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The Adderall Epidemic: Linking Illicit Adderall Use to Mental Distress on College Campuses

Adelle Ricci
Binghamton University, Biological Science, aricci3@binghamton.edu

Lee Ann Genussa
Binghamton University, Integrative Neuroscience, lgenuss1@binghamton.edu

Eva Kristoferson
Binghamton University, Integrative Neuroscience, ekristo1@binghamton.edu

Lina Begdache
Binghamton University, Health and Wellness Studies, lina@binghamton.edu

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Abstract

Background

Psychostimulants are widely misused on college campuses for recreation and academic gain, but many students are not aware of the impact of these drugs on mental health. Literature proposes psychostimulant use decreases the availability of dopamine receptors, thus promoting symptoms of mental distress. The purpose of this study is to assess the physical and mental symptoms of misuse, identify the populations at risk of misusing psychostimulants, and to deduce the most effective approaches to persuade users about the adverse effects of misuse.

Methods

An anonymous electronic survey was distributed to 596 college students in the Northeastern United States assessing demographics, perception of safety, frequency of use and mental health status. This survey was advertised on social media platforms, campus flyers, and tabling events. Pearson's Correlation Coefficient and Principal Component Analysis (PCA) were used to analyze data in SPSS version 25.0.

Results

Misusing psychostimulants is significantly correlated with higher levels of mental distress such as anxiety, depression, panic attacks, irritability, and suicidal thoughts. Risk factors for psychostimulant misuse include Greek life affiliation, age, and GPA. Participants stated that education via real life stories and mechanistic illustrations of negative physiological side effects would dissuade future misuse of psychostimulants.

Conclusions

Our research agrees with the literature connecting psychostimulant misuse and mental distress. This study provides insights to support informational sessions on college campuses to diminish the abuse of ADHD medications by college students. Efforts should be directed to educating the risky populations such as social science majors and Greek life organizations.

Keywords: Substance Use and Abuse, Mental Distress, GPA, Psychostimulants, Greek Life

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Introduction

The non-prescription use of Attention-Deficit/Hyperactivity Disorder (ADHD) psychostimulant medications such as Adderall, Ritalin, and Vyvanse is a prevalent and urgent issue impacting college students, yet research on the issue is limited. Studies report a range of 17% to 43% of American college students have used ADHD medications for non-medicinal purposes (Benson et al., 2015; DeSantis, Webb, and Norr, 2008).

Attention-Deficit/Hyperactivity Disorder (ADHD)

ADHD is a neurobehavioral disorder defined by symptoms of inattention and hyperactive impulses (American Psychiatric Association, 2000). The condition typically commences during childhood and about 50% of cases continue into adulthood (Wilens et al., 2004). Many of the symptoms of the disorder are due to disrupted or dysregulated dopamine neurotransmission in the central nervous system (Misener et al., 2004). Low levels of dopamine culminate in decreased motivation from the reward system; this is why patients with ADHD struggle to sustain attention on goal-oriented behaviors.

A dysfunctioning prefrontal cortex (PFC) also plays a key role in the cause of ADHD symptoms (Spencer, et al. 2015). The PFC plays a key role in maintaining attention assigning significance to the subject matter. The PFC also filters out distractions, shifting focus, and organizing thoughts and behaviors to achieve goals. In addition, the PFC regulates hyperactivity via the area's ability to regulate inappropriate emotions, impulses, and behaviors. Genetic linkage studies display that ADHD is associated with decreased dopamine release in the PFC (Castellanos, 2001). Small changes in dopamine concentrations in the PFC can excite the pyramidal cells and have marked effects on PFC function (Arnsten, 2009), disrupting the PFC's attention and hyperactivity regulation abilities. In patients with ADHD, neuroimaging displays anatomical alterations which would effectively decrease dopaminergic function in dopamine-rich portions of the brain like the PFC (and the striatum) (Castellanos, 2001).

Psychostimulant use for ADHD and Drug Mechanism

Along with behavioral therapy, a common and effective treatment for ADHD (as well as other CNS conditions such as narcolepsy) is the prescription of medications such as Adderall® (mixed salt amphetamine), Ritalin® (methylphenidate), Vyvanse® (lisdexamfetamine dimesylate) and Dexedrine®(dextroamphetamine). These compounds increase monoamine

neurotransmitter release in areas of the brain like the PFC and striatum, thus effectively treating symptoms of inattentively and impulsivity prominent in cases of ADHD. The efficacy of these medications for the use of treating ADHD have been confirmed (Gross, 1976; Greenhill et al., 2003, Faraone et al., 2006).

The most commonly prescribed psychostimulant to treat ADHD is Adderall, which is amphetamine-based. The chemical structure of amphetamines dictates its function. The planar geometry, small molecular size, aromatic rings, and a Nitrogen on the aryl side chain are structural qualities similar to that of neurotransmitter monoamines. These monoamines include catecholamine neurotransmitters such as dopamine, serotonin, and noradrenaline (Holmes & Rutledge, 1976). Due to its similar molecular structure to monoamines, amphetamines enter the cell through dopamine transporters, and proceed to alter the function of monoamine transporters like noradrenaline transporter (NET), dopamine transporter (DAT), and serotonin transporter (SERT), as well as vesicular monoamine transporter 2 (VMAT2) to reverse transport monoamines. The combined outcome is "reverse-transport:" reuptake transporters excessively pump neurotransmitters from the presynaptic neuron cytoplasm and storage vesicles into the synapse, rather than from the synapse back into the presynaptic neuron (Robertson et al., 2009).

The other most common drug used to treat ADHD is methylphenidate (Ritilan®). Methylphenidate acts through a similar method compared to amphetamines of increasing synapse concentrations of catecholamine neurotransmitters in the synapse. The drug contrasts from amphetamines by blocking reuptake of the neurotransmitters, rather than causing efflux of neurotransmitters. (Kuczenski & Segal, 2002). Regardless, the effect is similar to that of amphetamines: an increase of neurotransmitters in the CNS.

The flooding of the CNS with these monoamines stimulates the catecholamine-deficient

regions of the PFC and striatum in patients with ADHD. The result is increased attention, focus, and decrease in impulsive behaviors. This same mechanism of neurotransmitter release causes the feeling of euphoria and increased motivation in non-ADHD individuals. This "high" encourages the recreational use of the psychostimulants and is one of the primary reasons for the misuse of these medications.

Misuse of ADHD Medications

Today in the United States, the misuse of ADHD medications is on the rise in the college student population. Students who misuse ADHD medications report doing so due to the increase in attention and cognition they report to have while on the drug. Despite this perception, ADHD medication use in non-ADHD individuals is negatively related with GPA (Begdache et al., 2019). Additional evidence suggests that non-prescription use of ADHD drugs has no significant effect on attention (Repantis et al., 2010). These medications may also inhibit cognitive abilities such as cognitive flexibility and decision making (Smith & Farah, 2011). Conversely, other studies found small to moderate increase in function of working-memory, delayed memory and processing speed (response-time) in individuals who were administered small doses of amphetamines (Ilieva et al., 2015). Possible proposed explanations for these improvements were the placebo effect, or an increase in motivation (resulting from the release of dopamine upon intake of amphetamines) (Weyandt et al., 2016).

Effects of Long-term Misuse

The US Drug Enforcement Agency (DEA) classifies ADHD medications as Schedule II drugs due to their potential for addiction, dependency, and abuse. Other Schedule II drugs include cocaine, pain medications such as opium and OxyContin, and Phencyclidine (PCP) (United Stated Department of Justice, DEA, 2017). Despite the legal implications and potential,

students continue to abuse these medications illicitly (without a prescription from a licensed physician). As stated before, psychostimulants are widely considered safe for individuals to consume when given the proper dosage, and even children are prescribed the medications at a young age. The perceived safety of these medications has contributed to the normalization and increase in prevalence of psychostimulant misuse on college campuses (DeSantis & Hein, 2009). But the use of psychostimulants for recreation or academic benefit by individuals who do not have ADHD can have long-term adverse effects.

Most of the long-term adverse effects stem from dopamine dysregulation. Ricaurte et. al (2005) describes a decrease in striatal dopamine up to 30-50% in primates treated with doses of Adderall mimicking those in human clinical treatment. Other research describes a downregulation of dopamine receptor (D2/3) availability due to amphetamine-based psychostimulants like Adderall (Schrantee, et al., 2017). Downregulation of dopamine receptors is linked to anxiety, depression, nervousness, loss of motivation, and psychosis (Varga, 2012). Amphetamine abusers also exhibit deficits in decision-making cognition, which is hypothesized to be connected to the dysregulation of dopamine in the PFC (Rodgers, 1999). Given the delayed development of the PFC, college students are particularly vulnerable to developing psychiatric disorders related to PFC dysfunction (i.e. depression, anxiety, schizophrenia). Environmental factors like illicit stimulant use has been evidenced to exacerbate these risks by dysregulating dopamine in the developing brain (Paus, 2008).

In essence, many students who illicitly use non-prescription ADHD medications are uninformed or misinformed about the physical and mental impacts of these medications. The purpose of this study is to identify and classify patterns of physical and mental symptoms of misuse, classify perceived safety of the drug, determine populations at risk of misusing Adderall,

and to deduce the most effective approaches to persuade users about the adverse effects of misuse.

Methods

The Institutional Review Board at Binghamton University Human Subjects Research Review Committee reviewed and approved the study protocol. Inclusion criteria included being 18 years or older and being enrolled in a US college. The anonymous survey was built in Google Forms and the link was sent through social media platforms requesting responses from US college students. Participants gave consent to the study by accessing the survey. For Binghamton University data collection, the survey was shared on social media and advertised at tabling events on campus and no compensation was provided for participation. A total of 596 individuals completed the survey. The latter included a total of 40 questions addressing demographics, psychostimulant use, perceptions of psychostimulant safety, and potential methods to dissuade psychostimulant use. Responses were on a 6 likert-scale. In this survey, psychostimulants were first listed as "such as, but not limited to; Adderall, Ritalin, Concerta, or Vyvanse". Data were analyzed by employing Pearson's Correlation Coefficient and a Principal Component Analysis (PCA). The PCA was used to identify patterns in the data set that associate with the different beliefs and patterns of behaviors within the data set, which are important to understanding the reason behind misuse of psychostimulants. Sampling adequacy and inter-correlation of variables were assessed using Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity, respectively. To determine the number of principal components (PCs) retained, eigenvalue >1.0 criterion was used. A factor loading of 2.0 or more was considered. Additionally, the number of PCs selected was confirmed by visually examining the screen plot. PCs were then orthogonally rotated (varimax) to simplify and enhance their interpretability. All data were analyzed using

SPSS version 25.0.

Results

Demographics

Participants (n=596) self-reported sex, age, Greek life affiliation, ethnicity, and location of their college (Table 1).

Unprescribed psychostimulant use

Non-prescription psychostimulant misuse was positively correlated with social fraternities/sororities affiliation, social science majors, economics majors, males, alcohol consumption more than twice a week, recreational painkiller use, and low GPA. Hard science majors and participants without Greek affiliation were negatively correlated with non-prescription psychostimulant misuse.

Those who obtained unprescribed psychostimulants illegally were positively correlated with receiving it from a fraternity or sorority member ($p<0.05$) and negatively correlated with receiving it from a friend ($p<0.05$) (Table 2).

Side Effects

Those who used unprescribed psychostimulants reported panic attacks, weight loss, inability to concentrate, anxiety, irritability, depression, fatigue, headache, aggression, paranoia, lack of motivation, mood swings, sleep difficulty, and suicidal thoughts during use of unprescribed psychostimulants (Table 3).

Perceived Safety

Principal Component Analysis (PCA) identified 2 components: (1) Perception of psychostimulants safety and (2) Pattern for frequent users of psychostimulants. Component 1 reflects a pattern of perception that alcohol, marijuana, prescription painkillers, and caffeine as

less safe than psychostimulants and that those individuals would not be dissuaded by the negative psychological and psychological effects of psychostimulants. Component 2 reflects a pattern of frequent psychostimulant users who believe that psychostimulant is equally as safe as alcohol and prescription painkillers and that psychostimulants are safer than cocaine. Component 2 reveals that frequent psychostimulant users are stressed at least once a week and negative psychological and physiological effects would not be a strong enough motivator to dissuade use of psychostimulant.

Education

As for the educational outreach approaches, survey participants stated that sharing real life stories (38.9%) and negative side effects (35.9%) would be likely to dissuade their personal unprescribed psychostimulant use.

Discussion

The purpose of this study was to assess the relationship between psychostimulant use and overall mental health of college students. Particularly, this study focused on the adverse mental health effects potentially caused by unprescribed use of psychostimulants. The main findings of this study are: 1) Psychostimulants highly correlate with reports of adverse side effects and 2) Specific subpopulations of students including psychology majors and Greek affiliated students are more likely to misuse psychostimulants. The effects of prescription stimulants on mental wellbeing have been fairly well documented from a pharmacological perspective. Due to fluctuations in monoamine regulation, individuals who take psychostimulants regularly often report feelings of depression and anxiety (Sherzada, 2011). To evaluate mental health, participants were asked to report all adverse effects experienced from both prescribed and unprescribed use of psychostimulants. In accordance with the literature, our results did reveal a

number of adverse side effects with regard to mental health of the user. Ailments such as panic attacks, aggression, paranoia, weight loss, irritability, anxiety, suicidal thoughts, and lack of motivation all strongly correlated with psychostimulant use. Along with the current literature, these findings are extremely concerning when we consider the breadth of psychostimulant use across college campuses.

A secondary aim of the present study was to identify subpopulations of college students most at risk for this epidemic as well as general perceptions of psychostimulant use. The major findings from our survey suggest that students in social science majors such as psychology and economics are most likely to be using non-prescription psychostimulants. Before assuming that psychology and economics majors are the most at risk, however, it is important to test group difference between majors. In addition to use risk with respect to major, data showed that the most at-risk groups of users reside within the Greek life community. Our results revealed that there was a prominent correlation between non-prescription psychostimulant use and membership in a fraternity or sorority. Out of those users belonging to the aforementioned demographic, many reported acquiring the medication from another member of their fraternity or sorority. These findings align with McCabe et al. (2004) who described that Adderall use was correlated with membership in a social fraternity/sorority. Despite support from literature in the field, it is important to consider the impacts of selection bias on this survey.

Another concerning finding was the degree to which individuals use other drugs in addition to the non-prescription psychostimulant use. Drinking alcohol more than twice a week as well as recreational painkiller use correlates with non-prescription psychostimulant use. It is possible that psychostimulant abuse may prime the brain for further substance use, hence, individuals using these medications are more likely to use other drugs and engage in risky

behavior (Jardin et al., 2011).

A major contributing factor to the epidemic of non-prescription psychostimulant use potentially revolves around the perceived safety of these types of drugs by college students. Our data shows that a significant number of participants reported perceiving psychostimulants as safer to use than prescription painkillers. In fact, the data suggests that many college students are not aware nor educated about the risks associated with non-prescription psychostimulant use. This notion of perceived safety largely ties into the Health Belief Model created in the 1950s (Rosenstock et al., 1988). The Health Belief Model hypothesizes that health-related action is largely reliant on three factors: 1) Sufficient motivation to make a particular issue relevant, 2) The belief that one truly is vulnerable to a particular health threat, and 3) The belief that following a particular recommendation would be beneficial in preventing illness. With regard to perceived safety, it is imperative to consider point (2) of the Health Belief Model. To elaborate, it is very likely that college students who are not educated about psychostimulants do not perceive themselves to be vulnerable to the negative side effects of these drugs. As a result, some students may have the inherent belief that they are immune to the negative consequences of psychostimulants misuse. To combat this, it is imperative to reallocate university budgets in order to create programming that informs students about not only alcohol and marijuana, but also the dangers of psychostimulant misuse. When asked about prevention measures, participants reported that education via real life stories and illustrations of adverse side effects would be most likely to dissuade use. With regard to point (3) of the Health Belief Model, these findings suggest that true stories of the dangers of Adderall and similar drugs may encourage college students to be more open to listening to recommendations from health professionals. By implementing these measures in seminars and other information sessions, abuse of psychostimulants by college

students may be reduced. Our data suggest that it is imperative to specifically target at risk groups such as social science majors and Greek life organizations.

Conclusion

In summary, the current study reports that college students who illicitly used psychostimulants experienced symptoms of mental distress, such as depression, anxiety, and panic attacks. These findings are of great importance because hundreds of college students abuse psychostimulants yearly without knowledge of the implications. Without a proper education concerning psychostimulants, these students risk damaging their mental and physical health in a futile effort to excel in academics via medication misuse. Despite these efforts to boost academic performance, data revealed a negative relationship between illicit psychostimulant use and GPA. Additionally, mental distress, which may be caused by substance misuse is linked to lower academic performance. This conclusion along with other findings support the need for educational interventions to dissuade at risk students from illicit psychostimulant use.

References

American Psychiatric Association. (2000). DSM-IV-TR. American Psychiatric Association, Washington, DC.

Arnsten, A. F. (2009). Toward a New Understanding of Attention-Deficit Hyperactivity Disorder Pathophysiology. *CNS Drugs*, *23*(Supplement 1), 33–41. doi: 10.2165/00023210-200923000-00005

Begdache, L., Kianmehr, H., Sabounchi, N., Marszalek, A., & Dolma, N. (2019). Principal component regression of academic performance, substance use and sleep quality in relation to risk of anxiety and depression in young adults. *Trends in Neuroscience and Education*, *15*, 29–37. doi: 10.1016/j.tine.2019.03.002

Benson, K., Flory, K., Humphreys, K. L., & Lee, S. 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. doi: 10.1007/s10567-014-0177-z

Castellanos FX. (2001) Neuroimaging studies of ADHD. In: Solanto MV, Arnsten AF, Castellanos FX, editors. (eds) Stimulant drugs and ADHD: Basic and clinical neuroscience. New York: Oxford University Press, 243–258.

Desantis, A. D., Webb, E. M., & Noar, S. M. (2008). Illicit Use of Prescription ADHD Medications on a College Campus: A Multimethodological Approach. *Journal of American College Health*, *57*(3), 315–324. doi: 10.3200/jach.57.3.315-324

Drug Enforcement Administration, U.S. Department of Justice. (2017). Drugs of Abuse: 2017 Edition, A DEA Resource Guide. doi: 10.1037/e624282012-001

Faraone, S. V., Biederman, J., Spencer, T. J., & Aleardi, M. (2006). Comparing the efficacy of stimulants for ADHD in children and adolescents using meta-analysis. *MedGenMed*, *8*(4), 4. doi: 10.1007/s00787-009-0054-3

Greenhill, L. L., Swanson, J. M., Steinhoff, K., Fried, J., Posner, K., Lerner, M., … Tulloch, S. (2003). A Pharmacokinetic/Pharmacodynamic Study Comparing a Single Morning Dose of Adderall to Twice-Daily Dosing in Children With ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry*, *42*(10), 1234–1241. doi: 10.1097/00004583-200310000-00015

Gross, M. D. (1975). Caffeine in the Treatment of Children With Minimal Brain Dysfunction or Hyperkinetic Syndrome. *Psychosomatics*, *16*(1), 26–27. doi: 10.1016/s0033-3182(75)71230-6

Heal, D. J., Smith, S. L., Gosden, J., & Nutt, D. J. (2013). Amphetamine, past and present – a pharmacological and clinical perspective. *Journal of Psychopharmacology*, *27*(6), 479–496. doi: 10.1177/0269881113482532

Holmes, J. C., & Rutledge, C. O. (1976). Effects of the d- and l-isomers of amphetamine on uptake, release and catabolism of norepinephrine, dopamine and 5-hydroxytryptamine in several regions of rat brain. *Biochemical Pharmacology*, *25*(4), 447–451. doi: 10.1016/0006-2952(76)90348-8

Ilieva, I. P., Hook, C. J., & Farah, M. J. (2015). Prescription Stimulants Effects on Healthy Inhibitory Control, Working Memory, and Episodic Memory: A Meta-analysis. *Journal of Cognitive Neuroscience*, *27*(6), 1069–1089. doi: 10.1162/jocn_a_00776

Jardin, Looby, Earleywine (2011). Characteristics of College Students with Attention-Deficit Hyperactivity Disorder Symptoms Who Misuse Their Medications. *Journal of American College Health, 59*(5).

Kuczenski, R., & Segal, D. S. (2002). Effects of Methylphenidate on Extracellular Dopamine, Serotonin, and Norepinephrine: Comparison with Amphetamine. *Journal of Neurochemistry*, *68*(5), 2032–2037. doi: 10.1046/j.1471-4159.1997.68052032.x

Mantle, T. J., Tipton, K. F., & Garrett, N. J. (1976). Inhibition of monoamine oxidase by amphetamine and related compounds. *Biochemical Pharmacology*, *25*(18), 2073–2077. doi: 10.1016/0006-2952(76)90432-9

McCabe, Knight, Teter, and Wechlser (2004). Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Society for the Study of Addiction, 100* (1).

Misener, V. L., Luca, P., Azeke, O., Crosbie, J., Waldman, I., Tannock, R., … Barr, C. L. (2004). Linkage of the dopamine receptor D1 gene to attention-deficit/hyperactivity disorder. *Molecular Psychiatry*, *9*(5), 500–509. doi: 10.1038/sj.mp.4001440

Paus, T., Keshavan, M., & Giedd, J. N. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience*, *9*(12), 947–957. doi: 10.1038/nrn2513
Ramamoorthy, S., Shippenberg, T. S., & Jayanthi, L. D. (2011). Regulation of monoamine transporters: Role of transporter phosphorylation. *Pharmacology & Therapeutics*, *129*(2), 220–238. doi: 10.1016/j.pharmthera.2010.09.009

Rasmussen, N. (2008). America's First Amphetamine Epidemic 1929–1971. *American Journal of Public Health*, *98*(6), 974–985. doi: 10.2105/ajph.2007.110593

Repantis, D., Schlattmann, P., Laisney, O., & Heuser, I. (2010). Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research*, *62*(3), 187–206. doi: 10.1016/j.phrs.2010.04.002

Ricaurte, G. A., Mechan, A. O., Yuan, J., Hatzidimitriou, G., Xie, T., Mayne, A. H., & Mccann, U. D. (2005). Amphetamine Treatment Similar to That Used in the Treatment of Adult Attention-Deficit/Hyperactivity Disorder Damages Dopaminergic Nerve Endings in the Striatum of Adult Nonhuman Primates. *Journal of Pharmacology and Experimental Therapeutics*, *315*(1), 91–98. doi: 10.1124/jpet.105.087916

Robertson, S. D., Matthies, H. J. G., & Galli, A. (2009). A Closer Look at Amphetamine-Induced Reverse Transport and Trafficking of the Dopamine and Norepinephrine Transporters. *Molecular Neurobiology*, *39*(2), 73–80. doi: 10.1007/s12035-009-8053-4

Rogers, R. (1999). Dissociable Deficits in the Decision-Making Cognition of Chronic Amphetamine Abusers, Opiate Abusers, Patients with Focal Damage to Prefrontal Cortex, and Tryptophan-Depleted Normal Volunteers Evidence for Monoaminergic Mechanisms. *Neuropsychopharmacology*, *20*(4), 322–339. doi: 10.1016/s0893-133x(98)00091-8

Rosenstock et al., (1988). Social Learning Theory and the Health Belief Model. *Health Education Quarterly*, *15* (2), 175-183.

Schrantee, A., Bouziane, C., Bron, E. E., Klein, S., Bottelier, M. A., Kooij, J. J. S., … Reneman, L. (2017). Long-term effects of stimulant exposure on cerebral blood flow response to

methylphenidate and behavior in attention-deficit hyperactivity disorder. *Brain Imaging and Behavior*, *12*(2), 402–410. doi: 10.1007/s11682-017-9707-x

Schrantee, A., Václavů, L., Heijtel, D. F. R., Caan, M. W. A., Gsell, W., Lucassen, P. J., Reneman, L. (2015). Dopaminergic System Dysfunction in Recreational Dexamphetamine Users. *Neuropsychopharmacology*, *40*(5), 1172–1180. doi: 10.1038/npp.2014.301

Sherzada. (2011). An Analysis of ADHD Drugs: Ritalin and Adderall. *Johnson County Community College Honors Journal, 3*(1).

Smith, M.E., Farah, M.J. (2011). Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal health individuals. *Psychological Bulletin, 137*(5), 717-41. doi: 10.1037/a0023825.

Spencer, R. C., Devilbiss, D. M., & Berridge, C. W. (2015). The Cognition-Enhancing Effects of Psychostimulants Involve Direct Action in the Prefrontal Cortex. *Biological Psychiatry*, *77*(11), 940–950. doi: 10.1016/j.biopsych.2014.09.013

Surles, May, and Garry (2001). Adderall-Induced Psychosis in an Adolescent. *Journal of the American Board of Family Medicine.*

Varga, M. D. (2012). Adderall Abuse on College Campuses: A Comprehensive Literature Review. *Journal of Evidence-Based Social Work*, *9*(3), 293–313. doi: 10.1080/15433714.2010.525402

Weyandt, L. L., Oster, D. R., Marraccini, M. E., Gudmundsdottir, B. G., Munro, B. A., Rathkey, E. S., & Mccallum, A. (2016). Prescription stimulant medication misuse: Where are we and where do we go from here? *Experimental and Clinical Psychopharmacology*, *24*(5), 400–414. doi: 10.1037/pha0000093

Wilens, T. E., S. Faraone, and J. Biederman. (2004). Attention‑deficit/hyperactivity disorder in adults. JAMA 292, 619–623.

Table 1
Demographics of participants

Demographic		Percent of Population	n
Sex	Male	37.6%	224
	Female	60.3%	359
	Other	0.6%	3
	Prefer not to say	1.5%	9
Years of education	<16	96.1%	573
	>16	1.5%	9
	Prefer not to say	2.4%	14
Greek Life	Social Fraternity/Sorority	18.8%	112
	Professional Fraternity/Sorority	12.6%	75
	No Greek affiliation	66%	393
	Prefer not to say	5.4%	32
Ethnicity	White	71.3%	425
	Asian	10.1%	60
	Black	3.6%	21
	Native Hawaiian/Pacific Islander	0.3%	2
	Prefer not to say	1.8%	12
	More than one ethnicity	12.9%	77
Location	Northeast	99.6%	594
	Midwest	0.2%	1
	South	0.2%	1

Table 1. Showing demographic breakdowns of survey participants. N=596. * denotes $p<0.05$. **denotes $p<0.01$

Table 2
Demographic correlations with Unprescribed Psychostimulant Use

Variable	n	1	2	3	4	5	6	7	8	9	10	11	12
1. Social science	596	-											
2. Hard science	596	-0.50**	-										
3. Economics Major	596	-0.16**	-0.28**	-									
4. Males	596	0.010	-0.038	0.073	-								
5. Alcohol more than twice a week	596	0.009	-0.09*	0.12**	0.057	-							
6. Recreational Painkiller use	596	-0.001	-0.057	0.000	0.069	0.021	-						
7. Acquired psychostimulant from friend	596	0.031	0.062	-0.117	0.038	-0.203*	0.004	-					
8. Acquired psychostimulant from Sorority/Fraternity member	596	-0.009	-0.143	-0.057	-0.090	0.105	0.25**	-0.145	-				
9. No Greek affiliation	596	0.055	-0.048	0.034	-0.060	-.330**	-0.053	.247**	-.177*	-			
10. GPA	596	0.113	0.020	0.020	-0.141	-0.128	-0.023	0.092	0.189	0.122	-		
11. Social Fraternity/Sorority member	596	0.01	-0.058	0.004	0.068	.296**	0.073	-.216*	.213*	-.779**	-0.146	-	
12. Unprescribed Psychostimulant Use	596	0.113**	-0.132**	0.960*	0.101*	0.155**	0.088*	0.194*	0.226*	-0.214**	-0.596**	0.266**	-

Table 2. Showing correlation values for unprescribed psychostimulant use with various demographics. N=596. * denotes $p<0.05$. **denotes $p<0.01$

Table 3
Symptom Correlations with Unprescribed Psychostimulant Use

Variable	n	1	2	3	4	5	6	7	8	9	10	11
1. Panic Attacks	596	-										
2. Weight Loss	596	.273**	-									
3. Inability to Concentrate	596	-0.020	-0.026	-								
4. Irritability	596	.207**	.233**	0.050	-							
5. Anxiety	596	.438**	.274**	-0.036	.318**	-						
6. Depression/Negative Affect	596	.310**	.179**	-0.029	.275**	.402**	-					
7. Fatigue	596	.092*	.220**	.151**	.217**	.217**	.300**	-				
8. Headaches	596	.280**	.230**	0.043	.336**	.358**	.266**	.242**	-			
9. Suicidal Thoughts	596	.236**	.175**	-0.007	.158**	.123**	.158**	.181**	0.059	-		
10. No Effects	596	-.323**	-.419**	-.135**	-.432**	-.573**	-.462**	-.387**	-.502**	-.117*	-	
11. Unprescribed Psychostimulant Use	596	0.269**	0.327**	0.121**	0.384**	0.455**	0.309**	0.297**	0.414**	0.183**	0.105*	-

Table 3. Showing correlation values for unprescribed psychostimulant use with symptoms. N=596. * denotes $p<0.05$. **denotes $p<0.01$

Table 4
Factor loadings and communalities based on PCA with varimax rotation from An Inclusive Study of Adderall Use on College Campuses (N =596)

	Perception of Psychostimulant Safety Pattern	**Frequency of Psychostimulant Use Pattern**
Eigen Value	*14.909*	*11.518*
Total Variance	*2.687*	*2.598*
Negative Physiological and Psychological effects would dissuade use	-0.252	-0.245
Safer than marijuana	0.653	
Safer than alcohol	0.623	-0.251
Safer than caffeine	0.594	
Safer than prescription painkillers	0.324	-0.270
Equally safe as alcohol		0.209
Equally safe as prescription painkillers		0.372
Less safe than cocaine		-0.204
Frequency of use of psychostimulant		0.248
Stress: Once a week		0.401
Stress: 4-6 days a week		0.308
Stress: Every day		0.281

Table 4. Principal Component Analysis (PCA) with varimax rotation. Principal components loading for A) perception of psychostimulant safety, B) frequency of psychostimulant use patterns.