 10 to 18 years of age.

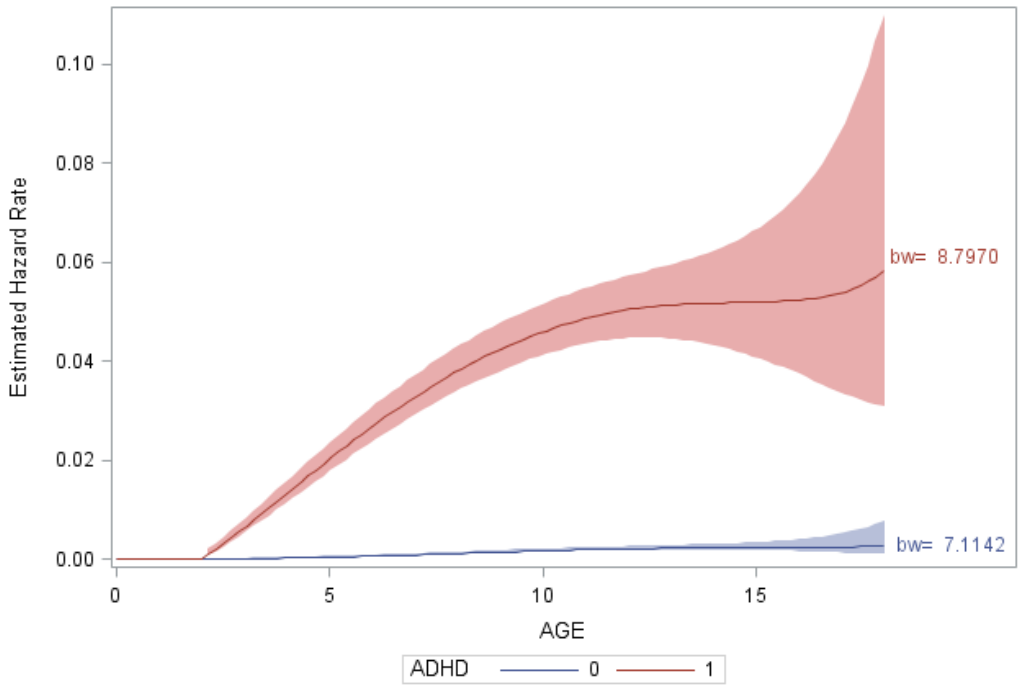


Figure 4-2. Hazard estimates of age of initiation into non-medical use of prescription stimulants by Attention Deficit Hyperactivity Disorder (ADHD) status among youth 10 to 18 years of age.

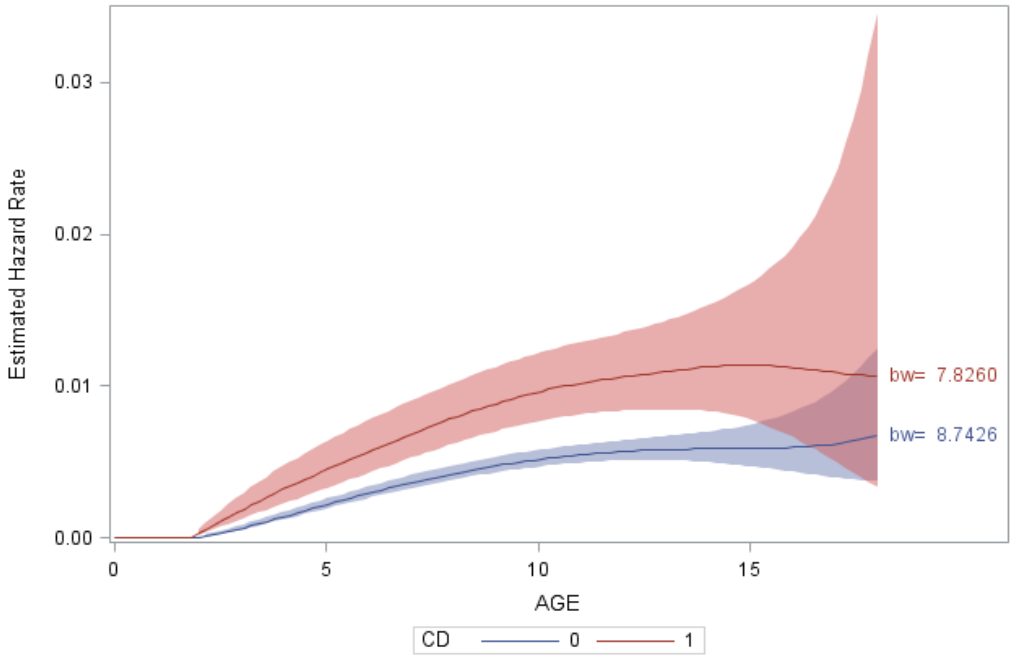


Figure 4-3. Hazard estimates of age of initiation into non-medical use of prescription stimulants by Conduct Disorder (CD) status among youth 10 to 18 years of age.

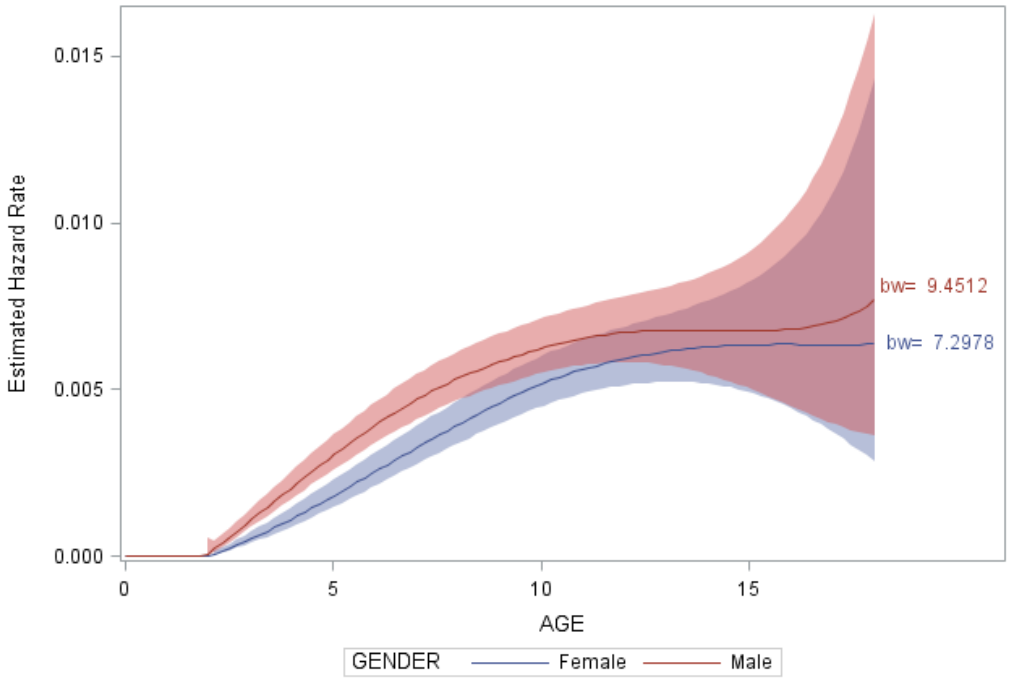


Figure 4-4. Hazard estimates of age of initiation into non-medical use of prescription stimulants by gender among youth 10 to 18 years of age.

CHAPTER 5
NON-MEDICAL USE OF PRESCRIPTION STIMULANTS AND THE USE OF OTHER SUBSTANCES AMONG YOUTH: A LATENT CLASS ANALYSIS

Background

A number of studies have indicated that prescription stimulants are now fairly common substances of misuse among youth in the United States; past one month non-medical use of prescription stimulant medication (NMU) rates between 5-10% have been reported in both regional and national studies (Cottler et al., 2013; McCabe and West, 2013; Wang et al., 2015). Adverse events leading to emergency department visits linked to NMU of stimulants are also at a significant high compared to most other drugs of abuse (Substance Abuse and Mental Health Services Administration, 2013b).

As NMU of stimulants continues to be a problem among youth, it is as important to view that NMU of stimulants may reflect more than an isolated form of substance use behavior (McCabe et al., 2014). Youth continue to misuse a number of substances such as alcohol, tobacco and other illicit drugs or use a combination of substances, and it is generally uncommon for youth to use only one particular class of drug (Gilreath et al., 2014). Polysubstance use, increased rates of other substance use and high risk behaviors are well documented among youth with NMU of stimulants (McCabe et al., 2012; Sweeney et al., 2013). There has been an emphasis in both the timeliness and need to better characterize contemporary patterns of substance use and abuse among youth with studies that include prescription medications (such as stimulants, opioids, benzodiazepines) together and separately from other drugs of abuse.

Much of our understanding of NMU of stimulants and other substance use behavior in youth along with their associated risk factors has primarily been achieved using a variable centered approach. Examples of this approach are many and

distinguish specific patterns of substance use among individual substances such as alcohol, tobacco or use across a range of substances; individual substance use variables are examined assuming sample homogeneity (McCabe et al., 2012). In contrast, person centered approaches such as Latent Class Analysis (LCA) assume sample heterogeneity and are used to empirically identify distinct subtypes or classes of individuals based on their shared patterns of observed indicator variables such as types of substance used or motives for use (Cleveland et al., 2010a; Lanza and Rhoades, 2013; McCabe and Cranford, 2012). Using LCA, a few studies have suggested considerable variability within the overall subgroup of young substance users which includes NMU of stimulants and other prescription medication such as opioids (Cranford et al., 2013). For instance, there are at least some subgroups that consist of polysubstance users, a subtype that engages in alcohol use with non-medical use of medication that includes stimulants grouped together (Chen et al., 2014; McCabe et al., 2009). A few studies have characterized youth based on their motives and routes for non-medical use indicating that there are motivational subtypes of non-medical use of prescription medication and have identified a subgroup of youth who use stimulants to achieve or perform better (McCabe et al., 2009).

Further, important differences in risk factors among subtypes of substance using youth have been shown to vary depending on subtype characteristics such as the number and category of drugs misused (Hall et al., 2010). Despite reports of coexisting use of NMU of stimulants and other substances of abuse, it has been suggested that some risk factors may be unique to NMU of stimulants (Schepis and Krishnan-Sarin, 2008). However, a number of prior studies have implicated that shared risk factors for

alcohol, tobacco and other drugs exist which include individual, personality and family related variables (Buu et al., 2009; Harden et al., 2008; Kendler et al., 2003; Thatcher and Clark, 2008; Ystrom et al., 2013). Whether risk factors for NMU of stimulants are indeed different or similar from those associated with multiple substance use is still not entirely clear. Most prior research limited the range of substances studied to alcohol, tobacco, and cannabis with the exception of a few recent studies that include the non-medical use of prescription drugs (Gilreath et al., 2014). One recent study conducted in two Midwestern cities sampled youth 12 to 18 years of age from an urban primary care setting and identified a three class model of lifetime substance use (i.e., low substance users, cannabis users, and polysubstance users which included prescription medication misusers) (Bohnert et al., 2014).

Because a majority of the previous studies that took the LCA approach to examine youth NMU of stimulants and other substance use have utilized student focused samples whether regional or national (Boyd et al., 2006; McCabe et al., 2009; McCabe and Cranford, 2012), there seems to be a dearth of studies that use nationally representative samples. Given that prescription medication misuse continues, we emphasize the importance of characterizing youth based on their patterns of substance use that also include the non-medical use of prescription medications with representative samples. The generation of generalizable data will be critical in informing tailored intervention efforts to address specific substance use patterns among youth.

We had the opportunity to address these gaps in current substance abuse literature using data from the National Monitoring of Prescription Stimulants Study (N-MAPSS) which sampled youth as young as 10 years of age from the general population

and assessed a range of substances that include alcohol, tobacco, marijuana, other illicit drugs, non-medical use of prescription stimulants, opioids and benzodiazepines. The present study aimed to use a person centered approach to identify empirically determined subtypes of youth based on their past 30-day substance use patterns and examined socio demographic, behavioral and mental health characteristics of these subtypes using a variable centered approach. We tested whether the class with the most number of substance use types would have the highest likelihood of mental and other behavioral problems. Thus, we used variables across several domains of risk by building on prior research on risk factors for substance use.

Methods

Sample and Procedures

The present study sample was drawn from the larger N-MAPSS study conducted across ten cities in the United States using a cross sectional design. Trained interviewers recruited youth 10 to 18 years of age at selected youth friendly entertainment venues (such as shopping malls, parks, sports and recreation centers, movie theatres) in four cross sections from 2008 to 2011. Interviews were conducted in private areas of the venues to ensure confidentiality. Youth gave verbal assent for participation in the study and were provided with a $ 10 at completion of the interview. Study protocols were approved by the Institutional Review Boards at Washington University in St Louis for the first three cross sections and University of Florida for the fourth cross section.

Measures

Substance use

The N-MAPSS survey assessed past 30 day use of seven types of substances which are: 1) Use of the prescription stimulants -Adderall® or Adderall XR®, Concerta®, Ritalin®, Daytrana®, and Vyvanse® measured individually. Pictures of each type of stimulant medication were presented and youth were asked to identify the stimulant by brand name and formulation. Specific questions asked for: a) past 30-day use of each stimulant; b) use of stimulant in greater quantity than prescribed; c) use that belonged to someone else (parents, brother or sister, different family member, someone from school or from work, someone unknown and other); d) route of ingestion of stimulant (by mouth, snorted/sniffed, smoked and other), and e) reasons for prescription stimulant use. Questions also assessed if each stimulant endorsed for use had been prescribed by a psychiatrist or a doctor. For the present study, past 30-day NMU of stimulants is defined as the use of any of the five aforementioned stimulants for use other than by mouth (except Daytrana® which comes as a patch), use of any stimulant that belonged to someone else or use that was more than prescribed. Youth who met this definition were considered as non-medical prescription stimulant users. 2) Use of the prescription opioids—Vicodin® and Oxycontin® were assessed. Pictures of the medications were presented and youth were asked whether they had used any in the last 30 days. Youth who responded positively to the use of any of the two prescription opioids by non-oral routes (snorted/sniffed, smoked or other) or use that belonged to someone else were categorized as non-medical prescription opioid users. 3) Use of prescription benzodiazepines—Valium® and Xanax® were measured. Reporting the use of any of the two prescription benzodiazepines assessed via non-oral routes or use that belonged

to someone else indicated classification into non-medical prescription benzodiazepine users. 4) Alcohol use in the past 30 days was assessed with the question “In the last 30 days, on how many days did you drink alcohol?” A drink was defined as ‘a beer, a glass of wine, or any other alcoholic drink, not just a sip’. Use of alcohol on at least one day in the past 30 days was regarded as alcohol users while those without any alcohol use in the past 30 days even if they were lifetime users were categorized as non-users of alcohol in the past 30 days. 5) Cigarette use in the past 30 days was measured among positive responders to the question “Have you ever smoked a cigarette?” Youth were asked if they still smoked every day, on some days or no use; those who reported smoking every day or on some days of the last 30 days were considered as cigarette users. Youth with no cigarette use in the lifetime question and lifetime cigarette use but with no use in the past 30 days were categorized as non-users of cigarette in the past 30 days. 6) Marijuana use in the past 30 days was assessed with “In the last 30 days, how many days did you use marijuana?” among those who reported lifetime use. Use of marijuana on at least one day in the past 30 days was categorized as marijuana users while no use in the past 30 days or lifetime question were categorized as non-marijuana users. 7) Other illicit drug use measured in the N–MAPSS survey included cocaine, heroin, club drugs, hallucinogens (LSD or mushrooms), anabolic steroids, methamphetamine and inhalants (gasoline or paint). Youth who endorsed at least one of the substances were classified as other illicit drug use users.

The distribution of use of all seven substances described above to be used in the study was examined. There were 41 cases with missing data for all the types of substance use variables, and these respondents were excluded from the present

analyses resulting in a final sample size of 11,007 youth on whom latent class analysis was conducted.

Socio-demographic characteristics

Socio-demographic variables were assessed in the N-MAPSS that included age, gender, race and ethnicity. Zip code level information was used to categorize area of residence into urban, suburban and rural. The survey also included items that elicited whether youth lived in a dual parent household, grades in school (dichotomized into A's, B's or C's vs. D's or F's), sleep timings at 12 am or later and self-rated general level of health (excellent, good, fair and poor). Youth were asked the number of meals they ate in a week with family; a categorical variable with less than five meals a week with family was coded 0 and five meals or more were coded as 1. These socio-demographic variables were examined to elucidate differences in substance use subtypes.

Mental and behavioral health

Based on items in the N-MAPSS, the following four variables representing mental and behavioral health were created: 1) diagnosis of ADHD by a doctor; 2) conduct problems (ever got into a lot of trouble at home or at school, ran away from home overnight and used or threatened someone with a weapon); 3) weight issues (very afraid of gaining weight, tried to lose weight by making oneself vomit, taking pills to lose weight, not eating for a day or two and exercising too much); 4) depressive symptoms (past 12 months loss of interest or depressed for at least 2 weeks); 5) anxiety symptoms (lifetime worry or stress for 6 months or more). ADHD, depressive and anxiety symptoms were dichotomous variables. We also categorized conduct problems and weight issues into dichotomous variables by coding 1 when youth endorsed at least

three of the individual items and 0 representing ‘no’ when youth endorsed two or less of the individual items for conduct problems and weight issues.

Peer substance use

Peer substance use influence was assessed with the question “How many of your close friends have tried Adderall, even once?” Youth reporting at least one close friend with the medication use were classified as ‘yes’ and having no friends was classified as ‘no’.

Analyses

The prevalence and distribution of the seven types of substance use among youth were examined. Using Mplus 7.0 (Muthén and Muthen, 2007), LCA was applied to empirically identify subtypes of youth with similar patterns of substance use that explain their responses based on the observed substance use indicator variables (past 30 day use of alcohol, marijuana, cigarettes, non-medical use of prescription opioids, non-medical use of prescription benzodiazepines, non-medical use of prescription stimulants and other illicit drugs respectively). The substance use variables were considered as indicators of the latent classes and it was expected that observed data among youth in the same latent class would cluster while it would differ from that of youth in other latent classes. Model building was carried out iteratively till an optimal model fit was achieved based on fit statistics and interpretability of the subtypes.

The fit of the LCA models was evaluated with the Lo-Mendell-Rubin-adjusted likelihood ratio test (LMR-LRT), Bootstrapped Likelihood Ratio Test (BLRT), Bayesian Information Criterion (BIC) adjusted Bayesian Information Criterion (ABIC) and entropy value (Lo et al., 2001; Nylund et al., 2007). The LMR-LRT and BLRT examines whether a model with one additional class (k classes) better describes the data compared to a

model with k-1 classes; a significant p value (<0.05) denotes improvement in model fit suggesting the selection of the model with k classes over the k-1 class model. The BIC and ABIC indicates the parsimony of the model; smaller values are indicative of an improved model and differences in BIC/ABIC of at least 10 relative to the previous model are taken as an indication to favor one model over another (Raftery, 1995). The BIC and ABIC have been shown to consistently identify the correct number of classes in categorical LCA models (Nylund et al., 2007). The entropy value reflects the classification quality of the model with values closer to 1.00 representing increased accuracy in assignment to a class. The conceptual interpretability and size of the classes were also considered in the model selection process.

Approximately 2.8% of the respondents had missing data on one or more explanatory variables. Multiple imputation procedure was carried out assuming missing at random (MAR) using SAS 9.4.

Multinomial logistic regression analysis with the imputed data was then carried out to examine the correlates of the LCA subtypes identified which included socio demographic characteristics, behavioral and mental health indicators, and peer stimulant use. The adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) are reported.

Results

Substance Use Patterns Among Youth

Substance use in the sample is displayed in Table 5-1. About 37% of all youth had used at least one type of substance in the past 30 days. The use of any individual substance by youth ranged from approximately 2% to around 27%; the most common substance used was alcohol (27%) while the least common substance misused was

benzodiazepines (2%). Overall, lower rates of all types of non-medical use of prescription drugs were endorsed by youth relative to alcohol, tobacco, marijuana and other illicit drugs.

LCA Defined Subtypes of Substance Use among Youth

Following best practices in LCA, the identification of the best fitting model was based on statistical fit measures as well as interpretability of the models. As seen in Table 5-2, the LCA of the seven observed substance use variables indicated that a 2 class model (BIC 38705.971; ABIC=38658.303; entropy=.85) differed from a 1 class model (VLMR $p<0.01$; BLRT $p<0.01$). Next, the 3 class model (BIC 38252.469; ABIC=38179.378; entropy=0.83) demonstrated better fit across all measures when compared to a 2 class model. When the 3 class model was compared to a 4-class model, both BIC and ABIC (BIC 38235.764; ABIC=38137.250) indicated improvement in fit; the VLMR and BLRT tests also indicated that a 4 class model was significantly different compared to a 3 class model ($p<0.01$) even though the entropy value decreased to 0.77. The identified subtypes in the four class model were distinct in the patterns of substance use and demonstrated potential for interpretability. Further, shown in Table 5-3 is the quality of correct classification of youth into each of the latent classes which was fairly high. The average conditional probability of being correctly classified as a member of class 1 was 0.75, 0.86 for class 2, 0.89 for class 3, and 0.74 for class 4. The 5 class model deteriorated appreciably in model fit from the 4 class model (BIC=38280.101; ABIC=38156.164; entropy 0.72). For these reasons, the 4 class solution which was comparatively parsimonious relative to other models and identified interpretable classes was favored over the other models.

The four classes were distinguished by distinct patterns of past 30-day substance use (Figure 5-1). Class 1 was the largest class and comprised of youth with a high probability of low to no substance use (80.2%). Class 2 consisted primarily of users of alcohol with some marijuana use and a lower probability of use of all other substances (13.0%). Class 3 manifested a high probability of the use of alcohol, tobacco, marijuana and other illicit drugs with a low probability of non-medical use of prescription drugs (4.7%). A high probability of non-medical use of prescription drugs with use of other types of substances was observed with membership in Class 4 (2.1%). We named these classes as low-no substance use, alcohol-marijuana use, alcohol, tobacco, marijuana and other illegal drug use (ATM+) and NMU of prescription medication and other substance use (Rx++) subtypes respectively.

Socio-Demographic Characteristics by LCA Subtypes

As shown in Table 5-4, there were significant differences among the LCA defined subtypes when compared on socio-demographic characteristics. Youth in the subtypes of alcohol-marijuana, ATM+ and Rx++ (mean: 16.23, 16.54 and 16.43 years respectively) were older than youth with low-no substance use (mean: 14.81 years). Almost two thirds of youth in the Rx++ subtype was Caucasian while other subtypes had lower representation among Caucasians and ranged from 40.7% (low-no substance use) to 53.4% (ATM+). Slightly higher representation of males was seen in ATM+ and Rx++ subtypes while there were a higher proportion of females in the low-no substance use and alcohol-marijuana use subtypes. Compared to other subtypes, Rx++, followed by ATM+ were more likely to have poorer grades, have sleep timings at or later than midnight, live in a single parent household and more likely to have fewer than 5 meals

per week with family. There were no differences in the area of residence by substance use subtype.

Mental and Behavioral Health Characteristics by LCA Subtypes

LCA defined subtypes significantly differed when compared on mental and behavioral health characteristics presented in Table 5-5. Overall, in a most interesting fashion, mental and behavioral health symptoms increased with every level of increasing type and number of substances used; higher rates were observed among those with NMU of prescription medications and use of other substances (Rx++) followed by alcohol, tobacco, marijuana and other drugs (ATM+), with comparatively lower rates in alcohol-marijuana users, and the least among youth with low-no substance use. Specifically, 69% of youth in Rx++ subtype rated their health as fair to poor. Emotional and mental health problems indicated by depression, anxiety symptoms, weight concerns, and ADHD and CD symptoms were highest among youth in the ATM+ and Rx++ subtypes while rates were relatively lower for those in the alcohol-marijuana subtype. Low-no substance users were comparatively least likely to report emotional and mental health problems than the other subtypes.

Peer Substance Use by LCA Subtypes

The rates of peer substance use in the LCA identified subtypes are displayed in Table 5-5 which indicates that the highest rate is among youth with Rx++ at 85.9% whereas only 19.6% of those in low-no substance use classification reported having at least one friend with stimulant use.

Multinomial Logistic Regression Analysis by LCA Subtypes

A latent class with covariates framework was used to determine the correlates of LCA identified subtypes using multinomial logistic regression analysis. LCA subtype

was the dependent variable of interest with low-no substance use as the referent group; the results are presented in Table 5-6. Relative to low-no substances users, each year increase in age increased the odds for membership in the subtypes of alcohol-marijuana use (AOR 1.35), ATM+ (AOR 1.37) and Rx++ subtypes (AOR 1.50). The socio-demographic characteristics of Caucasian race, poor grades in school and sleep timings at or after midnight increased the odds of membership into alcohol-marijuana, ATM+ and Rx++ subtypes compared to the low-no substance use subtype. Positive family related characteristics of regular meals with family and living with both parents decreased the odds of being in the subtypes of alcohol-marijuana use, ATM+ and Rx++ use groups relative to the referent class of low-no substance use. Relative to urban areas, residing in rural areas decreased the odds of membership into alcohol-marijuana use group. Gender was not related to any LCA identified subtype of substance use relative to low-no use subtype.

Among the mental and behavioral health problem indicators assessed, CD symptoms had the strongest association with substance use subtypes relative to not reporting CD symptoms. CD symptoms increased the odds of ATM+ by over eight times (AOR 8.68), almost six times for the Rx++ class (AOR 5.98) and about three times for alcohol-marijuana use (AOR 2.96). The likelihood of ATM+, Rx++ and alcohol-marijuana use increased with having weight concerns by 3.26, 2.49 and 1.74 times compared to not having any weight concerns. Depressive and anxiety symptoms only slightly increased the odds of membership in all subtypes (alcohol-marijuana use, ATM+, Rx++ groups) relative to the low-no use subtype. Further, only Rx++ subtype was associated with having been diagnosed with ADHD (AOR 1.63). Peer use of stimulant use was also

found to increase the likelihood of inclusion into all three subtypes of substance use; membership in ATM+ increased by over 13 times, inclusion into the Rx++ subtype by almost seven times and alcohol-marijuana by three times when youth had at least one friend who used stimulants compared to not having a friend who used stimulants.

Discussion

Our findings suggest heterogeneity in substance use patterns among a nationally representative sample of youth aged 10 to 18 years in the United States. More than a third of youth (37.2%) had used at least one type of substance in the past 30 days. Using LCA, we were able to empirically identify four subtypes of youth substance users: 1) non-medical users of prescription stimulants, opioids and benzodiazepines and other substances (Rx++); 2) primarily alcohol, tobacco and other illicit drug users with low non-medical use of prescription medication (ATM+); 3) primarily alcohol-marijuana users; and 4) low-no substance users. In particular, our study found that a small but distinct group of youth (2%) engaged in the non-medical use of prescription medication along with other substances (Rx++) which distinguished these youth from the ATM+ group (4.7%) which used majority of other substances but had low non-medical use of prescription medication. These two subtypes were characterized by increased association with poor behavioral and mental health indicators, particularly CD symptoms and weight concerns. Rx++ and ATM+ users were also more likely to have a peer who used stimulants and had decreased parental monitoring indicators. The largest subtype consisted of low-no use of substance (80.2%) and 13% of youth were in the alcohol-marijuana subtype; in comparison to the Rx++ and ATM+ subtypes, relatively few mental and behavioral health problems was observed among youth in these two groups. These findings indicate diversity in youth substance use and find support in utilizing

person centered approaches to examine youth non-medical use of prescription medication separately and together with other substance classes.

Non-medical Use of Prescription Stimulants, Opioids, Benzodiazepines and Other Substance Use (Rx++)

A subtype of youth (2.1%) demonstrated high likelihood of the non-medical use of stimulants, opioids or benzodiazepines and the use of other illicit substances for youth (cigarette, alcohol, marijuana, other illicit drugs). Our study results indicated that non-medical users of stimulants, opioids or benzodiazepines were included in the subtype which also used several other substances; the findings are similar to a study by Conway et al (2013) which used a nationally representative sample of 10th grade students. However, a web based study conducted among high school adolescents in Michigan using LCA identified a subgroup of youth with relatively high rates of prescription drug misuse (characterized by both misuse and excessive medical use of prescription) and alcohol use with low rates of other substances (Cranford et al., 2013). The study also found female gender at increased risk of membership of this subtype of prescription drug misusers while our study did not find class membership to vary with gender. The differences in findings are most likely due to characteristics of the samples which greatly vary in terms of representativeness.

The Rx++ subtype in our study was characterized by strong associations with CD symptoms. Additionally, increased likelihood of non-medical use of prescription medications and other substance use was linked to having ADHD symptoms, weight concerns, depression and anxiety symptoms and fair/poor self-reported health. Their risk profile is further supported by significant associations with having friends who used prescription stimulant medication. In particular, we found that CD was strongly

associated with Rx++ and ATM+ which is consistent with several prior studies (Costello, 2007; Fergusson et al., 2007). It has been shown that while CD increases the risk of onset of all substance classes, the risk associated with use of illicit substances is greater compared to licit substances (Hopfer et al., 2013). Further, increased depressive and somatic symptoms among poly substance users were reported in a national sample of 10th grade students (Conway et al., 2013) and among adolescent poly substance users attending urban primary health care clinics in Michigan (Bohnert et al., 2014). In particular increased association of depression as well as somatic symptoms characterized by headaches, stomachaches or backaches among students with multiple substance use have been found (Connell et al., 2010; Dierker et al., 2007). Our findings are in line with prior studies which have demonstrated that youth with use of multiple substance types have associated mental health needs which should be addressed along with efforts to reduce substance use (Bohnert et al., 2014; Conway et al., 2013).

Additionally, socio-demographic correlates for increased risk of Rx++ found in our study includes being older, of Caucasian race and having poor grades which confirm findings reported in prior studies (Bohnert et al., 2014). Family related factors such as living in single parent household and not eating meals regularly with family were positively associated with the risk of inclusion in the Rx++ subtype. These findings may reflect poorer levels of engagement or cohesion in the family which has been shown to exert detrimental influences in substance use (Taylor et al., 2012). Further, in light of the non-medical use of prescription medication occurring largely via friends, parental or known sources (Cottler et al., 2013; Johnston et al., 2014; Schepis and

Krishnan-Sarin, 2008), parental monitoring should be recommended which can be helpful for families with high risk profiles for substance use.

Alcohol, Tobacco, Marijuana and Other Illicit Drug Users (ATM+)

Our study identified a small group of youth who were predominantly ATM+. While this group demonstrated almost similar rates of ATM+ compared to the Rx++ subtype, this group was distinct in their low use of prescription medication. Although this subtype was characterized by similar risk factors as the Rx++ subtype, the rates and associated odds ratios were comparatively lower. However, CD symptoms showed the strongest association with ATM+, increasing the risk by over eight times compared to those without CD. The presence of CD has been associated with a particularly elevated risk for substance use disorders and also with the persistence of other mental disorders such as depression and anxiety (Nock et al., 2006).

Socio-demographic correlates for increased risk of ATM+ included older age, poor grades, living in a single parent household, less frequent meals with family in a week and sleep timings later than midnight. These youth were also likely to have at least one friend who used prescription stimulants. Poor grades were positively associated with both substance use subtypes, a finding that is congruent with a large body of research describing the association between lower academic achievement and substance use (Bachman et al., 2011; Bohnert et al., 2014; Wheeler, 2010).

Alcohol and Marijuana Users

A third subtype of youth who were primarily alcohol users with some use of marijuana and low rates of all other types of substances was identified in our study. This finding is consistent with the study by Conway et al (2013) using baseline data of a national longitudinal study of 10th graders that found a subtype that consisted of

predominantly alcohol users and another subtype that comprised of primarily marijuana users only. A number of prior studies have also indicated a subtype with high probability of alcohol and tobacco use or use of tobacco, alcohol and marijuana (Cleveland et al., 2010; Connell et al., 2010). Tobacco users in our study find representation in the Rx++ and the ATM+ subtypes but not in the predominantly alcohol using subgroup of youth; this finding may reflect the decreasing trend of tobacco use rates which has been documented in both national and regional studies (Gilreath et al., 2014).

The alcohol-marijuana user subtype in our study was characterized by older age, Caucasian race, poor grades, late bed timings, weight concerns, CD symptoms, depression and anxiety symptoms and peer stimulant use. Youth living in rural areas had decreased risk of membership in this subtype relative to those in urban areas.

Low-no Substance Users

A significant proportion of youth consisted of a subtype with comparatively low or no substance use, a finding consistent with other national studies that focus on youth substance use behavior (Conway et al., 2013). Their reduced risk profile was supported by reduced odds of behavioral and mental health issues, and peer stimulant use as compared with other substance use subtypes. Although this group demonstrated lesser involvement with all substance use types, some alcohol use was observed directing attention to what maybe the normative behavior among youth in contemporary times. Other studies carried out on youth in other populations such as primary care clinics and students have also established that the large majority of youth abstain from substance use (Bohnert et al., 2014; Cranford et al., 2013; Gilreath et al., 2014).

Study Limitations and Strengths

The findings of this study should be interpreted with the consideration of some limitations. The N-MAPSS used self-reports to assess for past 30 day substance use as well as the risk factors, which may be prone to under-reporting owing to social desirability and recall errors. The cross sectional nature of the study only allows the estimation of associations between substance use subtypes without the ability to make causal inferences. Recruitment of youth was not carried out using random sampling techniques and some youth who do not frequent entertainment venues might have been missed. Further, the period of substance use was not permissible with the present data which would have been more informative in terms of distinguishing youth based on persistent patterns of substance use.

The N-MAPSS data has noteworthy strengths. The large size and recruitment of the sample from youth friendly venues allowed the inclusion of school drop outs and home schooled youth in the study sample. Further, the sample is highly representative of the US population aged 10 to 18 years suggesting the high generalizability of study findings (Cottler et al, 2013). The study is also one of very few to assess substance use in youth younger than 12 years of age.

The detailed assessment in the N-MAPPS study has allowed the characterization of contemporary patterns of substance use and abuse and its associated risk factors among youth using a person centered approach. Study findings indicate that substance use continues to be a public health problem among youth. Further substance use among youth is linked to unmet mental health needs. It is known that the majority of youth in need of mental health services do not receive services. Improving access to

mental health services and care may play an important role in the prevention of substance abuse and dependence in youth.

Table 5-1. Substance use among youth in the N-MAPSS (n=11,007).

Substance Use	%
Cigarette use	9.9%
Alcohol use	27.0%
Marijuana use	17.2%
Non-medical stimulant use	3.6%
Non-medical opioid use	2.9%
Non-medical benzodiazepine use	2.1%
Other illicit drug use	11.7%
At least one substance use	37.2%

Table 5-2. Statistical fit measures for substance use subtypes of youth in the N-MAPSS (n=11,007).

Model fit statistics	Class 1	Class 2	Class 3	Class 4	Class 5
AIC	46338.204	38596.377	38084.425	38009.269	37995.156
BIC	46389.348	38705.971	38252.469	38235.764	38280.101
AIC	46367.103	38658.303	38179.378	38137.250	38156.164
VLMR		0.0000	0.0000	0.0016	0.0061
BLRT		0.0000	0.0000	0.0017	0.0065
Entropy		0.849	0.829	0.767	0.724

Table 5-3. Average latent class probabilities for most likely latent class membership for substance use (row) by latent class (column) youth in the N-MAPSS.

Latent class	Low-no use (n 8827)	Alcohol-marijuana (n 1435)	ATM+ (n 517)	Rx++ (n 228)
Class 1	0.748	0.100	0.000	0.151
Class 2	0.088	0.860	0.004	0.048
Class 3	0.002	0.0000	0.892	0.106
Class 4	0.176	0.013	0.070	0.741

Table 5-4. Demographic characteristics of substance use subtypes of youth in the N-MAPSS.

Characteristic	Low-no use (n 8827)	Alcohol-marijuana (n 1435)	ATM+ (n 517)	Rx++ (n 228)	p value
Age (mean)	14.8	16.2	16.5	16.4	<.0001***
Gender	46.6%	51.1%	55.9%	55.7%	<.0001***
Caucasian	40.7%	49.5%	53.4%	63.9%	<.0001***
Residence					
Urban	47.8%	47.9%	45.4%	40.3%	
Suburban	37.1%	37.5%	40.2%	38.2%	0.0875
Rural	15.1%	14.6%	14.3%	21.5%	
Poor grades (D's & F's)	20.0%	34.4%	51.8%	47.4%	<.0001***
Meals (≤5 per week)	45.6%	25.8%	18.6%	17.2%	<.0001***
Sleep timings (12am or later)	18.5%	34.9%	45.6%	49.1%	<.0001***
Dual parent household	58.3%	47.1%	41.6%	37.3%	<.0001***

* p <.05, ** p <.001, *** p <.0001;
Note: ADHD: Attention Deficit Hyperactivity Disorder; CD: Conduct Disorder

Table 5-5. Health characteristics of substance use subtypes of youth 10 to 18 years of age in the N-MAPSS.

Characteristic	Low-no use (n 8827)	Alcohol-marijuana (n 1435)	ATM+ (n 517)	Rx++ (n 228)	p value
Health rating (fair/poor)	4.7%	9.5%	16.5%	69.0%	<.0001***
ADHD diagnosis	9.8%	18.5%	33.7%	31.6%	<.0001***
CD symptoms (≥3)	7.2%	27.1%	49.9%	58.3%	<.0001***
Depressive symptoms	47.8%	64.5%	73.6%	78.5%	<.0001***
Anxiety symptoms	22.4%	35.8%	44.5%	53.1%	<.0001***
Weight concerns (≥ 3)	2.7%	7.4%	12.4%	18.0%	<.0001***
Friend stimulant use	19.6%	52.4%	72.7%	85.9%	<.0001***

$^{*}p$ <.05, $^{**}p$ <.001, $^{***}p$ <.0001

Note: ADHD – Attention Deficit Hyperactivity Disorder; CD – Conduct Disorder

Table 5-6. Correlates of substance use subtypes of youth in the N-MAPSS (n=11,007).

Characteristic	AOR	95% CI
Age (years)		
Low-no use	ref	-
Alcohol-marijuana	1.35	(1.30-1.40)
ATM+	1.37	(1.24-1.51)
Rx++	1.50	(1.40-1.60)
Male gender		
Low-no use	ref	-
Alcohol-marijuana	0.99	(0.87-1.13)
ATM+	0.99	(0.72-1.38)
Rx++	1.03	(0.83-1.29)
Caucasian race		
Low-no use	ref	-
Alcohol-marijuana	1.37	(1.20-1.56)
ATM+	1.95	(1.42-2.68)
Rx++	1.43	(1.15-1.78)
Residence		
Low-no use	ref	-
Alcohol-marijuana (Suburban vs. Urban)	0.96	(0.84-1.10)
Alcohol-marijuana (Rural vs. Urban)	0.82	(0.68-0.99)
ATM+ (Suburban vs. Urban)	1.04	(0.74-1.45)
ATM+ (Rural vs. Urban)	1.15	(0.55-1.04)
Poly sub (Suburban vs. Urban)	1.04	(0.83-1.30)
Poly sub (Rural vs. Urban)	0.76	(0.55-1.04)
4 meals or more with family a week		
Low-no use	ref	-
Alcohol-marijuana	1.69	(1.31-2.17)
ATM+	1.75	(1.19-2.57)
Rx++	1.49	(1.29-1.70)
Grades in school (D's or F's)		
Low-no use	ref	-
Alcohol-marijuana	1.48	(1.29-1.71)
ATM+	1.77	(1.29-2.43)
Rx++	2.34	(1.88-2.91)

Table 5-6 continued.

Characteristic	AOR	95% CI
Lives in single parent household		
Low-no use	ref	-
Alcohol-marijuana	1.26	(1.11-1.43)
ATM+	1.60	(1.17-2.18)
Rx++	1.29	(1.04-1.59)
Sleep after 12 pm		
Low-no use	ref	-
Alcohol-marijuana	1.39	(1.21-1.60)
ATM+	1.97	(1.45-2.69)
Rx++	1.63	(1.32-2.02)
ADHD		
Low-no use	ref	-
Alcohol-marijuana	1.09	(0.91-1.30)
ATM+	1.18	(0.84-1.65)
Rx++	1.63	(1.28-2.06)
CD symptoms		
Low-no use	ref	-
Alcohol-marijuana	2.96	(2.51-3.49)
ATM+	8.68	(6.23-12.10)
Rx++	5.98	(4.74-7.53)
Depressive symptoms		
Low-no use	ref	-
Alcohol-marijuana	1.32	(1.14-1.53)
ATM+	1.63	(1.19-2.24)
Rx++	1.71	(1.37-2.13)
Anxiety symptoms		
Low-no use	ref	-
Alcohol-marijuana	1.19	(1.04-1.37)
ATM+	1.82	(1.338-2.48)
Rx++	1.35	(1.09-1.68)
Weight concerns		
Low-no use	ref	-
Alcohol-marijuana	1.74	(1.34-2.27)
ATM+	3.26	(2.08-5.10)
Rx++	2.49	(1.75-3.56)
Friend stimulant use		
Low-no use	ref	-
Alcohol-marijuana	3.17	(2.79-3.61)
ATM+	13.61	(9.15-20.48)
Rx++	6.59	(5.26-8.26)

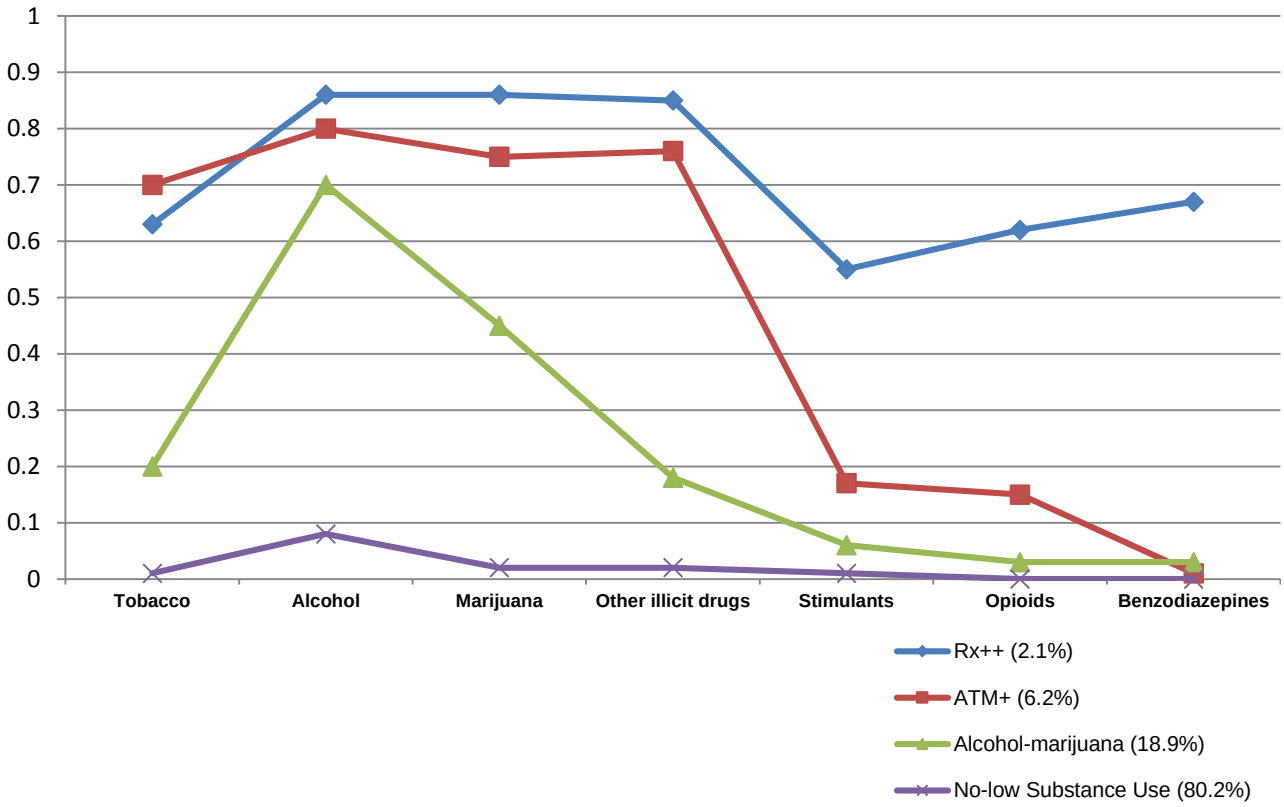


Figure 5-1. Item probability for latent class subtypes of youth in the four class model (N=11,007)

CHAPTER 6
CONCLUSION

The widespread use of pharmacotherapy for the treatment of Attention Deficit Hyperactivity Disorder has greatly increased the environmental availability of prescription stimulants in the United States. Increased prescribing and production of ADHD stimulants has been accompanied by reports of the non-medical use of stimulants prescription in the last two decades. Youth and young adults have been indicated to be at highest risk for the non-medical use of stimulants; about 5% of those aged 10 to 18 years engage in past 30 day non-medical use of stimulants. Of concern are the increased reports of adverse physical complications of non-medical use that is reflected by a significant rise in emergency department visits that involve stimulant misuse. Some efforts have been made to examine epidemiological characteristics of non-medical use of stimulants among youth using both national and regional samples. However, study results are not comparable because of the use of variable definitions in the measurement of non-medical use and because all stimulants commonly prescribed have not been assessed even by the existing national studies. Further, in the efforts to understand the non-medical use of stimulants among youth increased attention has been given to a few factors such as socio-demographic or perceived risks and harm related to stimulants, while others such as mental and behavioral health considered important in other substance use literature have not been given its due focus. It is known that substance use and misuse, and mental health problems co-occur, and each can influence the course and outcome of the other. Additionally, youth may misuse more than one substance type; polysubstance use among youth with non-medical use of stimulants has been commonly reported. Substance use and mental health problems

among youth relate to increased social and economic costs, as they often develop into more disabling conditions later in life associated with poorer outcomes. Preventive efforts are emphasized to help forestall the development and progression of substance misuse and mental disorders, and early intervention can limit their severity.

One of the most urgent tasks in addressing youth non-medical use of prescription stimulants is improving and expanding the evidence base using samples that are representative to ensure generalizability of study findings. Systematic research on the prevalence, nature and determinants of non-medical use of stimulants among youth and on the prevention, early intervention and treatment strategies will be critical to ensuring youth health and development. Thus, in order to improve understanding of the magnitude and mental and behavioral risk factors for the public health problem of non-medical use of stimulants, the present study assessed the correlates of past 30 day non-medical use of stimulants in terms of externalizing and internalizing problem behaviors using a representative national sample of youth aged 10 to 18 years in the US. We found 3.6% of youth aged 10 to 18 years reported the non-medical use of prescription stimulants. Overall, our sample showed high rates of externalizing problems of ADHD and CD problems with higher rates among those who used stimulants non-medically. Rates of internalizing problems of depressive and anxiety symptoms and weight concerns were comparable to other studies, although rates were higher in those with non-medical use of stimulants. Multinomial logistic regression models used indicated that the strongest association was between peer influence measured as having at least one friend who used a stimulant which increased the likelihood of non-medical use of stimulants by about six times. Externalizing and internalizing problems

also increased the risk of non-medical use of stimulants in youth. ADHD and CD symptoms independently increased the likelihood of non-medical use of stimulants as did the use of other substances of abuse such as cigarettes, alcohol, marijuana and other illicit drugs. Internalizing problems of depressive symptoms and weight concerns were associated with increased risk of non-medical use of stimulants. We did not find gender to moderate the association between externalizing problem behaviors of ADHD or CD, and the non-medical use of prescription stimulants.

With a view to aid strategic and targeted prevention efforts, we also aimed to assess the critical ages when youth are most likely to initiate non-medical use of stimulants and inform the public health community regarding factors that are associated with the onset. Using survival analysis, we modeled the time to onset of non-medical use of stimulants and found that prior to age 12 years, the rate of non-medical use of stimulants was low and below 2%. However, with each year increase in age at 13 years, the risk of initiating non-medical use of stimulants increased and peaked at 18 years of age with an incidence of 6.9%. We used Cox regression models to assess factors that were associated with the hazards of initiating non-medical use of stimulants. Being male, Caucasian and having ADHD symptoms increased the hazards of initiating non-medical use of stimulants. Further, the use of substances such as alcohol and marijuana prior to the non-medical use of stimulants was also associated with earlier non-medical use of stimulants compared to those who used later.

There have been reports of increased rates of the use of other substances among youth with non-medical use of stimulants as well as co-ingestion of stimulants with substances such as marijuana, alcohol and other illicit drugs. We were interested to

contextualize non-medical use of stimulants within the larger substance use and misuse public health problem among youth. Thus, we aimed to empirically identify subtypes of youth based on their patterns of use of seven substance classes (cigarettes, alcohol, marijuana, other illicit drugs, and non-medical use of stimulants, opioids and benzodiazepines). Additionally, we examined whether youths' mental and behavioral health characteristics varied by the substance use subtypes. Overall, 37% of youth had used at least one of the seven types of substance in the past 30 days. Latent class analysis identified four subtypes of substance use patterns: 1) strong representation of non-medical use of prescription medication (stimulants, sedatives and benzodiazepines) in a small but distinct group of youth (2.1%; Rx++); 2) primarily alcohol, tobacco and other illicit drug users with low non-medical use of prescription medication (4.7%; ATM+) group that represented about 5% of youth; 3) primarily alcohol-marijuana users consisting of 13% of youth and 4) low-no substance users that was the largest group (80%). We also examined the mental and behavioral health characteristics of the identified subtypes of substance use. The Rx++ and ATM+ subtypes were characterized by an increased association with behavioral and mental health problems and decreased parental monitoring indicators compared to the other two subtypes –alcohol and marijuana use group and the low-no use group.

Overall, the present study has identified a number of risk factors associated with the non-medical use of stimulants. As noted, an important risk factor is peer stimulant use that seems to be highly associated. The study findings suggest that non-medical use of stimulants is not an isolated behavior and seem to be part of a broader group of behaviors that are linked. In particular externalizing behaviors of ADHD and other

substance use are important factors associated with both the onset and past 30 day non-medical use of stimulants among youth. It is also clear that youth who engage in non-medical use of stimulants are also more likely to report the use of other drugs. Multiple studies including the present study have found associations between non-medical use of stimulants and increased rates of cigarette, alcohol, marijuana, and other illicit drug use among youth in the United States. There seems to be indications of internalizing problems such as depressive symptoms and weight concerns that may be linked to the non-medical use of prescription stimulants.

Thus, study findings suggest that targeting mental health problems among youth such as ADHD symptoms and preventing substance use may prevent non-medical use of stimulants in a substantial proportion of youth. It is estimated that 1 in 6 youth are exposed to prescription stimulants either medically or non-medically. Further, it has been reported that youths' perception of the risk of non-medical use of medication in general is low. A large majority may not be aware of their problematic non-medical use and at this time, there are no FDA-approved medications for treating stimulant addiction. The high level of exposure to stimulants among youth and the unavailability of pharmacotherapy to treat stimulant addiction highlights the importance of increasing prevention efforts before non-medical use develops into dependence or risk of adverse health outcomes increase. Prevention activities should ideally begin before the teen years when the risk of initiation begins to first set in.

An important aspect that emerged is one of improving access to treatment for the modifiable risk factors identified by the present study, such as Attention Deficit Hyperactivity Disorder and other substance use that are associated or co-occur with the

non-medical use of prescription stimulants. Additionally, physicians and pharmacists can play an important role in the identification and prevention of prescription stimulant abuse. Up-to-date knowledge on appropriate prescribing practices for stimulants particularly among youth with ADHD should be regularly provided. Youth and their parents (who visit clinics or the pharmacy) can be educated by physicians and pharmacists on the responsible and appropriate manner of use and storage of medications. Physicians can be more alert when prescribing or identifying misuse among those who are prescribed the medication. Because a large majority of non-medical users of stimulants obtain stimulant medication from people commonly known to them such as family or friends, physicians and pharmacists can also caution youth against the diversion of stimulants and the associated adverse effects either during prescribing or dispensing of stimulant medications.

Further, a worrisome misconception among youth is that the medications are safer to abuse than other illicit drugs because they are prescribed by medical professionals. Another common belief among youth is that stimulants improve cognitive performance in people who don't actually have ADHD which has been shown to be untrue and in fact is related to poorer grades. School and college substance abuse prevention efforts should work on clarifying these erroneous beliefs and stress on the dangers of non-medical use.

Non-medical use of prescription medication is a complex problem which requires a multi-pronged, strategic, and sustained effort which can be achieved only with coordinated efforts at all levels that range from public health to clinical medicine, public safety, and other stakeholders.

Lastly, the present study and the majority of studies have focused on the non-medical use of stimulants without focusing on whether youth use these medications persistently. Future efforts can be directed towards characterizing youth who non-medically use occasionally and those who are more regular users. Efforts to examine duration of use of stimulants among youth should be carried out. Further research is needed to identify those individuals whose non-medical use develops into dependence later in life. Intervention programs for youth with non-medical use of stimulants must be developed, and the outcomes evaluated.

APPENDIX A
NATIONAL MONITORING OF PRESCRIPTION STIMULANTS SURVEY

Interviewer ID: ___ ___ ___ Date: ___ ___ / ___ ___ / ___ ___ ___ ___

Venue:_____ CODE: ___ ___ Time (24 hour) ___ ___ : ___ ___

Respondent ID #: ___ ___ ___ 4 ___ ___ ___ ___ ___

N-MAPSS Survey

Washington University in St. Louis
SCHOOL OF MEDICINE

Part I
Wave 4

Directions

There are some questions that you will answer by filling in circles (multiple-choice questions) and some questions that you will answer by writing in your response (open-ended questions).

When answering multiple-choice questions, indicate your answers by filling in the circles.

INCORRECT MARKS ⊘ ⊗ ⊙ ◒ CORRECT MARK ●

For the open-ended questions, please write neatly.

Your answers are anonymous. **Do not write your name on the survey.**

Thank you for your help.
Phone number: 314-286-2252

October 6, 2010 (font changes)

1. What is your gender?

- ○ Male
- ○ Female

2. How old are you?

- ○ 10 ○ 11 ○ 12
- ○ 13 ○ 14 ○ 15
- ○ 16 ○ 17 ○ 18

3. Are you Hispanic or Latino?

- ○ No, I am not Hispanic or Latino.
- ○ Yes, I am Hispanic or Latino.

4. Which racial or ethnic group best describes you?

- ○ Alaskan Native/Eskimo
- ○ American Indian
- ○ Asian or Asian-American
- ○ Black or African-American
- ○ Middle Eastern
- ○ Pacific Islander
- ○ White, Euro-American, Caucasian
- ○ Biracial or Multiracial
- ○ Other (Specify: _____)

5. What is the zip code where you live most of the time?

_____ _____ _____ _____ _____

6. In the last 7 days, who have you lived with? Don't forget to include biological parents and step parents. Choose all that apply.

- ○ I lived with my mom and my dad at the same time.
- ○ I lived with my mom and my dad, but not at the same time.
- ○ I lived with my mom only.
- ○ I lived with my dad only.
- ○ I lived with foster parents.
- ○ I lived with other relatives.
- ○ Other (Specify:_____)

7. **How many brothers do you have? Don't forget to include stepbrothers and half brothers.**

   ○ 0 → **GO TO 9**

   ○ 1

   ○ 2

   ○ 3

   ○ 4

   ○ 5

   ○ More than 5

8. **How many of your brothers are older than you? Don't forget to include stepbrothers and half brothers.**

   ○ 0

   ○ 1

   ○ 2

   ○ 3

   ○ 4

   ○ 5

   ○ More than 5

9. **How many sisters do you have? Don't forget to include stepsisters and half sisters.**

   ○ 0 → **GO TO 11**

   ○ 1

   ○ 2

   ○ 3

   ○ 4

   ○ 5

   ○ More than 5

10. **How many of your sisters are older than you? Don't forget to include stepsisters and half sisters.**

    ○ 0

    ○ 1

    ○ 2

    ○ 3

    ○ 4

    ○ 5

    ○ More than 5

11. **In the <u>last 7 days</u>, how many times did your family eat <u>dinner</u> together?**

    ○ 0 ○ 1 ○ 2 ○ 3

    ○ 4 ○ 5 ○ 6 ○ 7

12. What grade are you in? If you aren't in school, what grade did you just finish?

- ○ 3rd grade
- ○ 4th grade
- ○ 5th grade
- ○ 6th grade
- ○ 7th grade
- ○ 8th grade
- ○ 9th grade
- ○ 10th grade
- ○ 11th grade
- ○ 12th grade

13. Which of the following best describes your grades?

- ○ Mostly A's
- ○ Mostly B's
- ○ Mostly C's
- ○ Mostly D's
- ○ Mostly F's
- ○ No grade or don't know

14. Have you ever been suspended from school for any reason? Include out-of-school suspensions, in-school suspensions, and bus suspensions.

- ○ No
- ○ Yes

.....

15. Do you have a job? Do not include chores.

- ○ No → **GO TO 17**
- ○ Yes

16. How many hours a week do you usually work for pay during the school year?

- ○ No hours
- ○ 1 to 4 hours
- ○ 5 to 8 hours
- ○ 9 to 12 hours
- ○ 13 to 16 hours
- ○ 17 to 20 hours
- ○ More than 20 hours

17. How much cash do you usually have with you on weekdays?

- ○ None
- ○ $1-5
- ○ $6-10
- ○ $11-15
- ○ $16-20
- ○ $21-25
- ○ $26-30
- ○ $31-40
- ○ $41-50
- ○ $51-60
- ○ $61-70
- ○ $71-80
- ○ $81-90
- ○ $91-100
- ○ $101-more

18. Do you have a debit card?

- ○ No → **GO TO 20**
- ○ Yes

19. Do your parents put money in your debit account on a regular basis?

- ○ No
- ○ Yes

20. How many sports teams do you play on?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 or more

21. How many hours a day do you watch TV?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 or more

22. How many hours a day do you play video games?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 or more

23. What time do you go to bed on week nights?

○ Before 7:00 pm ○ 10:00 to 10:59 pm

○ 7:00 to 7:59 pm ○ 11:00 to midnight

○ 8:00 to 8:59 pm ○ After midnight

○ 9:00 to 9:59 pm

24. What time do you get up on week days?

○ Before 5:00 am ○ 7:30 to 7:59 am

○ 5:00 to 5:29 am ○ 8:00 to 8:29 am

○ 5:30 to 5:59 am ○ 8:30 to 8:59 am

○ 6:00 to 6:29 am ○ 9:00 to 9:29 am

○ 6:30 to 6:59 am ○ 9:30 to 10:00 am

○ 7:00 to 7:29 am ○ After 10:00 am

25. Is your general health excellent, good, fair, or poor?

○ Excellent ○ Good

○ Fair ○ Poor

26. How many tickets or warnings have you received from the police?

_____ tickets or warnings

27. How many times have you been arrested?

○ 0

○ 1

○ 2 or more

28. When you were between 6 and 10 years old, did you…

	NO	YES
a. Lose things a lot?	○	○
b. Often have trouble finishing what you started?	○	○
c. Lose interest in things quickly?	○	○
d. Have trouble listening?	○	○

29. When you were between 6 and 10 years old, were you fidgety or so impatient that you couldn't wait your turn?

○ No

○ Yes

30. Has a doctor ever told you or your parents that you have Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD)?

○ No

○ Yes

○ I don't know

31. Have you ever gotten into a lot of trouble at home or at school or run away from home overnight?

○ No

○ Yes

32. Have you ever used a weapon or threatened someone with a weapon?

○ No

○ Yes

33. Have you ever been very afraid of gaining weight?

○ No

○ Yes

34. Have you ever tried to lose weight by…

	NO	YES
a. Making yourself vomit?	○	○
b. Taking pills?	○	○
c. Not eating for a day or two?	○	○
d. Exercising too much?	○	○

35a. In the last 12 months, have you had 2 weeks or more when you lost interest in things?

○ No

○ Yes

35b. In the last 12 months, have you had 2 weeks or more when you felt down or depressed?

○ No

○ Yes

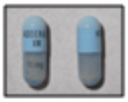
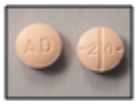
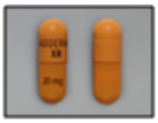
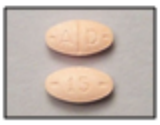
36a. Have you ever felt worried or stressed for 6 months or more?

○ No

○ Yes

36b. In the past 12 months, how often have you attended religious services at a church, mosque, temple, shrine, or synagogue?

○ Never ○ Sometimes ○ Often

	37.		38.
A.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
B.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
C.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
D.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
E.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
F.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
G.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
H.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
I.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____
J.		**Have you ever seen this medicine?** ○ No ○ Yes →	**What's the name of this medicine? Be as specific as you can.** _____

Interviewer ID: ___ ___ ___ Date: ___ ___ / ____ / ___ ___ ___ ___

Venue: _____ CODE: ___ ___ Time (24 hour) ___ ___ : ___ ___

Respondent ID #: ___ ___ ___ ___

N-MAPSS Survey

Part of the N-MAPSS

Washington University in St. Louis
SCHOOL OF MEDICINE

Part II
Wave 4

In this section we are asking about
pills, capsules, and patches
that you may have taken or may have used
even if they were not prescribed for you.

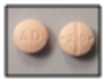
Your answers are anonymous. **Do not write your name on the survey.**

October 6, 2010 (font changes)

A.  Adderall 5 mg

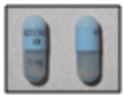
B.  Adderall 10 mg

C.  Adderall 15 mg

D.  Adderall 20 mg

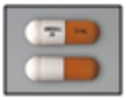
E.  Adderall 30 mg

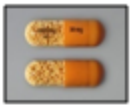
F.  Adderall XR 5 mg

G.  Adderall XR 10 mg

H.  Adderall XR 15 mg

I.  Adderall XR 20 mg

J.  Adderall XR 25 mg

K.  Adderall XR 30 mg

40. In the last 30 days, have you taken Adderall or Adderall XR? Examples are pictured above.

○ No → **GO TO 48**

○ Yes

41. Which ones have you taken in the last 30 days? Indicate from the pictures above all that you have taken.

○ A ○ B ○ C ○ D

○ E ○ F ○ G ○ H

○ I ○ J ○ K

42. How old were you the first time you took Adderall?

___ ___ years old

43. In the last 30 days, what are all the ways you used Adderall? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

44. In the last 30 days, have you gotten a prescription or refill for Adderall from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○

45. In the last 30 days, have you used Adderall that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

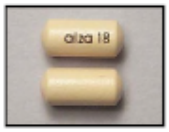
46. In the last 30 days, have you given Adderall to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

47. In the last 30 days, how many days did you…

a. Use Adderall more than prescribed? ___ ___

b. Use Adderall that belonged to someone else? ___ ___

A. 

Concerta 18 mg

B. 

Concerta 27 mg

C. 

Concerta 36 mg

D. 
Concerta 54 mg

48. In the last 30 days, have you taken Concerta? Examples are pictured above.

○ No → **GO TO 56**

○ Yes

49. Which ones have you taken in the last 30 days? Indicate from the pictures above all that you have taken.

○ A ○ B ○ C ○ D

50. How old were you the first time you took Concerta?

___ ___ years old

51. In the last 30 days, what are all the ways you used Concerta? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

52. In the last 30 days, have you gotten a prescription or refill for Concerta from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○

53. In the last 30 days, have you used Concerta that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

54. In the last 30 days, have you given Concerta to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

55. In the last 30 days, how many days did you…

a. Use Concerta more than prescribed? ___ ___

b. Use Concerta that belonged to someone else? ___ ___

A.  Daytrana 10 mg

B.  Daytrana 15 mg

C.  Daytrana 20 mg

D.  Daytrana 30 mg

56. In the last 30 days, have you used Daytrana? Examples are pictured above.

○ No → **GO TO 64**

○ Yes

57. Which ones have you used in the last 30 days? Indicate from the pictures above all that you have used.

○ A ○ B ○ C ○ D

58. How old were you the first time you used Daytrana?

___ ___ years old

59. In the last 30 days, have you used Daytrana in a way other than prescribed?

○ No

○ Yes→ How? _____

_____

60. In the last 30 days, have you gotten a prescription or refill for Daytrana from…	**NO**	**YES**
a. A psychiatrist?	○	○
b. Your doctor?	○	○

61. In the last 30 days, have you used Daytrana that belonged to…	**NO**	**YES**
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

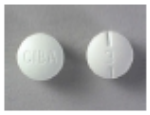
62. In the last 30 days, have you given Daytrana to…	**NO**	**YES**
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

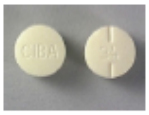
63. In the last 30 days, how many days did you…

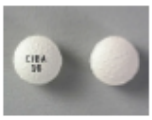
a. Use Daytrana more than prescribed? ___ ___

b. Use Daytrana that belonged to someone else? ___ ___

A.  Ritalin 5 mg

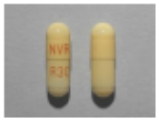
B.  Ritalin 10 mg

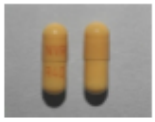
C.  Ritalin 20 mg

D.  Ritalin SR 20 mg

E.  Ritalin LA 10 mg

F.  Ritalin LA 20 mg

G.  Ritalin LA 30 mg

H.  Ritalin LA 40 mg

64. In the last 30 days, have you taken Ritalin, Ritalin SR, or Ritalin LA? Examples are pictured above.

○ No → **GO TO 72**

○ Yes

65. Which ones have you taken in the last 30 days? Indicate from the pictures above all that you have taken.

○ A ○ B ○ C ○ D

○ E ○ F ○ G ○ H

66. How old were you the first time you took Ritalin?

___ ___ years old

67. In the last 30 days, what are all the ways you used Ritalin? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

68. In the last 30 days, have you gotten a prescription or refill for Ritalin from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○

69. In the last 30 days, have you used Ritalin that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

70. In the last 30 days, have you given Ritalin to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

71. In the last 30 days, how many days did you…

a. Use Ritalin more than prescribed? ___ ___

b. Use Ritalin that belonged to someone else? ___ ___

A. Vyvanse 20 mg B. Vyvanse 30 mg C. Vyvanse 40 mg D. Vyvanse 50 mg E. Vyvanse 60 mg F. Vyvanse 70 mg

72. In the last 30 days, have you taken Vyvanse? Examples are pictured above.

○ No → **GO TO 80a**

○ Yes

73. Which ones have you taken in the last 30 days? Indicate from the pictures above all that you have taken.

○ A ○ B ○ C

○ D ○ E ○ F

74. How old were you the first time you took Vyvanse?

___ ___ years old

75. In the last 30 days, what are all the ways you used Vyvanse? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

76. In the last 30 days, have you gotten a prescription or refill for Vyvanse from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○

77. In the last 30 days, have you used Vyvanse that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you didn't know?	○	○
g. Someone not listed above?	○	○

78. In the last 30 days, have you given Vyvanse to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

79. In the last 30 days, how many days did you…

a. Use Vyvanse more than prescribed? ___ ___

b. Use Vyvanse that belonged to someone else? ___ ___

80a. In the last 30 days, have you taken Focalin, Focalin XR, Dexedrine, or Metadate?

○ No

○ Yes

80a1. Generic prescription stimulants are named by their chemical name such as Amphetamine Salts or Methylphenidate. They are not name brand medicines.

In the last 30 days, have you taken generic prescription stimulants?

○ No

○ Yes

We just asked about prescription stimulants that you used in the last 30 days. Now we want you to think about prescription stimulants that you have used in your lifetime, before the last 30 days.

Some examples of name brand prescription stimulants are Adderall, Concerta, Daytrana, Ritalin, Vyvanse, Focalin, Dexedrine, and Metadate. There are also generic prescription stimulants such as Amphetamine Salts and Methylphenidate.

80b. Not counting the last 30 days, have you ever used…			**80c. Was it ever prescribed for you?**		**80c1. Did you ever use it more than prescribed?**	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**
a. Any Adderall?	○	○→	○	○→	○	○
b. Concerta?	○	○→	○	○→	○	○
c. Daytrana?	○	○→	○	○→	○	○
d. Any Ritalin?	○	○→	○	○→	○	○
e. Vyvanse?	○	○→	○	○→	○	○
f. Any Focalin?	○	○→	○	○→	○	○
g. Dexedrine?	○	○→	○	○→	○	○
h. Any Metadate?	○	○→	○	○→	○	○
i. Generic Adderall (Amphetamine Salts)?	○	○→	○	○→	○	○
j. Generic Ritalin (Methylphenidate)?	○	○→	○	○→	○	○

80d. At what age did you first take any of the prescription stimulants listed above with or without a prescription?

___ ___ years old

○ I have never used any of these prescription stimulants. → **GO TO 88.**

80e. Not counting the last 30 days, did you ever use someone else's …

	NO	YES
a. Adderall?	○	○
b. Concerta?	○	○
c. Daytrana?	○	○
d. Ritalin?	○	○
e. Vyvanse?	○	○
f. Focalin?	○	○
g. Dexedrine?	○	○
h. Metadate?	○	○
i. Generic Adderall (Amphetamine Salts)?	○	○
j. Generic Ritalin (Methylphenidate)?	○	○

81. Have you ever taken more prescription stimulants than you did before to get the effect you wanted?

○ No

○ Yes

82. Did taking any prescription stimulants ever cause you to have problems…

	NO	YES
a. With your family?	○	○
b. With your teacher or boss?	○	○
c. With your friends?	○	○

83. Have you ever wanted to quit, tried to quit, or tried to cut down on using prescription stimulants?

○ No

○ Yes

84. In the first few hours or days of not taking prescription stimulants, have you ever felt sick because you had withdrawal symptoms?

○ No

○ Yes

85. Have you ever felt you needed to take prescription stimulants to feel okay?

○ No

○ Yes

86. Did taking prescription stimulants ever make you…	**NO**	**YES**
a. Feel high?	○	○
b. Stay awake?	○	○
c. Eat less or lose weight?	○	○
d. Focus on studying?	○	○
e. Relax, calm down, or relieve stress?	○	○
f. Feel good or be happy?	○	○
g. Feel cool?	○	○
h. Feel depressed?	○	○
i. Feel confused?	○	○
j. Feel anxious or keyed up?	○	○
k. Feel irritable?	○	○
l. Laugh or cry for no reason?	○	○
m. Feel overconfident or fearless?	○	○
n. Not remember periods of time?	○	○

87. Have you ever used prescription stimulants…	**NO**	**YES**
a. To get high?	○	○
b. Out of curiosity?	○	○
c. Because you were pressured to?	○	○
d. To stay awake?	○	○
e. To eat less or lose weight?	○	○
f. To help you study?	○	○
g. To relax?	○	○
h. Just because?	○	○
i. Because your doctor or parent told you to?	○	○
j. Because they are safer than "street drugs"?	○	○
k. To be cool or fit in?	○	○

88. How likely are you to be taking prescription stimulants one year from now?

- ○ Not at all likely
- ○ Possibly
- ○ Definitely

89. How likely are you to be taking prescription stimulants five years from now?

- ○ Not at all likely
- ○ Possibly
- ○ Definitely

90. Answer yes or no for each question. If yes, answer the column on the right.	**NO**	**YES**	**91. How old were you the last time that happened?**
a. Has anyone ever asked you to sell a prescription stimulant?	○	○ →	___ ___ years old
b. Has anyone ever asked you to give them a prescription stimulant?	○	○ →	___ ___ years old
c. Has anyone ever asked you to trade a prescription stimulant for something else?	○	○ →	___ ___ years old
d. Have you ever sold a prescription stimulant?	○	○ →	___ ___ years old
e. Have you ever given someone a prescription stimulant for free?	○	○ →	___ ___ years old
f. Have you ever traded a prescription stimulant for something else?	○	○ →	___ ___ years old
g. Have you ever stolen a prescription stimulant?	○	○ →	___ ___ years old
h. Has anyone ever stolen a prescription stimulant from you?	○	○ →	___ ___ years old
i. Have you ever been given a prescription stimulant for free?	○	○ →	___ ___ years old
j. Have you ever borrowed a prescription stimulant from someone, including your family?	○	○ →	___ ___ years old
k. Have you ever taken any prescription drugs at a party where pills were shared?	○	○ →	___ ___ years old
l. Have you ever bought a prescription stimulant from someone?	○	○ →	___ ___ years old

92. In the last 30 days, have you taken Xanax or Alprazolam? Examples are pictured above.

○ No → **GO TO 97**

○ Yes

93. How old were you the first time you took Xanax?

___ ___ years old

94. In the last 30 days, what are all the ways you used Xanax? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

95. In the last 30 days, have you gotten a prescription or refill for Xanax from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○
c. Your dentist?	○	○

96. In the last 30 days, have you used Xanax that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

97. In the last 30 days, have you taken Valium or Diazepam? Examples are pictured above.

○ No → **GO TO 102**

○ Yes

98. How old were you the first time you took Valium?

___ ___ years old

99. In the last 30 days, what are all the ways you used Valium? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

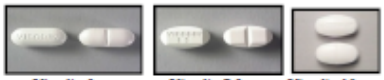
○ Other: _____

100. In the last 30 days, have you gotten a prescription or refill for Valium from…

	NO	YES
a. A psychiatrist?	○	○
b. Your doctor?	○	○
c. Your dentist?	○	○

101. In the last 30 days, have you used Valium that belonged to…

	NO	YES
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○



102. In the last 30 days, have you taken Vicodin or Hydrocodone? Examples are pictured above.

○ No → **GO TO 107**

○ Yes

103. How old were you the first time you took Vicodin?

___ ___ years old

104. In the last 30 days, what are all the ways you used Vicodin? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

105. In the last 30 days, have you gotten a prescription or refill for Vicodin from…	**NO**	**YES**
a. A psychiatrist?	○	○
b. Your doctor?	○	○
c. Your dentist?	○	○

106. In the last 30 days, have you used Vicodin that belonged to…	**NO**	**YES**
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

107. In the last 30 days, have you taken OxyContin or Oxycodone? Examples are pictured above.

○ No → **GO TO 112**

○ Yes

108. How old were you the first time you took OxyContin?

___ ___ years old

109. In the last 30 days, what are all the ways you used OxyContin? Choose all that apply.

○ By mouth

○ Snorted or sniffed

○ Smoked

○ Other: _____

110. In the last 30 days, have you gotten a prescription or refill for OxyContin from…	**NO**	**YES**
a. A psychiatrist?	○	○
b. Your doctor?	○	○
c. Your dentist?	○	○

111. In the last 30 days, have you used OxyContin that belonged to…	**NO**	**YES**
a. One of your parents?	○	○
b. Your brother or sister?	○	○
c. A different family member?	○	○
d. Someone from school?	○	○
e. Someone from work?	○	○
f. Someone you don't know?	○	○
g. Someone not listed above?	○	○

112. Answer yes or no for each question. If yes, answer the column on the right.			113. Was it prescribed for you?	
	NO	YES	NO	YES
a. Have you ever taken Ativan (Lorazepam)?	○	○→	○	○
b. Have you ever taken Klonipin (Clonazepam)?	○	○→	○	○
c. Have you ever taken Ambien?	○	○→	○	○
d. Have you ever taken Soma?	○	○→	○	○
e. Have you ever taken Percocet?	○	○→	○	○
f. Have you ever taken Codeine?	○	○→	○	○
g. Have you ever taken Lortab?	○	○→	○	○
h. Have you ever taken Darvocet?	○	○→	○	○

114. Have you ever used marijuana?

○ No → **GO TO 117**

○ Yes

115. At what age did you first use marijuana?

___ ___ years old

116. In the last 30 days, how many days did you use marijuana?

○ 0 days

○ 1 or 2 days

○ 3 to 5 days

○ 6 to 9 days

○ 10 to 19 days

○ 20 to 29 days

○ All 30 days

117. Have you ever tried…	NO	YES
a. Cocaine or crack?	○	○
b. Heroin?	○	○
c. Club drugs like ecstasy?	○	○
d. Hallucinogens like LSD or mushrooms?	○	○
e. Anabolic steroids?	○	○
f. Cough syrup/"purple drank" to get high?	○	○
g. Methamphetamine?	○	○
h. Inhalants like gasoline or paint?	○	○

118. At what age did you first take any of the drugs listed in question 117?

___ ___ years old

○ I have never used any of these drugs.

118a. In the past 12 months, how often has a parent or guardian warned you not to use marijuana?

○ Never ○ Sometimes ○ Often

119. Have you had an energy drink in the last 7 days?

○ No

○ Yes

120. Have you ever smoked a cigarette?

○ No → **GO TO 123a**

○ Yes

121. At what age did you smoke your first cigarette?

___ ___ years old

122. Do you still smoke cigarettes everyday or some days?

○ No → **GO TO 123a**

○ Yes, I currently smoke cigarettes every day.

○ Yes, I currently smoke cigarettes some days.

123. How many cigarettes do you usually smoke on the days that you smoke?

___ ___ cigarettes

123a. Does anyone in your household smoke cigarettes or cigars or use chewing tobacco, snuff, or dip?

○ No

○ Yes

123b. In the past 12 months, how often has a parent or guardian warned you not to smoke or chew tobacco?

○ Never ○ Sometimes ○ Often

123c. Have you ever used Snus, Orbs or Taboka?

○ No

○ Yes

123d. Have you ever used any other kind of smokeless tobacco?

○ No

○ Yes

124. Have you ever had a beer, a glass of wine, or any other alcoholic drink, not just a sip?

○ No → **GO TO 129h**

○ Yes

125. At what age did you first have a full alcoholic drink?

___ ___ years old

126. How many alcoholic drinks did you have in the last 7 days?

___ ___ drinks

127. In the last 30 days, on how many days did you drink alcohol?

○ 0 days

○ 1 or 2 days

○ 3 to 5 days

○ 6 to 9 days

○ 10 to 19 days

○ 20 to 29 days

○ All 30 days

128. In the last 30 days, did you drink 5 or more alcoholic drinks within a few hours?

○ No

○ Yes

128a. In the last 30 days, have you mixed alcohol and an energy drink together?

○ No

○ Yes

129. Have you ever gotten alcohol…

	NO	YES
a. From your parent?	○	○
b. From your friend's parent?	○	○
c. From your brother or sister?	○	○
d. From another relative?	○	○
e. From your friend?	○	○
f. On your own?	○	○
g. Using a fake ID?	○	○

129h. In the past 12 months, how often has a parent or guardian warned you not to use alcohol?

○ Never ○ Sometimes ○ Often

130. Have you ever gambled on the internet? Don't forget to include poker games and sports bets.

○ No

○ Yes

131. Have you ever played Second Life?

○ No

○ Yes

○ I have never heard of Second Life.

132. How big of a problem do you think prescription stimulants are with kids your age?

○ It is not a problem.

○ It is a small problem.

○ It is a moderate problem.

○ It is a big problem.

○ It is a very big problem.

133. Out of 10 teenagers, how many do you think have tried Adderall, even once?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10

134. How many close friends do you have?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 ○ more than 10

135. How many of your close friends have tried Adderall, even once?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 ○ more than 10

135a. How many of your close friends have tried marijuana, even once?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 ○ more than 10

135b. How many of your close friends smoke cigarettes or chew tobacco?

○ 0 ○ 1 ○ 2 ○ 3

○ 4 ○ 5 ○ 6 ○ 7

○ 8 ○ 9 ○ 10 ○ more than 10

136. How truthfully have you answered these questions?

○ Not at all ○ Somewhat ○ Completely

137. How should kids your age be told about prescription drugs and their effects?

_____

_____

_____

_____

138. If you ran the world, how would you stop kids from taking other people's prescription medicines?

_____

_____

_____

_____

139. Why do people use prescription stimulants without a prescription?

_____

_____

_____

_____

140. Height: _____ feet _____ inches

141. Weight: ___ ___ ___ pounds

Thank you for taking our survey.
Your information is very important to us.

Please see the interviewer to get your gift card.

Time Completed: (24 hour): ___ ___ : ___ ___

Respondent Accompanied by Parent?

○ No

○ Yes

OFFICE USE ONLY: SURVEY FINAL DISPOSITION	
VALID SURVEY	0
INVALID ZIP	1
R NOT TRUTHFUL	2
COGNITIVELY IMPAIRED	3
IN COLLEGE	4
EARLY BREAKOFF (DID NOT COMPLETE BOOK I)	5
LANGUAGE PROBLEM	6
SUSPECT SURVEY	8

APPENDIX B
SENSITIVITY ANALYSIS

Table B-1. Estimated hazards of lifetime prescription stimulant use initiation among youth 10 to 18 years of age in the N-MAPPS

Characteristic	Model 1[a] AHR (95% CI)	Model 2[b] AHR (95% CI)	Model 3[c] AHR (95% CI)	Model 4[d] AHR (95% CI)
Gender				
Female	ref	ref	ref	ref
Male	1.11 (0.92-1.34)	1.08 (0.91-1.26)	1.09 (0.93-1.27)	1.08 (0.89-1.30)
ADHD symptoms				
No	ref	ref	ref	ref
Yes	3.82 (3.00-4.85)	1.43 (1.20-1.70)	4.13 (3.46-4.92)***	4.64 (3.75-5.74)

[a] Final model with MU only and both excluded;
[b] Model with MU only coded 0 and both coded as NMU;
[c] Model with MU excluded and both coded as NMU;
[d] Model with MU coded as non-use and both excluded;
Note: ADHD – Attention Deficit Hyperactivity Disorder

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BIOGRAPHICAL SKETCH

Sonam Ongmu Lasopa received the Bachelor of Arts (Honors) in Psychology from Lady Shri Ram College in 1998, Master of Arts in Applied Psychology from the University of Delhi, South Campus in 2000 and Master of Philosophy in Clinical Psychology from the National Institute of Mental Health and Neuro Sciences (NIMHANS) in 2004. She joined the Department of Psychiatry at Sir Thutob Namgyal Memorial Hospital under the Department of Healthcare, Human Service and Family Welfare, Government of Sikkim to serve as the first Clinical Psychologist in the state of Sikkim, India. In 2011, Sonam joined the Epidemiology and Prevention Research Group, Department of Psychiatry, College of Medicine, Washington University in St. Louis as a NIH Fogarty Pre doctoral Research Fellow under the mentorship of Dr. Linda. B. Cottler. Subsequently, she moved to the Department of Epidemiology, College of Public Health and Health Professions and College of Medicine at the University of Florida in 2011 as a Pre doctoral Research Fellow under Dr. Cottler. She joined the Ph.D. program in the fall of 2012 with Dr. Cottler serving as the chair of the dissertation committee for the work on the prevalence and risk factors for non-medical use of prescription stimulants among youth in the United States. Sonam received the Ph.D. in epidemiology from the University of Florida in the fall of 2015.

Sonam's research interests include substance abuse and mental health with focus on the assessment of health needs and improving access to mental health care service delivery. She has served as both principal and co-investigator on government funded grants that assessed the impact of iodine deficiency on cognitive functioning in young children in two of four districts in Sikkim--an iodine endemic region in the Himalayas. Some of Sonam's work has focused on Nepal; she was involved in the

assessment of health needs in rural Nepal in 2010 and a post-earthquake needs assessment following the 7.8 magnitude Nepal earthquake in 2015 as part of services to the Himalayan Family Healthcare Project, a nonprofit organization based in St Louis Missouri. Sonam has worked as a member of Dr. Cottler's lab which is heading the World Health Organization (WHO) ICD-11 Field Trials for Substance Use and Related Health Conditions at the University of Florida and is part of a workgroup on a multisite project to develop a cross-cultural measure of life chaos funded by the Fogarty International Centre. Recently, Sonam has been involved in a project with the University of Florida Center for Arts in Medicine, that pertains to the development of metrics to assess the state level impact of the arts on health in Florida.

She has published papers and abstracts on assessing health needs in rural Nepal and prescription stimulant misuse, and diversion of prescription stimulant medications among youth in the United States. She has received awards for her presentations at conferences from the National Institute on Drug Abuse (NIDA) in the years 2013 to 2015 that include 1) NIDA travel award to attend the 103rd Annual meeting of the American Psychopathological Association (APPA) at New York in 2013; 2) NIDA Women & Sex/Gender Junior Investigator travel award to attend the College of Problems of Drug Dependence (CPDD), Puerto Rico in 2014 and 3) NIDA travel award to attend the International Women's and Children's Health and Gender Group Conference, Arizona in 2015. She also received a scholarship to attend the Summer Institutes of Biostatistics at the University of Washington, Seattle in July, 2015. At the University of Florida, Sonam has been recognized as one of two students among a

group of 12 faculty, staff, students and alumni who exemplify the Gator Good -- a University of Florida mission to change the world for the better through research.

Sonam has also served as member of a number of professional organizations such as: 1) State Mental Health Authority, Department of Health Care, Human Service and Family Welfare, Government of Sikkim, India in the years 2006-2008; 2) Life Associate Member of the Indian Psychiatric Society (IPS) since 2004; 3) Student Affiliate Member of the American Psychological Association (APA) in 2013; 4) Student Member of the American Public Health Association (APHA) in 2014.

She has been co-advisor to two Ph.D. students at the Manipal Institute of Medical Sciences, Sikkim, India and faculty for a Bachelor of Nursing in Psychiatry course at Sir Thutob Namgyal Memorial, Gangtok, Sikkim, India. At the University of Florida, Sonam was Teaching Assistant for the course on Principles of Epidemiology under Dr. Cindy Prins in the Department of Epidemiology, College of Public Health and Health Professions in the years 2012 and 2013. As a member of the District Mental Health Program in Sikkim, India, Sonam has trained several medical officers, nurses, police personnel, teachers and community leaders in the recognition of mental illness to improve access and delivery of mental health services. She has trained counselors appointed under the Sikkim State AIDS Control Society, Government of Sikkim on counseling skills for HIV/AIDS and Medical Officers on communication skills and counseling for adolescents under the Adolescent Reproductive School Health Program, Government of Sikkim, India.