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Psychostimulant use among undiagnosed college students: Revealing perceptions anddebunking the myth of cognitive benefits

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ABSTRACT

SHAIT, REBECCA Psychostimulant use among undiagnosed college students: Revealing perceptions and debunking the myth of cognitive benefits

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Previous research suggests there is a rising trend of non-medical psychostimulant use on college campuses. The current study examined the prevalence of non-medical psychostimulant use, assessed students' motivations and perceptions of the cognitive and emotional benefits, and attempted to influence their views by giving them real scenarios where psychostimulants are not effective for individuals without ADHD. Results revealed that there is a prevalence of non-medical psychostimulant use at Union College. Non-medical psychostimulant users had a more positive perception that these medications enhance performance, cognition, memory, mood/energy, and motivation to start and complete work. There were no significant interactions or differences in reported planned use of non-medical users after exposing them to scientific evidence and social media scenarios where psychostimulants are not beneficial for individuals without ADHD. Nevertheless, there is a need to promote safe and legal use of these substances as well as change students' study habits to better manage academic pressure. My goal is to start a conversation about the consequences of non-medical psychostimulant use amongst college students without ADHD.

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INTRODUCTION

Psychostimulants activate the central nervous system and are thought to mimic neurotransmitters such as dopamine and norepinephrine. Psychostimulants are typically prescribed for people with ADHD, a chronic condition characterized by attention difficulty, hyperactivity, and impulsive behavior as well as people with narcolepsy, a chronic sleep disorder with overwhelming daytime drowsiness (Mayo Clinic). According to the National Institute on Drug Abuse (2014), stimulant ADHD medications gradually increase levels of dopamine, which is similar to the way dopamine is naturally produced in the brain. Thus, for people with ADHD, these medications are believed to affect chemical imbalance and signal transmission between neurons. ADHD medications increase wakefulness, regulate impulsiveness, and improve attention span and focus. Popular brand name psychostimulant medications include Adderall, Ritalin, Concerta, Vyvanse, Dexedrine, and Modafinil.

There is a rising trend in ADHD diagnoses, especially in the United States. Rates of ADHD diagnosis increased an average of 3% per year from 1997 to 2006 and an average of approximately 5% per year from 2003 to 2011 (CDC, 2015). According to the U.S. Centers for Disease Control and Prevention, 11 percent of children aged 4–17 have been diagnosed with ADHD as of 2011. There is also a rising trend of using prescription stimulants to manage symptoms of ADHD, as demonstrated by the fact that children who are taking medications for their ADHD diagnosis increased 28% between 2007 and 2011 (CDC). It is estimated that more than half of US children and adolescents diagnosed with ADHD receive medication (CDC).

The prevalence rate of ADHD is estimated to be between 2-8% amongst college students (Benson et al., 2015). Consequently, there is also a growing trend of non-medical

psychostimulant use amongst college students. According to the National Survey on Drug Use and Health 2009, full-time college students (ages 18-22) were twice as likely to have used Adderall non-medically in the past year compared to individuals who do not attend college. Psychostimulant use ranks second among illicit drugs used in college with marijuana being the most commonly used drug. According to Johnston et al. (2014), 10.7% of college students have used Adderall non-medically in the past year. The rate of stimulant medication misuse amongst college students is estimated at 17% (Benson et al., 2015).

Non-medical psychostimulant use is an important issue to address for several reasons. First, non-medical use of psychostimulants is illegal. It is illegal for students with prescriptions to give or sell their medications to others and it is illegal for students without a prescription to consume these medications. Also, college students without an ADHD diagnosis use psychostimulants as an academic shortcut. Students are thus not developing the coping, time management, organization, and study skills they need to succeed in life after graduating college (The Coalition to Prevent ADHD Medication Misuse, 2015). College students also use psychostimulants for recreational purposes, and so they have potential for abuse and unknown interaction effects with alcohol and other drugs. A lot more research needs to be conducted on the neurological, cognitive, and behavioral effects for those with and without an ADHD diagnosis. According to the National Institute on Drug Abuse (2014), when prescription stimulants are "taken in doses or via routes other than those prescribed, stimulants can increase brain dopamine in a rapid and highly amplified manner…[and disrupt] normal communication between brain cells." There are a lot of myths that need to be debunked, such that everyone is using these medications, the drugs are safe, and they improve academic performance and cognition (Medicine Abuse Project, 2015).

Previous research highlights the prevalence of non-medical psychostimulant use. McCabe, Knight, Teter, & Wechsler (2005) examined characteristic differences amongst illicit users and non-users. McCabe et al. surveyed 119 four-year colleges across 39 states in 2001 to investigate substance use and health behavior. After analyzing the self-reports from 10,904 non-medical psychostimulant users, it was revealed that use was higher amongst college students who were male, white, members of fraternities and sororities, and had lower grade point averages (GPAs). Rates were specifically high at colleges in the Northeast with highly competitive admission standards. McCabe et al. revealed that non-medical psychostimulant users were more likely to report use of alcohol and seven times more likely to report frequent binge drinking. College campuses with overall high and medium binge drinking levels had significantly higher overall rates of non-medical psychostimulant use compared to schools with lower levels of binge drinking. The most frequently reported motivations for non-medical use were to improve concentration and enhance alertness. Students who earned a B or lower GPA were almost two times more likely to report non-medical use compared to students who earned a B+ or higher (McCabe et al.).

Bronwen, McLaughlin, & Blake (2006) explored the patterns of non-medical psychostimulant use at a liberal arts college in New England. The college had an enrollment of 6,000 and 347 undergraduate students completed an anonymous survey. Participants were asked about their own non-medical use and their perceived peer non-medical use. Thirty-one participants (8.9%) reported non-medical psychostimulant use. Non-medical users believed that the stimulants helped students study better, stay awake, and lose weight. In addition, 247 students (71.4%) reported peers who used psychostimulants non-medically and about half of the participants knew peers who sold psychostimulants to other students (Bronwen et al.). It

is interesting that 149 students (44.3%) knew of peers who visited a physician in attempt to receive psychostimulant medication even though they don't believe they have ADHD.

DuPont, Coleman, Bucher, & Wilford (2008) surveyed 18-24 year olds enrolled in two or four-year colleges in March 2004 about their non-medical use of methylphenidate (i.e. Ritalin or Concerta). Approximately 5.3% of 2,087 students reported non-medical methylphenidate use at least once while 38.2% of non-medical users self-reported use in the past year (DuPont et al.). Non-medical users were also asked to identify brands of methylphenidate that they used most often. Fifty-four percent used Ritalin most often and 14% used Concerta most often, while 35% answered they didn't know the brand name of the medication. It is alarming that there is such a high percentage of non-medical users unaware of the brand-name product they use. If students do not know what medication they are taking, then they cannot look up dose information, side effects, and safety information. A critical finding was 90% of non-medical users obtained methylphenidate free from friends, family members, or acquaintances (DuPont et al.). This finding highlights the easy access for obtaining psychostimulants without an ADHD diagnosis or prescription.

Researchers have explored the relation between non-medical psychostimulant use and binge drinking amongst college students. Teter, McCabe, Boyd, & Guthrie (2003) surveyed 2,250 University of Michigan students in 2001. Researchers found that illicit methylphenidate users were significantly more likely to use alcohol as well as report negative alcohol and drug consequences compared to prescription stimulant users and students who did not use these medications. Almost 98% of illicit methylphenidate users reported a binge-drinking episode in the past two weeks. These results are supported by the National Survey on Drug Use and Health 2009 report that revealed almost 90% of full-time college students

who used Adderall non-medically were considered past month binge alcohol users. More than half of those students were considered heavy alcohol users. Teter et al. also revealed that past-year illicit methylphenidate users had significantly lower grade point averages compared to nonusers. Past-year illicit users had a GPA of 3.13 ± .06 while non-users had a GPA of 3.28 ± .01. The combination of high alcohol use and low GPA demonstrates that the culture of psychostimulant use amongst college students needs to be changed.

Social media is an important tool for monitoring and understanding public health problems, especially pertaining to college students. Hanson, Burton, Giraud-Carrier, West, Barnes, & Hansen (2013) examined Twitter for tweets that mentioned Adderall and its side effects. Tweets from students with GPS data were identified and clustered to nearby colleges and universities. From November 2011 to May 2012, 213,633 tweets from 132,099 users were collected (Hanson et al.). Researchers found that the number of tweets about Adderall increased during traditional college and university final exam periods (December and May). Highest rates of Adderall tweets came from colleges and universities in the Northeast and South regions of the US. Specifically, Vermont, Massachusetts, and Alabama had the highest rates of Adderall tweets. Using Adderall as a study aid was mentioned in 12.9% of the tweets. Alcohol was the most common substance mentioned along with Adderall (about 4.8% of tweets). The most common side effects were sleep deprivation (5.0%) and loss of appetite (2.6%). Social media influences social norms and so twitter feeds can create a gross misperception that consuming psychostimulants without a prescription is safe, socially acceptable, and normal behavior. This gross perception can lead to greater non-medical use since individuals view their peers as using psychostimulants as well. Mentioning alcohol or

other substances along with Adderall could make peers believe that consuming several drugs is not dangerous.

Jardin, Looby & Earleywine (2011) investigated college students with psychostimulant prescriptions to uncover characteristic differences between medical misusers and appropriate users. Forty-four undergraduate students at a large northeastern university were assessed based on the DSM-IV symptoms for ADHD, 40-item Prescription Stimulant Expectancy Questionnaire, and Zuckerman's 40-item Sensation Seeking Scale. Forty-five percent of participants stated they misused their medication (Jardin et al.). Of the medical misusers, 27.9% reported using an alternative route of administration (i.e. intra-nasally), 62.8% reported taking a higher dose then recommended, 23.3% reported simultaneous use of their medication with other drugs/alcohol to feel intoxicated, and 48.8% reported giving and/or selling their medication (Jardin et al.). Medical misusers were significantly more likely to state that they recreationally use nicotine, marijuana, hallucinogens, opiates, and cocaine. Medical misusers also had significantly higher scores on Zuckerman's Sensation Seeking Scale and on the hyperactivity component of the DSM-IV symptoms for ADHD.

Hartung, Canu, Cleveland, Lefler, Mignogna, Fedele, Correia, Leffingwell, Thad, & Clapp (2013) compared appropriate users, nonmedical misusers, medical misusers, and nonusers of stimulant medication amongst college students. Participants were recruited from four public universities located in the Southeast. Participants reported on their substance abuse, stimulant use, and ADHD symptoms (based on DSM-IV self-report measure). Nonmedical and medical misusers were more likely than appropriate users to endorse using stimulants in order to stay awake. Specifically, nonmedical misusers were more likely to encourage use to study compared to appropriate users. Nonmedical misusers also reported

greater parental pressure to succeed academically compared to nonusers. Thus, parental expectation of academic success may influence students' decisions to use psychostimulants non-medically. Approximately 81% of nonmedical misusers reported obtaining stimulants from a friend. Medical misusers were more likely to promote use in order to increase academic performance compared to appropriate users (Hartung et al.). Thirteen percent of nonmedical misusers and 24% of medical misusers indicated using stimulants to get high. All three stimulant medication user-groups reported high rates of simultaneous alcohol use, which is concerning due to the unknown interaction effects of stimulants and alcohol.

DeSantis, Anthony, & Cohen (2013) examined characteristics of students who distribute psychostimulant medications. The participants included 120 undergraduates (5.2% of sample) with current prescriptions for ADHD at a Southeastern University. The survey included questions about demographic information, specific medication use, side effects, relationship with healthcare provider, morality of distributing ADHD stimulants to others, perception of others' legal and illegal use, and use of other substances (DeSantis et al.). Participants were asked if they had given or sold their prescribed stimulants. Sixty-three students (52.5%) admitted to giving their prescribed medication away and 47 students (39.2%) admitted to selling their medication to someone without a prescription (DeSantis et al.). Both students who sold and gave away their medications were similar in their use of illegal drugs and misuse of stimulants. For example, distributors were more likely to take their medication less frequently and use stimulants for non-medical purposes. Distributors overestimated the percentage of illegal users and prescribed users. Participants involved in Greek life were more likely to distribute their current prescription for illegal consumption (DeSantis et al.). Participants who sold or gave medications to others were more likely to

report that they belong to peer groups that also used psychostimulants non-medically. Participants believed that taking psychostimulants without a prescription is a "safe and moral act" (DeSantis et al.).

Benson, Flory, Humphreys, & Lee (2015) conducted an extensive literature review and meta-analysis on the misuse of stimulants amongst college students. Thirty studies demonstrated that non-medical use is associated with several demographic, academic, and psychosocial factors (Benson et al). There are important characteristic differences between misusers and non-users. Out of 19 studies that reported on gender, 13 found that males misused stimulant medications more than females. Five studies investigated whether class year was related to non-medical use. Two of the five studies found that a significantly greater number of upperclassmen are non-medical users compared to underclassmen. For example, DeSantis et al (2008) found that 18% Freshmen, 31% Sophomores, 49% Juniors, and 55% Seniors had misused stimulant medication. Seven out of 10 studies found significant differences between Greek and non-Greek students. Dussault & Weyandt (2013) reported that Greek life members differed significantly from nonmembers on perception of stimulant medication safety. Greek life members perceived stimulants to be safer than non-members. Greek life members also reported higher rates of perceived peer non-medical psychostimulant use. Out of eight studies, six showed that misusers were more likely to have lower GPAs, skip a greater percentage of class, and spend less time studying.

Benson, Flory, Humphreys, & Lee (2015) also investigated the relationship between non-medical use and use of other substances. All sixteen studies that examined substance use (such as alcohol and marijuana) found a positive correlation or significant difference between stimulant misusers and nonusers in rates of other substance use (Benson et al). Nevertheless,

the majority of non-medical users take psychostimulants for academic purposes. All 15 studies pertaining to students' motivations were related to academics. In general, the majority of college students believe that psychostimulants are somewhat easy or very easy to obtain (Benson et al). Peers were the most common source for obtaining these medications. The greatest predictor of diverting stimulant medication was misusing stimulant medication (i.e., taking more medication than prescribed). Fifty-seven percent of misusers diverted their medication compared to 21% of those who used stimulant medications as prescribed (Benson et al). Benson et al discussed how consequences of non-medical psychostimulant use are less commonly studied. One study found that in a general college student sample, effects were experienced "often" or "always" for academic motives, 59% for getting high, and 39% for losing weight (Rabiner et al., 2009).

Motivations for Non-Medical Psychostimulant Use on College Campuses

Smith & Farah (2011) examined fourteen studies that investigated reasons for non-medical prescription stimulant use. The most common reasons they found were related to cognitive enhancement such as concentration, attention, memorization, alertness, study habits, academic assignments, grades, and before tests or finals week (Smith & Farah). Recreational purposes were less common, but still mentioned. Motivations included weight loss, experimentation, to "get high," and to "be able to drink and party longer without feeling drunk."

According to a Comprehensive Literature Review by Matthew Varga (2012), there are four main factors that contribute to Adderall Abuse on college campuses. These characteristics include pressure to succeed, sociocultural expectation, collegiate lifestyle, and

accessibility to psychostimulants (Varga). Personal or familial stress can cause students to feel pressure to succeed. Sociocultural expectation is exemplified by the fact that college students perceive recreational psychostimulant use as common, legal, and acceptable compared to other drugs or stimulants (such as cocaine). The rise of ADHD diagnoses and treating ADHD with prescription stimulants contributes to sociocultural expectation. Students believe that college is the time to "experiment" and may feel peer pressured to try psychostimulants. For most students, college is the first time they are without supervision from their parents and this could cause them to experiment with drugs and alcohol. In addition, college courses are harder than high school classes, which could cause some students to use psychostimulants to maintain their academic performance. Students with prescriptions for psychostimulants allow easy access for peers to obtain these medications.

Similarly, Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Arria (2012) examined trends in motivations for non-medical psychostimulant use amongst college students. Researchers collected annual data from 2004-05 to 2008-09 academic year. Participants included 1253 individuals from a large, public university in the mid-Atlantic region. By the time students were seniors, 61.8% were offered psychostimulants and 31% used them (Garnier-Dysktra et al.). Annually, participants were asked to explain why they used prescription stimulants non-medically. Their responses were coded into five categories including curiosity/experimentation, improve focus/study/work, stay awake to party, get high/feel good, and other reasons (Garnier-Dykstra et al.). The results revealed that curiosity was more likely to be a motive for underclassmen as compared to upperclassmen. Studying was the most common motive every year of college. This pattern may indicate that later in college, non-medical psychostimulant use is "less about novelty-seeking behavior and more

of an academic shortcut to achieve better grades" (Garnier-Dykstra et al.). The results also highlight that even when motives change over time, there is still a prevalence of non-medical use. A friend with a prescription was the most common source every year. Overusing one's own legitimate prescription, however, increased over time. Non-medical prescription stimulant use was also associated with lower GPA.

Perception and Non-Medical Psychostimulant Use

Perception is thought to play a large role in non-medical psychostimulant use. Simon & Stewart (2013) reviewed evidence explaining how perception influences stimulant use in society and athletics. Simon & Stewart claim there are ambiguous cognitive advantages of methylphenidate and amphetamines (particularly Adderall) due to a lack of sufficient evidence of positive effects in individuals without ADHD. Nevertheless, whether the medication has specific physiological or behavioral effects may be less important than the perception that it works well and peers are using it (Simon & Stewart). Illicit users report higher estimates for the prevalence of use compared to non-users whereas non-users are closer to the actual prevalence rate.

Looby & Earlywine (2011) examined how students' expectations of receiving methylphenidate affected their cognitive performance and subjective arousal. Participants reported a lifetime non-use of prescription stimulant medication and were characteristic of two of the following risk factors for prescription stimulant use: involvement of sorority or fraternity life, GPA below 3.5, at least one episode of binge drinking in the past two weeks, or past-month cannabis use (Looby & Earlywine). Ninety-six subjects (60% male) completed cognitive tests and questionnaires assessing mood state. For the experimental group,

participants received a placebo, which they thought was 20 mg of Ritalin, and completed cognitive tests. During the other visit, they received no medication. The control group received no medication on both visits. Participants were given a cover story that researchers were examining the influence of methylphenidate on mood and cognitive performance.

Some of the cognitive tests included the California Verbal Learning Test- 2nd edition, RMBT-II, digit span, and a subtest from Wechsler adult intelligence scale III (Looby & Earleywine, 2011). Twenty minutes following the placebo administration as well as following the completion of the tests, the experimental group reported significant increases in mood and drug effects compared to the non-administration visit and control group (Looby & Earleywine). Experimental participants reported the strongest mood effects during the administration visit and the weakest during the non-administration compared to the control group, whose mood remained steady between visits (Looby & Earleywine). Students truly believed that "Ritalin" (placebo) improved their mood. It is important to note that the experimental participants did not expect to perform better or believe they performed better on the administration visit compared to the non-administration visit or control group (Looby & Earleywine). Thus, it is possible that these students had not taken psychostimulant medications because they believe it won't enhance their cognition and solely affect mood.

Dodge, Williams, Marzell, and Turrisi (2012) examined college students' perceptions of non-medical psychostimulant use for academic purposes compared to steroid use for athletic performance. Approximately 1200 freshman males from a college in the mid-Atlantic region completed the study. Participants read two scenarios where an individual performed better than expected after taking a performance enhancer prior to an important event (Dodge et al.). One scenario involved a male collegiate-athlete and the other described a male

student. Participants were asked about their history of substance abuse and sport participation. Researchers assessed participants' perception of cheating and the degree to which they felt psychostimulants or steroids were necessary for success. The results showed that participants believed the athlete was more of a cheater than the student and this difference was greater as past prescription stimulant misuse increased (Dodge et al.). Participants also felt Adderall was more necessary than steroids for bringing about success (Dodge et al.). If students don't believe taking psychostimulants without a prescription is cheating then it further contributes to non-medical use. It is a debate amongst several universities and colleges over whether non-medical psychostimulant use should be written in their Honor Code.

Ilieva & Farah (2013) investigated the perceived motivational and cognitive benefits of college students using psychostimulants non-medically. Forty University of Pennsylvania undergraduates with no history of ADHD who used psychostimulants at least once in their lives participated in the study. The participants completed an online survey assessing their previous use of psychostimulants and their perceived effects. Students were asked to assess the benefits of the medication. Participants believed that motivation, energy, and attention were the most strongly enhanced after using psychostimulants.

Vrecko (2013) conducted a qualitative analysis to see how university students describe their experiences of psychostimulant use. The qualitative investigation consisted of semi-structured interviews of 24 students attending an elite university on the East Coast of the US. Participants were required to have used psychostimulants for academic reasons as well as not have an ADHD diagnosis or prescription. Participants' self-reports suggested that psychostimulants enhanced general levels of energy and wellbeing (Vrecko). Participants

believed that they had to work less hard to motivate them to complete their work. This "driveness" is an important factor in increasing productivity especially since participants frequently stated that a lack of interest in work compelled them to use psychostimulants. Participants believed that they could not only remain continuously engaged in their work, but also take greater enjoyment in their work after taking psychostimulants.

Cognitive Effects of Non-Medical Psychostimulant Use

Smith & Farah (2011) investigated 17 studies on the effects of amphetamine and methylphenidate on cognitive control for individuals not diagnosed with ADHD. Cognitive control includes reasoning, problem solving, and managing time and attention. Out of 17 studies, psychostimulant medications had no effect in 10 studies, mixed effects in 1 study, and positive outcomes in six studies. Thus, there is no guarantee that taking psychostimulants non-medically before a task will improve performance. To investigate effects of working memory, 27 tasks from 23 articles were assessed. The evidence was mixed with some findings of enhancement and some null results. Researchers suggest that stimulants may enhance working memory, at least for some individuals in certain task contexts, but the effects are "not so large or reliable as to be observable in all or even most working memory studies" (Smith & Farah). To assess if stimulants enhance learning, 24 tasks from 22 articles were examined. Overall, the effects of stimulants on learning is that they do help with the consolidation of declarative learning with effect sizes varying widely from small to large depending on the task and individual study (Smith & Farah). Researchers believe psychostimulants may enhance cognition, but the enhancement effect is small and may not be

practical in the real world. Individual differences within samples as well as inconsistent dosages across studies could lead to mixed cognitive results.

Ilieva, Boland, & Farah (2012) also investigated the cognitive effects of mixed amphetamine salts (i.e. Adderall) in individuals without an ADHD diagnosis. The study was a double blind, placebo-controlled, crossover study. The participants were 46 Caucasians aged 21-30 who responded to ads placed in the area of Drexel University and University of Pennsylvania. The researchers hypothesized that Adderall would improve cognitive performance compared to a placebo. Participants completed seven sessions that included practice, baseline SAT, baseline cognitive, on-pill SAT, on-pill cognitive, on-pill (placebo) SAT, and on-pill (placebo) cognitive again. The experimental group was given 20 mg of mixed amphetamine salts while the control group was given a placebo that looked identical to the real medication.

Cognitive tests included memory, face memory, word memory, working memory, digit span forward and backward, object-2-back, inhibitory control, Go-No/go, flanker, creativity, remote associations test, group embedded figures task, standardized tests, raven's advanced progressive matrices, scholastic achievement test, and perceived drug effect. Overall, there was a lack of any evidence of reliable enhancement across 13 different measures of cognitive performance (Ilieva, Boland, & Farah, 2012). On average, participants believed that the psychostimulant enhanced their cognitive performance more than the placebo. Nevertheless, there was no actual enhancement on average. Participants who felt more enhanced still did not show a true enhancement effect (Ilieva et al.). Similar to Smith & Farah (2011), the interpretation of the results is that methylphenidate is not a powerful

cognitive enhancer. If psychostimulants enhance cognition for individuals without ADHD, the effects are likely to be small (Ilieva et al.).

Bagot & Kaminer (2014) conducted a systematic review on cognitive enhancement and non-ADHD young adults. Fourteen articles were examined that involved young adults aged 12-25. Researchers found that methylphenidate appeared to improve "performance in unfamiliar tasks but results in a deficit in planning latency and increased impulsivity leading to poorer performance in familiar tasks" (Bagot & Kaminer). One study found that 20 mg and 40 mg of methylphenidate lead to increased delayed recall of words in a verbal memory task, but not immediate recall. Looby and Earlywine (2011), nevertheless, found that on a Memory After Delay task, individuals without ADHD who received psychostimulant medication performed significantly worse on the number of words they recalled compared to those who did not receive psychostimulant medication. Delayed Memory Task is important for short-term memory and learning new material, studying for a test, and memorizing lines of a script. Bagot & Kaminer also reveal that amphetamine may improve consolidation of information, but suggest that there is no overall "robust cognitive enhancing effect."

Caffeine Vs. Psychostimulant Medication

Haskell, Kennedy, Wesnes, & Scholey (2005) investigated the cognitive and mood effects of caffeine in habitual users and habitual non-users through a placebo-controlled, double blind, and balanced crossover study. Following overnight caffeine withdrawal, 24 habitual caffeine consumers (217 mg/day) and 24 habitual non-consumers (20 mg/day) received a 150 ml drink containing either 75 or 150 mg of caffeine or a placebo. Cognition and mood were assessed at baseline and 30 minutes after consuming the drink. The

assessments included the Cognitive Drug Research computerized test battery, two serial subtraction tasks, a sentence verification task, and subjective visual analogue mood scales. The results revealed that there were significant improvements in simple reaction time, digit vigilance reaction time, numeric working memory reaction time, and sentence verification accuracy after both habitual consumers and non-consumers drank caffeine (Haskell et al.) Self-reported mental fatigue was reduced and rating of alertness increased significantly.

Franke, Lieb, & Hildt (2012) explored how German university students view the cognitive benefits of caffeine compared to prescription stimulants. Researchers conducted face-to-face interviews and asked questions such as "is there a difference between the use of caffeine and stimulants like amphetamine or methylphenidate for cognitive enhancement? Is there a moral difference between the use of caffeine and stimulants?" The mean age of participants were 25.8 years old and 2/3 of participants were male. Eight participants (44.8%) stated there is a difference in general between the use of caffeine and stimulants for the purpose of cognitive enhancement (Franke et al.). Participants believed the effects of stimulants lasted longer than caffeine, but side effects of caffeine were more predictable than stimulants. Participants also discussed that stimulants affect individuals differently where some experience enhanced cognitive effects and other experience harmful effects. A particularly interesting finding was that some participants believed caffeine had "wake-promoting effects" while stimulants have "real" cognitive enhancing effects.

The majority of participants (ten) stated that there was no moral difference in using caffeine compared to psychostimulants non-medically. Seven participants stated that there was a moral difference. Three participants believed there was no moral difference between "cognitive enhancers" whether it is coffee, energy drinks, or Ritalin. Participants did not

believe caffeine was harmful to one's health, but ten students stated that the misuse of psychostimulants could have "negative implications" for one's health. Overall, the medical and legal consequences played an important role in participants' decision to use caffeine or stimulants for cognitive enhancement (Franke, Lieb, & Hildt, 2012).

Wood, Sage, Shuman, & Anagnostaras (2014) claim that dose is an important factor for the cognitive effects of psychostimulants. Researchers reviewed stimulants such as amphetamine, methylphenidate, modafinil, and caffeine explaining their history, mechanism of action, legal use and non-medical use as well as cognitive effects. Wood et al. argue that the cognitive effects of psychostimulants is an inverted U-shaped dose-effect curve such that moderate arousal is beneficial to cognition whereas too much activation leads to cognitive impairment. Studies with individuals who don't have ADHD reveal that low doses of amphetamine can improve measures of cognition. Mattay et al (2000) had 10 subjects without ADHD consume 0.25 mg/kg D-amphetamine or a placebo before performing a working memory task while undergoing fMRI scanning. Subjects who had a low baseline score (on placebo) showed improvement for the most challenging aspects of the task after taking D-amphetamine. D-amphetamine, however, impaired participants who had a high working memory at baseline. FMRI scans revealed that those who improved their performance on the task showed a small increase in prefrontal cortex after taking d-amphetamine while larger increases in activity revealed cognitive impairment (Wood et al.).

Wood, Sage, Shuman, & Anagnostaras (2014) also discuss the cognitive effects of caffeine. Caffeine, unlike amphetamine or methylphenidate, doesn't act on the dopamine receptor. Caffeine primarily acts on the adenosine receptor. Additionally, habitual consumption of caffeine is found to be "quite safe, revealing no adverse effects on a number

of health measures, including cardiovascular health, cancer incidence, and calcium balance" (Nawrot et al., 2003). Research on the cognitive effects of caffeine reveal that lower doses of caffeine can lead to positive effects whereas higher doses produce impairment. Kaplan et al. (1997) revealed that participants who had consumed 250 mg (~3 mg/kg) of caffeine improved performance on the digit symbol substitution task, a test of perceptual speed and memory, more so than a 500-mg (~6 mg/kg) dose compared to the placebo. Smith & Rogers (2000) also found that low doses of 12.5, 50, or 100 mg of caffeine all enhanced Simple Reaction Time performance when compared to controls. A low dose of caffeine (150 mg) was also found to "improve the speed of digit vigilance reaction time, as well as the accuracy of Rapid Visual Information Processing" (Haskell et al., 2008).

Dixit (2012) and Barch & Carter (2005) investigated how individuals without an ADHD diagnosis perform on the Stroop task after consuming either caffeine or the psychostimulant medication "Dexedrine." The Stroop task is associated with how individuals manage thoughts and focus attention. This is important when reviewing complex material, engaging in simultaneous computations or tasks, and creating graphic or visual art. The effect size for performance on the Stroop task when taking caffeine is three (Dixit). The effect size when taking Dexedrine prior to the Stroop task was .4. Thus, for the Stroop task, the effect size was greater for individuals without an ADHD diagnosis who consumed caffeine prior to the task compared to those individuals without an ADHD diagnosis who consumed psychostimulant medication.

Health Risks and Prevention of Non-Medical Psychostimulant Use

There is no guarantee that taking psychostimulants non-medically will produce students' desired or intended effects. According to Advokat, Guildry, & Martino (2008), 74% of misusing students at a large Southern university experienced decreased appetite, 71% experienced insomnia, 29% experienced irritability, 27% experienced headaches, and 23% experienced stomachaches. There is also potential for abuse when taking psychostimulants recreationally. For example, consuming psychostimulants intra-nasally causes individuals to experience a high similar to cocaine. According to Benson, Flory, & Humphreys (2015), college students report using psychostimulants non-medically in order to consume more alcohol over a longer period of time.

Arria & Du Pont (2010) discuss approaches to prevent non-medical psychostimulant use amongst college students. Arria & Du Pont claim that there are many myths about psychostimulants that contribute to the college culture of non-medical use. Media outlets spread myths and create an overall relaxed attitude toward non-medical use. For example, media outlets spread the myth that non-medical psychostimulant use increases academic performance by using headlines such as "smart drugs" and "performance enhancers." Research, however, shows that there is individual variation in psychostimulant cognitive effects and experiences. College students without an ADHD prescription cannot assume that they will experience the same benefits as those with ADHD since non-medical use is often "intermittent, without medical supervision, and performance improvements may be dependent on baseline cognitive ability" (Arria & Du Pont).

Arria & Du Pont (2010) uncover eight strategies to prevent non-medical psychostimulant use. These strategies include dispelling the popular myths by continuing

research and disseminating findings, promoting awareness of the legal risks for the diversion and nonmedical use of psychostimulants, encouraging physicians to advise their patients against diversion since there are legal and health risks, and empowering parents to take a central role in prevention (Arria & Du Pont). There must also be a multidisciplinary campus action plan involving administrators, professors, and health center professionals to generate discussions about the negative consequences of non-medical psychostimulant use. Since non-medical psychostimulant use is associated with other substance use, early intervention strategies to assess risk may be "influential in preventing the progression to substance abuse" (Arria & DuPont).

Before trying to change college students' use of psychostimulants non-medically, it is important to understand students' motivations and perceptions. According to Benson, Flory, & Humphreys (2015), perceived risk of psychostimulants is an important factor in deciding to use psychostimulants non-medically. Researchers argue that universities should provide information to students about the negative consequences of misuse in order to increase students' perceived risk and decrease their misuse (Benson et al., 2015). Since an overwhelmingly large number of students misuse for academic reasons and believe that the medications are effective, an academic intervention could be very influential in changing students' misuse. An academic intervention can include instruction in study skills and academic goal setting, which could influence college students' misuse (Benson et al., 2015). Time and stress management as well as organization skills should also be incorporated into freshmen year courses.

Hypotheses:

It is expected that:

1. There is a prevalence of non-medical psychostimulant use amongst Union College students similar to other liberal arts colleges.
    a. ~8.9% of sample size (Bronwen et al., 2006)
    b. Characteristically male, members of Greek life, lower GPAs, greater alcohol intake and frequency, more likely to skip class and sleep less
2. Perception of cognitive and mood benefits as well as use by peers will be greater for non-medical users
    a. Non-medical users will have a more positive perception of performance, cognition, consistent side effects, mood/energy, memory, motivation
    b. Non-medical users will perceive more peers as using psychostimulants non-medically compared to non-users
3. Examining scenarios where non-medical psychostimulant use is not effective for individuals without an ADHD diagnosis will significantly reduce non-medical users' planned use of psychostimulants
    a. Expected decrease for:
        i. Scientific Evidence Approach- research where non-medical psychostimulant use has negative or mixed cognitive effects
        ii. Social Media Pitch- memes showing negative side effects of using Adderall without a prescription

My goal is to start a conversation about non-medical psychostimulant use amongst Union College students by gathering scientific evidence and seeing if a prevalence exists as well as pilot possible interventions for changing the culture of use.

METHODS

Participants

The sample (N=221) consisted of Union College undergraduate students aged 18-23 years old. Seven participants were discarded for lack of effort. The valid sample consisted of 214 students. There were 138 females and 76 males. Eighty participants completed the first condition (academic scenario), 75 students completed the second condition (social media pitch), and 59 students completed the third condition (control). Seventy students reported non-medical use of psychostimulants (including those both with and without a psychostimulant prescription). Sixty-one students reported non-medical use and did not have a prescription for ADHD, and so when assessing characteristics of non-medical users, these 61 students were investigated. Participants were volunteers who were solicited through campus-wide emails sent by Cay Anderson-Hanley. Students received a four-dollar stipend or ½ psych credit for completing the survey. Prior to beginning the web-based questionnaire, students read the informed consent form. The participants were not aware that non-medical use of psychostimulants was being investigated in the study. Due to the nature of the study, anonymity and confidentiality of the participants were protected.

Procedures

Prior to beginning the study, a detailed application was submitted and approved by the Human Subjects Review Committee. The researcher also applied and was awarded a Student Research Grant of $459 to pay participants. The web-based questionnaire was administered through a campus-wide email sent to Union College undergraduates by Cay Anderson-Hanley. The cover story stated that the researcher was investigating recreational substance use amongst Union College students. The first campus-wide email was sent Week 9 of Winter term 2015. The informed consent was placed in the email and then students had the option to choose link one, two, or three. Each link represented a different condition (academic approach, social media pitch, and control condition respectively). All three surveys had the same questions pertaining to psychostimulant use, perception and motivations for taking psychostimulants non-medically, alcohol intake, sleep and exercise pattern, and general demographic questions.

The first condition contained three graphs highlighting research where non-medical psychostimulant use was not effective (Appendix A). The graphs demonstrated data from the Dixit (2012), Barch & Carter (2005), Smith & Farah (2011), and Looby & Earleywine (2011) studies previously mentioned. Participants were required to explain what they learned from the graphs in 2-3 sentences. The second condition showed three different memes where characters experienced negative side effects from taking psychostimulants (Appendix B). The memes were taken from the UC Boulder #AdderallProblems Campaign. The health center along with two senior students at UC Boulder placed these images at the University Memorial Center during finals week to make other students aware of the consequences of non-medical psychostimulant use. For the current study, participants looked at the images

and were required to describe how the characters were feeling and why they were feeling this way. The third condition consisted of three filler questions pertaining to different areas on the Union College campus (Appendix C). The survey took approximately 15 minutes to complete and students collected their $4 stipend or ½ psych credit by showing a screenshot of the last page of the survey to the researcher in Professor Anderson-Hanley's lab on campus. After the campus wide-email was sent, there were 147 participants (47 who used psychostimulants non-medically) so another campus-wide email was sent during Finals Week of Winter term 2015. The links were presented in a different order to ensure sample randomization.

Measures

The Alcohol Use Disorders Identification Test: Self Report Version developed by the World Health Organization was used to assess alcohol frequency and intake. To assess college students' motivations for using psychostimulants non-medically, a question was designed based on the DeSantis et al. (2008) survey. The reasons for illegal use consisted of "To stay awake to study, To concentrate on work, To help memorize, To stay awake and have fun, To make work more interesting, For the high (the good feeling), To suppress your appetite, To self-medicate your ADHD, Other."

Statistical Analysis

Data collected was analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS v. 19.0). Independent samples t-tests and a chi-squared analysis was used to assess the prevalence and characteristics of non-medical users. A Repeated Measures ANOVA was conducted to evaluate non-medical users reported future use pre and post

experimental manipulation and to see if any interactions existed. Tukey's univariate was also used to compare the three experimental conditions and their reported future use. Paired t-tests were used to assess the trend within each condition pre and post intervention.

RESULTS

There were a total of 221 Union College students who completed the survey. Seven participants were discarded for lack of effort. After manually reviewing the data, participants were discarded based on their responses to the open-ended questions. For example, when asked to explain what participants learned from the three graphs (write 2-3 sentences), one participant responded "Adderol, Adderol, Adderol." Thus, this participant did not take the time to study and read the information about the graphs as well as did not follow instructions about writing a few sentences. The total valid sample size was 214 students with 76 males (36%) and 138 females (64%). Eighty percent of the sample (N=172) considered themselves to be non-minority. Forty-seven percent of the sample (N=101) participated in Greek life.

Seventy students (33%) self-reported non-medical psychostimulant use. Nine (4.2%) students self-reported non-medical use, but also had a prescription for psychostimulants. The majority of medical misusers had a prescription for Concerta, Ritalin, or Vyvanse. There were four reports of selling medications to peers and eight (89%) reports of giving their medications to peers. Sixty-one (29%) students self-reported non-medical use and did not have a prescription for psychostimulants. Fifty-eight (95%) out of 61 non-medical users reported obtaining these medications from a friend. The most popular medications used by illicit users were Adderall, Ritalin, Vyvanse, and Concerta. Adderall was mentioned 58 times (95%), Ritalin was mentioned 34 times (56%), Vyvanse was mentioned 25 times (41%), and

Concerta was mentioned 12 times (5.6%). When the whole sample was asked, "Why college students use these medications," the top three motivations for non-medical psychostimulant use were to concentrate on work, to stay awake to study, and to take these "study drugs" during midterm/finals (Figure 1).

Further analysis was focused on non-medical users without a psychostimulant prescription. A chi-squared analysis was used to assess the relationship between non-medical use and Greek life, gender, and ethnicity. The results revealed that non-medical use is significantly higher amongst those in Greek life, $X^2(1)= 5.78$, $p = .02$. Thirty-six (59%) of non-medical users are involved in Greek life. The results demonstrated that males are almost significantly more likely to be non-medical users, $X^2(1)= 2.80$, $p = .10$. Non-medical users are also almost significantly more likely to belong to a non-minority ethnic group, $X^2(1)= 2.27$, p=.17.

Illicit users significantly differed from non-users on a variety of characteristics. Six independent samples t-test revealed that non-medical users reported greater peer use, greater pressure to succeed, higher alcohol frequency and alcohol intake, greater number of skipped classes, and lower GPAs, $t(197) = 6.97$, $p = 0.00$, $t(197) = 2.16$, $p = 0.03$, $t(197) = 5.61$, $p = 0.00$, $t(197) = 4.95$, $p = 0.00$, $t(197) = 4.74$, $p = 0.00$, $t(197) = 3.19$, $p = 0.00$. Differences in sleep and exercise pattern were not significant for illicit and non-users, $t(197) = 0.84$, $p =0.40$ and , $t(197) = 0.92$, $p = 0.36$. Refer to Figure 2 to see the differences in GPA between illicit and non-users. Figure 3 demonstrates the difference in perceived peer use between illicit users and non-users.

Illicit users and non-users significantly differed in their views of morality and legality affecting their decision to use psychostimulants non-medically (Figure 4). Two independent

samples t-tests revealed that morality and legality had a greater impact for non-users, $t(197) = 5.93$, $p = 0.00$ and , $t(197) = 6.10$, $p = 0.00$. When asked if Union should incorporate non-medical use of psychostimulants into its Honor Code, illicit users and non-users also differed on their response (Figure 5). An independent samples t-test revealed that non-users are significantly more supportive of implementing this policy, $t(197) = 8.26$, $p = 0.00$.

Illicit users and non-users differed on their perception of benefits of using psychostimulants non-medically (Figure 6). Non-medical users had a more positive perception of the benefits of non-medical psychostimulant use. Independent samples t-tests revealed that non-medical users reported that these medications allow for better performance, enhanced cognition, improved mood/energy, improved memory, and enhanced motivation to start and complete work, $t(197) = 7.19$, $p = 0.00$, $t(197) = 6.44$, $p = 0.00$, $t(197) = 5.29$, $p = 0.00$, $t(197) = 3.46$, $p = 0.00$, $t(197) = 6.29$, $p = 0.00$. When asked "To what extent do you think students experience consistent side effects after taking these medications?", there were no significant differences in illicit users and non-users' reports, $t(197) = 1.17$, $p = 0.24$.

For the experimental manipulation, non-medical users from the three conditions were compared. There were 20 non-medical users in the first condition, 21 in the second condition, and 20 in the third condition. Non-medical user reports of planned future use were assessed pre and post experimental manipulation (Figure 7). After conducting a repeated measures ANOVA, it was revealed that there was not a significant interaction between pre and post intervention and condition, $F(2, 58)=1.46$, $p=0.24$. Tukey's univariate compared the results from the three conditions, and they were not significant. To assess within group changes, paired t-tests were conducted. There seemed to be a downward trend in reported future use for non-medical users in the scientific evidence condition, $t(19) = 1.68$, $p=.11$.

Randomization failed to create statistically equivalent groups, as demonstrated by a higher pre-intervention score for those in the scientific evidence condition. Samples were then matched based on their pre-intervention score and analysis was re-run (Figure 8). There were 18 participants in each condition. After conducting the match-paired samples ANOVA, it was revealed that there still was not a significant interaction between pre and post intervention and condition, $F(2, 51)= 1.44$, $p=.25$. Tukey's univariate was also not significant. Nevertheless, the downward trend for the scientific evidence approach still existed, $t(17)=1.68$, $p=.11$.

DISCUSSION

The present study revealed that there is a prevalence of non-medical psychostimulant use amongst Union College students. While previous research at a liberal arts college found that 8.9% of students were non-medical psychostimulant users, the present study found that 29% of the sample reported non-medical use. This percentage is also higher than the estimated non-medical rate of 17% amongst college students. It is important to note that this percentage may be inflated due to the cover story that was used in the campus-wide email. The cover story stated that the researcher was interested in assessing recreational substance use, which might have attracted a larger number of non-medical psychostimulant users.

Characteristic differences between illicit users and non-users supported previous literature. Non-medical use was significantly higher amongst those who are in Greek life and have lower GPAs. The average GPA for an illicit user was 3.24 and the average GPA for a non-user was 3.43. Illicit users were almost significantly more likely to be males ($p=0.10$). If there was a more equivalent ratio of males to females in the total sample size then it is

believed that non-medical users would have been significantly more likely to be males. In addition, illicit users drink more frequently and drink a greater amount when they are drinking. It was found that on average illicit users drink 2-3 times a week and non-users drink 2-4 times a month. Illicit users consume about 5-6 alcoholic beverages whereas non-users consume 3-4 alcoholic drinks on a day when they are drinking. Illicit users skip more class than non-users (about 1-2 times per term compared to never skipping class). All of these findings support previous non-medical psychostimulant research.

An important factor in the non-medical use of psychostimulants is the diversion of medication by peers with prescriptions. Eight out of the nine medical misusers reported giving their medications to peers. Easy accessibility is also exemplified by the fact that 95% of non-medical users reported obtaining psychostimulants from a friend. These results demonstrate the importance of physician-parent involvement for those with a psychostimulant prescription. Physicians and parents must emphasize the importance of not distributing medications to friends. Distribution is not only illegal, but negatively affects the individual who is prescribed and should be taking the physician-recommended dose.

Illicit users also perceived a greater number of peers as using these medications as well. The perception of peer use contributes to greater non-medical use as illicit users may have greater accessibility to these medications. In addition, peer use creates a misperception that everyone is using psychostimulants and that they are socially acceptable or normal, which could also lead to greater use. Illicit users had a more positive perception of the benefits of non-medical psychostimulant use. The benefits included better performance, enhanced cognition, improved mood/energy, increased memory, and enhanced motivation to start and complete work. It is interesting that non-users still had a positive perception of the

benefits of non-medical use since their reports were not zero. If non-users believe that the medications have benefits, why don't they use psychostimulants non-medically? One reason could be the morality and legality aspect of taking psychostimulants non-medically. For example, non-users reported that morality and legality impacted their decision significantly more than illicit users.

While the experimental manipulation indicated a non-significant interaction or difference between the three conditions, there was a downward trend for those in the scientific evidence approach. This downward trend still existed when a matched-pair samples analysis was conducted. Thus, educating students on scientific research may be useful for changing the culture of use. Revealing previous literature on non-medical psychostimulant use could be influential if the intervention period is longer or if more graphs highlighting information on safety effects, negative consequences, or dose is incorporated.

Many US universities and colleges, such as Duke, have modified their Honor Code Statements to prohibit the use of psychostimulants non-medically. Not only is non-medical psychostimulant use a violation of Duke's drug policy, but it is also considered cheating. While enforcement is difficult, having non-medical psychostimulant use in the Honor Code "symbolically" makes a statement. When asked if Union should implement a similar policy, non-medical users did not believe that non-medical use should be included in the Honor Code, while non-users were more open to the idea. This is a decision that administrators may explore in the future.

Strengths

This is the first research study conducted at Union College examining non-medical psychostimulant use. It was found that there is a prevalence of non-medical psychostimulant

use. Results from this study replicated previous research on college students and psychostimulants, such as characteristic differences between illicit users and non-users and perceptions on the benefits of these medications. Understanding the characteristic differences and perceptions of illicit users and non-users is the first step in preventing non-medical use. Future research should expand on this pilot study.

Limitations

The web-based questionnaires were sent through a campus wide email with a cover story that the researcher was investigating recreational substance use. The cover story may not have been broad enough, which could have steered certain people away and attracted more non-medical users than intended (since non-medical psychostimulant use is associated with alcohol and other substance use). It would have also been better to have a larger sample size so that it could be a better representation of the Union College student population.

In addition, the question "To what extent do you think students experience consistent side effects after taking these medications?" may have been unclear and thus yielded not significant results. Side effects for non-medical psychostimulant use can either be physiological (i.e. increase heart rate) or behavioral (i.e. students browsing Facebook for five hours instead of writing a paper). It would make more sense to word the question- "To what extent do you think students experience the desired effect of these medications based on the motives they endorsed?" It also would have been interesting to assess perception of performance, cognition, mood/energy, memory, and motivation pre and post experimental manipulation instead of just pre intervention.

Future Research

For future research, a longer intervention period may be more influential in changing the culture of non-medical use. For example, putting up informational flyers around campus (i.e. Reamer Student Center or Schaffer Library) could affect students' decisions to use psychostimulants or at least compel them to look up more information on the medications they use. It would also be important to have illicit users and non-users complete cognitive tests to see if there are cognitive benefits for individuals without an ADHD diagnosis. Previous literature highlights the mixed cognitive effects of psychostimulant use so it would be important to see how illicit users score compared to non-users. Future research should also expand on the placebo effect. Researchers should administer some students with a placebo and other students with a dose of Adderall and see how they perform on various cognitive tasks and mood assessments.

Because students are primarily misusing for academic reasons, Union College should add time management and study skills into the Freshman Year Preceptorial course or Sophomore Research Seminar. It is also important to have health care professionals at the Wellness Center, administrators, and professors initiate conversations on the negative consequences of non-medical psychostimulant use.

CONCLUSION

Some argue that Adderall and other psychostimulant medications should be readily available for use by the population because the effects are similar to caffeine. The researcher, nevertheless, argues that there needs to be a lot more research done on the cognitive and neurological effects of psychostimulant medications and that they should remain illegal for

non-medical use. Caffeine, which has been studied for decades, does not pose any serious health risks when consumed in moderate amounts as well as the side effects are more predictable. Nutritional facts and other important health information on caffeine are easily accessible because it is legal and the most commonly used psychostimulant in the world. On the contrary, non-medical psychostimulant users often do not know what dose or brand-name medication they are taking. Finding a medication that produces an individual's intended effect can be referred to as a "trial and error process." DeSantis, Webb, & Noar (2008) found that none of the 175 non-medical users they interviewed searched for information from health professionals, medical reference guides, or even Internet sites before taking their first dose. There is also individual variation in the cognitive effects of psychostimulant medications. Side effects can include cardiovascular problems, loss of appetite, and insomnia. Psychostimulant medications also have the potential for abuse when taken recreationally since they can be consumed intra-nasally or orally and combined with other drugs and alcohol.

It is imperative to change the attitude surrounding non-medical psychostimulant use amongst college students. College students without ADHD have a perception that using psychostimulants enhances their academic performance, motivates them to start and complete work, helps them cram during midterms/finals, and improves their mood and energy. It is difficult to change these opinions, but "understanding students' motives for stimulant medication misuse is a critical first step in preventing misuse" (Benson, Humphreys, & Lee, 2015). This pilot study should be the first of many efforts in order to change the culture of non-medical use.

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REFERENCES

Arria, A.M., & DuPont, R.L. (2010). Nonmedical prescription stimulant use among college students: why we need to do something and what we need to do. *Journal of Addictive Diseases*, 29, 417-426.

Arria, A.M. (2015). Nonmedical Use of Prescription Stimulants. What College Administrators, Parents, and Students Need to Know. *Medicine Abuse Project.*

Bagot, K. & Kaminer, Y. (2014). Efficacy of stimulants for cognitive enhancement in non-attention deficit hyperactivity disorder youth: a systematic review. *Addiction,* 109, 547-557.

Barch, D. & Carter, C. (2005). Amphetamine improves cognitive function in medicated individuals with schizophrenia and in healthy volunteers. *Schizophrenia Research*, 77, 43-58.

Benson, K., Flory, K., Humphreys, K., & Lee, S. (2015). Misuse of Stimulant Medication Among College Students: A Comprehensive Review and Meta-analysis. *Clinical Child and Family Psychology Review*, 18(1), 50-76.

Bronwen C. Carroll, MD, Thomas J. McLaughlin, ScD; Diane R. Blake, MD (2006). Patterns and Knowledge of Nonmedical Use of Stimulants Among College Students. *Arch Pediatr Adolesc Med.* 160(5), 481-485.

The Coalition to Prevent ADHD Medication Misuse (2015). Potential Medical and Developmental Consequences of Misuse.

Center for Disease Control and Prevention (2015). Attention-Deficit/Hyperactivity Disorder (ADHD).

DeSantis, AD., Webb, E., & Noar, S. (2008) Illicit Use of Prescription ADHD Medications on a College Campus: A Multimethodological Approach. *Journal of American College Health*, 57(3), 315-323.

DeSantis, AD., Anthony, KE, & Cohen EL. (2013) Illegal College ADHD Stimulant Distributors: Characteristics and Potential Areas of Intervention. *Substance Use Misuse*, 48(6), 446-456.

Dixit, A., Goyal, A., Thawani, R., & Vaney, N. (2012). Effect of Caffeine on Information Processing: Evidence from Stroop Task. *Indian Journal of Psychological Medicine*, 34(3), 218-222.

Dodge, T., Williams, K., Marzell, M., Turrisi, R. (2012). Judging Cheaters: Is Substance

Misuse viewed similarly in the athletic and academic domains? *Psychology of Addictive Behaviors*, 26(3), 678-682.

DuPont, R., Coleman, J., Bucher, R., Wilford, B. (2008). Characteristics and Motives of College Students Who Engage in Nonmedical Use of Methylphenidate. *The American Journal on Addictions*, 17(3), 167-171.

Franke, A., Lieb, K., Hildt, E. (2012). What Users Think About the Differences between Caffeine and Illicit/Prescription Stimulants for Cognitive Enhancement. *PLOS One*, 7(6), e40047.

Garnier-Dykstra, L., Caldeira, K., Vincent, K., O'Grady, K., Arria, A. (2012). Nonmedical use of prescription stimulants during college: Four-year trends in exposure opportunity, use, motives, and sources. *The Journal of American College Health,* 60(3), 226-234.

Hanson, C., Burton, S., Giraud-Carrier, C., West, J., Barnes, M., Hansen, B. (2013). Tweaking and Tweeting: Exploring Twitter for Nonmedical Use of a Psychostimulant Drug (Adderall) Among College Students. *Journal of Medical Internet Research*, 15(4), e62.

Hartung, Cynthia M. Canu, Will H. Cleveland, Carolyn S. Lefler, Elizabeth K. Mignogna, Melissa J. Fedele, David A. Correia, Christopher J. Leffingwell, Thad R. Clapp, Joshua D (2013). Stimulant Medication Use in College Students: Comparison of Appropriate Users, Misusers, and Nonusers. *Psychology of Addictive Behaviors*, 27(3), 832-840.

Haskell, C., Kennedy, D., Wesnes, K., & Scholey, A. (2005). Cognitive and Mood improvements of caffeine in habitual consumers and habitual non-consumers of caffeine. *Psychopharmacology,* 179, 813-825.

Ilieva, I.P., Boland, J., & Farah, M (2012). Objective and Subjective Cognitive Enhancing Effects of Mixed Amphetamine Salts in Healthy People. *Neuropharmacology*, 64, 496-505.

Ilieva, I.P. & Farah, M.J (2013). Enhancement Stimulants: Perceived Motivational and Cognitive Advantages. *Frontiers in Neuroscience- Neuropharmacology*, 198(7), 1-6.

Jardin, B., Looby, A. & Earleywine, M. (2011). Characteristics of College Students With Attention-Deficit Hyperactivity Disorder Symptoms Who Misuse Their Medications. *Journal of American College Health*, 59(5), 373-377.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E. & Miech, R. A. (2014).

Monitoring the Future national survey results on drug use, 1975–2013: Volume 2, College students and adults ages 19–55. Ann Arbor: Institute for Social Research, The University of Michigan.

Looby, A & Earleywine, M (2011). Expectation to receive Methylphenidate Enhances Subjective Arousal but not Cognitive Performance. *Experimental and Clinical Psychopharmacology*, 19(6), 433-444.

Mayo Clinic (2015). Attention-Deficit/Hyperactivity Disorder.

McCabe, S., Knight, J., Teter, C., & Wechsler, H. (2005). Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Addiction*, 100(1), 96-106.

National Institute on Drug Abuse (2014). Drug Facts: Stimulant ADHD Medications: Methylphenidate and Amphetamines.

Simon, O & Stewart, B. (2013). Enhancement Drug Use in Society and Sport: the science and sociology of stimulant use and the importance of perception. *Sport in Society: Cultures, Commerce, Media, Politics*, 16(6), 789-804.

Smith, M & Farah, M. (2011). Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. *APA/Psychological Bulletin,* 137(5), 717-741.

Teter, C., McCabe,S., Boyd, C., & Guthrie, S. (2003). llicit Methylphenidate Use in an Undergraduate Student Sample: Prevalence and Risk Factors. *Pharmocotherapy,* 23(5): 609-617.

U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Office of Applied Studies. *National Survey on drug use and health, 2009*.

Varga, Matthew (2012). Adderall Abuse on College Campuses: A Comprehensive Literature Review. *Journal of Evidence-Based Social Work*, 9, 292-313.

Vrecko, Scott. (2013). Just How Cognitive Is "Cognitive Enhancement"? On the Significance of Emotions in University Students' Experiences with Study Drugs. *AJOB Neuroscience*, 4(1), 4-12.

Wood, S., Sage, JR., Shuman, T., Anagnostaras, SG. (2014). Psychostimulants and Cognition: A continuum of Behavioral and Cognitive Activation. *Pharmacological Reviews,* 66(1), 193-221.

Figure 1. Motivations for Non-Medical Psychostimulant Use

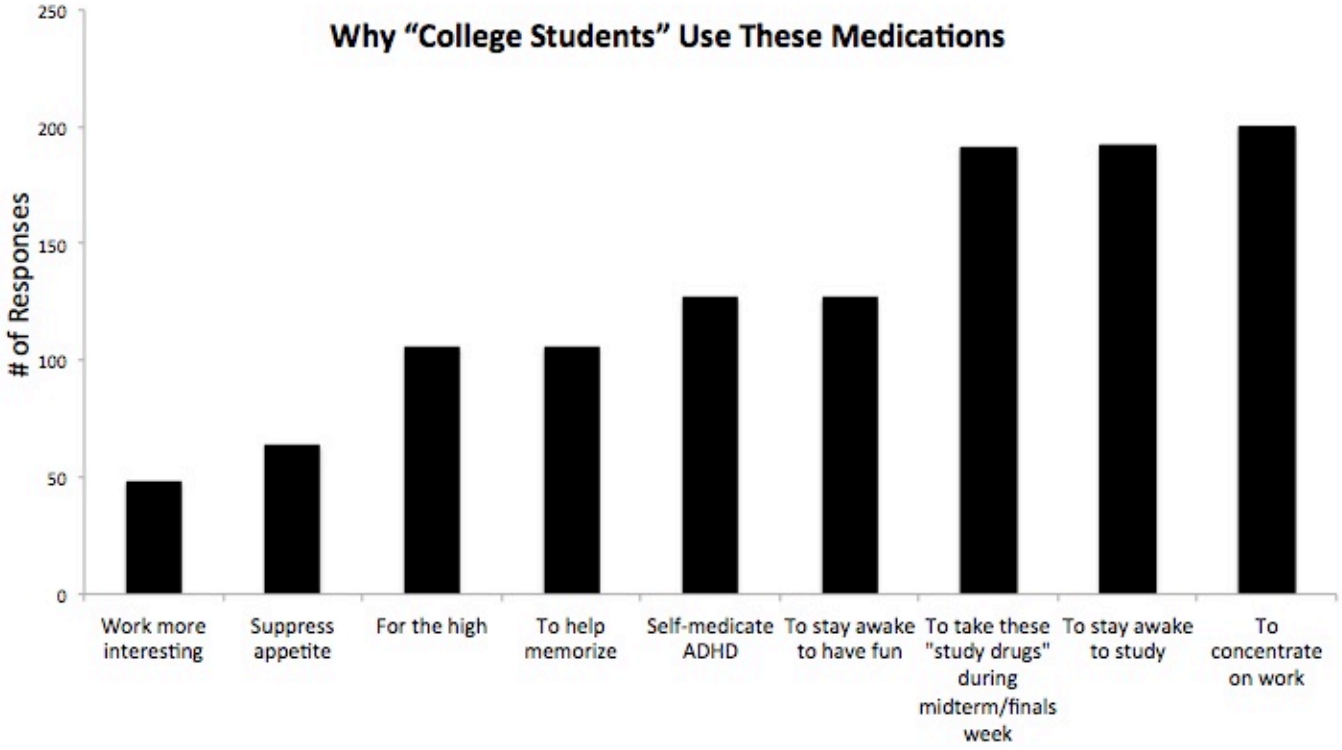


Figure 2. GPA differences between illicit users and non-users

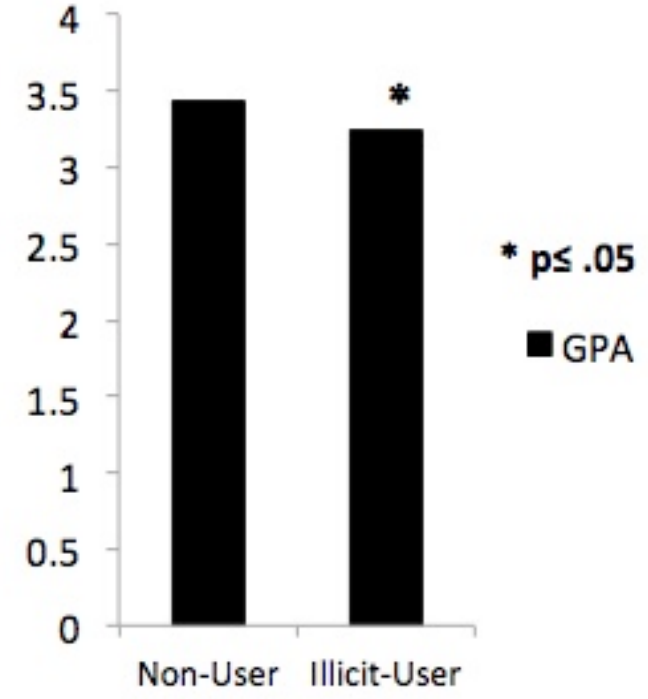


Figure 3. Peer use differences between illicit users and non-users

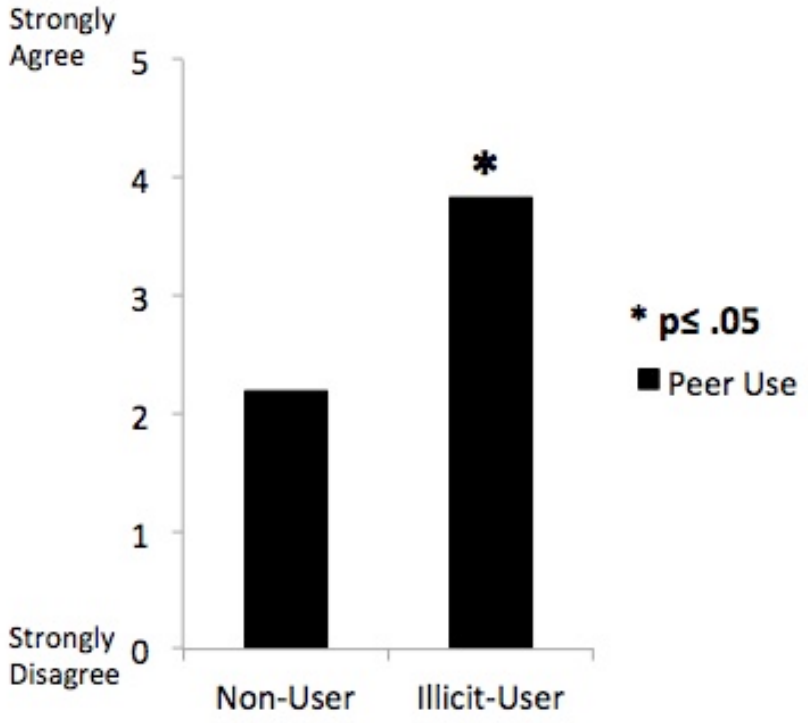


Figure 4. Morality/Legality differences between illicit users and non-users

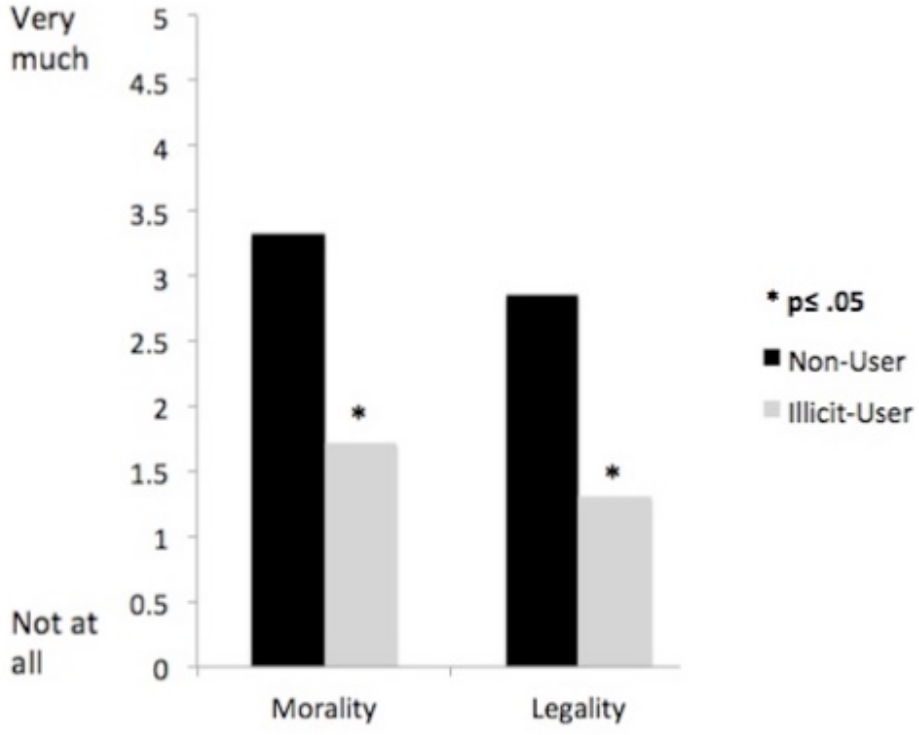


Figure 5. Honor Code and non-medical psychostimulant use

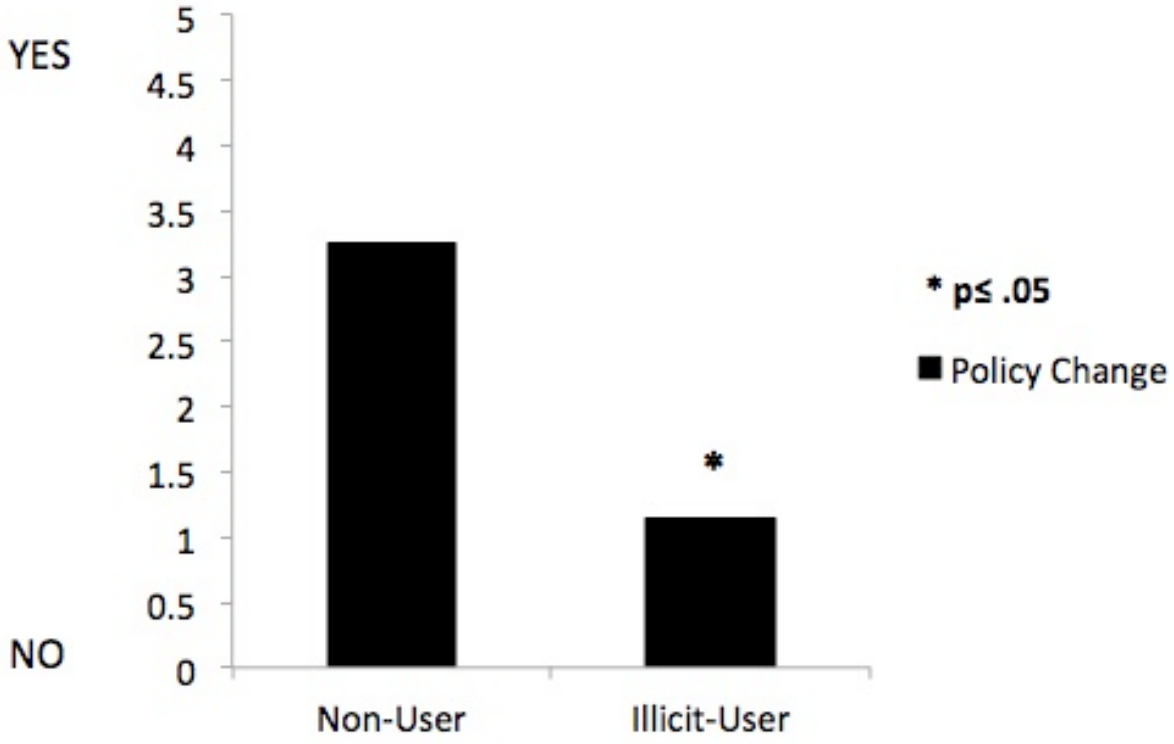


Figure 6. Perception of benefits of non-medical psychostimulant use

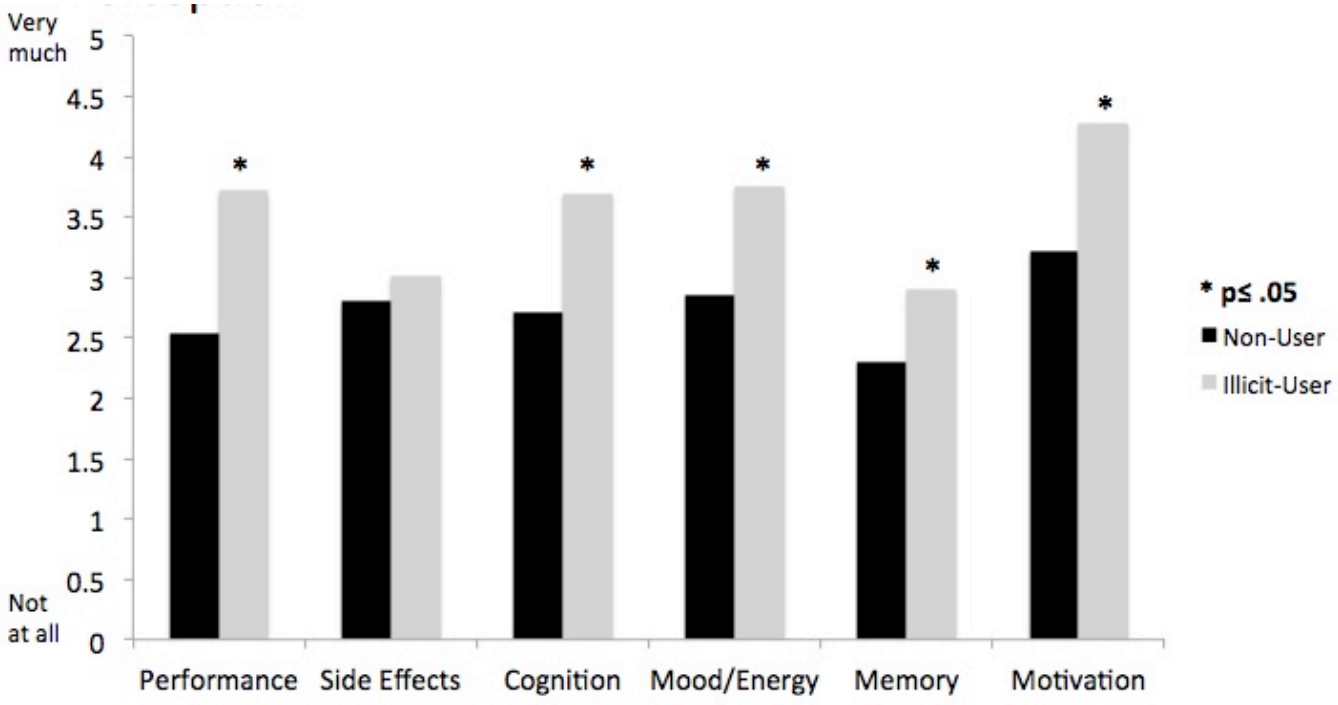


Figure 7. Pre and Post Experimental Manipulation (Group 1=Scientific Evidence, Group 2= Social Media Pitch, Group 3= Control)

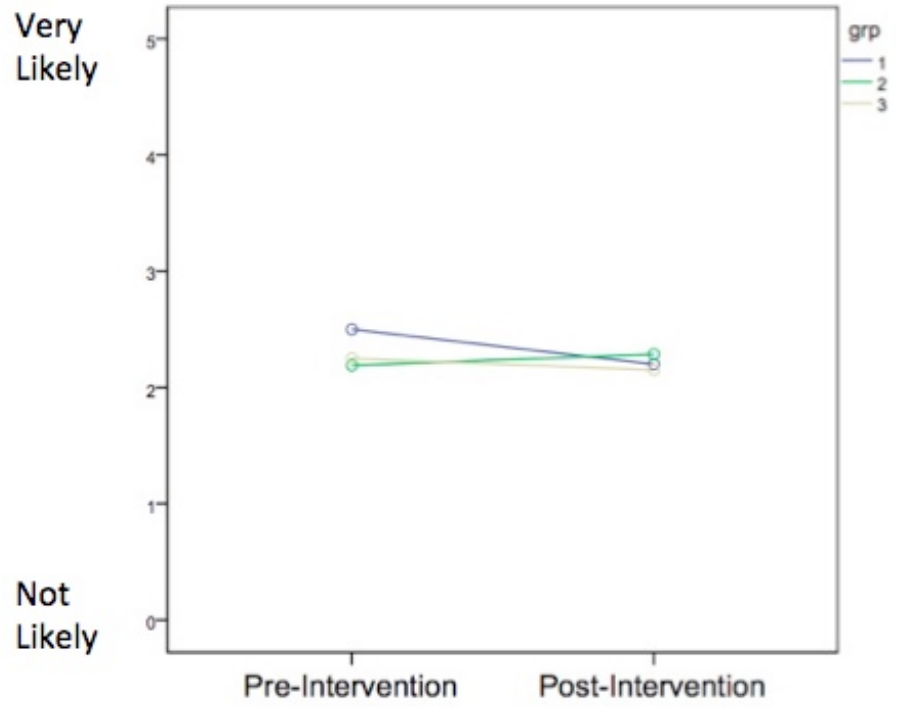
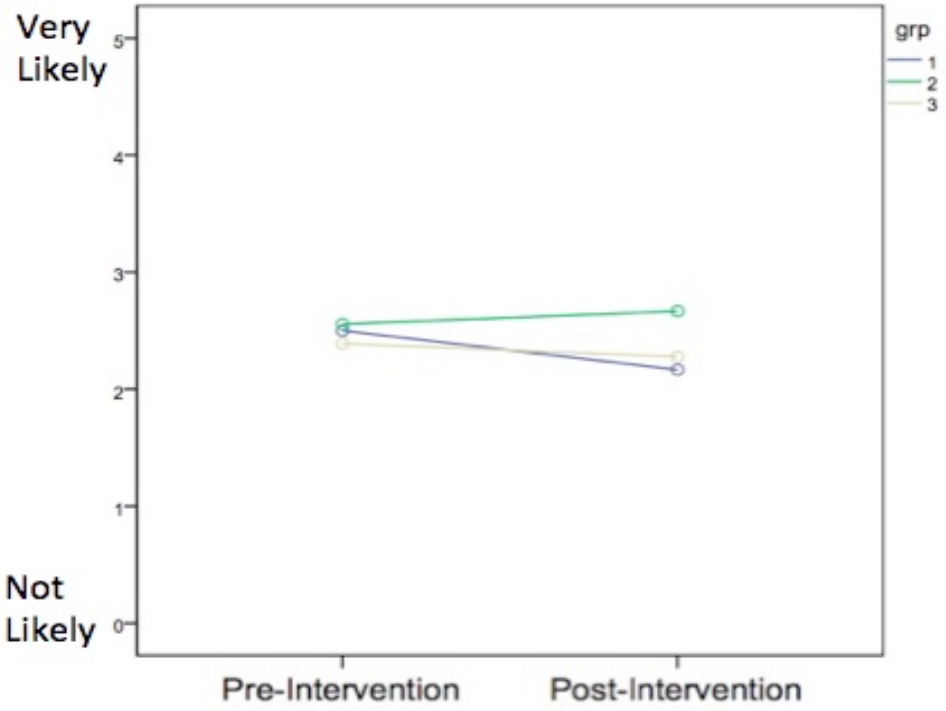


Figure 8. Matched Pre Experimental Manipulation (Group 1=Scientific Evidence, Group 2= Social Media Pitch, Group 3= Control)



APPENDIX A

Condition 1-Scientific Evidence Approach to Debunk Cognitive Benefit Myth

Student Life Survey

Please answer the questions below to the best of your ability. In the following questions, the word "medication" refers to psychostimulants such as Adderall (Amphetamine, Dextroamphetamine Mixed Salts), Ritalin (Methylphenidate), Vyvanse (lisdexamfetamine), Modafinil (Provigil), Dexedrine (Dextroamphetamine), Nootropil (Piracetam), Ephedrine (Ephedra) etc.

* Required

1. **Which of the following do you currently have a PRESCRIPTION for?** *
   Mark only one oval.
   - ◯ Adderall
   - ◯ Ritalin
   - ◯ Concerta
   - ◯ Vyvanse
   - ◯ Dexedrine
   - ◯ Nootropil
   - ◯ Modafinil
   - ◯ Ephedrine
   - ◯ I am not prescribed any medications of this kind
   - ◯ Other: _____

2. **Have you ever used these medications for non-medical use, such as cramming for a test or going out to a party?** *
   Mark only one oval.
   - ◯ Yes
   - ◯ No

3. **Which of the following have you used? (check all that apply)** *
Check all that apply.

- [ ] Adderall
- [ ] Ritalin
- [ ] Concerta
- [ ] Vyvanse
- [ ] Dexedrine
- [ ] Nootropil
- [ ] Modafinil
- [ ] Ephedrine
- [ ] I have never taken these medications
- [ ] Other:

4. **When was the first time you took these medications?** *
Mark only one oval.

- ◯ Preschool
- ◯ Elementary School
- ◯ Middle School
- ◯ High School
- ◯ College
- ◯ I have never taken these medications

5. **Where do you get this type of medication from? (check all that apply)** *
Check all that apply.

- [ ] Doctor
- [ ] Friend
- [ ] Family member
- [ ] Acquaintance/classmate
- [ ] I have never taken these medications
- [ ] Other:

9. **Please select one or more of the following reasons as to why YOU have used these medications (check all that apply):** *
Check all that apply.

- [ ] To stay awake to study
- [ ] To concentrate on work
- [ ] To help memorize
- [ ] To stay awake to have fun
- [ ] To make work more interesting
- [ ] For the high (good feeling)
- [ ] Suppress appetite
- [ ] Self-medicate ADHD
- [ ] I don't use these medications
- [ ] Other: _____

10. **Have you ever sold medications to someone?** *
Mark only one oval.

- ◯ Yes
- ◯ No

11. **Have you ever given medications to someone?** *
Mark only one oval.

- ◯ Yes
- ◯ No

12. **How often do you have a drink containing alcohol?** *
Mark only one oval.

- ◯ Never
- ◯ Monthly
- ◯ 2-4 times a month
- ◯ 2-3 times a week
- ◯ 4 or more times a week

6. **When was the last time you took one of these medications?** *
Mark only one oval.

- ( ) More than a year ago
- ( ) 6 months to a year ago
- ( ) Within the last few months
- ( ) Within the last few weeks
- ( ) I take the medication daily
- ( ) I have never taken these medications

7. **How often do you take these medications?** *
Mark only one oval.

- ( ) A few times a year
- ( ) A few times a month
- ( ) A few times a week
- ( ) Daily
- ( ) I have never taken these medications

8. **Please select one or more of the following reasons as to why college students might use these medications (check all that apply):** *
Check all that apply.

- [ ] To stay awake to study
- [ ] To concentrate on work
- [ ] To help memorize
- [ ] To stay awake to have fun
- [ ] To make work more interesting
- [ ] For the high (good feeling)
- [ ] Suppress appetite
- [ ] Self-medicate ADHD
- [ ] To take these "study drugs" during midterm/finals week
- [ ] Other: _____

13. **How many drinks containing alcohol do you have on a typical day when you are drinking?** *

Mark only one oval.

- ◯ I never consume alcohol
- ◯ 1 or 2
- ◯ 3 or 4
- ◯ 5 or 6
- ◯ 7 to 9
- ◯ 10+

14. **On average, how often do you skip class each trimester?** *

Mark only one oval.

- ◯ I never skip class
- ◯ 1-2
- ◯ 3-4
- ◯ 5+

15. **On average, how many hours of sleep (per night) do you get during the school year?** *

Mark only one oval.

- ◯ 4 or less
- ◯ 5-6
- ◯ 7
- ◯ 8+

16. **On average, how many hours do you exercise per week?** *

Mark only one oval.

- ◯ 0
- ◯ 1-2
- ◯ 3-4
- ◯ 5+

Please use the 0-5 scale described in each question below to answer the following questions to the best of your ability. Medication refers to NON-MEDICAL psychostimulant use, where individuals use these stimulants (i.e. Adderall, Ritalin, Vyvanse) without a prescription or misuse their prescription stimulant. The situations below specifically pertain to academic settings.

17. **To what extent do you think these medications help students perform better?** *
Mark only one oval.

	0	1	2	3	4	5	
These medications do not help at all	◯	◯	◯	◯	◯	◯	These medications make individuals the best students they can be

18. **To what extent do you think students experience consistent side effects after taking these medications?** *
Mark only one oval.

	0	1	2	3	4	5	
They experience different side effects every time they use these medications	◯	◯	◯	◯	◯	◯	They always experience the same side effects from these medications

19. **To what extent do these medications enhance cognition?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

20. **To what extent do these medications enhance mood/energy?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

21. **To what extent do these medications enhance memory?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

22. **To what extent do these medications enhance motivation to start/complete work?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

23. **If you were to consider using a medication to help with your academics how much would "morality" impact your decision?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

24. **If you were to consider using a medication to help with your academics how much would "legality" impact your decision?** *
Mark only one oval.

	0	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	◯	Very much

25. **To what extent do you agree with the following statement: "Most of my friends have tried or currently use these medications in order to focus on various school assignments"** *
Mark only one oval.

	0	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	◯	Strongly agree

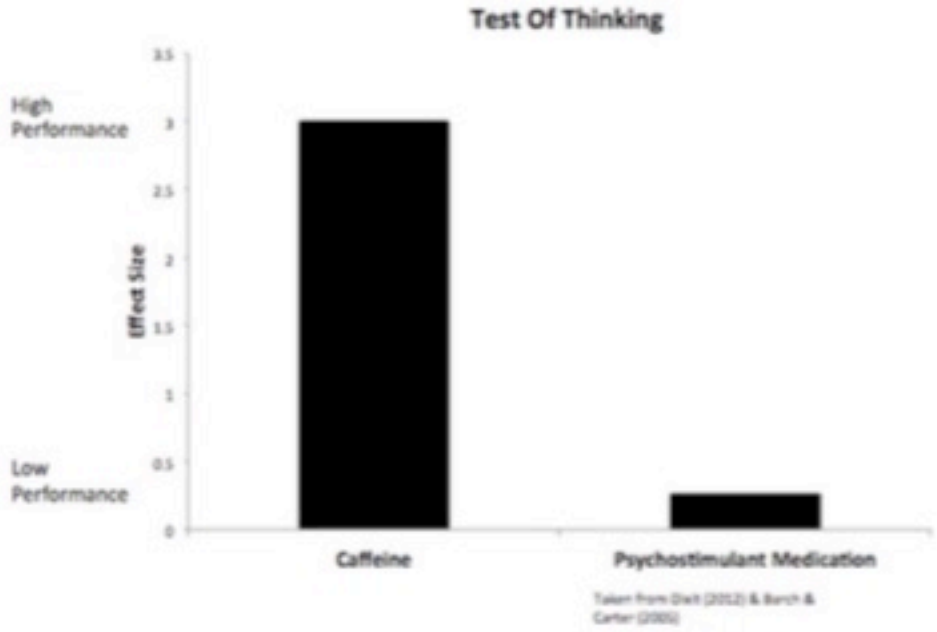
26. **To what extent do you feel pressure to succeed academically in college (either from self, family, friends)** *
Mark only one oval.

	0	1	2	3	4	5	
No pressure	◯	◯	◯	◯	◯	◯	A lot of pressure

27. **How likely are you to take these medications for your next academic engagement (i.e. paper, test, art project, musical performance)?** *
Mark only one oval.

	0	1	2	3	4	5	
Not likely	◯	◯	◯	◯	◯	◯	Very likely

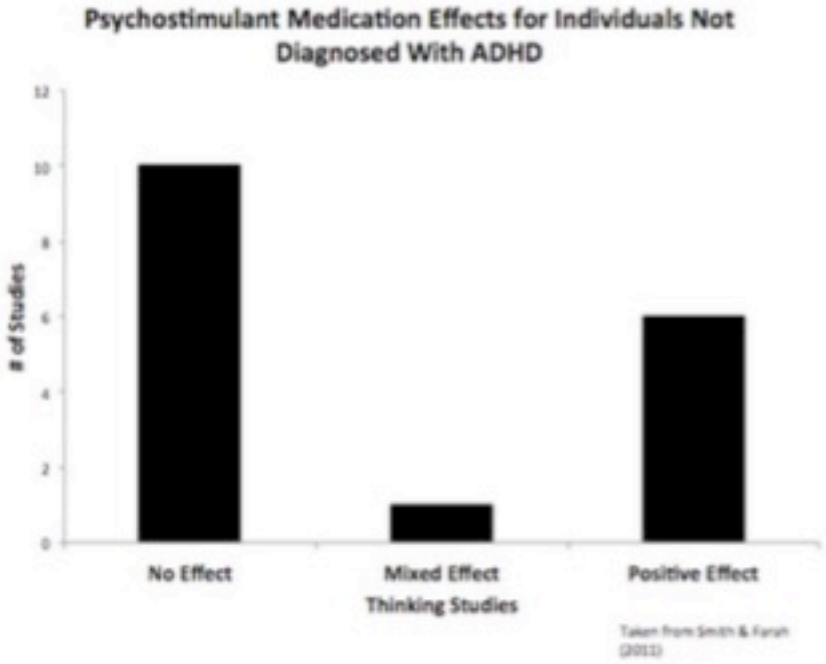
Research Indicating The Effects of Psychostimulant Medications



Test of Thinking

*Test associated with how individuals manage thoughts and focus attention
*Important when reviewing complex material, engaging in simultaneous computations or tasks, and creating graphic or visual art
*Individuals not diagnosed with ADHD, who used Caffeine, performed better than those individuals not diagnosed with ADHD who used the psychostimulant medication "Dexedrine" prior to the task

28. **Please explain what you learned from this graph (write 2-3 sentences):** *



Test of Thinking Pt. 2

*Out of 17 studies, psychostimulant medications had no effect in 10 studies, mixed effects in 1 study, and positive outcomes in 6 studies for individuals not diagnosed with ADHD
*Tests measure for reasoning, problem solving, and managing time and attention
*No guarantee that taking these medications non-medically before a task will improve performance

29. **Please explain what you learned from this graph (write 2-3 sentences):** *

Memory After Delay

*Participants not diagnosed with ADHD who received psychostimulant medication performed significantly worse on the number of words they recalled
*Delayed Memory Task is important for short-term memory and learning new material, studying for a test, and memorizing lines of a script

30. **Please explain what you learned from this graph (write 2-3 sentences):** *

31. **How likely are you to use these medications for your next academic engagement (i.e. paper, test, art project, musical performance)?** *
Mark only one oval.

	0	1	2	3	4	5	
Not likely	◯	◯	◯	◯	◯	◯	Very Likely

32. **Many US universities and colleges, such as Duke and Wesleyan, have modified their Honor Code Statements to prohibit the use of psychostimulants non-medically. Do you think Union should implement a similar policy?**
Mark only one oval.

	0	1	2	3	4	5	
No	◯	◯	◯	◯	◯	◯	Yes

I have a few final questions:

33. **What is your gender?** *
Mark only one oval.

- ◯ Male
- ◯ Female

34. **What ethnicity do you consider yourself?** *
Mark only one oval.

- ◯ African-American
- ◯ Hispanic
- ◯ Caucasian
- ◯ Asian
- ◯ Other: _____

35. **What is your age in years?** *

_____

36. **What is your major?** *

_____

37. **What is your GPA?** *

38. **Are you involved in a sorority or fraternity on campus?** *
Mark only one oval.

- ◯ Yes
- ◯ No

Thank you for taking the time to participate in my survey! I will be sure to keep all provided information anonymous and confidential. The purpose of my study is to assess the prevalence, as well as perceptions and motivations of non-medical psychostimulant use on campus. My goal is to start a conversation about the consequences of non-medical psychostimulant use amongst college students. The results of this study will be presented at Steinmetz. Please print or

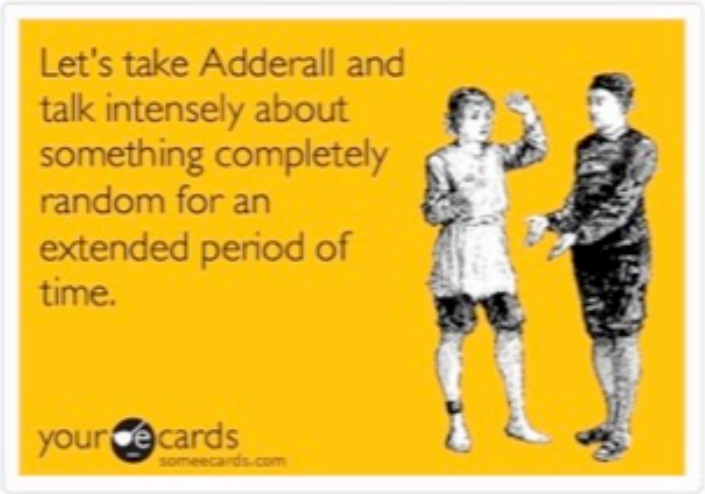
screenshot the following page and bring to Bailey 203 to receive $4 stipend or 1/2 psych credit (Week 10: Fri 1030-130, Finals Week: Monday 11-5). If you have any questions, please email shaitr@union.edu. Thanks so much!

APPENDIX B

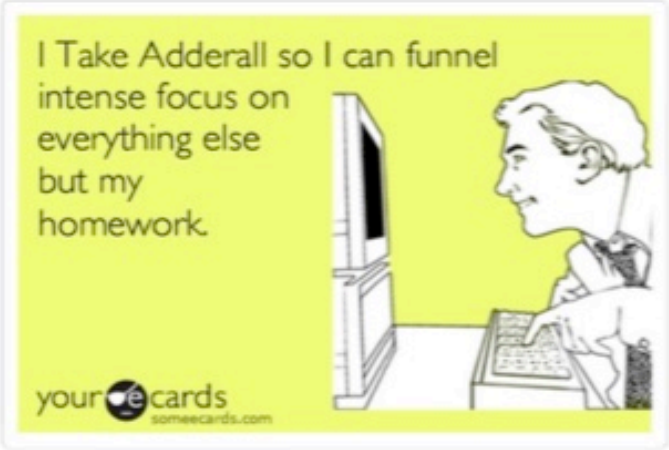
Condition 2-Social Media Pitch for Negative Side Effects

Social Media and Psychostimulant Medication

28. **Please describe how the character is feeling in this image. Why is he feeling this way? How would the character act if he felt compelled to take the medication again? (write 2-3 sentences):** *



29. **Please describe how the characters are feeling in this image. Why are they feeling this way? How would these characters act if they felt compelled to take the medications again? (write 2-3 sentences):** *

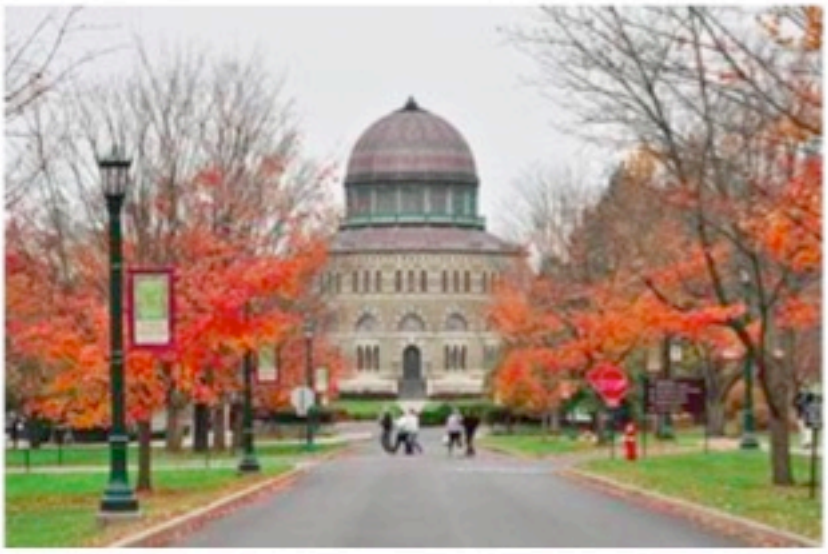


30. **Please describe how the character is feeling in this image. Why is he feeling this way? How would the character act if he felt compelled to take the medication again? (write 2-3 sentences):** *

APPENDIX C

Condition 3-Control

28. **Count the number of places where someone might socialize effectively. Describe which place in this picture would be most effective for studying and which place would be most effective for socializing. (write 2-3 sentences) ***



29. **Please describe the architecture of this building. How many levels are there in this building? Which level would be most effective for studying and why? Who was Eliphalet Nott? (write 2-3 sentences)** *

30. **How many students come into this building every day? Describe why students would spend many hours here. How effective is this building for completing various assignments? (write 2-3 sentences)** *