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A Longitudinal Study of the Motivations for the Non-medical Use of Prescription Drugs in a National Sample of Young Adults

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A LONGITUDINAL STUDY OF THE MOTIVATIONS FOR THE NON-MEDICAL USE OF PRESCRIPTION DRUGS IN A NATIONAL SAMPLE OF YOUNG ADULTS

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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Dedication

I would like to dedicate this dissertation to my husband. Matthew, you have been my biggest supporter throughout this process. I would have had to endure many more all-nighters, hours spent worrying, and forgetting to celebrate the accomplishments along the way if it was not for you. Thank you for inspiring me to keep following my dreams, and reminding me I can achieve them. I love you and cannot wait to celebrate “getting those letters” and everything else with you soon!

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Abstract

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Young adults are most at-risk for the non-medical use of prescription drugs (NMUPD) and many of its associated negative consequences. Understanding this population's motivations for use can help to inform efforts to reduce NMUPD. Past research has been limited in scope, consisting primarily of cross-sectional work with college students focusing on prescription stimulants. The current study researched how motivations for NMUPD changed over young adulthood using three waves of data from a longitudinal, nationally representative sample of 14,990 19 to 24 year olds in the Monitoring the Future study cohorts collected between 1976 to 2013. Prescription stimulants, central nervous system (CNS) depressants, and opioids were investigated, along with sex and college attendance as potential moderators. Differences in NMUPD motivations for young adults who initiated NMUPD in high school versus in early young adulthood were studied. Additionally, motivation patterns of new users were investigated. Analyses indicated that both recreational and self-treatment motivations commonly were reported over time and across drug classes, with four to five popular motivations acknowledged in each class. In general, generalized estimated equations repeated measure analyses found that NMUPD motivations remained relatively stable across young adulthood, with some reductions for the

motivations of experimentation and boredom, and an increase in select self-treatment motivations. Overall, men were more likely to endorse recreational motivations, while women were more likely to endorse self-treatment motivations, though this varied somewhat by prescription drug class. Young adults not enrolled in college courses were more likely to endorse using stimulants non-medically for different reasons than their peers who were enrolled. There also were differences in motivations based on if young adults initiated NMUPD in high school compared to when they were 19/20 years old. However, motivations were fairly consistent across young adult development regardless of when NMUPD was initiated. These data suggest that efforts aimed at preventing or reducing NMUPD in young adult populations should include targets to reduce both self-treatment and recreational motivations; may need to be tailored by prescription drug class, sex, and college attendance status; could start in high school; and can be used for new and continued users across young adulthood.

A Longitudinal Study of the Motivations for the Non-medical Use of Prescription Drugs in a National Sample of Young Adults

Statement of the Problem

The non-medical use of prescription drugs (NMUPD) is a significant and growing public health concern with young adults at great risk for use, abuse, and related negative outcomes (e.g., National Institute on Drug Abuse (NIDA), 2011). According to NIDA, NMUPD occurs when individuals either use medications that were not prescribed to them, use their prescribed medications in higher quantities or manners other than prescribed, or take medications for purposes other than prescribed (e.g., to get high; NIDA, 2014). The types of prescription drugs used for non-medical purposes most often are stimulants, opioids, and central nervous system (CNS) depressants (NIDA, 2011).

As a population characterized by instability and experimentation, young adults (ages 18-25) are clearly an at-risk group for substance use (Arnett, 2005). It is during young adulthood that, on average, people report initiation of illicit substance use, including NMUPD (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013b). Young adults exhibit the greatest illicit drug use compared to all other age groups in the United States (SAMHSA, 2013b). Additionally, within the twenties is the mean age for onset of NMUPD disorders, and for seeking treatment for these disorders (Huang et al., 2006). Further, evidence suggests that adolescent decision-making is different than that of young adults, which is different from older adults, as a result of brain development (for a reviews see Spear, 2013; Steinberg, 2008). Consequently the motivations to engage in NMUPD, and the interventions targeting NMUPD, will likely vary by

age. Therefore, this study focuses on the developmental period of young adulthood, the population considered most at-risk.

NMUPD is the second most commonly reported form of illicit substance use by young adults, after marijuana (SAMHSA, 2013b). This is a growing public health concern. For example in 2014, 884,000 young adults engaged in NMUPD for the first time in the past year (Lipari et al., 2015). In full-time college students (ages 18 to 22), NMUPD initiation peaked with an average of 850 new users per day for prescription opioids alone in 2013 (Lipari, 2015). More people also have been seeking treatment for prescription opioid abuse, with rates for young adults increasing by approximately 26% from 2002 to 2010 (SAMHSA, 2011).

NMUPD has been linked with abuse and dependence (Huang et al., 2006; Hurwitz, 2005; Kroutil et al., 2006; SAMHSA, 2013b), and a variety of other negative outcomes in young adults, including mental illness (Arria et al., 2008; Bavarian et al., 2013; Janusis & Weyandt, 2010; Lo et al., 2013; McCauley et al., 2009; McCauley et al., 2010; McCauley et al., 2011; Van Eck et al., 2012; Zullig & Divin, 2012), increasing number of emergency room visits (SAMHSA, 2013a; SAMHSA, 2013b), arrest and delinquency (Drazdowski et al., 2015; Herman-Stahl et al., 2007), and more unintentional overdose deaths (Paulozzi, 2012). Additionally, young adults who engage in NMUPD are significantly more likely than their peers to use other illicit drugs and to combine prescription drugs with alcohol and other substances, which increases the risk of potentially dangerous drug interactions and their negative outcomes (Garnier et al., 2009; McCabe et al., 2006; SAMHSA, 2006). Of particular concern for young adults in collegiate settings, many students who endorsed the non-medical use of prescription stimulants and opioids also reported spending less time studying, skipping classes more often, earning lower grades (Arria et al., 2008), more frequent sexual risk behaviors (Benotsch, Koester, Luckman, Martin, &

Cejka, 2011), and more sleep problems (Clegg-Kraynok, McBean, & Montgomery-Downs, 2011). Clearly NMUPD, particularly by young adults, is a large and growing public health problem with significant consequences. Therefore, prevention is key to reducing this public health concern and its grave costs to society.

Unfortunately, the majority of individuals with NMUPD disorders never receive treatment for their drug use problems or any mental health issues (Huang et al., 2006). One way to prevent substance use is to investigate why specific groups of people use and to target interventions specifically to certain predictors. One of these factors, on the individual level, is the motivations for why young adults decide to engage in NMUPD. Although it is only one small piece of the etiology for drug use and abuse, and needs to be considered along with other factors such as molecular genetics, personality patterns, culture, etc. (see Kendler, 2012); motivations can be self-reported and are amendable to change (e.g., Miller et al., 1993).

Different theories exist to explain why individuals are motivated to abuse substances. One theory is the self-medication hypothesis initially articulated by Khantzian (1985; 1997) and Duncan (1974a; 1974b; 1975). This theory posits that individuals engage in drug abuse to treat underlying disorders or problems that have not been properly treated by other means. For others, initial use may have started appropriately, such as for pain or for sleep, but then developed into addictions based on the properties of the medications themselves (Alam et al., 2012). More common in young adults is the theory that individuals ages 18 to 25 are motivated to engage in drug use for recreational reasons, partially as the result of the instability and exploration encompassing that developmental life stage (Arnett, 2005).

Previous research supports that motivations for substance use are important predictors of use patterns and problems in young adults. For example, drinking motivations predict alcohol

consumption and alcohol-related problems in young adults and adolescents (Kuntsche et al., 2005), as well as mediate or moderate environmental and individual variables with alcohol-related outcomes in these populations (Cooper et al., 2000; Magid et al., 2007; Kuntsche et al., 2010; Kenney et al., 2014). Research investigating motivations in young adults supports that similar patterns exists for NMUPD. For example, college students who use prescription drugs recreationally are more likely to endorse using other drugs, binge drinking, and combining their prescription drugs with other substances (Advokat, Guidry, & Martino, 2008; Barrett, Darredeau, Bordy, & Pihl, 2005; McCabe, Cranford, Boyd, & Teter, 2007; McCabe, Boyd, & Teter, 2009). Although, in at least one study there were no significant differences in lifetime number of drugs used between students who used stimulants recreationally versus as a study aid (Barrett et al., 2005). Additionally, in another study, recreational users also were more likely to report using treatment services for substance use compared to users who engaged in NMUPD for self-treatment reasons. Unfortunately, the frequency for using treatment services was still small (10.3%; McCabe et al., 2009). Also, students motivated to use prescription stimulants for recreational reasons were more likely to report intranasal use than those using it as a study aid; a risk factor for drug abuse (Franke et al., 2011). Clearly, motives are important, not just in how they related to NMUPD, but also how they relate to other risk behaviors.

Since different motivations relate to different patterns of use and outcomes, prevention and intervention efforts will likely need to be targeted to most effectively address the individual's needs based on their specific motivations for use. For instance, an individual reporting addiction as a motive may need different treatment than an individual reporting recreational motives, like to have fun. Additionally, motivations have been recognized by SAMHSA as an important treatment target (Center for Substance Abuse Treatment, 2013).

The research conducted on the motivations for NMUPD in young adults to date is limited in several important ways. The majority of the work has surveyed students in higher education, with little work considering how motivations may be similar or different among young adults who are not attending college. Additionally, the preponderance of research is about the non-medical use of prescription stimulants. Very few studies have focused on other commonly abused prescription drug classes like prescription opioids and CNS depressants (National Institute on Drug Abuse (NIDA), 2011). Further, only one longitudinal study has been conducted looking at motivations over time in this population (Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Arria, 2012). However, Garnier-Dykstra and colleagues (2012) focused only on college students who non-medically used prescription stimulants. McCabe, Schulenberg, O'Malley, Patrick, and Kloska (2014) did investigate trends in the non-medical use of prescription opioids during young adulthood in a national sample, but did not include motivations in the analyses. Without longitudinal work, it is unclear exactly how motivations for NMUPD may change over time and if the same motivations continue to influence individuals as they progress developmentally.

Therefore, the current study contributes to the literature on the motivations for NMUPD in young adults by addressing some of the limitations of past work. First, the sample consisted of a nationally representative sample of high school seniors who have been followed longitudinally across three biennial follow-up waves covering ages 19-24 years. With this sample, questions about how motivations for NMUPD change over time on the national population level were answered. Also, if there are differences over time for motivations for NMUPD of young adults who attend college as compared to their peers who do not were investigated, as well as sex differences. Further, motivations for new users in the beginning of young adulthood, compared

to those who used in high school, as well as changes in NUMPD motivations for new users over time were studied. Specific motivations for the non-medical use of prescription stimulants, CNS depressants, and opioids were investigated. Thus, expanding the knowledge on less studied prescription drug classes. The strengths of the current study move the research on the topic of motivations for NMUPD forward.

Review of the Literature

Definition and Prevalence of NMUPD in Young Adults

As noted, NMUPD occurs when individuals either use medications that were not prescribed to them, use their prescribed medications in higher quantities or manners other than prescribed, or take medications for purposes other than prescribed (e.g., to get high; NIDA, 2014). Rates of NMUPD vary across prescription drug class and sample. For example, estimates from recent nationally representative databases suggest prevalence rates from 3.3% to 4.8% in young adults (SAMHSA, 2014). However, studies in U.S. college student samples report ranges from 4% to 43% (Advokat et al., 2008; Stone & Merlo, 2011). The types of prescription drugs abused most often are stimulants, CNS depressants, and opioids (NIDA, 2011).

Stimulants are commonly prescribed for Attention-Deficit/Hyperactivity Disorder (ADHD), the sleep disorder narcolepsy, and obesity (NIDA, 2011; Yu, 2012). Prescription trends suggest that the number of methylphenidate prescriptions (e.g., Concerta, Ritalin) have remained relatively stable since 1996 (NIDA, 2011), but the rates of amphetamine prescriptions (e.g., Adderall, Dexedrine) have increased (Califano, 2005); with a reported 463% increase between 1998 and 2007 alone (Belouin, Reuter, Borders-Hemphill, & Mehta, 2008). These medications typically are abused because of their ability to increase alertness and attention (Yu, 2012). As stimulants tend to increase heart rate and blood pressure, they have been associated with sudden

death (Gould et al., 2009). However, it should be noted that two large studies have provided evidence that stimulants do not increase the risk of negative cardiovascular events (Cooper et al., 2011; Habel et al., 2011). That being said, the risk of adverse cardiovascular events still exists for individuals in the abuse setting who are taking large dosages (Yu, 2012). Tolerance for these medications develops over time, resulting in individuals needing higher doses, or more potent drugs to achieve the "high," similar to other illicit drugs like cocaine and D-amphetamine (i.e., "speed"; Rosenfield, Hébert, Stanbrook, Flegel, & MacDonald, 2011).

CNS depressants often are referred to as tranquilizers or sedatives. They include barbiturates, benzodiazepines, and nonbenzodiazepine sleep medications (Yu, 2012). These medications commonly are prescribed for anxiety or sleep problems as they slow normal brain function. Specifically, barbiturates are used to treat sleep and anxiety disorders (Yu, 2012). Benzodiazepines treat anxiety disorders, insomnia, panic disorders, seizures, and muscle spasticity (Lalive, Rudolph, Luscher, & Tan, 2011). Nonbenzodiazepines hypnotics, also known as "Z-drugs," are designed to aid sleeping and be less likely to produce tolerance or dependence problems (Nutt & Stahl, 2010). Prescribing trends provide evidence that there has been a significant reduction in barbiturate prescriptions; however, this is counter-balanced with an increase in all other CNS depressant medications (Califano, 2005). These medications are abused because of their ability to reduce anxious feelings and inhibitions, similar to the reported euphoric effects of alcohol (Yu, 2012). Withdrawal symptoms include insomnia, tremors, agitation, anxiety, gastric problems and muscle spasms, which can lead to physical dependence (Lalive et al., 2011). The prevalence of lifetime use of CNS depressants among young adults for benzodiazepines only was estimated to be about 13% in 2013 (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014).

Opioids are prescribed primarily for pain relief (U.S. Food and Drug Administration, 2014). These medications also can be prescribed as antitussive or antidiarrheal agents (Yu, 2012). Trends in prescribing suggest that opioids are being used increasingly to treat chronic pain, acute and postsurgical pain, as well as for palliative care (Manchikanti, Fellows, Ailinani, & Pampati, 2010). This trend is the most noticeable in the U.S., as the U.S. alone consumes around 80% of the world's supply of opioids even though residents only make up 4.6% of the world's population (Manchikanti et al., 2010). Prescription opioids are commonly abused because of their ability to induce a feeling of euphoria. Abuse of prescription opioids also leads to tolerance for these medications (NIDA, 2011). Undesirable withdrawal symptoms, such as sleep problems, anxiety, chills, runny nose, sweating, muscle twitching, muscle aches, and agitation, also encourage users to continue to use these medications (SAMHSA, 2013c). Among young adults, the prevalence of the non-medical use of prescription opioids has remained relatively stable since 2002, with a recent decline according to the National Survey on Drug Use and Health (NSDUH), ranging from 20.8% (2013) to 25.5% (2005-06). A similar trend was reported in the Monitoring the Future (MTF) study, with prevalence rates for young adults ranging from 14.5% (2013) to 17.9% (2006; SAMHSA, 2014).

Rates of overall NMUPD are rising and young adults are at more risk than other age group. For example, in 2010 there was an average of 6,600 new NMUPD initiates per day (SAMHSA, 2013b). There were approximately 1.4 million new users of tranquilizers and sedatives. From 2002 to 2010, the rate of just opioid dependence increased from 0.4% to 0.6% of the population, resulting in an increase from 936,000 to 1,400,000 people with about one third aged 18 to 25 (SAMHSA, 2011). More people have also been seeking treatment for opioid abuse; with the rates for young adults increasing by approximately 26% from 2002 to 2010.

Additionally, the early 20s is the mean age for onset of NMUPD disorders across types of prescription medication, and the mid-20s is the mean age for seeking treatment for NMUPD disorders (Huang et al., 2006). Therefore, young adults are an important population to target for prevention and intervention.

There are a variety of reasons for why NMUPD is becoming more common, especially with young adult populations. First, there has been an increase in retail sales of prescription medications that has led to more availability (Yu, 2012). Specifically, between 1997 and 2007, the retail sales of opioids more than doubled, with 126.5 million grams sold in 2007 (Manchikanti et al., 2010). From 1991 to 2010, the total number of opioid prescriptions increased from 76 million to 210 million (NIDA, 2011). Another factor implicated in the increasing rates of NMUPD is the perception that because they are prescribed, and thus approved by Federal Drug Administration (FDA), they are "safer" than other drugs. Many studies have found that young adults believe this to be true (Arria, Caldeira, Vincent, O'Grady, & Wish, 2008; DeSantis, Webb, & Noar, 2008; Fleary, Heffer, & McKyer, 2013; Inciardi, Surratt, Kurtz, & Cicero, 2007; Mui, Sales, & Murphy, 2014). Prescription drugs, like prescription opioids, also are perceived as less stigmatizing and less illegal when compared to other illicit drugs like heroin (Inciardi et al., 2009). Further, young adults also appear to not be knowledgeable about the illegality of giving or taking prescription drugs without a doctor's permission (DeSantis et al., 2008). For these reasons, it is important to further investigate NMUPD users in this developmental period.

Negative Behaviors and Outcomes Associated with NMUPD in Young Adults

Every prescription medication comes with warnings of potential adverse side effects. Individuals engaging in NMUPD are putting themselves at-risk for experiencing these negative effects. For instance, if one takes too many prescription opioids he/she may experience loss of

muscle tone, confusion, slowness of heart rate, stupor, respiratory depression, coma, and even sudden death (SAMHSA, 2013c); while overdoses of stimulants can result in seizures, feelings of paranoia, respiratory failure, or cardiac arrest. Other adverse effects of stimulants include headache, palpitations, hypertension, arrhythmias, depression, agitation and aggressiveness (NIDA, 2011). CNS depressant abuse can produce disinhibitory and aggressive effects that result in violence and assault (Lader, 2011). The risk of experiencing these adverse effects is increased when prescription drugs are combined or used in combination with other drugs or alcohol. If CNS depressants are used with alcohol and opioids, the aforementioned problems are more severe and common (Jann, Kennedy, & Lopez, 2014; Lader, 2011). In another example, CNS depressants and alcohol are commonly also found in opioid-related deaths in the United States (Webster et al., 2011). Also, individuals who engage in NMUPD have reported medical problems such as cardiac arrhythmias and respiratory depression (Nissen, 2006), as well as cognitive deficits (Barker, Greenwood, Jackson, & Crowe, 2004; Barker, Greenwood, Jackson, & Crowe, 2004).

Further, medical emergencies related to NMUPD have increased 132% from 2004 to 2011 (SAMHSA, 2013b). Over 1.2 million emergency department (ED) visits involved the non-medical use of prescription medicines, over-the-counter drugs, or other types of pharmaceuticals in 2011, accounting for 51% of all ED visits involving illicit substances (SAMHSA, 2013a; Paulozzi, 2012). Since 2004, rates of suicide cases that involve some type of CNS depressant have increased between 105% and 148% depending on type of medication (SAMHSA, 2013a). NMUPD also is involved in the rising numbers of unintentional overdose deaths. From 1999 to 2000, unintentional overdose deaths involving opioid pain relievers alone have quadrupled, and by 2007 they outnumbered those involving heroin and cocaine combined (Paulozzi, 2012).

NMUPD also leads to abuse and dependence (Huang et al., 2006; Hurwitz, 2005; Kroutil et al., 2006; SAMHSA, 2013b) and potentially may be "gateway" drugs for other illicit substances. Approximately, 54,000 young adults met criteria for NMUPD abuse or dependence in 2012 (SAMHSA, 2013b), with individuals reporting the most abuse and dependence for stimulants in the United States, specifically amphetamines (Huang et al., 2006). In samples from a variety of studies of individuals who inject heroin, 24%-86% reported the misuse of prescription opioids first, suggesting that NMUPD may be a risk factor for future drug use (Brands, Blake, Sproule, Gourlay, & Busto, 2004; Cicero, Ellis, Surratt, & Kurtz, 2014; Cicero, Ellis, & Surratt, 2012; Grau et al., 2007; Lankenau et al., 2012; Peavy et al., 2012; Pollini et al., 2011).

Young adults who report NMUPD also report more cigarette smoking, heavy episodic drinking, marijuana use, cocaine use, hallucinogen use, inhalant use, and use of other illicit substances (Garnier et al., 2009; McCabe et al., 2006; SAMHSA, 2006). These combinations can increase their risks of negative outcomes. Indeed, more than half of ED visits for prescription drug abuse involve multiple drugs and approximately 20% also involve alcohol (SAMHSA, 2013b). Further, NMUPD drug use disorders are associated with many other Axis I and II disorders (Huang et al., 2006). This comorbidity between mental health problems and substance use puts NMUPD users at even greater risk for negative outcomes. For instance, individuals with comorbid mental health symptoms who engage in NMUPD are at increased risk of NMUPD overdoses (Braden et al., 2010; Porucznik, Johnson, Sauer, Crook, & Rolfs, 2011).

Within the general community, NMUPD has become a public safety threat, with increases in property and violent crime associated with prescription drug diversion (Inciardi et al., 2007). NMUPD is a predictor for an increased risk of future delinquency in youth already

involved in the justice system (Drazdowski, Jäggi, Borre, & Kliewer, 2015), although other known risk factors (e.g., previous delinquency, violence exposure) put youth more at risk than NMUPD alone. Young adults specifically, from a national sample, also have increased arrest rates if they report the non-medical use of prescription stimulants (Herman-Stahl, Krebs, Kroutil, & Heller, 2007).

Of particular concern for young adults in collegiate settings, many students who endorse the non-medical use of prescription stimulants and opioids spent less time studying, skipped classes more often, and earned lower grades (Arria et al., 2008). Additionally, NMUPD has been associated with more frequent sexual risk behaviors in college students (Benotsch, Koester, Luckman, Martin, & Cejka, 2011). They also report more sleep problems (Clegg-Kraynok, McBean, & Montgomery-Downs, 2011). Further, depression has been associated with NMUPD in college students (Bavarian, Flay, & Smit, 2014; McCauley et al., 2011; Zullig & Divin, 2012). Similar results have been found for the relation between ADHD symptoms and the non-medical use of prescription stimulants in college students (Arria et al., 2011; Janusis & Weyandt, 2010; Van Eck et al., 2012). There is a wealth of evidence that NMUPD, particularly by young adults, is a large and growing public health problem with significant consequences.

Developmental Stage of Young Adulthood

The international chronological age for defining adulthood is 18 years old (Cohen, Stromquist, Behrman, & Lloyd, 2006). However, in today's society in the United States the traditional transitional markers that have defined adulthood, such as marriage and having children, are no longer the most prominent markers characterizing young adults (e.g., Settersten, Furstenberg, & Rumbaut, 2005). Scholars are recognizing that there is a separate developmental period between adolescence and adulthood. This new transitional time in development is

occurring across cultures in industrialized nations. For example, in Japan, “freeters” are individuals aged 15 to 34 who typically are working part-time, temporary positions and are not enrolled in higher education (Newman, 2008). In the United States the popular press has referred to individuals in this developmental stage as “twixters” (Grossman, 2005), or used the term “adultscence” (Gordon & Shaffer, 2004). These terms highlight a more recently recognized in-between developmental stage of young adulthood where more self-exploration occurs after adolescence and the stability and maturity of adulthood is not yet achieved. During this period some of the following social role transitions are expected to occur: leaving home, gaining financial independence, gaining independence in decision making, making a partnership commitment, renegotiating relationships with parents, starting a career, becoming a parent, engaging with the community and the wider social world (Hutchison, 2015).

More research has been conducted about the development of the brain during this life stage and have found that brain development does not cease in adolescence (see Casey & Jones, 2010; Crews, He, & Hodge, 2007; Gladwin, Figner, Crone, & Wiers, 2011; Spear, 2013; Steinberg, 2008 for reviews). Rather, researchers have found that in young adulthood the brain is still developing and a neurologic pruning process occurs which leads to more focused and efficient processing in the later adult years. Gray and white matter continue to increase into the early 20s. Additionally, brain areas responsible for emotions (e.g., amygdala) become fully developed by mid-adolescence while the frontal lobes are still in development. Research has now found evidence that the frontal lobes do not reach maturity until approximately age 25. As the frontal lobes are responsible for long-term thinking, it is more common to see emotion-driven decision-making as compared to methodical decision-making during this stage. Accordingly, there are increases in risk-taking with young adults being less likely to regard possible

consequences. Further, there is an increased susceptibility during this stage to the rewarding properties of substances as compared to older adults.

Which biological ages define young adulthood is debated by developmental psychologists and scholars. For example, suggested age ranges have included 17 to 45 (Levinson, 1986), 18 to 34 (Settersten et al., 2005), and 22 to 34 (Ashford & LeCroy, 2010). However, some theorists have found these age ranges too broadly defined. Specifically, Arnett (2000) states, “It makes little sense to lump late teens, twenties, and thirties together and call the entire period young adulthood. The period from ages 18 to 25 could hardly be more distinct from the thirties.” (p. 479).

Theory of emerging adulthood. Jeffery Arnett has specifically defined the term “emerging adulthood,” to capture the distinct development stage between adolescence and adulthood that occurs between ages 18 to 25 in industrialized societies (Arnett, 2000). This age stage is based on research suggesting that the majority of young adults ages 18 to 25 do not believe that they have reached adulthood yet; but by age 30 most people believe they have reached adulthood. The central focus of emerging adulthood is a prolonged identity exploration (Arnett, 2007; Arnett, 2006). Specifically, during this stage young adults are exploring social and economic roles by experimenting with new experiences related to love, work, financial responsibilities, and educational interests, without committing to a particular long-term plan. Arnett conceptualizes this as a period of unstructured time where emerging adults are not yet attached to social institutions (Arnett, 2007). For instance, young adults in this stage are moving out from their families of origin and have not formed new families of their own yet. The mid-20s is when residential instability and mobility are typically at their highest (Rindfuss, Cooksey, &

Sutterlin, 1999). Additionally, many are moving out from prior educational systems into new educational or employment sectors.

As a result of all these changes, this developmental period is marked by experimentation and instability. Therefore, it is not surprising that it also is during the ages of 18 to 25 that we find the most reported illicit drug use (SAMHSA, 2013b). Further, between the ages of 18 to 25 are when many individuals are at-risk for developing mental health disorders. Beyond being at the most risk for NMUPD abuse and dependence (Huang et al., 2006), young adults also are at-risk for the onset of many other disorders such as depression, generalized anxiety, schizophrenia, and bi-polar disorder to name a few (Kessler et al., 2005).

Theories of Motivations for Substance Abuse in Young Adults

There are many theoretical frameworks for the motivations behind initial drug use and continuing drug abuse. One theory for why individuals are motivated to use and abuse drugs is the psychodynamic and behaviorally self-medication hypothesis initially articulated by Khantzian (1985; 1997) and Duncan (1974a; 1974b; 1975). This theory posits that individuals engage in drug abuse to treat underlying disorders or problems that have not been properly treated by other means. Self-medication occurs because individuals self-diagnosis their symptoms or problems and seek means to alleviate these symptoms. As a result, individuals chose to use or abuse certain substances based on their specific symptoms. For example, an individual who has self-diagnosed attention problems may self-medicate with prescription stimulants, while a person with anxiety and sleep problems would instead self-medicate with CNS depressants. Further, this theory highlights the negative reinforcement experienced by drug users. Users who self-medicate are motivated to reduce their symptoms and negative affect, as well as to avoid withdrawal symptoms. These experiences reinforce future use of drugs. This

theory is supported by findings that one factor that differentiates recreational users from problematic users is the presence of negative reinforcement. If the presence of negative reinforcement is reported, individuals are more likely to be problematic users (Nicholson, Duncan, & White, 2002). The self-medication hypothesis would support motivations where individuals are using prescription drugs non-medically as they were intended (e.g., stimulants to improve concentration). Additionally, this theory would support motivations that suggest escaping stressors and problems (e.g., to get away from my problems or troubles).

However, the self-medication hypothesis does not appear to account for all young adults who use prescription drugs non-medically. For others, initial prescription drug use may have started appropriately, such as with a prescription for pain or for sleep from a doctor, but then developed into addictions based on the properties of the medications themselves. For example, studies have shown that patients are more likely to become long-term opioid users if they were prescribed with an opioid within seven days of surgery, compared with those who received no opioid prescription (Alam et al., 2012). As all of the prescription drugs that are commonly abused have some addictive properties with the development of tolerance and associated withdrawal symptoms, as noted earlier, this theory of substance use and abuse also may be occurring and needs to be considered as a potential motivation (e.g., because I am "hooked"—I feel I have to have them).

Additionally, more common in young adults is the theory that individuals ages 18 to 25 engage in more drug use for recreational reasons as part of the self-exploration process and instability experienced during this this developmental period (Arnett, 2005). Specifically Arnett (2005) suggests that emerging adults use substances because they are curious about the experiences of using various substances and want to have a wide range of experiences before

they settle into adult life. Also, since constructing a stable identity may be confusing and difficult, emerging adults may use substances to relieve these negative feelings stemming from identity confusion. Further, as emerging adulthood is a time of instability; young adults may be more likely to use substances because of the stress and negative affect that are associated with disruptions in life (e.g., new residences, romantic partners, educational and vocational settings).

Young adults also have the ability to make more independent decisions, and are frequently transitioning out of their parents' house which may lead to engaging in more deviant behaviors including substance use. Substance use also may be explained by the feeling of in-between experienced by many young adults; that they are no longer adolescents but not yet adults. Therefore, young adults have the ability to make independent choices about substance use that their caregivers previously had decided against, however, they do not yet feel the need to be as responsible in their drug use as they believe adults should act. This part of Arnett's theory also is supported by research on brain development suggesting that young adults do not yet have the cognitive capacity to make methodical decisions over emotion-driven decisions (e.g., Steinberg, 2008).

Finally, Arnett (2005) proposes that emerging adulthood sets individuals up for believing that they have the opportunity to make dramatic changes in their lives and optimism is very common. As a result of this optimism people in this developmental stage may not fully consider the negative consequences that may result from substance use. All of these potential explanations may relate to different motivations to engage in NMUPD, especially recreational motives (e.g., to experiment—to see what it's like, to feel good or get high, to seek deeper insights and understanding, to have a good time with my friends, to fit in with a group I like, because of boredom/nothing else to do, etc.).

For the purposes of this study the focus point for prevention and intervention will be on the individual level and one's reported motives to use. Although it is only one small piece of the etiology for drug abuse and needs to be considered along with other factors such as molecular genetics, personality patterns, culture, etc. (see Kendler, 2012), motivations are a factor that can be self-reported and are amendable to change (e.g., Miller, Benefield, & Tonigan, 1993). Since different motivations relate to different theories of drug abuse, prevention and intervention efforts will likely need to be targeted to most effectively address the individual's needs based on their specific motivations for use. For instance, an individual reporting addiction as a motive may need different treatment than an individual reporting recreational motives. Motivations have been recognized by SAMHSA as an importance treatment target. This is highlighted in their publication, "Enhancing Motivation for Change in Substance Abuse Treatment," a 260-page document that is part of their Treatment Improvement Protocol (TIP) Series (Center for Substance Abuse Treatment, 2013).

Furthermore, given the theory of instability in this life stage (Arnett, 2005), there may be changes in the patterns of motivations reported by young adults across this period. Research is needed on this topic to help determine where to target interventions to make them developmentally appropriate. Hopefully research in this area will help reduce the findings that the majority of individuals with NMUPD disorders never received treatment for their drug use problems or any mental health issues (Huang et al., 2006).

Research on Motivations for NMUPD in Young Adults

With the high rates of use and the associated negative outcomes from use, research on the motivations for NMUPD in young adults has been a burgeoning area. The following section describes the research on motivations for NMUPD in exclusively young adults to date. The

description of the studies is organized by class of prescription medication investigated as defined by NIDA: stimulants, opioids, and CNS depressants so summaries of the general trends in motivations can be described. Then, research that included young adults not currently enrolled in college will be discussed to address any differences found in this population. If sex differences have been reported in any studies they also are presented. Finally, results that include work outside of the United States, but still conducted in industrialized nations, will be reviewed as a comparison for motives across cultures. After reviewing the results of the separate drug classes research that has investigated motives across drug classes (i.e., NMUPD in general) will be discussed to acknowledge general trends in NMUPD.

Overall, the majority of the studies investigated the motivations to use stimulants non-medically; followed by studies investigating prescription opioids and CNS depressants, respectively, either as a separate study or along with investigating the motives for the non-medical use of stimulant mediations. Across class of prescription medication, the majority of the research was conducted in the United States with college students and was cross-sectional.

Motivations for the non-medical use of stimulants. Thirty-five studies have investigated the motivations for the non-medical use of prescription stimulants in young adult populations exclusively. Of these articles, 31 were conducted in the United States and four were conducted outside of the United States. Additionally, all articles included college student samples, while two included other young adult populations. Sample sizes ranged from 50 to 9,161 young adults.

Stimulant motivation results in United States samples. Overall, in all but three studies, the common motivations for stimulant non-medical use were to use the medications for academic reasons and for reason the medications are clinically prescribed (e.g., to improve concentration;

Advokat et al., 2008; Barrett et al., 2005; Bavarian et al., 2013; Clegg-Kraynok et al., 2011; DeSantis et al., 2008; Dupont, Coleman, Bucher, & Wilford, 2008; Dussault & Weyandt, 2013; Franke et al., 2011; Gallucci, Usdan, Martin, & Bolland, 2014; Garnier-Dykstra et al., 2012; Ghandour, El Sayed, & Martins, 2012; Hall, Irwin, Bowman, Frankenberger, & Jewett, 2005; Hartung et al., 2013; Herman et al., 2011; Holloway & Bennett, 2012; Judson & Langdon, 2009; Lookatch, Dunne, & Katz, 2012; Lord et al., 2009; Low & Gendaszek, 2002; McCabe et al., 2009; McNiel et al., 2011; Peterkin, Crone, Sheridan, & Wise, 2011; Prudhomme White, Becker-Blease, & Grace-Bishop, 2006; Rabiner, Anastopoulos, Costello, Hoyle, McCabe, & Swartzwelder, 2009a; Rabiner, Anastopoulos, Costello, Hoyle, McCabe, & Swartzwelder, 2009b; Rozenbroek & Rothstein, 2011; Rozenbroek & Rothstein, 2011; Stone & Merlo, 2011; Teter, McCabe, Cranford, Boyd, & Guthrie, 2005; Teter, McCabe, LaGrange, Cranford, & Boyd, 2006; Tuttle, Scheurich, & Ranseen, 2010; Upadhyay et al., 2010; Weyandt et al., 2009).

Even though the main motivations were to use prescription stimulants for academic reasons or for the drugs prescribed effects, recreational motives also were common. For example, across studies the motivation to get high was reported in 2% to 43% when it was recorded in the sample (Gallucci et al., 2014; Teter et al., 2005). Additionally, there were some unique motivations that were mentioned. These included, “I ran out of my own prescription” (Gallucci et al., 2014), “prevent the academic advantage of others” (Gallucci et al., 2014), aphrodisiac/enhance sexual performance (Lookatch et al., 2012; Lord, Brevard, & Budman, 2011), increase energy to exercise/enhance athletic performance (Judson & Langdon, 2009; Lookatch et al., 2012; Low & Gendaszek, 2002), “makes me feel more confident and social” (Clegg-Kraynok et al., 2011) and “safer than street drugs” (Ghandour et al., 2012; McCabe et al., 2007).

Other trends in stimulant motivation results. There were three studies that listed non-academic motivations. However, all of these studies focused only on specific motivations not related to stimulant medications intended uses. For example, Upadhyaya and colleagues (2005) investigated 334 college students at one university who used prescription stimulants non-medically to get high, which occurred in 25% of students who reported having a prescription for stimulants. The other two studies focused on the motivation to use stimulant medications non-medically for weight loss, with prevalence rates of this motivation ranging from 4% to 12% in two samples of approximately 700 undergraduate students at the same university (Jeffers, Benotsch, & Koester, 2013; Jeffers & Benotsch, 2014). No sex differences were reported. In the one sample, the authors found that weight loss motivation was related to a variety of other problems including more body image concerns, more use of illicit drugs, more eating disorder symptoms, including using vomiting and other pills (e.g., laxatives, diet pills) for weight control (Jeffers & Benotsch, 2014). All of these studies are limited by the fact that they only assessed one potential motivation for NMUPD and only investigated students at one university per sample. Additionally, all were cross-sectional.

Evidence that motivations change over time in young adulthood. The most comprehensive study of motivations across this developmental period was conducted by Garnier-Dykstra and colleagues (2012). In the only longitudinal study, the authors investigated the non-medical use of prescription stimulants across four years in a sample of 1,253 undergraduate students in a large, public university in the mid-Atlantic region (ages 17-19 years) with in-person interviews. Motivations were assessed by recording the participants' verbatim responses to the question, "What were the reasons you had for using <prescription stimulant>?" Answers were then coded into one of five categories. The results found that across all time points, using

prescription stimulants to “improve focus/study/work” remained the most reported motive for non-medical use and increased over time. Additionally, curiosity/experimentation motivations significantly decreased over time. There were no significant changes in the following motives: to get high, to stay awake to party, and other. However, it should be noted that this study only included students at one university.

Studies including young adults not in higher education. The only study that did not exclusively investigate a student population in the United States found that motivations to use stimulants non-medically in young adults are similar to those in college. In a sample of 3,307 young adults (ages 18 to 25) recruited from the Harris Poll Online panel, the most frequently reported motive was, “to be more productive” (Upadhyaya et al., 2010). Across different formulas of stimulant medications, young adults also reported using stimulants non-medically for recreational reasons (22%-43%). These results highlight that recreational motives for use are important in the young adult population in general as well, and not just for young adults in collegiate settings. Additionally, there may not be many differences for why individuals are motivated to engage in NMUPD based on whether they attend college or not. Unfortunately differences in motivations based on whether individuals were enrolled in college or not was not tested in this study. Therefore, definitive conclusions about the lack or presence of differences in motivations between these populations cannot be made.

Stimulant motivation results in non-American samples. In studies conducted outside the United States, Barrett and colleagues (2005) surveyed the motives of 50 Canadian students who solely reported the non-medical use of stimulant medication methylphenidate. The results indicated that out of the two options provided, most students (70%) categorized their non-medical use as recreational, while the rest reported using methylphenidate as a study aid. The co-

occurrence of these motives was not assessed. Franke and colleagues (2011) sampled 1,547 pupils (i.e., students in grammar school, public vocational schools, or young adults preparing for university or obtaining a job) and university students in Germany. However, the only motivation assessed was using stimulant medications for solely cognitive enhancement purposes. Overall, rates were low in the sample (0.1-1.3% over time), with males reporting more non-medical use of prescription stimulants for cognitive enhancement as compared to females for pupils. No sex differences were found in the university student sample. Ghandour and colleagues (2012) assessed the non-medical motives of 570 Lebanese students, and found that most university students sampled reported using stimulant medications for their prescribed purposes and for academic reasons (e.g., to concentrate, increase alertness, help study). Unlike most of the other studies, but similar to the results of Canadian students (Barrett et al., 2005), a sample of 1,517 undergraduate and postgraduate students in the United Kingdom reported using stimulants non-medically mostly for pleasure, to lose weight, or "to play sport," with academic motives for use being the least endorsed (Holloway & Bennett, 2012).

Summary. Based on the large amount of research conducted to date in different universities it can be concluded that most young adults in collegiate settings are motivated to use prescription stimulants non-medically to experience the intended effects of stimulant medications. Additionally, it appears that recreational motives also are common, though prevalence rates are more varied across samples. Further, conclusions about the motivations to engage in the non-medical use of prescription stimulants for young adults not attending college is questionable given that only two studies have included participants from this population, and the two studies were from different countries, making conclusions based on similarities or differences difficult as culture may account for some of the differences. There do appear to be

differences in motivations based on country, with some young adults outside of the United States reporting more recreational motives. Given the limited studies conducted outside of the United States this conclusion should be made with caution.

Motivations for the non-medical use of opioids. Seven studies have investigated the motivations for the non-medical use of prescription opioids in entirely young adult samples. Of these articles, five were conducted in the United States, two out of the United States, and all were in college student samples. Relieving pain was a popularly reported motivation, although it was not consistently the most frequently reported motivation. Relieving pain was typically followed by reports of more recreational motives like to have fun, get high, and curiosity.

Opioid motivation results in United States samples. Lord and colleagues (2011) focused solely on the motivations for the misuse of opioid prescriptions in a sample of 527 American collegiate students in four-year institutions using the social media site Facebook to recruit participants. The authors found that the most common motivations were not necessarily related to the intended uses of the medication, as most students reported using prescription opioids to relax, followed by have fun. Only 19% of students reported using prescription opioids to manage chronic pain, and improving sleep was not listed as a motive in the initial checklist, but was provided by at least one participant in the additional write in category. When sex differences of motivations were investigated, males were more likely to report using opioid prescriptions for the non-medical uses of getting high and having fun as compared to females. Females on the other hand were more likely to report being motivated to misuse opioids to cope with depression or anxiety, to help with chronic pain, and to manage weight. Finally, students who had begun misusing prescription opioids before college reported the motives “to get high” and “to have fun” more frequently than those students who began misusing in college. A methodological strength

of this study was that included students from a variety of colleges. However, as compared to other research the smaller sample size suggests that selection bias may be more prominent in this sample compared to others, especially because no incentive was offered for participation in the study.

Some of the same authors investigated motives using similar questions in a subset of young adults; 950 PharmD students in a college of pharmacy in the United States training to become pharmacists (Lord et al., 2009). The results suggested that similar to the findings of American college students in general, students primarily used prescription opioids non-medically to have fun and relax. Although in this sample, more students did report using prescription opioids to manage chronic pain (23%). Further, the motivation to improve sleep was specifically queried in this study with 20% of the sample reporting using opioids for this purpose. In regards to sex differences, men were more likely to use opioids non-medically to get high.

McCabe and colleagues (2009) investigated motivations for opioid use as well and found within their lifetime most undergraduates from their sample of 3,639 students attending a large public research university used prescription opioids for self-treatment motives only. This was followed by a combination of self-treatment and recreation motives (mixed subtype) and then recreational only motives. However, there was a slightly different pattern for past year prescription opioid non-medical use. For participants reporting past year non-medical use, more students reporting mixed motivations (self-treatment and recreational), followed by self-treatment only motives, with the least number of students endorsing recreational only motives again. There were sex differences in motivational subtypes. More females reported self-treatment motives for prescription opioids, while males endorsed more recreational and mixed motivation subtypes. Further, students from the recreational subtype were more likely to endorse binge

drinking, alcohol abuse, other illicit drug use, and drug abuse. However, more students from the recreational subtype also reported using treatment services for substance use the most of all subtypes, although the frequency was still low (10.3%). It is important to note that students in the self-treatment subtype did not significantly differ than students who endorsed no non-medical use of prescription opioids on these measures.

Within the same sample, research that focused more specifically on the motivations for the non-medical use of prescription opioids was conducted analyzing the responses from 4,580 undergraduate students completing the online survey (McCabe et al., 2007). The main motivation reported was to use the drug non-medically as clinically intended, to relieve pain. The next two most common motives were: to get high and because of experimentation. To help with sleep was the fourth most common motive reported. Type of motivation was found to be important in relation to other substance use and substance-related problems, such that students who reported motivations other than to relieve pain were more likely to report binge drinking, alcohol problems, using illicit drugs, and experiencing more drug use related problems, compared to non-medical users using for pain relief and non-users. Students who reported misusing prescription opioids for pain were more likely than non-users to endorse using marijuana or other illicit drugs only; no other substance abuse behaviors were significantly different. The authors again found sex differences for some motivations. Males were more likely than females to report using prescription opioids to get high, for experimentation, because they believed they were safer than street drugs, and to counteract the effects of other drugs. There were no sex differences for the motivations of pain relief, to help sleep, and to decrease anxiety.

Using a smaller sample, Rozenbroek and Rothstein (2011) assessed the motivations for the non-medical use of prescription opioids of 413 undergraduate college students using an in

class survey. The authors found that most students reported using the medications to “feel good,” followed by curiosity, and other motivations. No participants reported using them to improve their sleep. Unfortunately, the motive to help manage pain was not directly assessed, a prominent weakness in this study.

Opioid motivation results in non-American samples. The research study conducted in Lebanon also investigated the motivations for prescription opioid non-medical use (Ghandour et al., 2012), which was the most commonly reported prescription drug used non-medically in the sample. The main motives reported included using the drug as it was clinically intended (i.e., relieves pain, helps sleep), followed by decreasing anxiety and experimentation. The study conducted in the United Kingdom found similar results, with an overwhelming majority of students being motivated to use prescription opioids non-medically to relieve pain (Holloway & Bennett, 2012), although sleep was not assessed. Opioids also were the most commonly reported prescription drug used non-medically in this sample as well.

Summary. Strong conclusions about the motivations for the non-medical use of prescription opioids is difficult to determine at this time given the limited amount of research conducted thus far. Further, two of the studies with the largest sample sizes came from the same sample of undergraduate students limiting the generalizability of their findings. The results therefore are equivocal for whether young adults are motivated to use prescription opioids non-medical to treat pain or for more recreational purposes in the United States, especially considering that not all of the studies assessed pain relief as a possible motivation for use. However, there is an emerging trend that more college students in the United States use prescription opioids recreationally as compared to students in other countries. Further, as no studies included young adults not attending college the motivations for the non-medical use of

prescription opioids in this population is yet to be determined. On the other hand, there were consistent sex differences noted, primarily that men were more likely to report using prescription opioids non-medically for recreational reasons compared to women.

Motivations for the non-medical use of CNS depressants. Five studies have investigated the motivations for the non-medical use of prescription CNS depressants in young adult populations along with the other prescription medications described above. Of these articles, three were conducted in the United States, two outside of the United States, and all were in student samples. In three studies to use the drugs as clinically intended (e.g., to sleep, to relieve anxiety) was the most reported motivation. While in one study the general motive "makes me feel good" was most commonly reported (Rozenbroek & Rothstein, 2011) and to get high was the most reported in another (Stone & Merlo, 2011). Across studies to get high and curiosity motives were the next most frequently reported motivations.

CNS depressant motivation results in United States samples. One study of 413 American college students investigated CNS depressants as a whole group of medications. Using an in-class survey researchers found that the majority of students used CNS depressants to feel good, followed by curiosity, and then to perform better at school (Rozenbroek & Rothstein, 2011). Stone and Merlo (2011) on the other hand focused on benzodiazepines specifically. In their sample of 383 mainly undergraduate university students most used benzodiazepines specifically to get high or "party," followed by to relax or "zone out." A large number of students also endorsed "other" reasons which were not detailed in the study. Both of these studies had small samples of the total college student population (approximately 12,000 to 32,000 students, respectively), suggesting that selection bias may have occurred in these studies.

McCabe and colleagues (2009), discussed above, divided CNS depressants into sleeping and sedative/anxiety medications. Within the motivation subtypes, most students reported using sleeping medications for self-treatment only, across lifetime and past-year use. Though there were differences in prevalence rates based on sex for motivational subtypes for sleeping medication the differences were small (i.e., largest difference for self-treatment subtype, 2.9% female:2.1% male). For sedatives/anxiety medications and both lifetime and past-year use, the most popular subtype was recreational only, followed by the mixed subtype, with the least amount of students endorsing the self-treatment only subtype. The differences in motivation subtype based on sex were more prominent, with more females categorized in the self-treatment only subtype, and more males in the recreational only and mixed subtype.

CNS depressant motivation results in non-American samples. Two studies investigated the non-medical use of CNS depressants in samples outside of the United States. Along with the other prescription medications described above, Ghandour and colleagues (2012) researched the motivations for CNS depressants in Lebanese students. These authors categorized anxiety and sleeping medications separately. In line with their other results, the authors found that students from their sample were motivated to use both sleeping and anxiety medications primarily for their clinically intended purposes, though there were still many students who endorsed using CNS depressants for other reasons like to get high or counteract the effects of other drugs. In the sample of university students from the United Kingdom, a similar categorization of CNS depressants was made, but the two categories were labeled sleeping aids and sedatives (Holloway & Bennett, 2012). The main motives for non-medical use also were to use the medications as clinically intended, but the second most commonly reported reason for both was

to get high. However, this motive was much less frequently endorsed for sleeping aids (6%) as compared to sedatives (27%).

Summary. Similar to the work on prescription opioids, positive assumptions about the motivations for the non-medical use of prescription CNS depressants is difficult to determine given the limited literature on this topic to date. However, there is an emerging trend that CNS depressants used for sleeping may be more likely to be used as clinically intended compared to sedative and anxiety medications. Again, as no research was conducted on non-student populations the motives for these young adults to use is not currently known. In terms of sex differences, there is emerging evidence that females may be more likely to use CNS depressants non-medically for reasons they are prescribed, while males may be more likely to use them for recreational reasons.

Motivation findings across prescription drug classes. Two studies looked at motivations across prescription drug classes to assess NUMPD in general, not limited by prescription drug class. Both of these studies were discussed above and were cross-sectional research using college students as participants. One study was conducted in the United States and focused on sex differences in the motivations for NMUPD in general (McCabe et al., 2009). The other study was conducted in Lebanon and investigated if motivations across prescription drug class for NMUPD differed based on where young adults got their prescriptions (Ghandour et al., 2012).

McCabe and colleagues (2009) found sex differences across prescription drug classes in their sample of American college students. For instance, women reported more self-treatment motives as compared to men, while men reported more recreational and mixed (self-treatment and recreational) motives. Ghandour and colleagues (2012) found that type of motivation varied

not only based on prescription medication class, but also based on other variables. For example, Lebanese students who reported obtaining sleeping, anxiety, and pain medications from their parents in general were using them for their intended purpose. Similarly, students who obtained their stimulant medications from a doctor or pharmacist reported using the medication non-medically for its intended purpose only, though it was not how the doctor prescribed the medication. However, students who obtained stimulants from friends and family members other than parents were more likely to report using the medication for other unintended purposes (e.g., to get high).

As these were the only two studies to research the motivations for NMUPD across multiple prescription classes and they occurred in different cultures and investigated different variables it is difficult to draw overall conclusions from their findings. Still, though varied, these results suggest that motivations for NMUPD are influenced by different factors. Also, the findings are a reminder that context matters when researching motivations and needs to be considered when interpreting results from any study.

Difficulties in reviewing NMUPD motivation results. There are many reasons why evaluating research on NMUPD as a whole is difficult. First, the definition of "non-medical" use varies between studies. Some definitions only include illegal act of using a medication without a prescription, or researchers remove participants from their data set who report having a prescription for medications (e.g., DeSantis et al., 2008; Dussault & Weyandt, 2013; Franke et al., 2011; Jeffers & Benotsch, 2014). Eliminating these participants is concerning because they may still be using their own prescription non-medically. Indeed, studies that have included and analyzed data of young adults who do have prescriptions for medications find that participants are using their medications non-medically. For example, in terms of stimulant medications

prevalence rates of young adults using their own prescription non-medically range from 2% to 47% in studies discussed. Further, differences in motivations were noted in at least two of these studies. Results found that individuals who misuse others' prescriptions reported more recreational motives than those who use their own medications non-medically (Gallucci et al., 2014), or used prescriptions less "to control ADHD symptoms" (Hartung et al., 2013). These findings suggest that both groups of young adults need to be considered when investigating NMUPD and studies that have not included students who have a prescription for medications may be underreporting the prevalence of NMUPD. Further, only studies with prescription stimulants have specifically looked at the differences between these populations. It is not clear if similar findings exist for prescription opioid and CNS depressant non-medical users.

Other studies have included participants who have a prescription but ask about tolerance (e.g., use for longer periods than prescribe; Ghandour et al., 2012) and motives in their "non-medical" definition (e.g., for reasons other than indicated by a prescription; Lord et al., 2009). Additionally, one researcher only included the motive "to get high" to infer NMUPD (Upadhyaya et al., 2005). Other researchers do not state that they defined NMUPD, thereby leaving the definition of "non-medical" use to the discretion of the participants (e.g., Rozenbroek & Rothstein, 2011; Stone & Merlo, 2011; Tuttle et al., 2010; Weyandt et al., 2009). This lack of consistency across studies makes comparisons difficult and drawing conclusions complicated.

Another inconsistency in the research is that different medications were grouped and termed differently across studies (e.g., sedative/anxiety vs. sleeping pills, etc.). In particular, CNS depressants had the most varied definition across studies. This is probably because CNS depressants cover a variety of medications. Only one study grouped CNS depressants together into a single category (Rozenbroek & Rothstein, 2011). However, using the broad category of

CNS depressants may not allow researchers to find differences in motivations between the categories within that class of medication. For instance, McCabe and colleagues (2009) found differences between different motivational subtypes. The self-treatment subtype was the most prevalent for the non-medical use of sleeping medications, where the recreational subtype was most prevalent for sedative/anxiety medications. University students in the United Kingdom also endorsed using sedatives more to get high as compared to sleeping aids, as they were defined in the study (Holloway & Bennett, 2012). Therefore, results that group different types of CNS depressants together may be missing some of the subtleties between the different types of medications.

Motivations also were not consistently assessed across studies. Some studies included very broad motivations (e.g., "makes me feel good," Rozenbroek & Rothstein, 2011). This makes it difficult to pinpoint non-medical users real motivation as it is unclear to determine if they were using the drug as it was intended for example, or for other more recreational reasons. Most other studies had more specific motivations listed, and found differences in the more nuanced responses. Other studies combined motivations like "to help me study/perform better at school" (Rozenbroek & Rothstein, 2011). These motives are double-barreled, and there may be students who are non-medically using prescription drugs for self-treatment reasons (e.g., using opioids to treat chronic pain) and therefore, it may help them perform better at school which is different than using that medication to help them study. The lack of specificity may make findings difficult to interpret and may not be as helpful in developing prevention or intervention efforts.

Two studies used a specific scale to assess the motivations to use prescription drugs non-medically. Dussault and Weyandt (2013) used the Stimulant Survey Questionnaire (SSQ),

developed by Weyandt and colleagues (2009) for the study of the non-medical use of prescription stimulant medications. Within this scale, participants were able to rate their likeliness of different motivations for the non-medical use of stimulants on a scale of 1 (*never*) to 5 (*always*). The reliability for this factor was the strongest of all the scales factors though (α = .92). However, within the scoring of this scale motivations are not specifically highlighted, but are grouped together in a factor with other questions about context (e.g., use at parties), administration (e.g., "I have snorted prescription stimulants"), beliefs about harm (e.g., "using prescription stimulants occasionally is harmless"), knowledge about prescription stimulants and being offered prescription stimulants. This can make interpretations from studies using these scaled more difficult as more than just motivations are considered, confounding potential outcomes. Further, this scale only assesses motivations for the use of prescription stimulants.

Other authors reported piloting their questions first (DeSantis et al., 2008; McNiel et al., 2011), while others stated that they based their questions on previous research (Clegg-Kraynok et al., 2011; Gallucci et al., 2014; Hall et al., 2005; Hartung et al., 2013; Jeffers & Benotsch, 2014; Judson & Langdon, 2009; Stone & Merlo, 2011). One study reported using both methods (Holloway & Bennett, 2012). However, almost all modified the motivations provided in previous work. Garnier-Dykstra and colleagues (2012) and Lookatch and colleagues (2012) on the other hand, recorded students answers and then coded them into motivational categories. Finally, some of the studies had young adults choose or list one motive (Barrett et al., 2005; Dupont et al., 2008; Franke et al., 2011; Gallucci et al., 2014; Holloway & Bennett, 2012; McNiel et al., 2011; Rozenbroek & Rothstein, 2011; Stone & Merlo, 2011; Upadhyaya et al., 2010), while the rest allowed for the selection of multiple motivations (Advokat et al., 2008; Bavarian et al., 2013; Clegg-Kraynok et al., 2011; DeSantis et al., 2008; Dussault & Weyandt, 2013; Garnier-Dykstra

et al., 2012; Ghandour et al., 2012; Hall et al., 2005; Hartung et al., 2013; Herman et al., 2011; Judson & Langdon, 2009; Lookatch et al., 2012; Lord et al., 2009; McCabe et al., 2009; Peterkin et al., 2011; Prudhomme White et al., 2006; Rabiner, Anastopoulos, Costello, Hoyle, McCabe, & Swartzwelder, 2009a; Rabiner, Anastopoulos, Costello, Hoyle, McCabe, & Swartzwelder, 2009b; Teter et al., 2005; Teter et al., 2006; Tuttle et al., 2010; Weyandt et al., 2009). The varying measurement models add to the complication of interpreting results across studies.

Limitations of past research. The overwhelming majority of the work on motivations for NMUPD in young adults is limited in scope. Most of the research has been conducted cross-sectionally on motivations for the non-medical use of stimulant medications in student samples from the United States. There is especially a lack of longitudinal research in this population, as well as studies on the motivations to use CNS depressants non-medically. Also, although a few more studies have investigated the motives for opioid non-medical use, there is still a dearth of knowledge in this area. Since, as expected due to their different therapeutic properties, the motivations behind the different classes of prescription medications vary, this research is imperative and may be able to further prevention and intervention efforts that focus not only on stimulants, but on prescription opioids and CNS depressants as well.

Research on motivations also needs to include young adults who are not currently students in higher education. Only two studies reached out to young adults in other areas. Franke and colleagues (2011) included young adults in Germany who were in vocational training, preparing for university or obtaining a job. Upadhyaya and colleagues (2010) used the Harris Poll Online panel to connect to young adults outside of academia in the United States. Impressively, through different sampling techniques, about half of the sample in Upadhyaya and colleagues (2010) consisted of young adults that did not identify as college students. Given that

this sample reported using stimulants non-medically both as the medications were intended and for recreational purposes, similar to college students, there may be some similar treatment approaches to both groups. As both of these studies only investigated the motives for non-medical stimulant use, there is a need for research on the motivations for non-college enrolled young adults' non-medical use of other prescription medications. However, it is important to note non-medical use of at least stimulants tends to be more prevalent in full-time college students as compared to those who are not in college or are only part-time students (SAMHSA, 2009). This suggests that young adults not in college may be at less risk for these behaviors and the associated negative outcomes. More research needs to be conducted with other prescription medication classes to determine if this pattern is replicated.

Present Study

NMUPD is a significant and growing public health concern with young adults at great risk for use, abuse, and related negative outcomes. The most substantial gap in the current literature is the lack of comprehensive longitudinal investigations assessing motivations for NMUPD for multiple prescription drug classes in a representative sample of young adults and how these motivations may change over time. The present study contributes to the literature on NMUPD by addressing some of the limitations in previous research investigating the motivations to use prescription drugs non-medically. First, the sample consisted of a nationally representative sample of young adults that have been followed longitudinally across three biennial follow-up waves (modal ages 19/20 to 23/24 years from wave 1 to 3). With this sample, information about how motivations change over time in a representative sample of young adults were assessed. Also, if there are differences over time for motivations for NMUPD of young adults based on sex, or who attend college, was researched. If motivations are different for young adults who

endorsed using in high school, or if motivations for NMUPD change over time for new users were investigated as well. Further, specific motivations for the non-medical use of prescription stimulants, opioids, and CNS depressants were studied, expanding the knowledge on less researched prescription drug classes. The strengths of the present study clearly advance the current NMUPD literature.

This study has the potential to help prevention and intervention efforts in several ways. For example, by identifying if motivations change over time, developmentally appropriate efforts to reflect these changes can be enacted. Additionally, if the change in motivations is different for young adults in college as compared to their peers not in college, or based on sex, the best ways to intervene with these unique populations can be better understood to increase effectiveness. Finally, results from this study can help to explain if there are differences in motivations for young adults who started NMUPD in high school or if there are changes in motivations over time for new users. These findings in particular can help to inform prevention efforts by targeting what motivates young adults to initiate NMUPD.

A series of generalized estimating equations (GEE) repeated measure analyses tested variations in motivations of NMUPD through secondary data analyses. Separate equations were developed for each of the following: (1) non-medical use of stimulants, (2) non-medical use of CNS depressants, and (3) non-medical use of prescription opioids. Following the bivariate analyses, each equation was reestimated to test if sex or attending college moderated the relation of motivations for NMUPD over time. Binary logistic regression models were then used to estimate if individuals who reported NMUPD in high school endorsed different motivations than individuals who reported initiating use in wave 1 (e.g., beginning of young adulthood). Finally,

GEE models tested whether NMUPD motivations changed over time for new users. Again, separate analyses were conducted for each class of prescription drugs.

Based on the developmental theory of young adults and previously examined research the following results are hypothesized.

Statement of the Hypotheses

Hypothesis 1. It is predicted that the motivations to feel good or get high, for experimentation, and boredom will decrease over time across all prescription drugs classes as young adults move towards more stability.

Hypothesis 2. It is predicted that "self-treatment" motives (i.e., stimulants: to stay awake, to get more energy, to help me study, and to help me lose weight; opioids: to relax or relieve tension, to get sleep, and to relieve physical pain and; CNS depressants: to relax or relieve tension, and to get sleep) as well as addiction motives (i.e., because I am "hooked"—I feel I have to have them) will increase over time across all prescription drug classes as exposure to prescription drugs and the risk for psychiatric problems increases.

Hypothesis 3. It is predicted that there will be no change over time in the following motives: to seek deeper insights and understanding, because of anger or frustration, to get through the day, to increase the effects of some other drug(s), to decrease (offset) the effects of some other drug(s), as a substitute for heroin, and to control coughing.

Hypothesis 4. It is predicted that sex differences will be observed for CNS depressant and opioid prescription drug classes, such that males will endorse more recreational motivations (i.e., to experiment, to feel good or get high, to seek deeper insights and understanding, to have a good time with my friends, to fit in with a group I like, because of boredom, to increase or decrease the effects of some other drug(s)e (offset) the effects of some other drug(s)), as

compared to females who will report more self-treatment motivations, or using the medications as they are clinically intended. Moderation analyses are largely exploratory given the lack of previous research in this area.

Hypothesis 5. It is predicted that college attendance will not moderate the relations of change of motives over time across all prescription drug classes, such that both young adults in and out of college will experience the same changes in motives over time because they are all experiencing the same developmental life stage and associated changes.

Hypothesis 6. It is predicted that young adults who started NMUPD in high school, compared to their peers who initiated NMUPD right after high school will be more likely to endorse recreational motivations.

Hypothesis 7. It is predicted that over time the motivations for new non-medical users of prescription drugs will be similar to those of continued users, such that all young adults experience the same changes in motivations over time because they are all experiencing the same developmental life stage and associated changes.

Method

Participants

The sample consisted of 14,990 participants who were surveyed in their first, second, and third biennial follow-up surveys following high school completion (waves 1, 2, and 3, respectively) from 1976 to 2013 as part of the Monitoring the Future (MTF) project. Due to the aims of the proposed study and concerns about sample size, the 36 cohorts were combined and the analyses were conducted on all available data. After accounting for sampling bias, the sample consisted of 48% male and 73% White participants (weighted). Based on previous studies

analyzing similar data from this project, the retention rate was estimated to be just below 50% (McCabe et al., 2014).

Measures

Using six randomly distributed questionnaire forms, the MTF assesses demographic and psychosocial characteristics and standard measures of substance use.

Demographics. Demographics were assessed at wave 1 and consisted of participant self-reports of age, sex (i.e., male/female), race/ethnicity (i.e., White/non-White), and if they were enrolled in an academic course (i.e., During March of this year, were you taking courses at any school or college?).

NMUPD. NMUPD was assessed at all three waves with items asking respondents on how many occasions (if any) they had used prescription medications on their own, without a doctor's orders during the past 12 months. There were separate questions for each prescription medication class: (1) prescription stimulants (e.g., Dexedrine, Ritalin, Adderall, Concerta, Methamphetamine); (2) prescription CNS depressants/tranquilizers (e.g., Librium, Valium, Xanax, Soma, Serax, Ativan, Klonopin); and (3) prescription opioids (e.g., Methadone, Codeine, OxyContin, Percodan, Opium, Demerol, Percocet, Ultram, Morphine, and Vicodin). The response scale was (1) no occasions, (2) one to two occasions, (3) three to five occasions, (4) six to nine occasions, (5) 10–19 occasions, (6) 20–39 occasions and (7) 40 or more occasions.

Motivations for NMUPD. Motivations for NMUPD were assessed by asking participants who reported past-year NMUPD to indicate the most important reasons for NMUPD from a check-all-that-apply list of binary items. As noted in Table 1, all prescription drug classes listed the following motives: (a) to experiment—to see what it's like, (b) to relax or relieve tension, (c) to feel good or get high, (d) to seek deeper insights and understanding, (e) to have a

good time with my friends, (f) to fit in with a group I like, (g) to get away from my problems or troubles, (h) because of boredom, nothing else to do, (i) because of anger or frustration, (j) to get through the day, (k) to increase the effects of some other drug(s), (l) to decrease (offset) the effects of some other drug(s), and (m) because I am "hooked"—I feel I have to have them.

Table 1.

NMUPD motivations assessed by prescription drug class

Stimulants	CNS depressants	Opioids
1. To experiment—to see what it's like	1. To experiment—to see what it's like	1. To experiment—to see what it's like
2. To relax or relieve tension	2. To relax or relieve tension	2. To relax or relieve tension
3. To feel good or get high	3. To feel good or get high	3. To feel good or get high
4. To seek deeper insights and understanding	4. To seek deeper insights and understanding	4. To seek deeper insights and understanding
5. To have a good time with my friends	5. To have a good time with my friends	5. To have a good time with my friends
6. To fit in with a group I like	6. To fit in with a group I like	6. To fit in with a group I like
7. To get away from my problems or troubles	7. To get away from my problems or troubles	7. To get away from my problems or troubles
8. Because of boredom, nothing else to do	8. Because of boredom, nothing else to do	8. Because of boredom, nothing else to do
9. Because of anger or frustration	9. Because of anger or frustration	9. Because of anger or frustration
10. To get through the day	10. To get through the day	10. To get through the day
11. To increase the effects of some other drug(s)	11. To increase the effects of some other drug(s)	11. To increase the effects of some other drug(s)
12. To decrease (offset) the effects of some other drug(s)	12. To decrease (offset) the effects of some other drug(s)	12. To decrease (offset) the effects of some other drug(s)
13. To stay awake	13. To get sleep	13. To get sleep
14. To get more energy	14. Because I am "hooked"—I feel I have to have them	14. As a substitute for heroin
15. To help me lose weight	15. To relieve physical pain	15. Because I am "hooked"—I feel I have to have them
16. Because I am "hooked"—I feel I have to have them		16. To relieve physical pain
17. To help me study		17. To control coughing

Specific motives for stimulants included: (a) to stay awake, (b) to get more energy, (c) to help me study, and (d) to help me lose weight. Both CNS depressants and opioids included the motives, “to get sleep,” and “to relieve physical pain.” Opioids had the additional motives, “as a substitute for heroin,” and “to control coughing.”

Procedures

According to the MTF website (The Regents of the University of Michigan, 2014), the MTF project begun in 1975 with the goal to study changes in the beliefs, attitudes, and behavior of young people in the United States. The MTF project is a repeated series of surveys in which the same segments of the population (8th, 10th, and 12th graders; college students; and young adults) are presented with the same set of questions over a period of years to see how answers change over time. The project has been conducted under a series of research grants from NIDA, a part of the National Institutes of Health. Surveys have been carried out each year since 1975 by the University of Michigan Survey Research Center. The MTF uses a three-stage sampling procedure to gather a nationally representative sample of students. In stage 1, geographic areas or primary sampling units are selected; in stage 2, schools within primary sampling units are selected (with probability proportionate to class size); and in stage 3, students within schools are selected. Within each school, up to 350 students may be included. In schools with fewer students, the usual procedure is to include all of them in the data collection. In larger schools, a subset of students is selected either by randomly sampling entire classrooms or by some other random method that is judged to be unbiased.

For the in-school survey, about 10 days before the administration, the students are given flyers explaining the study. Also, advance letters to parents inform them about the study and provide them a means for declining their child's participation if they so desire. The actual

questionnaire administrations are conducted by the local Institute for Social Research representatives and their assistants, following standardized procedures detailed in a project instruction manual. The questionnaires are group administered in classrooms during a normal class period whenever possible; however, circumstances in some schools require the use of larger group administrations. For those students selected to participate in the follow-up surveys, the questionnaires are mailed to the participants with a return, self-addressed, stamped envelope and a small monetary gift from the University of Michigan as a token of appreciation. Because so many questions are included in the MTF, much of the questionnaire content is divided into six different questionnaire forms, which are randomly distributed. This approach results in six virtually identical subsamples. The questionnaires sent in the follow-up survey are directly comparable to the base year questionnaires, both in content and in numbers of questionnaire forms. The measures relevant for this study were asked on Form 1; therefore, this study focused on the subsamples receiving Form 1 within each cohort.

Each year about 16,000 students in approximately 133 public and private high schools nationwide participate by completing surveys administered in classrooms. A randomly selected sample of approximately 2,400 students from each senior class is followed up biannually after high school on a continuing basis. These respondents receive the mail questionnaire at their home, which they complete and return to MTF. The biennial follow-up surveys begin 1 year after high school for one random half of each cohort and 2 years after high school for the other half (for more information on the procedures see Bachman, Johnston, & O'Malley, 2014). For the purpose of the current study, the two halves were combined (combining modal ages 19/20, 21/22 and 23/24 years) due to sample size concerns and reported lack of significant differences across the two halves on substance use measures (McCabe et al., 2014). The student response

rates for high school seniors ranged from 77% to 85% between 1976 and 2012 (Bachman et al., 2014). The follow-up panel data for surveys through wave 3 is estimated to be approximately just below 50% (Bachman et al., 2014; McCabe et al., 2014).

Data Analysis

First, sampling weights were used to correct for any unequal probabilities of selection that occurred at any stage of sampling for all analyses so the results could be generalized to the national population. Then, descriptive statistics were calculated to examine the frequencies and distribution properties of each variable, as well to gain a better understanding of the sample demographics. This was followed by a test to determine if the missing data was missing completely at random (MCAR).

A series of generalized estimating equations (GEE) repeated measure analyses tested variations in motivations of NMUPD using SPSS Version 23. GEE models were used because of their flexible approach to handling correlated data structures that arise from repeated measures of the same individuals over time (Diggle, Heagerty, Liang, & Zeger, 2013; Liang & Zeger, 1993; Zeger, Liang, & Albert, 1988; Zeger & Liang, 1992). Further, GEE can handle binary outcome data and time-varying and time-invariant predictors (Homish, Edwards, Eiden, & Leonard, 2010). Additionally, GEE provides population averaged estimates, which is appropriate for nationally representative data. Although the correlation structure in GEE does not affect the marginal parameter estimates, it does affect the standard error estimates. Therefore, the GEE were conducted using an unstructured correlation matrix, which is a completely general correlation matrix. This decision was based on theory, comparison to the actual correlation matrixes, and Quasi-likelihood under Independence Model Criterion (QIC) comparisons. It should be noted that across models there were very small differences observed in the QIC values.

To answer the question if motivations of NMUPD change over the developmental period of young adulthood, GEE repeated measures equations were developed for non-medical users, in which each motive was, in turn, entered into a separate equation as the dependent variable, with wave (i.e., time) as the repeated factor in each equation. Separate equations were developed for each of the following: (1) non-medical use of stimulants, (2) non-medical use of CNS depressants, and (3) non-medical use of opioids. Next, analyses were conducted to determine if differences existed in the motivations for NMUPD based on young adults' sex and college attendance. Following the bivariate analyses, each equation was re-estimated with wave as the repeated factor and the main effect of sex or college attendance and the first-order interaction of Sex/College Attendance*Wave included in the model. For all GEE analyses, a Wald chi-square test determined whether or not wave, sex, college attendance, and the Sex/College Attendance*Wave interaction were significantly associated with each dependent variable (i.e., each motivation). For models with significant chi-square tests, pairwise comparisons of estimated marginal means produced from these models were evaluated in order to determine among which waves the participants differed with respect to the dependent variable. The pairwise comparisons used a Bonferronni correction to control for the likelihood of making a Type I error as a result of multiple comparisons.

Binary logistic regression models were then used to estimate if individuals who reported NMUPD in high school endorsed different motives than individuals who did not report NMUPD in high school on Wave 1 NMUPD. Each prescription drug class was investigated separately. For example, individuals who reported non-medical use of prescription stimulants in high school were compared to new non-medical users of prescription stimulants at Wave 1. Similarly, participants who reported non-medical use of prescription CNS depressants in high school were

compared to new non-medical users of CNS depressants at Wave 1. The same method was used for prescription opioids. Therefore, the groups may not be mutually exclusive as a participant may have endorsed non-medical use of more than one class of prescription medications either in high school or Wave 1.

Finally, GEE repeated measures equations tested whether NMUPD motivations changed over time for new users. Again, separate analyses were conducted for each class of prescription drugs. Similarly as described above, GEE were developed for new non-medical users, in which each motive was, in turn, entered into a separate equation as the dependent variable, with wave as the repeating factor in each equation. Moderators were not included in these analyses because of sample size concerns. Additional post hoc analyses, including exploratory latent class analyses, are discussed in the results section.

Results

Descriptive Statistics

Table 2 reports the sample demographics including sex, race/ethnicity, age, enrollment in college classes, and past year NMUPD for the total sample and for users, as appropriate. Of note, most individuals reported infrequent use (1-2 times in the past year) and the percentages of users attending college classes decreased over time for all prescription drug classes. Table 3 reports the frequencies and percentage of users that endorsed each motivation across all waves. It should be noted that some motives have smaller sample sizes as they were added to the study in later years. For stimulants, the top NMUPD motivations consistently included (in terms of high frequencies): to help me study, to stay awake, to get more energy, to feel good or get high, to experiment, and to help me lose weight. For CNS depressants, the top NMUPD motivations consistently included: to relax or relive tension, to get sleep, to feel good or get high, to experiment, and to

relieve physical pain. The frequencies of NMUPD motivations for prescription opioids were slightly more varied, but consistently included: to feel good to get high, to experiment, to relax or relieve tension, and to relieve physical pain. Table 4 reports the frequencies, means, and standard deviations of the number of motivations endorsed by users by prescription drug class to gain a better understanding of how many motives were endorsed overall. Across all prescription drug classes it was common to endorse more than one motive, but not more than four or five motives across all waves.

Table 2.

Sample demographics for total sample and past year NMUPD users by prescription drug class

Demographic	Total sample			Stimulants			CNS depressants			Opioids		
N	12,223			Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3
Sex (*n*, % male)	5,789 (47.5)			288 (43.6)	273 (44.7)	185 (47.5)	123 (36.1)	126 (40.9)	119 (40.8)	153 (41.9)	148 (43.1)	113 (42.1)
Race/ethnicity (*n*, % White)	8,736 (72.5)			582 (88.6)	529 (87.6)	335 (85.8)	295 (88.3)	273 (89.1)	254 (86.6)	322 (88.6)	301 (89.6)	231 (86.1)
	Wave 1	Wave 2	Wave 3									
N of users[a]	9,237	8,629	7,836	757	724	466	428	444	406	549	492	376
Age (*M*(*SD*))[a]	19.52 (0.46)	21.49 (0.44)	23.47 (0.43)	19.43 (0.26)	21.47 (0.26)	23.38 (0.26)	19.51 (0.24)	21.42 (0.23)	23.52 (0.24)	19.49 (0.24)	21.49 (0.29)	23.47 (0.28)
Taking college classes (*n*, %)	5,753 (68.1)	4,447 (56.8)	2,193 (30.7)	398 (60.7)	295 (48.6)	113 (29.0)	203 (60.1)	148 (48.4)	84 (28.8)	251 (68.1)	192 (56.5)	88 (32.9)
Number of occasions used in past year (*n* (%))												
0				7,719 (92.1)	7,152 (92.1)	6,721 (94.5)	8,023 (95.9)	7,450 (96.0)	6,820 (95.9)	7,949 (95.6)	7,396 (95.6)	6,822 (96.2)
1-2				217 (2.6)	214 (2.8)	133 (1.9)	183 (2.2)	160 (2.1)	147 (2.1)	189 (2.3)	174 (2.2)	132 (1.9)
3-5				131 (1.6)	133 (1.7)	78 (1.1)	78 (0.9)	57 (0.7)	57 (0.8)	79 (0.9)	77 (1.0)	63 (0.9)
6-9				98 (1.2)	77 (1.0)	50 (0.7)	36 (0.4)	46 (0.6)	39 (0.6)	46 (0.6)	35 (0.4)	29 (0.4)
10-19				95 (1.1)	78 (1.0)	51 (0.7)	27 (0.3)	28 (0.4)	24 (0.3)	27 (0.3)	24 (0.3)	18 (0.2)
20-39				52 (0.6)	51 (0.7)	38 (0.5)	9 (0.1)	9 (0.1)	9 (0.1)	14 (0.2)	14 (0.2)	14 (0.2)
40+				73 (0.9)	61 (0.8)	44 (0.6)	10 (0.1)	11 (0.1)	18 (0.2)	14 (0.2)	19 (0.2)	14 (0.2)

Note. All descriptive statistics are weighted. All percentages are reported as valid percentages, not including participants who had missing values.

[a] Information provided by researchers at University of Michigan with access to full data set.

Table 3.

Frequencies of endorsed NMUPD motivations over time and percentage of users

NMUPD Motivation	Wave 1 *n* (% of users)	Wave 2 *n* (% of users)	Wave 3 *n* (% of users)
Stimulants (*n*)	645	587	376
To experiment—to see what it's like	272 (42.2)	206 (35.1)	99 (26.4)
To relax or relieve tension	73 (11.3)	46 (7.9)	24 (6.3)
To feel good or get high	254 (39.3)	218 (37.2)	131 (34.8)
To seek deeper insights and understanding	29 (4.4)	21 (3.5)	17 (4.5)
To have a good time with my friends	175 (27.1)	161 (27.4)	100 (26.5)
To fit in with a group I like	11 (1.7)	12 (2.0)	9 (2.5)
To get away from my problems or troubles	45 (7.0)	32 (5.5)	17 (4.5)
Because of boredom, nothing else to do	66 (10.2)	49 (8.4)	31 (8.3)
Because of anger or frustration	42 (6.6)	20 (3.3)	13 (3.5)
To get through the day	159 (24.7)	50 (25.6)	91 (24.1)
To increase the effects of some other drug(s)	61 (9.4)	41 (7.0)	33 (8.8)
To decrease (offset) the effects of some other drug(s)	27 (4.1)	27 (4.7)	20 (5.4)
To stay awake	416 (64.5)	381 (64.8)	243 (64.6)
To get more energy	390 (60.5)	371 (63.1)	264 (70.2)
To help me lose weight	205 (31.8)	182 (31.0)	130 (34.5)
Because I am "hooked"—I feel I have to have them	9 (1.3)	8 (1.3)	4 (1.1)
To help me study[a]	35 (75.9)	56 (74.9)	35 (63.6)
CNS depressants (*n*)	313	285	271
To experiment—to see what it's like	114 (36.4)	93 (32.6)	76 (28.2)
To relax or relieve tension	230 (73.3)	216 (75.8)	217 (80.1)
To feel good or get high	120 (38.2)	17 (40.9)	98 (36.2)
To seek deeper insights and understanding	10 (3.1)	8 (2.9)	4 (1.5)
To have a good time with my friends	60 (19.1)	69 (24.3)	46 (17.1)
To fit in with a group I like	2 (0.6)	5 (1.8)	4 (1.5)
To get away from my problems or troubles	59 (18.8)	40 (14.1)	55 (20.4)
Because of boredom, nothing else to do	33 (10.5)	31 (11.0)	25 (9.2)
Because of anger or frustration	42 (13.3)	40 (13.9)	47 (17.5)
To get through the day	20 (6.4)	14 (4.9)	25 (9.1)
To increase the effects of some other drug(s)	44 (14.0)	43 (15.1)	32 (11.8)
To decrease (offset) the effects of some other drug(s)	10 (3.1)	15 (5.3)	24 (8.9)
To get sleep	146 (46.6)	131 (45.9)	144 (53.3)
Because I am "hooked"—I feel I have to have them	30 (9.5)	21 (7.2)	6 (2.3)
To relieve physical pain[b]	81 (26.2)	95 (32.9)	93 (34.3)

NMUPD Motivation	Wave 1 *n* (% of users)	Wave 2 *n* (% of users)	Wave 3 *n* (% of users)
Opioids (*n*)	325	304	242
To experiment—to see what it's like	168 (51.7)	120 (39.5)	79 (32.6)
To relax or relieve tension	157 (48.3)	166 (54.4)	130 (53.8)
To feel good or get high	179 (55.1)	145 (47.8)	118 (48.8)
To seek deeper insights and understanding	16 (5.0)	12 (3.8)	11 (4.7)
To have a good time with my friends	96 (29.5)	82 (26.8)	57 (23.4)
To fit in with a group I like	5 (1.4)	10 (3.2)	3 (1.1)
To get away from my problems or troubles	51 (15.8)	43 (14.1)	36 (15.0)
Because of boredom, nothing else to do	53 (16.2)	36 (11.9)	32 (13.1)
Because of anger or frustration	30 (9.2)	31 (10.2)	20 (8.1)
To get through the day	22 (6.8)	19 (6.1)	22 (8.9)
To increase the effects of some other drug(s)	55 (17.0)	47 (15.3)	34 (14.0)
To decrease (offset) the effects of some other drug(s)	9 (2.9)	8 (2.5)	11 (4.5)
To get sleep	91 (28.1)	87 (28.7)	70 (29.0)
As a substitute for heroin	6 (1.8)	7 (2.3)	6 (2.3)
Because I am "hooked"—I feel I have to have them	25 (7.8)	19 (6.4)	10 (4.3)
To relieve physical pain[c]	151 (46.8)	178 (58.0)	157 (64.6)
To control coughing[c]	31 (9.5)	32 (10.5)	25 (10.2)

Note. NMUPD = Non-medical use of prescription drugs. All frequencies and percentages are weighted.
[a] Motivation added in 2009, sample size: Wave 1 = 46, Wave 2 = 74, Wave 3 = 55
[b] Motivation added in 1981, sample size: Wave 1 = 309, Wave 2 = 288, Wave 3 = 271
[c] Motivation added in 1981, sample size: Wave 1 = 324, Wave 2 = 307, Wave 3 = 242

Table 4.

Frequencies, means, and standard deviations of number of motives endorsed by users by prescription drug class

Number of Motives Endorsed	Wave 1	Wave 2	Wave 3
Stimulants (*M* (*SD*))	3.73 (2.31)	3.47 (2.11)	3.49 (2.21)
1 (*n* (% of users))	195 (16.4)	167 (17.1)	91 (14.9)
2 (*n* (% of users))	216 (18.1)	202 (20.7)	151 (24.7)
3 (*n* (% of users))	228 (19.1)	194 (19.9)	124 (20.3)
4 (*n* (% of users))	183 (15.4)	156 (16.0)	91 (14.9)
5 (*n* (% of users))	142 (11.9)	114 (11.7)	64 (10.5)
6 (*n* (% of users))	89 (7.5)	62 (6.4)	36 (5.9)
7 (*n* (% of users))	60 (5.0)	32 (3.3)	20 (3.3.)
8 (*n* (% of users))	29 (2.4)	18 (1.8)	12 (2.0)
9 (*n* (% of users))	21 (1.8)	9 (0.9)	8 (1.3)
10 (*n* (% of users))	10 (0.8)	9 (0.9)	9 (1.5)
11 (*n* (% of users))	9 (0.8)	7 (0.7)	1 (0.2)
12 (*n* (% of users))	4 (0.3)	3 (0.3)	1 (0.2)
13 (*n* (% of users))	1 (0.1)	1 (0.1)	1 (0.2)
14 (*n* (% of users))	3 (0.3)	0 (0.0)	2 (0.3)
15 (*n* (% of users))	1 (0.1)	0 (0.0)	0 (0.0)
16 (*n* (% of users))	0 (0.0)	0 (0.0)	0 (0.0)
17 (*n* (% of users))	0 (0.0)	0 (0.0)	0 (0.0)
CNS Depressants (*M* (*SD*))	3.47 (2.20)	3.45 (2.26)	3.49 (2.31)
1 (*n* (% of users))	109 (18.9)	98 (18.8)	77 (17.5)
2 (*n* (% of users))	115 (19.9)	125 (24.0)	102 (23.1)
3 (*n* (% of users))	119 (20.6)	92 (17.7)	90 (20.4)
4 (*n* (% of users))	86 (14.9)	60 (11.5)	62 (14.1)
5 (*n* (% of users))	55 (9.5)	62 (11.9)	39 (8.8)
6 (*n* (% of users))	41 (7.1)	26 (5.0)	28 (6.3)
7 (*n* (% of users))	19 (3.3)	23 (4.4)	14 (3.2)
8 (*n* (% of users))	19 (3.3)	13 (2.5)	10 (2.3)
9 (*n* (% of users))	3 (0.5)	17 (3.3)	6 (1.4)
10 (*n* (% of users))	6 (1.0)	2 (0.4)	7 (1.6)
11 (*n* (% of users))	3 (0.5)	0 (0.0)	1 (0.2)
12 (*n* (% of users))	0 (0.0)	0 (0.0)	3 (0.7)
13 (*n* (% of users))	2 (0.3)	0 (0.0)	0 (0.0)
14 (*n* (% of users))	1 (0.2)	0 (0.0)	2 (0.5)
15 (*n* (% of users))	0 (0.0)	2 (0.4)	0 (0.0)

Number of Motives Endorsed	Wave 1	Wave 2	Wave 3
Opioids (*M* (*SD*))	3.75 (2.46)	3.58 (3.73)	3.53 (2.54)
1 (*n* (% of users))	106 (17.4)	100 (19.7)	80 (21.0)
2 (*n* (% of users))	115 (18.9)	95 (18.7)	84 (22.0)
3 (*n* (% of users))	122 (20.0)	83 (16.4)	69 (18.1)
4 (*n* (% of users))	80 (13.1)	79 (15.6)	44 (11.5)
5 (*n* (% of users))	66 (10.8)	50 (9.9)	35 (9.2)
6 (*n* (% of users))	36 (5.9)	33 (6.5)	25 (6.6)
7 (*n* (% of users))	31 (5.1)	29 (5.7)	15 (3.9)
8 (*n* (% of users))	22 (3.6)	14 (2.8)	11 (2.9)
9 (*n* (% of users))	12 (2.0)	2 (0.4)	7 (1.8)
10 (*n* (% of users))	6 (1.0)	9 (1.8)	3 (0.8)
11 (*n* (% of users))	6 (1.0)	5 (1.0)	2 (0.5)
12 (*n* (% of users))	4 (0.7)	4 (0.8)	1 (0.3)
13 (*n* (% of users))	1 (0.2)	2 (0.4)	2 (0.5)
14 (*n* (% of users))	2 (0.3)	0 (0.0)	1 (0.3)
15 (*n* (% of users))	0 (0.0)	0 (0.0)	1 (0.3)
16 (*n* (% of users))	0 (0.0)	0 (0.0)	1 (0.3)
17 (*n* (% of users))	0 (0.0)	2 (0.4)	0 (0.0)

Note. All frequencies and percentages are weighted.

Missing Data Analyses

Since many of the analyses that were run operate under the assumption that the data is missing completely at random, missing data analyses were conducted. According to Little's chi-square statistic (Little, 1988) data was missing completely at random (MCAR), $\chi^2 = 12882.59$, $df = 16252$, $p = 1.00$. Regardless, as discussed previously, for tests that may be biased based on missing data patterns, other precautions were implemented. For example, the correlation structure was specified in the GEE analyses, even though GEE models are more flexible for missing data compared to other models (Zeger et al., 1988).

Changes in NMUPD Motivations Across Young Adulthood

Table 5 reports the motivations that had significant differences across waves for all NMPUD users, including the Wald Chi-square statistic and results from the subsequent pairwise comparisons using Bonferroni corrections. Overall, there were relatively few motives that evidenced a main effect of time. For stimulants, in general, participants reported less

experimentation and more motivation to increase energy over time. For CNS depressants, participants reported more motivation to decrease the effects of other drugs and to relieve physical pain over time. For opioids, participants reported less experimentation, less boredom, and more motivation to relieve physical pain as they matured. Additionally, GEE models for the motivations of addiction for stimulants, and to decrease the effect of other drugs for opioids were unable to converge, potentially as a result of the small number of participants endorsing these motives across waves (i.e., 20 and 28; respectively).

Table 5.

Significant changes in NMUPD motivations across young adulthood for all users

NMUPD Motivation	Wald chi-square	Pairwise comparisons
Stimulants		
To experiment—to see what it's like	χ^2 (2, N = 792) = 17.08***	Wave 1 > Wave 3*** Wave 2 > Wave 3**
To get more energy	χ^2 (2, N = 792) = 11.92**	Wave 1 < Wave 3**
CNS depressants		
To decrease (offset) the effects of some other drug(s)	χ^2 (2, N = 535) = 8.82*	Wave 1 < Wave 3**
To relieve physical pain	χ^2 (2, N = 534) = 6.23*	Wave 1 < Wave 2*
Opioids		
To experiment—to see what it's like	χ^2 (2, N = 559) = 10.86**	Wave 1 > Wave 2* Wave 1 > Wave 3*
Because of boredom, nothing else to do	χ^2 (2, N = 559) = 10.86**	Wave 1 > Wave 2*
To relieve physical pain	χ^2 (2, N = 560) = 9.12*	Wave 1 < Wave 3*

Note. NMUPD = Non-medical use of prescription drugs. Unweighted sample sizes are reported for the Wald chi-square statistics. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Sex as a Moderator in Changes in NMUPD Motivations

Table 6 reports the Wald chi-square statistics for NMUPD motivations that had a main effect for sex and/or significant moderation (Wave*Sex), along with the frequencies and percentages of the sex differences observed. For stimulants, significantly more males endorsed

the following motivations: experimentation, have a good time with friends, increase the effects of other drugs, decrease the effects of other drugs, and to stay awake. More females endorsed using stimulants non-medically to lose weight.

For CNS depressants, more males endorsed the following motivations: experimentation, to feel good/get high, and have a good time with friends. More females endorsed being motivated to use CNS depressants non-medically to get sleep.

For opioids, more males endorsed the following motivations: experimentation, to feel good/get high, and to have a good time with friends. More females endorsed using opioids non-medically to get sleep, relieve physical pain, and to control coughing.

Two motivations were moderated by sex, as indicated by a significant Wave*Sex interaction. These included to feel good/get high for stimulant medications and to have a good time with friends for CNS depressants.

Additionally, GEE models for the following motivations were unable to converge or received an error for concerns about validity: addiction for stimulants, seeking deeper understanding, fit in with a group, boredom, to decrease the effects of other drugs for CNS depressants, and fit in with a group, to decrease the effect of other drugs, and as a substitute for heroin for opioids. Further, for the motivation to get through the day for stimulant medications, although a significant Wald chi-square was reported for a Wave*Sex moderation (χ^2 (2, N = 790) = 11.40, p = .003), no significant findings were reported in the subsequent pairwise comparisons.

Table 6.

*Frequencies and percentages of users by sex and wave for significant GEE models, Wald chi-square and pairwise comparisons for main effect of sex and wave*sex*

NMUPD Motivation	Wave 1 Male: *n* (%) Female: *n* (%)	Wave 2 Male: *n* (%) Female: *n* (%)	Wave 3 Male: *n* (%) Female: *n* (%)	Wald chi-square for sex	Wald chi-square for Wave*Sex
Stimulants					
To experiment—to see what it's like	127 (45.5) 143 (39.4)	109 (41.1) 96 (30.3)	57 (32.4) 42 (21.1)	χ^2 (1, N = 790) = 8.94** Male > Female	*ns*
To feel good or get high	110 (39.2) 142 (39.4)	103 (38.7) 114 (36.0)	73 (41.9) 57 (28.7)	*ns*	χ^2 (2, N = 790) = 10.27** Wave 1 females > Wave 3 females* Wave 3 males > Wave 3 females*
To have a good time with my friends	88 (31.3) 86 (23.7)	79 (29.5) 82 (25.7)	59 (33.7) 41 (20.6)	χ^2 (1, N = 790) = 6.24* Male > Female	*ns*
To increase the effects of some other drug(s)	36 (12.8) 25 (6.8)	26 (9.8) 15 (4.7)	21 (12.0) 12 (5.9)	χ^2 (1, N = 790) = 12.02** Male > Female	*ns*
To decrease (offset) the effects of some other drug(s)	17 (6.1) 9 (2.6)	17 (6.3) 11 (3.4)	14 (8.2) 6 (3.0)	χ^2 (1, N = 790) = 8.75** Male > Female	*ns*
To stay awake	193 (68.9) 221 (61.1)	190 (71.5) 188 (59.1)	131 (75.0) 108 (54.9)	χ^2 (1, N = 790) = 25.45*** Male > Female	*ns*
To help me lose weight	24 (8.6) 180 (49.8)	32 (11.9) 149 (47.0)	19 (10.7) 110 (55.9)	χ^2 (1, N = 790) = 120.58*** Female > Male	*ns*
CNS depressants					
To experiment—to see what it's like	50 (44.6) 63 (31.6)	57 (47.9) 36 (21.7)	44 (40.2) 32 (20.0)	χ^2 (1, N = 535) = 27.85*** Male > Female	*ns*
To feel good or get high	52 (47.0) 66 (33.1)	66 (55.5) 50 (30.4)	55 (49.8) 43 (26.6)	χ^2 (1, N = 535) = 15.56*** Male > Female	*ns*
To have a good time with my friends	29 (26.3) 30 (15.1)	43 (36.3) 26 (15.7)	28 (25.1) 19 (11.6)	χ^2 (1, N = 535) = 6.31* Male > Female	χ^2 (1, N = 535) = 6.69* Wave 1 females < Wave 2 males* Wave 2 females < Wave 2 males*
To get sleep	45 (40.7) 100 (49.9)	44 (36.9) 87 (52.3)	54 (48.9) 90 (56.3)	χ^2 (1, N = 535) = 5.77** Female > Male	*ns*

NMUPD Motivation	Wave 1 Male: *n* (%) Female: *n* (%)	Wave 2 Male: *n* (%) Female: *n* (%)	Wave 3 Male: *n* (%) Female: *n* (%)	Wald chi-square for sex	Wald chi-square for Wave*Sex
Opioids					
To experiment—to see what it's like	91 (65.0) 75 (41.1)	69 (51.1) 51 (30.1)	45 (44.2) 33 (24.1)	χ^2 (1, N = 557) = 24.75*** Male > Female	*ns*
To feel good or get high	89 (63.8) 89 (48.7)	81 (59.7) 64 (38.0)	64 (62.3) 54 (39.3)	χ^2 (1, N = 557) = 12.40*** Male > Female	*ns*
To have a good time with my friends	55 (39.0) 41 (22.4)	46 (34.2) 35 (21.0)	34 (32.8) 23 (16.6)	χ^2 (1, N = 557) = 11.81*** Male > Female	*ns*
To get sleep	28 (19.8) 64 (34.9)	31 (22.6) 57 (33.7)	25 (24.7) 44 (31.8)	χ^2 (1, N = 557) = 7.70** Female > Male	*ns*
To relieve physical pain	57 (41.1) 94 (51.4)	68 (49.3) 110 (65.3)	57 (55.2) 100 (72.3)	χ^2 (1, N = 558) = 8.83** Female > Male	*ns*
To control coughing	9 (6.4) 22 (11.9)	10 (7.3) 22 (13.2)	7 (6.5) 17 (12.3)	χ^2 (1, N = 558) = 4.68* Female > Male	*ns*

Note. NMUPD = Non-medical use of prescription drugs. Unweighted sample sizes are reported for the Wald chi-square statistics. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

College Attendance as a Moderator in Changes in NMUPD Motivations

Table 7 reports the Wald chi-square statistics for NMUPD motivations which had a main effect for college attendance and/or significant moderation (Wave*College Attendance), along with the frequencies and percentages of the college attendance differences observed. There only were valid significant findings for NMUPD motivation for stimulant medications. Specifically, young adults not enrolled in college courses were more likely to endorse the following motivations: to relax or relive tension, to feel good/get high, have a good time with friends, and to help lose weight.

GEE models for the following motivations were unable to converge or received an error for concerns about validity: addiction and to help study for stimulants, seeking deeper understanding, to have a good time with friends, fit in with a group, to decrease the effects of other drugs, and addiction for CNS depressants, and to feel good/get high, seeking deeper understanding, to have a good time with friends, fit in with a group, to get away from problems, to increase the effects of other drugs, to decrease the effects of other drugs, as a substitute for heroin, and addiction for opioids. Further, for the motivation, because of anger or frustration, for opioid medications, although a significant Wald chi-square was reported for a college attendance main effect (χ^2 (1, N = 558) = 3.86, p = .049), no significant findings were reported in the subsequent pairwise comparisons.

Table 7.

*Frequencies and percentages of users by college attendance and wave for significant GEE models, Wald chi-square and pairwise comparisons for main effect of college attendance and wave*college attendance*

NMUPD Motivation	Wave 1 Not enrolled: *n* (%) Enrolled: *n* (%)	Wave 2 Not enrolled: *n* (%) Enrolled: *n* (%)	Wave 3 Not enrolled: *n* (%) Enrolled: *n* (%)	Wald chi-square for college attendance	Wald chi-square for Wave*College Attendance
Stimulants					
To relax or relieve tension	34 (14.0) 38 (9.7)	30 (10.0) 16 (5.8)	21 (7.9) 3 (2.5)	χ^2 (1, N = 1013) = 8.21** Not enrolled > Enrolled	*ns*
To feel good or get high	110 (44.7) 140 (35.9)	141 (47.1) 76 (26.9)	98 (36.7) 33 (30.7)	χ^2 (1, N = 1013) = 12.18*** Not enrolled > Enrolled	*ns*
To have a good time with my friends	74 (30.3) 99 (25.3)	97 (32.3) 63 (22.3)	73 (27.6) 26 (24.5)	χ^2 (1, N = 1013) = 4.48* Not enrolled > Enrolled	*ns*
To help me lose weight	87 (35.5) 116 (29.6)	117 (38.8) 64 (22.9)	98 (37.0) 30 (28.3)	χ^2 (1, N = 1013) = 7.03** Not enrolled > Enrolled	*ns*

Note. NMUPD = Non-medical use of prescription drugs. Unweighted sample sizes are reported for the Wald chi-square statistics. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Differences in NMUPD Motivations for Youth who Used in High School Compared to New Users at Wave 1

Table 8 reports the significant results from logistic regression analyses which estimated if new NMUPD users at Wave 1 (coded "1") reported different motives than individuals who reported NMUPD in high school (coded "0") for each prescription drug class. Participants who did not endorse NMUPD in high school were more likely to endorse the following motivations: (1) For stimulants: to feel good/get high, to get through the day, to stay awake, to get more energy, and to lose weight, (2) for CNS depressants: to feel good/get high, (3) for opioids: to relax/relieve tension, to feel good/get high, to get away from problems, to get sleep, as a substitute for heroin, and to relieve physical pain. Effect sizes ranged from small (R^2 = .008) to large (R^2 = .075). The motivation most influenced by new NMUPD status at Wave 1 was using prescription opioids as a substitute for heroin, with participants who reported no non-medical use of prescription opioids in high school 6.06 times more likely to endorse this motivation compared to individuals who reported using prescription opioids non-medically in high school.

Table 8.

Significant logistic regression model results, effect sizes, and odd ratios of NMUPD motivations for new users at Wave 1 compared to individuals who reported use in high school

NMUPD Motivation	Model Results Nagelkerke's R2	OR (95% CI)
Stimulants		
To feel good or get high	χ^2 (1) = 3.98, p = .046, R^2 = .008	1.38 (1.01-1.90)
To get through the day	χ^2 (1) = 5.12, p = .024, R^2 = .012	1.52 (1.06-2.17)
To stay awake	χ^2 (1) = 5.75, p = .016, R^2 = .012	1.50 (1.08-2.09)
To get more energy	χ^2 (1) = 19.73, p < .001, R^2 = .042	2.11 (1.52-2.93)
To help me lose weight	χ^2 (1) = 11.39, p = .001, R^2 = .025	1.78 (1.27-2.48)
CNS depressants		
To feel good or get high	χ^2 (1) = 5.05, p = .025, R^2 = .022	1.71 (1.07-2.73)
Opioids		
To relax or relieve tension	χ^2 (1) = 16.99, p < .001, R^2 = .068	2.61 (1.64-4.15)
To feel good or get high	χ^2 (1) = 4.99, p =.025, R^2 = .020	1.68 (1.06-2.66)
To get away from my problems or troubles	χ^2 (1) = 5.81, p = .016, R^2 = .030	2.10 (1.15-3.83)
To get sleep	χ^2 (1) = 5.75, p = .017, R^2 = .025	1.83 (1.12-2.99)
As a substitute for heroin	χ^2 (1) = 4.14, p = .042, R^2 = .075	6.06 (0.87-41.67)
To relieve physical pain	χ^2 (1) = 5.42, p = .020, R^2 = .022	1.71 (1.09-2.69)

Note. NMUPD = Non-medical use of prescription drugs. No NMUPD in high school = 1, NMUPD in high school = 0.

Post hoc analyses for wave 1 NMUPD use comparing young adults who used in high school and young adults who initiated use in wave 1. To rule out the alternative explanation that engaging in NMUPD in high school is a protective factor in post hoc analyses were conducted. Independent t-test analyses were conducted to compare frequency of past year NMUPD wave 1 use for young adults who used in high school versus young adults who initiated NMUPD in wave 1. As seen in Table 9, results indicated that there were statistically significant relations between when young adults initiated NMUPD (in high school versus wave 1) and their frequency of NMUPD use at wave 1. Specifically, young adults who reported using any class of prescription drug non-medically in high school were more likely to use any other class of

prescription drug non-medically at wave 1. Levene's test for equality of variances was significant for all analyses and the results presented are the values when equal variances were not assumed. Effect sizes were in general medium range (Cohen's *d*: 0.36-0.70), with the highest effect sizes in the medium to large range consistently observed for future use of previously used prescription drug class (e.g., if used stimulants non-medically in high school, most likely to use stimulants at wave 1 compared to other prescription drug classes).

Table 9.

Independent t-test results for wave 1 NMUPD use across prescription drug classes comparing youth who initiated NMUPD in high school versus initiated NMUPD in wave 1

NMUPD Frequency	Initiated NMUPD in high school (*M* (SD))	Initiated NMUPD in Wave 1 (*M* (SD))	*t*-value	*df*	Cohen's *d*
NMUPD Stimulant Users					
Past year stimulant use	2.08 (1.79)	1.13 (0.67)	14.83***	816.91	0.70
Past year CNS depressant use	1.35 (1.01)	1.05 (0.34)	8.21***	812.56	0.40
Past year opioid use	1.33 (0.98)	1.06 (0.42)	7.58***	821.84	0.36
CNS depressants					
Past year stimulant use	2.00 (1.76)	1.17 (0.79)	9.91***	461.81	0.60
Past year CNS depressant use	1.63 (1.27)	1.04 (0.34)	9.68***	42.55	0.62
Past year opioid use	1.46 (1.17)	1.07 (0.43)	7.09***	453.87	0.44
Opioids					
Past year stimulant use	1.91 (1.68)	1.18 (0.81)	9.19***	468.55	0.55
Past year CNS depressant use	1.43 (1.10)	1.06 (0.38)	7.13***	455.66	0.45
Past year opioid use	1.68 (1.34)	1.06 (0.38)	9.75***	448.46	0.63

Note. NMUPD = Non-medical use of prescription drugs. * $p < .05$, ** $p < .01$, *** $p < .001$.

Changes in NMUPD Motivations Across Young Adulthood for New Users

Table 10 reports the motivations that had significant differences across waves for new NMUPD users at each wave, including the Wald Chi-square statistic and results from the

subsequent pairwise comparisons using Bonferroni corrections. Overall, similar to all users, there were relatively few motivations that evidenced a main effect of time for new NMUPD users.

Similar patterns were observed, including the same significant differences between waves, for the following motivations of all NMUPD and new NMUPD users by prescription drug class: (1) For stimulants, the motivation to experiment decreased less over time, and to get more energy increased over time in general; (2) for CNS depressants, to relieve physical pain increased over time; (3) for opioids, to experiment decreased over time, and boredom decreased over time. Further, for opioids a similar pattern of reporting more of the motivation to relieve physical pain was seen between Wave 1 and Wave 3. However, for new users there was an additional significant difference between Wave 1 and Wave 2, with increases over time. Compared to the results for all NMUPD users, new users had different trajectories of the following motivations. For CNS depressants, there were no significant differences found over time for the motivation to decrease the effects of other drugs in new users like there was for all users. Additionally, new users did report a significant increase between Wave 2 and Wave 3 for the motivation to get through the day.

Additionally, the GEE models for the following motivations were unable to converge or received an error for concerns about validity: addiction for stimulants, seeking deeper understanding, boredom, and to decrease the effects of other drugs for CNS depressants, and to get away from problems, to increase the effects of other drugs, and to decrease the effects of other drugs for opioids.

Table 10.

Frequencies, percentages of users, and significant changes in NMUPD motivations across young adulthood for new users

NMUPD Motivation	Wave 1 *n* (%)	Wave 2 *n* (%)	Wave 3 *n* (%)	Wald chi-Square	Pairwise comparisons
Stimulants					
To experiment—to see what it's like	164 (42.6)	127 (40.7)	42 (29.9)	χ^2 (2, N = 847) = 16.87***	Wave 1 > Wave 3***
					Wave 2 > Wave 3**
To get more energy	193 (53.4)	163 (52.3)	79 (56.3)	χ^2 (2, N = 847) = 12.45**	Wave 1 < Wave 3**
CNS depressants					
To get through the day	9 (4.4)	5 (2.8)	14 (8.9)	χ^2 (2, N = 446) = 6.29*	Wave 2 < Wave 3*
To relieve physical pain	27 (12.2)	53 (28.1)	43 (27.8)	χ^2 (2, N = 442) = 6.01*	Wave 1 < Wave 2*
Opioids					
To experiment—to see what it's like	105 (43.6)	71 (33.0)	37 (26.2)	χ^2 (2, N = 472) = 10.71**	Wave 1 > Wave 2*
					Wave 1 > Wave 3**
Because of boredom, nothing else to do	28 (11.5)	16 (7.6)	13 (9.2)	χ^2 (2, N = 472) = 10.66**	Wave 1 > Wave 2**
To relieve physical pain	84 (35.1)	101 (47.0)	73 (51.4)	χ^2 (2, N = 471) = 8.62*	Wave 1 < Wave 2*
					Wave 1 < Wave 3*

Note. NMUPD = Non-medical use of prescription drugs. Unweighted sample sizes are reported for the Wald chi-square statistics. * $p < .05$, ** $p < .01$, *** $p < .001$.

Post Hoc Analyses for NMUPD Motivations

Latent class analyses (LCAs) were conducted in an exploratory fashion as a potential method of data reduction to provide more information for the motivations that were not able to be reliably tested with the GEE analyses once moderators were included, likely as a result of smaller sample sizes once the data were weighted. However, as suggested in the literature and other similar studies (e.g., McCabe & Cranford, 2012), the low frequency motivations were removed from the LCAs. Therefore, that data was still not captured. One advantage of LCAs is that they are considered person-centered, while GEEs are for estimating the population level information (Homish et al., 2010). One strength of this data set is that it is nationally representative and there is the potential to look at population-level information. Therefore, it was decided that investigating the motives individually provided better insight into this phenomena, rather than grouping them together. The results from the LCAs can be provided by the author upon request. It should be noted that there were not clear consistent class findings across waves for all of the prescription drug classes.

Discussion

The present study investigated the developmental changes in NMUPD motivations during young adulthood (ages 19 to 24; three waves of data) in a nationally representative sample combining data from 1976 to 2013. Additionally, changes in NMUPD motivations by sex, college attendance, use in high school, or new user status were researched. NMUPD motivations were studied across the prescription drug classes of stimulants, CNS depressants, and opioids. Approximately 4-8% of young adults endorsed NMUPD, which was similar to, or slightly lower than, other national estimates (e.g., SAMHSA, 2014). Stimulants (e.g., Adderall) were the most frequently used prescription drug class in the past year across young adulthood. This suggests

that research and interventions targeting the non-medical use of prescription stimulants continue to be important endeavors. However, in general, young adults who did endorse NMUPD most commonly reported infrequent use (1-5 times in the past year). While the reports of infrequent use call into question how problematic NMUPD is on the national level, the known negative consequences of NMUPD cannot be ignored (e.g., Arria et al., 2008; Bavarian et al., 2013; Janusis & Weyandt, 2010; Lo et al., 2013; McCauley et al., 2009; McCauley et al., 2010; McCauley et al., 2011; Van Eck et al., 2012; Zullig & Divin, 2012). Future work should thoroughly investigate what are the predictors and mechanisms of problematic NMUPD, specifically by prescription drug class, to get a better understanding of how frequency of NMUPD relates to the reported adverse outcomes.

Below, the results are reviewed in terms of the hypotheses and previous research. Areas of future research in relation to each major finding are discussed. Unique and unexpected findings are highlighted. Limitations of the current study, emerging research questions, and general conclusions close the section. Key findings from this study were that both recreational and self-treatment motivations were commonly reported over time and across drug classes, suggesting a need for multifaceted treatments. Generally, NMUPD motivations remained relatively stable across young adulthood. The motivations of experimentation and boredom decreased for some drug classes, and increased in select self-treatment motivations. Overall, men were more likely to endorse recreational motivations, while women were more likely to endorse self-treatment motivations, with some exceptions by prescription drug class. Women also were more likely to report using prescription stimulants non-medically to lose weight. Young adults not enrolled in college courses were more likely to endorse using stimulants non-medically for different reasons than their peers who were enrolled. There also were differences in motivations

based on if young adults initiated NMUPD in high school compared to when they were 19 to 20 years old. Yet, there were not many differences in NMUPD motivations across young adult development for new users.

Programs which target the most popularly endorsed NMUPD motivations will likely be successful in reducing NMUPD across young adult development for new and continued users. However, to be the most effective, efforts focusing on reducing NMUPD may need to be adapted by prescription drug class, sex, and college attendance status. Prevention efforts which start in high school may be useful in reducing NMUPD in the young adult population.

Descriptive Findings and Implications

Certain motivations were popular across the three waves of data for NMUPD and the majority of young adults endorsed multiple motivations, leveling off around four to five reasons for engaging in NMUPD. For stimulants the motivations endorsed primarily were educational enhancement (i.e., to help me study), and the clinical reasons the medications are prescribed, or self-treatment motivations (i.e., to stay awake, to get more energy). Recreational motivations (i.e., to feel good or get high, to experiment) and weight loss rounded out the stimulant category. For CNS depressants, NMUPD motivations focused mainly around self-treatment (i.e., to relax or relieve tension, to get sleep), recreational motivations (i.e., to feel good or get high, to experiment), and for the side-effect of pain relief. For the non-medical use of prescription opioids the commonly reported motivations included recreational (i.e., to feel good to get high, to experiment) and self-treatment motivations (e.g., to relax or relieve tension, to relieve physical pain). The results give support to both the self-medication hypothesis and Arnett's theory on recreational substance use in emerging adulthood (Arnett, 2005; Duncan,1974a; 1974b; 1975; Khantzian, 1985; 1997). Given the variety of motivations endorsed for NMUPD, prevention and

intervention efforts should be multifaceted to address the different motivations. Since, across prescription drug classes, both self-treatment and recreational motivations were commonly reported, both need to be included in prevention and intervention efforts. Additionally, there may be a need to design specific interventions based on each drug class's inherent properties and clinically prescribed effects, as well as popular side effects (e.g., weight loss for stimulants and physical pain relief for CNS depressants).

Interestingly, the percentages of NMUPD users attending college classes decreased over time for all prescription drug classes. This suggests that young adults who engage in NMUPD may be at more risk for college drop out. On the other hand, there may be other confounding factors (e.g., mental or physical health issues, Huang et al., 2006) that makes attending college classes difficult for this population and NMUPD more likely, and is an area of future research. This finding complements other work that has found that college students who endorse the non-medical use of prescription stimulants and opioids spent less time studying, skipped classes more often, and earned lower grades compared to their non-using peers (Arria et al., 2008). These factors may explain the observed reduction in college attendance over time. The results from the present study also suggest that similar risk factors may be relevant for college students who use CNS depressants non-medically. Additionally, future work need to consider graduation rates which may also explain the low numbers of college attendance, particularly when the sample is 23 to 24 years old.

Changes in NMUPD Motivations Across Young Adulthood

In terms of the main aims of the study, according to GEE models, motivations to engage in NMUPD were relatively stable over time. As a result, many of the study's hypotheses about overall changes in NMUPD motivations across young adulthood were only partially supported,

and in general, varied by prescription drug class. The prediction that was most accurate was that there would be no change over time for following motivations: to seek deeper insights and understanding, because of anger or frustration, to get through the day, to increase the effects of some other drug(s), to decrease (offset) the effects of some other drug(s), as a substitute for heroin, and to control coughing. The only time this hypothesis was not supported was for CNS depressants, where to decrease the effects of some other drug(s), was found to increase between wave 1 and wave 3. This finding proposes that CNS depressants may be more likely to be combined with other drugs, especially as young adults get older. This may be because as young adults age they become exposed to a greater variety of substances, and therefore they are more likely to be combing drugs. Indeed in young adult and college student samples, those who engage in NMUPD were more likely to endorse using other drugs, binge drinking, and combining their prescription drugs with other substances (Advokat et al., 2008; Barrett et al., 2005; Garnier et al., 2009; McCabe et al., 2007; McCabe et al., 2009; McCabe et al., 2006; SAMHSA, 2006). These behaviors increase the risk of potentially dangerous drug interactions and their negative outcomes. Specifically with CNS depressants, the disinhibitory and aggressive effects that result in violence and assault, as well as the risk for opioid-related deaths, are increased when CNS depressants are combined with alcohol and other drugs (Jann et al., 2014; Lader, 2011; Webster et al., 2011). Additionally, as this suggests that young adults are using a variety of drugs, treatment programs may not be effective if they are only targeting NMUPD. More research needs to be conducted in understanding how NMUPD fits into the larger drug culture, and how and why using CNS depressants to regulate the effects of other drugs increases overtime, while the use of stimulants and opioids to regulate the effects of other drugs remain more stable.

It was predicted that for recreational motivations, like to feel good or get high, for experimentation, and boredom, would decrease over time across all prescription drugs classes as young adults move towards more stability based on Arnett's theory of emerging adulthood (Arnett, 2005). This hypothesis also was partially supported. The NMUPD motivation of experimentation decreased across young adulthood for stimulant and opioid medications. Additionally, the NMUPD boredom motivation decreased between wave 1 and wave 2 for opioid medications, and was stable between waves 2 and 3. These findings support Arnett's theory that as young adults age they are less likely to use substances for recreational reasons as part of the self-exploration process and instability experienced during this this developmental period decreases. As a result, targeting these more recreational motivations may be more appropriate when individuals are entering young adulthood; at least for stimulant and opioid medications.

On the other hand, using prescription drugs non-medically to feel good or get high was consistent over time and a popularly endorsed motivation across prescription drug classes (i.e., reported by 35-55% of users). This should remain a target of intervention across young adulthood. The popularity and consistency of this motivation calls into question parts of Arnett's theory (2005) which would suggest that young adults would engage less in NMUPD to feel good or get high as they become more stable and potentially experience less stress and optimism. Additionally, according to research on brain development around this age, young adults should have the cognitive capacity to make methodical decisions over emotion-driven decisions (e.g., Steinberg, 2008), which would decrease this emotionally related motivation. Therefore, more work needs to be conducted to see if by age 24 young adults are actually experiencing less stress and negative affect associated with disruptions in life as proposed (e.g., new romantic partners, educational and vocational settings). Since much research has found that many young adults feel

like they are reaching “adulthood” later and later as traditional markers of adulthood are being continually delayed (e.g., getting married, buying a house, bearing children; Hutchison, 2015), this motivation may not actually decrease until later than the age range investigated in this study (e.g., 30 years old, Arnett, 2000). This could be tested using later cohorts from the MTF study as more data becomes available in later follow-up waves.

It was also predicted that “self-treatment” motivations (e.g., using the medications as they are clinically intended) and addiction motivations would increase over time across all prescription drug classes as exposure to prescription drugs and the risk for psychiatric problems increases (e.g., Kessler et al., 2005), under the self-medication hypothesis (Duncan, 1974a; 1974b; 1975; Khantzian, 1985; 1997). Again this hypothesis was partially supported in all prescription drug classes. For stimulants, to get more energy was endorsed more in wave 3 compared to wave 1. In reference to CNS depressants and opioids, to relieve physical pain increased over time (between wave 1 and wave 2 for CNS depressants, and wave 1 and wave 3 for opioids). This suggests that more outreach may be needed as young adults age to counter these motivations. Also, prevention may be possible in early young adulthood by using evidence-based treatments to target these motivations. For example, introducing and promoting ways to increase energy through the use of exercise (Haskell et al., 2007), or to decrease physical pain through the use of evidence based treatments (e.g., Garg, Joshi, Mishra, & Bhatnagar, 2012), may help to prevent young adults from engaging in NMUPD. Future research on how to continue to target these motivations in ways that have less potentially dangerous and harmful effects compared to NMUPD, are user-friendly, and accessible to young adults continues to be important.

However, other self-treatment motivations (i.e., stimulants: to stay awake, to help study, and to lose weight; CNS depressants: to relax or relieve tension and to get sleep; and opioids: to relax or relieve tension, and to get sleep) were stable across the three waves of data collection. This is not to say that these motivations are not important treatment targets, as many are commonly reported as motivations by this population. Rather, because these self-treatment motivations remain stable over time targeting them throughout young adulthood is vital.

Again, making alternative methods of treatments available beyond NMUPD is necessary. Connecting young adults to mental health professionals who can accurately diagnose and prescribe appropriate treatments, including medications, may help to alleviate these symptoms while reducing the risks associated with NMUPD, including the potential negative interactions of ingesting different substances when not being followed by a medical professional (McCabe et al., 2009). This is especially important as young adults may also misdiagnose their symptoms, resulting in use of inappropriate medications which in turn may lead to making their underlying problem worse, not better (Holloway & Bennett, 2012).

Moreover, using prescription CNS depressants and opioids medications as a sleep aid was endorsed as a relatively common motivation, and to get more energy and to stay awake was noted as a common motivation for stimulants. Given that the effects of taking medications to reduce sleep problems have been shown to decline in effectiveness over time and there is increasing research that supports such protocols as cognitive-behavior therapy as evidence-based treatments for disorders like insomnia (Morin, 2010), assessing and targeting sleep problems may be an effective prevention and intervention tool for reducing NMUPD in young adults. Additionally, as there is evidence that young adults who use prescription stimulants non-medically report worse subjective and overall sleep quality, as well as more sleep disturbances

compared to their peers who do not endorse non-medical use of stimulants (Clegg-Kraynok et al., 2011). As a result, targeting sleep problems may be beneficial to all young adults non-medically using prescriptions, regardless of prescription drug class.

Further, the addiction motivation did not vary across young adult development. One reason for this finding may be the low percentage of participants who endorsed addiction as a motivation, especially for stimulant medications (endorsement ranged from 1.1% to 9.5% of users). The number of young adults reporting addiction as a motivation for the non-medical use of prescription stimulants was so low the GEE model was unable to converge. There are a few potential reasons for why the addiction motivation was endorsed at such a low level across prescription drug classes. One may be that certain prescription medications have less addictive properties. In particular, stimulants medications are known to be less addictive as compared to opioids and CNS depressants (e.g., NIDA, 2011). Alternatively, individuals in this population may lack insight into their motivations and the potential that they are addicted to these medications, or are responding in a socially desirable manner. However, given that most of the sample reported infrequent use, another conclusion could be that not many individuals are addicted to the medications investigated. This also may explain the low numbers of young adults seeking treatment (e.g., 3.5% to 10.3%; McCabe et al., 2009), although more have been seeking treatment over time (e.g., SAMHSA, 2011). The results from this study suggest that targeting addiction as a motivation for use may not be as effective as targeting other motivations for use. Further, other treatment models that tend to focus on the addictive qualities of substances (e.g., many twelve-step programs, Arria & DuPont, 2010) may not be as appropriate for this population of substance users. Research needs to investigate though whether young adults

endorsing recreational motives report improved outcomes from receiving such treatments (Arria & DuPont, 2010).

Sex Effects on NMUPD Motivations in Young Adults

This study also investigated the role of sex in NMUPD motivations and if sex moderated the changes in NMUPD motivations across young adulthood using GEE models. It should be noted, that some of motivations were unable to investigated in this sample as the GEE models were unable to converge or received an error for concerns about validity. In general, the hypothesis that more males would endorse recreational motivations compared to females was supported. Specifically, significantly more males endorsed recreational motivations for stimulants (i.e., experimentation, have a good time with friends, increase the effects of other drugs, decrease the effects of other drugs). Males also were more likely than females to be motivated to use prescription stimulants non-medically stay awake. Similarly, for CNS depressants and opioids, more males endorsed the following recreational motivations: experimentation, to feel good/get high, and have a good time with friends. These findings are similar to previous work that found that males were more likely to endorse recreational and mixed motivations (both recreational and self-treatment motivations) compared to females in varied samples of higher education students (Lord et al., 2011; Lord et al., 2009; McCabe et al., 2007; McCabe et al., 2009). These findings support the generalization of this sex difference to the larger young adult population.

Conversely, as generally predicted, more females reported self-treatment motivations, or using the medications as they are clinically intended, compared to males for CNS depressants and opioids, similar to previous work (Lord et al., 2011; McCabe et al., 2007; McCabe et al., 2009). More females endorsed being motivated to use CNS depressants and opioids non-

medically to get sleep as well. Further, more females endorsed using opioids non-medically as well to relieve physical pain and to control coughing. For stimulant medications, females did not report more self-treatment motivations, which also was found in one other study (McCabe et al., 2009). Again, the sex differences found in smaller samples of young adult students appears to hold true for the greater young adult population.

As a result, it is advisable that prevention and intervention efforts may be more effective if they are sex-specific. Programs for males could focus more on recreational motivations, while programs for females could focus on more self-treatment motivations. Efforts to reduce NMUPD in males should emphasize other methods to engage in recreational activities or promote positive risk-taking experiences that have less negative consequences associated with them (e.g., recreational sports leagues). Research on the effectiveness of these alternative approaches needs to be explored further. Focus groups including males who do and do not engage in NMUPD may help researchers and practitioners discover some of the different methods used in these populations to achieve the same recreational goals. On the other hand, programs for females may include more evidence-based approaches for sleep and pain improvement as previously discussed. Additionally, connecting females to mental health professionals to target the underlying symptoms may be more appropriate.

Moreover, more females endorsed using stimulants non-medically to lose weight. This contradicts previous work on this topic which found similar reports of using stimulants non-medically for weight loss purposes (Jeffers et al., 2013; Jeffers & Benotsch, 2014). However, this research was conducted at one university, which may limit the studies' findings. The results from this nationally representative sample highlights that this finding may not be true for the broader young adult population. This result is not surprising though, given that in the general

population, young adult females tend to report more concerns about weight loss, using multiple methods to achieve weight loss, and are diagnosed with more eating disorders (Wilson, Grilo, & Vitousek, 2007). Given that weight loss was reported by 31% to 35% of non-medical stimulant users this is a significant motivation to include in prevention and intervention efforts, specifically treatment groups that are aimed at treated young adult female populations. Programs that have been found to be effective in making healthy lifestyle changes in young adults, specifically with weight loss as an outcome (e.g., Anderson, Konz, Frederich, & Wood, 2001), could be effective in this population to reduce using prescription stimulants non-medically for weight loss reasons.

There were two motivations where sex moderated the changes in NMUPD motivations over time: to feel good/get high for stimulant medications and to have a good time with friends for CNS depressants. In particular, females in wave 3 (ages 23/24) were less likely to report the motivation to feel good/get high for the non-medical use of stimulants compared to females in wave 1 (ages 19/20) and males in wave 3. Furthermore, males in wave 2 (ages 21/22) were more likely to endorse the motivation to have a good time with friends for CNS depressant non-medical use compared to both wave 1 and wave 2 females. Even though protections against Type I errors were implemented, given the paucity of moderation findings it is possible that these results are more likely the consequence of chance, and should not be emphasized. However, as these select findings highlight more recreational motivations, they are in line with previous work that as young adults age they may become more mature and engage in NMUPD less frequently for recreational reasons (Arnett, 2005). Further, these results support research on sex differences on risk-taking behaviors in adolescence and young adulthood where females have been found to mature more quickly in their decision making processes as compared to males (e.g., Harris,

Jenkins, & Glaser, 2006). Future studies need to replicate these results before heavily weighing the implications.

College Attendance Effects on NMUPD Motivations in Young Adults

Differences in young adults' NMUPD motivations based on college attendance were researched as well using GEE models. Results from the CNS depressant and opioid prescription drug classes supported the hypothesis that that college attendance would not moderate the relations of change in motives over time because young adults in and out of college both experience the same developmental life stage and associated changes, which provides support for general theories on young adult development (Arnett, 2005). However, there were general differences in NMUPD motivations for young adults in regards to the non-medical use of prescription stimulants, though no moderation was found. The one study that included a significant sample of young adults both enrolled and not enrolled in college classes found that, in general, the sample reported using stimulants non-medically both as the medications were intended and for recreational purposes, similar to studies of solely college students (Upadhyaya et al., 2010). However, this study did not specifically examine differences in NMUPD motivations by college attendance. The present study found that young adults not enrolled in college courses were more likely to endorse using stimulants non-medically to relax or relive tension, to feel good/get high, have a good time with friends, and to help lose weight. Notably, none of the motivations reported more by young adults not enrolled in college courses were using the medications as they are clinically intended. This highlights that young adults not in college may be at higher risk for using stimulants non-medically for unique reasons and alternative ways to directly address these motivations may be needed. Future research needs to continue to include young adults not in college to verify these findings. Also, since a variety of

motivations were unable to be reliably run, research needs to look more closely at some of the less reported motivations and in CNS depressant and opioid prescription drug classes.

High School NMUPD Users Have Different Motivations and Risk Factors

To gain a better understanding changes in motivations during the early young adulthood, logistic regression analyses revealed that young adults who started NMUPD at wave 1 (ages 19/20), compared to those who started NMUPD in high school, were more likely to endorse the following motivations: (1) For stimulants: to feel good/get high, to get through the day, to stay awake, to get more energy, and to lose weight, (2) for CNS depressants: to feel good/get high, and (3) for opioids: to relax/relieve tension, to feel good/get high, to get away from problems, to get sleep, as a substitute for heroin, and to relieve physical pain. Consequently, young adults who engage in NMUPD for the first time when they are 19 to 20 years old appear to be motivated by different factors compared to young adults who had previous NMUPD exposure in high school. Both recreational and self-treatment motivations were noted in different prescription drug classes and therefore, these results only partially supported the hypothesis that young adults who initiate NMUPD shortly after high school would be more likely to endorse recreational motivations.

In reference to the differences in recreational motivations that were found, it is possible that there is less novelty for individuals who engage in NMUPD at earlier ages. Specifically, the recreational motivation to feel good/get high was more likely to be reported by new wave 1 users across all prescription drug classes and highlights an important commonality. One reason this motivation may be more prevalent in new users is that young adults who reported NMUPD in high school may be experiencing some tolerance effects (e.g., Rosenfield et al., 2011). Since to feel good/get high is so widespread, prevention interventions for 19 to 20 year olds that target this motivation will likely be effective across prescription drug classes.

Other motivations that were reported more by new wave 1 users suggest that self-treatment needs may be higher in this population compared to young adults who used in high school. As young adulthood is when many mental health illnesses emerge (Kessler et al., 2005), it is not surprising that self-treatment motivations are more popular. This may also imply that those who use NMUPD in high school may have different symptom profiles and needs compared to individuals who start NMUPD later. This needs to be further investigated by future researchers. Regardless of whether young adults are treating actual symptoms, the theme of self-treatment suggests that young adults are not receiving the proper medical and mental health treatment needed. This may be occurring for a variety of reasons including stigma around receiving treatment, previous negative treatment experiences, limited access to health care, and/or a lack of awareness that NMUPD is a problem (Lord et al., 2011). Additionally, young adults may not have the resources to cope with stressors in more adaptive ways. Fostering support systems, like study or treatment groups, and suggesting adaptive coping strategies like proper diet and exercise, may help young adults better manage their stress (Herman et al., 2011). All of these potential problems could be addressed with prevention and intervention strategies, and may be needed more as individuals transition from adolescence to young adulthood. Future research should not only assess why there is a treatment gap, but funding should be provided for studies investigating the effectiveness of targeting these different barriers to treatment.

Interestingly, the motivation most influenced by new NMUPD at wave 1 was using prescription opioids as a substitute for heroin, with participants who reported no non-medical use of prescription opioids in high school 6.06 times more likely to endorse this motivation compared to individuals who reported using prescription opioids non-medically in high school. One explanation for this may be that these individuals were first using heroin in high school and

then initiated prescription opioid use in early adulthood. Although, much of the research to date suggests the opposite relation, that individuals who inject heroin are more likely to report the misuse of prescription opioids first (Brands, Blake, Sproule, Gourlay, & Busto, 2004; Cicero, Ellis, Surratt, & Kurtz, 2014; Cicero, Ellis, & Surratt, 2012; Grau et al., 2007; Lankenau et al., 2012; Peavy et al., 2012; Pollini et al., 2011); this highlights the need for work to also research the alternative direction. At least one investigation, where the authors pooled data from the National Survey on Drug Use and Health, did research the alternative hypothesis. While individuals who used heroin before using prescription opioids non-medically were at an increased risk for NMUPD, the risk was much greater in the opposite direction, from the non-medical use of prescription opioids to heroin (2 times more likely versus 19 times more likely, respectively; Muhuri, Gfroerer, & Davies, 2013). However, these findings highlight that reducing heroin use may consequently also lead to a reduction in the non-medical use of prescription opioids. This may be particularly salient for adolescents who use heroin in high school. However, the timing of use of heroin versus prescription opioids is not completely clear in this study, as the use is surveyed in the past year. More research on the specific timing and interplay of these two illicit substances needs to occur.

It is important to recognize that NMUPD in high school was a risk factor for further NMUPD in the following two years, based on frequency data. Post hoc analyses revealed that those individuals who reported NMUPD for any prescription drug class in high school were more likely to endorse NMUPD across all prescription drug classes at wave 1. Importantly, if a participant used a particular class of prescription drugs in high school, the strongest effects were for future use of that drug class (e.g., if used stimulants in high school had stronger effect sizes for future stimulant use compared to other drug classes). This suggests that targeting NMUPD in

high school could prevent increased use of NMUPD in early young adulthood, even if rates of NMUPD are lower during adolescence (SAMHSA, 2013b). Further, it does not appear that the interventions need to target any one specific prescription drug class. Instead, targeting one or all of the drug classes studied would probably reduce the risk of NMUPD across the board.

Motivations to Initiate Use Similar to Motivations of General Use Across Young Adulthood

Finally, what motivates young adults to initiate NMUPD across young adult development was studied using GEE models. In general, similar to all users, there were relatively few motivations that changed over time for new NMUPD users. Additionally, motivations that did change most often reflected the changes observed in all users. This supports the hypothesis that, overall, young adults experience the same changes in motivations over time because they are all experiencing the same developmental life stage and associated changes, which support Arnett's (2005) theory. A few differences in motivations were found between all users and new users, but these were sparse and there were none for the non-medical use of prescription stimulants. Specifically, for new non-medical users of prescription opioids along with increases in the motivation to relieve physical pain between wave 1 and wave 3, new users also reported an increase between wave 1 and wave 2. For CNS depressants, there were no significant differences found over time for the motivation to decrease the effects of other drugs in new users like there was for all users. Additionally, new users did report a significant increase between wave 2 and wave 3 for the motivation to get through the day. While these findings highlight areas for potential future research, the findings need to be interpreted with caution before they are replicated. Since two of the findings found more significant differences between more waves, and in the previously observed direction, this could mean that new users report these motivations on a sharper slope. In other words, new users may feel the need to relieve physical pain by using

prescription opioids or to get through the day by using CNS depressants more frequently than all users. New users may also be at less risk for combining CNS depressants with other drugs. This may be because new users are less experienced with drugs in general and are therefore less likely to be combining substances.

Limitations and Future Research

As with all research, this study has limitations that need to be acknowledged and ideally addressed in future work. First, this study was secondary data analysis of a reduced data set which limited the types of questions and confounding variables that could be assessed. Future work needs to consider other factors that may influence NMUPD motivations in this population including other demographic factors (e.g., geographic location, GPA, race/ethnicity, etc.) and other known risk factors for drug use (e.g., stress, trauma, other drug use, etc.). Second, the current study only assessed frequency of NMUPD and does not include measures of problematic NMUPD. Since most of the sample reported infrequent use, investigating measures of problematic use will likely lead to more bountiful information on which motivations may be most appropriate to target to make the most impact. Additionally, even with a large data set NMUPD frequency were low once the data were weighted, and consequently so were some of the reported motivations for use, resulting in difficulties for gaining a thorough understanding of the less frequently endorsed motivations. However, more research needs to be conducted about the importance of motivations that are less frequently reported. Spending energy and resources on these motivations may not be as useful on a larger scale compared to focusing on NMUPD motivations that are more common in young adulthood. Future work using factor analyses or other methods of data reduction may be helpful in determining how these motivations may group together in a clinically relevant way. To increase the sample size for this study multiple cohorts

were combined from 1976 to 2013, but cohort effects were not assessed as part of this work. Given the changes in NMUPD frequency (e.g., Lipari et al., 2015) and the increasing availability of prescription drugs overtime (Yu, 2012), research needs to look at how that may influence this study's findings. This study also relied on self-reports which are subject to social desirability and call into question the accuracy of participants' reports of negative behaviors, like drug use (Kazdin, 2003). Some studies that have not looked at motives have used unique methods in assessing NMUPD including testing campus wastewater for evidence of stimulant medication use in college populations (Burgard, Fuller, Becker, Ferrell, & Dinglasan-Panlilio, 2013). These innovative and other more traditional approaches, like using other reporters, should be considered in future work. This research leaves some other emerging questions unanswered. These include: How different is NMUPD from other drug use? Are current treatments targeting these motivations and do they work; specifically for young adults? Are there cultural similarities and differences in NMUPD motivations across countries? Researchers and advocates for the prevention of NMUPD in young adults should address these emerging areas while considering the current findings and concerns of prior research.

Conclusion

Even with these limitations acknowledged, the current study had several strengths including being the first work to investigate the changes in NMUPD across young adulthood in a nationally representative sample. Results from this study need to be replicated, but can be generalized to the American young adult population. As NMUPD motivations were generally stable over time the best approach to targeting NMUPD based on motivations will be to address the motivations endorsed the most frequently over time. However, since endorsing more than motivation was common, these interventions need to be multifaceted. Prevention and

intervention programs may need to be specialized by sex, and should start in high school to prevent future use. Young adults both enrolled and unenrolled in college classes need to be targeted, but those not enrolled in college classes may have different motivation patterns, at least in terms of stimulant medications. Programs should address these differences and be tested for their effectiveness.

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Vita

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