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Association between ADHD Medication, Cannabis, and Nicotine Use, Mental Distress, and Other Psychoactive Substances

Nicole Scott, Emily Dwyer, Cara Patrissy, Samantha Bonventre, Lina Begdache

***Abstract*—**Across North America, the use and abuse of Attention Deficit Hyperactivity Disorder (ADHD) medication, cannabis, nicotine, and other psychoactive substances across college campuses have become an increasingly prevalent problem. Students frequently use these substances to aid their studying or deal with their mental health issues. However, it is still unknown what psychoactive substances are likely to be abused when college students illicitly use ADHD medication. In addition, it is not clear which psychoactive substance is associated with mental distress. Thus, the purpose of this study is to fill these gaps by assessing the use of different psychoactive substances when illicit ADHD medication is used; and how this association relates to mental stress. A total of 702 undergraduate students from different college campuses in the US completed an anonymous survey distributed online. Data were self-reported on demographics, the use of ADHD medications, cannabis, nicotine, other psychoactive drugs, and mental distress, and feelings and opinions on the use of illicit study drugs were all included in the survey. Mental distress was assessed using the Kessler Psychological Distress 6 Scale. Data were analyzed in SPSS, Version 25.0, using Pearson's Correlation Coefficient. Our results show use of ADHD medication, cannabis use (non-frequent and very frequent), and nicotine use (non-frequent and very frequent); there were both statistically significant positive and negative correlations to specific psychoactive substances and their corresponding frequencies. Along the same lines, ADHD medication, cannabis use (non-frequent and very frequent), and nicotine use (non-frequent and very frequent) had statistically significant positive and negative correlations to specific mental distress experiences. As these findings are combined, a vicious loop can initiate a cycle where individuals who abuse psychoactive substances may or may not be inclined to use other psychoactive substances. This may later inhibit brain functions in those main areas of the brain stem, amygdala, and prefrontal cortex where this vicious cycle may or may not impact their mental distress. Addressing the impact of study drug abuse and its potential to be associated with further substance abuse may provide an educational framework and support proactive approaches to promote awareness among college students.

***Keywords*—**Stimulant, depressant, nicotine, ADHD medication, psychoactive substances, mental health, illicit, ecstasy, adrenochrome.

Nicole Scott*, Emily Dwyer, and Samantha Bonventre are with Binghamton University, Department of Biological Sciences, USA (*corresponding author, e-mail: nscott2@binghamton.edu, edwyer4@binghamton.edu, sbonven1@binghamton.edu).

Cara Patrissy is with Binghamton University, Department of Integrative Neuroscience (e-mail: cpatris1@binghamton.edu

Lina Begdache is with Binghamton University, Department of Health and Wellness (e-mail: lina@binghamton.edu).

I. Introduction

ADHD and Adderall

ADHD medications, such as Adderall and Vyvanse, have been commonly misused among college students across the United States for recreational and academic purposes. In 1944, Methylphenidate was discovered as a "non-addictive stimulant" to treat "hyperkinesis" among children. [1]. Hyperkinesis later became known as ADHD. The prescription stimulants used to treat ADHD come in two forms: amphetamine-containing salts and methylphenidate [1]. Prescription stimulants are illicitly used through oral, intranasal and intravenous routes of administration [2]. Adderall, a methylphenidate, is classified as a Schedule II drug by the Drug Enforcement Administration due to the prevalence of its abuse, which may lead to dependence [3]. For those with ADHD, Adderall tends to be prescribed by doctors with an aim to decrease symptoms of inattention, impulsivity and hyperactivity in the treatment of ADHD [3]. Amphetamine and methylphenidate work by increasing central dopamine and norepinephrine activity [4]. Further analysis of Adderall in conjunction with one's mood and autonomic activation has revealed alteration in one's activated mood as well as heightened automatic activation, heart rate and blood pressure [5].

Illicit prescription stimulant use occurs for a range of reasons. One of the most common reasons for illicit use is to enhance academic performance as well as experience a "high" [6]. Therefore, these drugs are commonly referred to as "study drugs" [2]. In a sample survey of 150 undergraduate students, about 35.5% illicitly took prescription amphetamines, which include D, L-amphetamine, methylphenidate or D-amphetamine [2]. Unfortunately, the misuse of stimulants is most prevalent among college-aged individuals, 18-24 years when compared to individuals 26-49 years [3]. The increased prevalence of illicit use of these stimulants has been reported to be due in part to accessibility by college students by falsifying symptoms to obtain a prescription from a medical provider [1]. This is extremely alarming as the misuse of study drugs results in the potential for addiction. A review of over 60 studies showed that continuous use of methylphenidate mimics symptoms similar to cocaine in regards to causing a "high" or "rush" [2].

Cannabis

Within the past few years, marijuana use among college students, and college-aged individuals have been at an all-time

high, surpassing levels since the 1980s [7]. Marijuana is a mind-altering substance made from the dried flowers, leaves, stems, and seeds of the cannabis plant, containing over 100 cannabinoids, including tetrahydrocannabinol (THC), and cannabidiol (CBD) [8]. THC is an impairing substance in marijuana, while CBD is not. In colleges across the United States, it is common for marijuana to be smoked, vaped, and mixed into foods or drinks, more commonly known as "edibles" [8]. Cannabinoids function by stimulating two receptors in the endocannabinoid system, CB1 and CB2. The endocannabinoid system plays a role in pain, memory, movement, appetite, immunity, salivation and cardiopulmonary function [9]. Binding to different parts of the central nervous system exhibits many different functions, some including the hippocampus with short-term memory impairment; the neocortex with impairment of judgment and sensation; basal ganglia and altered reaction times; hypothalamus and increased appetite; amygdala and paranoia and anxiety [9]. Factors that influence the effect of marijuana use on an individual include the amount of marijuana taken; frequency of marijuana use; use of marijuana with other substances; mode of marijuana use; previous drug experience; genetics; and sex. College students utilize cannabis for a variety of reasons: heightening sociability, easing emotional distress from both personal and academic stressors and seeking sex and intimacy [10].

As there is a misconception that cannabis is a harmless drug, studies have found that cannabis usage has an adverse effect on mental health [11]. The same study investigated the extent of how casual the association between cannabis usage and mental distress is. In their research, they found that cannabis usage leads to poor mental health and that frequent users are subject to a higher risk of mental distress than less frequent users. Other studies reported that while acute doses of CBD, the cannabinoid, is not mind-altering, were found to reduce anxiety in both animals and humans, whereas THC, the impairing cannabinoid, produced anxiogenic responses, especially at higher dosages [12]. A 2015 study conducted at the University of Maryland found that freshman students who used marijuana more frequently tended to skip more of their classes, contributing to their lower GPAs. While this did negatively impact GPA, there was no significant translation to later graduation [13].

Nicotine

Cigarette smoking is the most preventable leading cause of mortality in the United States [14]. The use of nicotine sustains tobacco addiction and in turn, can cause many health problems including lung disease and cancer [15]. The pharmacological reasons for nicotine use are enhancement of mood, either directly or through relief of withdrawal symptoms, and augmentation of mental or physical functions [16]. In the brain, nicotine attaches to acetylcholine receptors and releases dopamine, which causes feelings of pleasure [17] and alters brain circuitry involved in learning, stress and self-control, resulting in addiction and dependence [18].

Adolescents and young adults are particularly susceptible to nicotine receptor upregulation and addiction because of enhanced brain plasticity [19]. Young adults have a higher prevalence of smoking than children or adults [20]. A recent study found that college students continue to have high rates of tobacco product use compared to the general population, with 18.6% of students reporting using cigarettes within the last 30 days and 26.2% of students using any tobacco product [21]. Mental disorders account for nearly one-half of the disease burden in the United States [22]. Smoking prevalence is higher among patients with mental illness compared to those without mental illness [23]. Studies have demonstrated that psychological disorders like depression, anxiety, alcoholism and eating disorders are correlated with smoking [24].

Mental Distress

Mental Distress is characterized by feelings of sadness, tension, anger, and anxiety [25]. Mental Distress can be used as an umbrella term for anxiety, depression, and additional mental health issues in individuals. Chronic mental distress can cause inflammation in the brain by stimulating the activity of microglial cells [26].

Mental health problems are prevalent among college students, especially during the transition from high school into college [27]. Many of these mental health disorders develop and symptoms begin during early adulthood [27]. Research has indicated that anxiety disorders are the most common psychiatric problem among college students as 11.9% of college students suffer from an anxiety disorder; depression is also common as 7-9% experience symptoms [27]. It has been indicated that those who suffer from mental illness are more likely to use cannabis at higher rates than those who do not [28]. A recent study conducted during the pandemic reported that those who did not use psychoactive substances exhibited lower levels of stress [29].

Literature Gaps and Current Objectives

Previous studies of illicit ADHD medication use suggested that the misuse across college campuses has increased by around 7% [30]. As these data enable a small understanding of the prevalence of ADHD medication use, alongside stimulants and depression use, investigation of the mutual relation between different substance use with mental distress and psychological stress is limited. Therefore, the purpose of this study was to assess the use of ADHD medication, cannabis, nicotine, depressants, and other psychoactive substances, in relation to mental distress and several neurobehaviors. Our findings may serve as a foundation for educational initiatives to raise public awareness of the consequences of substance abuse on college campuses.

II. Methods

Study Design

The Binghamton University Institutional Review Board reviewed and approved the study protocol. The inclusion criteria for this study included being at least 18 years old and enrolled in a US higher education institution. An anonymous survey was created using Google Forms and was shared on

several social media platforms and university listservs targeting college students. Participants had to consent to the study in order to access the survey. In addition, there was no compensation or incentive offered for completing the survey. The survey included 80 questions evaluating demographics, usage of ADHD medication, alcohol, and psychoactive substances, academic performance, and physical and mental distress. Survey questions on cannabis, nicotine, and other psychoactive substances were retrieved from the 2019 cycle of the OSDUHS's Form A and Form B by the University of Toronto's Center for Addiction and Mental Health [31]. These questions assessed the frequency of cannabis, nicotine, and other psychoactive drug use on frequency and time frame of use. Mental stress was assessed by the Kessler Psychological Distress Scales (K6) [32]. The Stress Mindset Scale [33] and Perceived Stress Scale [34], were also used to assess the potential relationship between substance use and a stress mindset resulting in perceived stress feelings. The Brief Resilience Scale (BRS) [35] was also used to study the impact of these substances on resilience.

ADHD Medication Drug Use and Further Mental Distress

The majority of the survey responses were on a 6-point Likert scale. Demographic questions assessed age, gender, major, class year, GPA, college of enrollment, and ethnicity. GPA standards for admission to the majority of graduate institutions define a GPA of 3.0 or less as "poor," whereas a GPA of 3.1-3.99 was considered "average" and a GPA of 3.5 or higher was deemed "high" [36]. Participants were asked about ADHD drug usage such as Adderall, whether it is an illicit use or a prescription. Follow-up questions included reasons for illicit use and choices given were weight control, academic improvement or physical performance, or other. Correlations were determined using Pearson's Correlation Coefficient, SPSS version 25.

III. Results

Demographics

In Tables I-VI, percentages were calculated for each subcategory of a categorical variable. This was done using the mathematical formula of responses for a subcategory of a question divided by the total number of responses for a category, then multiplied by 100. For example, for the question of gender identity, the percentage of female responses was found by counting the number of female responses divided by 702 total responses of the survey and then multiplied by 100.

Table I depicted the demographic percentages of gender identities of male, female, and non-binary as well as other/prefer not to say in relation to all 702 responses. Out of all 702 responses, females predominantly took the survey with ~60.5%.

Table II displayed the demographic percentages of the age groups of 18-29 years, 30-39 years, 40-49 years, 50-years and above, and prefer not to say in relation to all 702 responses. Out of all 702 responses, the 18-29-year age group predominantly took the survey with ~94.3%.

TABLE I
DEMOGRAPHIC PERCENTAGES OF GENDER IDENTITY

Gender Identity	Percentages
Male	35.8974359
Female	60.5413105
Non-Binary	2.56410256
Other/Prefer not to say	0.997151

TABLE II
DEMOGRAPHIC PERCENTAGES OF AGE GROUPS

Age (Years)	Percentages
18-29	94.301994
30-39	0.997151
40-49	0.997151
50 and above	3.27635328
Prefer not to say	.42735043

TABLE III
DEMOGRAPHIC PERCENTAGES OF MAJOR

Major	Percentages
Natural Sciences (Biology, Chemistry, Neuroscience, Engineering, Math)	42.022792
Social Sciences (Psychology, Sociology, Economics, Anthropology, History, Political Science, Linguistics)	25.0712251
Business, Finance, Accounting, Management	15.3846154
Arts (Music, Art, Art History, Dance, English)	3.84615585
Double (or more) Major	5.6980057
N/A/Prefer not to say	7.97720595

TABLE IV
DEMOGRAPHIC PERCENTAGES OF ATTENDED COLLEGES

Attendance of College	Percentages
Binghamton University	76.3532764
Other Colleges	21.6524217
N/A	1.99430199

Table III showed the demographic percentages of the majors who took the survey of Natural Sciences (Biology, Chemistry, Neuroscience, Engineering, Math), Social Sciences (Psychology, Sociology, Economics, Anthropology, History, Political Science, Linguistics), Business, Finance, Accounting, Management, Arts (Music, Art, Art History, Dance, English), Double (or more) Major, or prefer not to say in relation to all 702 responses. Out of all 702 responses, the Natural Sciences majors (Biology, Chemistry, Neuroscience, Engineering, Math) predominantly responded with ~42.02%.

Table IV displayed the demographic percentages of attendance of college either at Binghamton university, other colleges, or N/A, in relation to all 702 responses. Out of all 702 responses, Binghamton University was predominantly attended as shown by ~76.4%.

Table V demonstrates the demographic percentages of regions participants lived in such as North America/Central America, South America, Europe, Asia, Africa, Middle East/ North Africa, Australia and N/A/prefer not to stay in relation to all 702 responses. Out of all 702 responses, responses from North America/Central America were predominant as shown by ~97.6%.

Lastly, Table VI shows the demographic percentages of

GPA of below 1.5, 1.5 to 1.9, 2.0 to 2.4, 2.5 to 2.9, 3.0 to 3.4, 3.5 to 4.0, and N/A/Prefer not to say in relation to all 702 responses. Out of all 702 responses, participants with a 3.5 to 4.0 GPA mainly took the survey.

TABLE V
DEMOGRAPHIC PERCENTAGES OF REGION LIVING IN

Region Living in	Percentages
North America/Central America	97.5783476
South America	0.14245014
Europe	0.71225071
Asia	0.42735043
Africa	0.56980057
Middle East/North Africa	0.14245014
Australia	0
N/A/Prefer not to say	0.42735041

TABLE VI
DEMOGRAPHIC PERCENTAGES OF CURRENT GPA

Current GPA	Percentages
Below 1.5	0.997151
1.5 to 1.9	0.28490028
2.0 to 2.4	1.42450142
2.5 to 2.9	5.12820513
3.0 to 3.4	24.6438746
3.5 to 4.0	55.2706553
N/A/Prefer not to say	12.2507123

TABLE VII
ASSOCIATIONS BETWEEN ADHD MEDICATION USE AND MENTAL DISTRESS

Relationship	r
Feeling worthless	.087*
Feeling everything was an effort	.082*
Feeling hopeless	.103**
Feeling restless/fidgety	-.132**
Rate your mental health or emotional health	.182**
Feeling unable to work or carry out your normal activities	.169**

*p < 0.01 = **; p < 0.05 = **

ADHD Medication Use and Mental Distress

As shown in Table VII, participants who used ADHD medication illicitly or non-illicitly showed a statistically significant ($p < 0.01$) positive correlation with feelings of worthlessness, hopelessness, unable to work or carry out normal activities, and rating one's mental health. However, there was a statistically significant ($p < 0.01$) negative correlation between ADHD medication use and feeling restless/fidgety. There was a statistically significant ($p < 0.05$) positive correlation between ADHD medication use and feeling everything was an effort.

ADHD Medication Use Experience and Psychoactive Drug Use

Table VIII indicated statistically significant ($p < 0.01$) negative correlations between experience with ADHD medications and psychoactive drug use of used cannabis 3-5 times in last 12 months, used cannabis 10-19 times in last 12 months, used adrenochrome 6-9 times in last 12 months, used ecstasy/MDMA (Methylenedioxy-methamphetamine) but not in last 12 months, used ecstasy/MDMA 6-9 times in last 12 months, and smoked 100+ cigarettes in life and at least 1 cigarette every day during the last month. There was a statistically significant ($p < 0.05$) negative correlation between ADHD medication use experience and the use of sniff or huff glue or other solvents 6-9 times in the last 12 months.

TABLE VIII
ASSOCIATIONS BETWEEN EXPERIENCE WITH ADHD MEDICATIONS AND PSYCHOACTIVE DRUG USE

Relationship	r
Used Cannabis 3-5 times in last 12 months	-.438**
Used Cannabis 10-19 times in last 12 months	-.411**
Used Adrenochromes 6-9 times in last 12 months	-1.000**
Used Ecstasy/MDMA but not in last 12 months	-.611**
Used Ecstasy/MDMA 6-9 times in last 12 months	-1.000**
Used sniff or huff glue or other solvents 6-9 times in last 12 months	-.677*
Smoked 100+ cigarettes in life and at least 1 cigarette every day during the last month	-.404**

*p < 0.01 = **; p < 0.05 = **

TABLE IX
ASSOCIATIONS BETWEEN PHYSICIAN PRESCRIBED/NON-PHYSICIAN PRESCRIBED ADHD MEDICATION USE AND OTHER DRUG USE

Relationship	r
Drink alcohol in last 12 months	-.365**
Used cannabis 20-39 times in the last 12 months	-.163*
Used sedatives or tranquillizers with a prescription but not in the last 12 months	*.491***
Used sedatives or tranquillizers with a prescription 10-19 times in the last 12 months	.562**
Used Ecstasy/MDMA but not in the last 12 months	.479**

*p < 0.01 = **; p < 0.05 = **

Physician Prescribed/Non-Physician Prescribed ADHD Medication Use and Other Drug Use

In this study, a question of whether or not ADHD medication use was either prescribed by a physician or not was included. Table IX depicts the statistically significant ($p < 0.01$) positive correlation between physician prescribed/non-physician prescribed ADHD medication use and used sedatives or tranquillizers with a prescription but not in the last 12 months, used sedatives or tranquillizers with a prescription 10-19 times in the last 12 months, and used ecstasy/MDMA but not in the last 12 months. There was a statistically significant ($p < 0.01$) negative correlation between physician-prescribed/non-physician prescribed ADHD medication use and drink alcohol in the last 12 months. However, there was a statistically significant ($p < 0.05$) negative correlation between physician-prescribed/non-physician prescribed ADHD medication use and used cannabis 20-39 times in the last 12 months.

Non-frequent Cannabis Use and Mental Distress

Table X shows the statistically significant ($p < 0.01$) negative relationship between non-frequent cannabis use (not used in the last 12 months) and feeling unable to control the important things in life. Also, a statistically significant ($p < 0.05$) negative correlation was found between non-frequent cannabis use (not used in the last 12 months) and feeling nervous, and worthless, and it is hard for me to snap back when something bad happens.

TABLE X
ASSOCIATIONS BETWEEN NON-FREQUENT CANNABIS USE (NOT USED IN LAST 12 MONTHS) AND MENTAL DISTRESS

Relationship	r
Feeling nervous	-.100*
Feeling worthless	-.112*
It is hard for me to snap back when something bad happens	-.104*
Feeling unable to control the important things in life	-.144**

*p < 0.01 = **; p < 0.05 = **

TABLE XI
ASSOCIATIONS BETWEEN NON-FREQUENT CANNABIS USE (NOT USED IN LAST 12 MONTHS) AND PSYCHOACTIVE DRUG USE

Relationship	r
Used sedatives or tranquillizers with a prescription but not in the last 12 months	.463**
Used sedatives or tranquillizers with a prescription 10-19 times in the last 12 months	.433**
Used sedatives or tranquillizers with a prescription 20-39 times in the last 12 months	.406**
Used adrenochromes but not in the last 12 months	1.000**
Used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) but not in the last 12 months	.297**
Used sniff or "huff" glue or other solvents in the last 12 months	.488**

*p < 0.01 = **; p < 0.05 = **

TABLE XII
VERY FREQUENT CANNABIS USE (40 TIMES IN LAST 12 MONTHS) AND MENTAL DISTRESS

Relationship	r
Upset because of something that happened unexpectedly	.123**
Feeling unable to control the important things in your life	.121**
Feeling that everything was an effort	.138**
Rate your mental or emotional health	-.188**

*p < 0.01 = **; p < 0.05 = **

Non-frequent Cannabis Use and Psychoactive Drug Use

Table XI depicts the statistically significant ($p < 0.01$) positive correlations between non-frequent cannabis use (not used in last 12 months) and used sedatives or tranquillizers with a prescription but not in the last 12 months, used sedatives or tranquillizers with a prescription 10-19 times in the last 12 months, used sedatives or tranquillizers with a prescription 20-39 times in the last 12 months, used adrenochromes but not in the last 12 months, used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) but not in the last 12 months, and used sniff or "huff" glue or other solvents in the last 12 months.

Very Frequent Cannabis Use and Mental Distress

Table XII demonstrates a statistically significant ($p < 0.01$) positive correlation between very frequent cannabis use (40 times in the last 12 months) and feeling upset because of something that happened unexpectedly, feeling unable to control the important things in your life, and feeling that everything was an effort. In addition, there is a statistically significant ($p < 0.01$) negative correlation between very frequent cannabis use (40 times in the last 12 months) and rate your mental or emotional health.

Very Frequent Cannabis Use and Psychoactive Drug Use

Table XIII shows the statistically significant ($p < 0.01$) positive correlation between very frequent cannabis use (40 times in the last 12 months) and smoked 100 or more cigarettes in your life and at least 1 cigarette every day during the last month, used "sniff" or "huff" glue or other solvents 40 or more times in the last 12 months, and used adenochromes 40 or more times in the last 12 months.

TABLE XIII
VERY FREQUENT CANNABIS USE (40 TIMES IN LAST 12 MONTHS) AND PSYCHOACTIVE DRUG USE

Relationship	r
Smoked 100 or more cigarettes in your life and at least 1 cigarette every day during the last month	.182**
Used "sniff" or "huff" glue or solvents 40 or more times in the last 12 months	.452**
Used adenochromes 40 or more times in the last 12 months	1.000**

*p < 0.01 = **; p < 0.05 = **

TABLE XIV
NON-FREQUENT NICOTINE USE (FEW PUFFS TO A WHOLE CIGARETTE IN YOUR LIFE) AND MENTAL DISTRESS

Relationship	r
Feeling nervous	-.130*
Feeling hopeless	-.138*
Feeling restless/fidgety	-.131*
Feeling everything was an effort	-.132*
Feeling able to do only half or less of what you would normally have been able to do	-.140*

*p < 0.01 = **; p < 0.05 = **

TABLE XV
NON-FREQUENT NICOTINE USE (FEW PUFFS TO A WHOLE CIGARETTE IN YOUR LIFE) AND PSYCHOACTIVE DRUG USE

Relationship	r
Taken any medications for ADHD such as, but not limited to; Adderall, Ritalin, Concerta, or Vyvanse	.225**
Used LSD or "acid" but not in the last 12 months	.255*
Used pain relief pills without a prescription in the last 12 months	.225*
Used sedatives or tranquillizers with a prescription in the last 12 months	.424*
Used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 6-9 times in the last 12 months	.297*

*p < 0.01 = **; p < 0.05 = **

Non-frequent Nicotine Use and Mental Distress

Table XIV reveals a statistically significant ($p < 0.01$) negative correlation between non-frequent nicotine use (few puffs to a whole cigarette in your life) and feeling nervous, feeling hopeless, feeling restless/fidgety, feeling everything was an effort, and feeling able to do only half or less of what you would normally have been able to do.

Non-frequent Nicotine Use and Psychoactive Substances

As in Table XV, there is a statistically significant ($p < 0.01$) positive correlation between non-frequent nicotine use (few puffs to a whole cigarette in your life) and take any medications for ADHD such but not limited to: Adderall, Ritalin, Concerta or Vyvanse. There was a statistically significant ($p < 0.05$) positive correlation between non-frequent nicotine use (few puffs to a whole cigarette in your life) and used LSD or acid but not in the last 12 months, used pain relief pills without a prescription in the last 12 months, used sedatives or tranquilizers without a prescription in the last 12 months, used sedatives or tranquillizers with a prescription in the last 12 months, and used psilocybin or

mescaline (also known as “magic mushrooms”, “shrooms”, “mesc”, etc.) 6-9 times in the last 12 months.

Very-Frequent Nicotine Use and Mental Distress

Table XVI reveals a statistically significant ($p < 0.01$) positive correlation between very frequent nicotine use (100 or more cigarettes in your life and at least 1 cigarette every day during the last month) and feeling so depressed that nothing could cheer you up. There was a statistically significant ($p < 0.05$) positive correlation between very frequent nicotine use (100 or more cigarettes in your life and at least 1 cigarette every day during the last month) and feeling hopeless and feeling unable to work or carry out your normal activities. Lastly, there was a statistically significant ($p < 0.01$) negative correlation between very frequent nicotine usage and the belief that experiencing stress facilitates learning and growth.

TABLE XVI
VERY-FREQUENT NICOTINE USE (100 OR MORE CIGARETTES IN YOUR LIFE AND AT LEAST 1 CIGARETTES EVERY DAY DURING THE LAST MONTH) AND MENTAL DISTRESS

Relationship	*r*
Feeling so depressed that nothing could cheer up	.170**
Feeling hopeless	.128*
Feeling unable to work or carry out your normal activities	.136*
Experiencing stress facilitates my learning and growth	-.122*

*$p < 0.01$ = **; $p < 0.05$ = **

TABLE XVII
VERY-FREQUENT NICOTINE USE (100 OR MORE CIGARETTES IN YOUR LIFE AND AT LEAST 1 CIGARETTE EVERY DAY DURING THE LAST MONTH) AND PSYCHOACTIVE DRUG USE

Relationship	r
Used cannabis 40 times in the last 12 months	.182**
Used LSD or “acid” 40 times in the last 12 months	.492**
Used pain relief pills without a prescription in the last 12 months	.492**
Used sedatives or tranquillizers with a prescription 6-9 times in the last 12 months	-.424*
Used cocaine 40 or more times in the last 12 months	.540**
Used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 1-2 times in the last 12 months	-.330**
Used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 40+ times in the last 12 months	.859**
Used MDMA or Ecstasy 40+ times in the past 12 months	.708**
Used “sniff” or “huff” glue or other solvents 40 or more times in the last 12 months	.603**

*$p < 0.01$ = **; $p < 0.05$ = **

Very-Frequent Nicotine Use and Psychoactive Substances

Table XVII displays a statistically significant ($p < 0.01$) positive correlation between very frequent nicotine use (100 or more cigarettes in your life and at least 1 cigarette every day during the last month) and used cannabis 40 times in the last 12 months, used LSD OR “acid” 40 times in the last 12 months, used pain relief pills without a prescription in the last 12 months, used cocaine 40 or more times in the last 12 months, used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 40+ times in the last 12 months, used MDMA or ecstasy 40+ times in the past 12 months, and used “sniff” or “huff” glue or other solvents 40 or more times in the last 12 months. There was a statistically significant ($p < 0.01$) negative correlation between very frequent nicotine use (100 or more cigarettes in your life and at least 1 cigarette every day during the last month) and used sedatives or tranquillizers with a prescription 6-9 times in the last 12 times and used psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 1-2 times in the last 12 months.

IV. DISCUSSION

The purpose of this study was to investigate the relationship between both prescribed and illicit ADHD medication use, marijuana use, nicotine use, other psychoactive drug use, and mental distress. The main findings of this study were as follows: 1) ADHD medication usage, whether prescribed or illicit, increased symptoms of anxiety and depression; 2) Non-frequent cannabis usage showed was negatively correlated with mental distress while frequent cannabis usage was positively correlated with mental distress, 3) Non-frequent nicotine usage showed was negatively correlated with mental distress while frequent nicotine usage was positively correlated with mental distress, 4) Very frequent nicotine usage showed significant positive correlations with the usage of psychoactive substances cocaine, cannabis, LSD, unprescribed pain relief pills, sedatives, magic mushrooms, MDMA, and “huff”, and 5) Unprescribed ADHD medication usage was correlated to higher alcohol and cannabis usage in the last 12 months. These findings suggest that cannabis, nicotine, and ADHD drug use may be related to increased mental distress and also increased substance abuse.

Demographics

In our anonymous survey, there were 702 total responses of which 35.89% were males and 60.54% were females, indicating that the majority of the participants were females. Non-binary participants consisted of 2.56% of total respondents and “prefer not to say participants” consisted of .99% of total respondents. Non-binary and prefer not to say responses were not included in our analysis. Age demographics were also included and the most predominant age group was 18-29 years with 94.30% of participants. This indicates that the majority of participants were between the ages of 18-29 years, which coincides with our research as advertising for the survey was mainly done on the Binghamton University campus and in the Binghamton area and this population is mostly college students. Also, our survey analyzed the study focus of each participant and what major they were pursuing, of which 42.02% were natural sciences majors and 25.07% were social sciences majors, demonstrating that most of our respondents were science majors. In addition, 76.35% of our participants attended Binghamton University also suggesting that most of our participants are students at Binghamton. Region of living demographics suggested that most of our respondents were located in North America with 97.57% of total participants. Lastly, we tested for current GPA of which 24.64% of participants had between a 3.0 to 3.4 GPA and 55.27% of participants had between a 3.5 to 4.0 GPA. This suggests that the majority of the participants 79.91% had a GPA of 3.0 or

better.

ADHD Medication and Mental Distress

The correlational results of this study indicate that ADHD medication usage may increase symptoms of mental distress. ADHD medication use has shown significant positive correlations to feelings of worthlessness, that everything is an effort, hopelessness, and inability to carry out normal activities. ADHD medication usage is more prevalent in competitive academic institutions, is positively correlated with perfectionism, and is found to peak in high periods of academic stress [37]. A 2013 New York Times article [43] described Richard Fee, a 24-year-old college graduate, becoming addicted to ADHD medications Adderall and Vyvanse, a struggle that ultimately led to his suicide. According to his parents, Richard lied to his physicians to obtain prescriptions. As his addiction worsened, Richard began to show symptoms of paranoia, mood swings, delusions, and insomnia; he struggled with depression, anxiety, and suicidal thoughts. The struggles that Fee showed display a real-life example of the correlations we found: increased use of ADHD medication correlates to increased symptoms of mental distress.

Our results showed conflicting correlations, stating that ADHD medication usage had a positive correlation to self-rated mental health and a negative correlation to feelings of restlessness/fidgetiness. Since that correlation focused on overall ADHD usage, not differentiating between prescribed and illicit use, it may be accounting for the benefits of ADHD medication usage on people who have been diagnosed with ADHD/ADD and have been prescribed the medication by a physician. A 2019 review argued that stimulant usage, such as Adderall, Ritalin, and Concerta, can be beneficial when managing Attention-Deficit-Hyperactivity-Disorder, but can cause adverse effects when used outside of a prescription for academic enhancement. This supports our correlations as ADHD medication usage showed adverse effects for mental distress symptoms, except restlessness, which is a common symptom of ADHD [38].

Associations between Experience with ADHD Medications and Other Psychoactive Drugs

Our results displayed various correlations between ADHD medication experience and multiple psychoactive substances. When examining the experience of individuals who took ADHD medication as well as various psychoactive substances, negative correlations were found. Specifically, when examining the relationship between cannabis use, 3-5 times within the last 12 months and 10-19 times within the last 12 months, and one's experience with ADHD medications, a negative correlation existed. The correlational results of this study indicate that Ecstasy/MDMA use in conjunction with ADHD medication experience was negatively correlated. A 2011 study examined the use of MDMA to cope with negative situations such as loss, trauma, abuse, etc. The study found that some of the participants who struggled with MDMA addiction also had ADHD as well as other mental illnesses such as anxiety, depression etc. [39]. This supports our results indicating a link between negative experiences with MDMA and ADHD medication. One's experience with ADHD medications and smoking 100+ cigarettes in their life as well as at least one cigarette every day during the last month was negatively correlated. A 2014 study found that individuals with ADHD have a significantly higher risk of smoking cigarettes in their lifetime [40]. The study discovered that adolescents with ADHD are more likely to smoke if they are in a household with poor parental monitoring, as well as child-parent relationships; parents seeking treatment for their children are said to be more involved in parenting [40]. These results suggest that smoking among individuals with ADHD can be prevented if a healthy child-parent relationships exists.

Associations between Cannabis with Mental Distress and Psychoactive Substances

The correlational results of the study for cannabis use were broken down into non-frequent use, not used in the last 12 months, and very frequent use used 40 or more times within the last 12 months. Non-frequent cannabis use displayed negative correlations between feeling worthless and nervousness. Additionally, non-frequent use was associated with negative correlations for difficulty snapping back after hard times and feeling unable to control the important things in life. These results indicate there is not a causation relationship between cannabis use and these emotions/ feelings. In contrast, very frequent cannabis use was positively associated with negative emotions such as feeling unable to control important things in your life and feeling upset because something occurred unexpectedly. This displays that very frequent cannabis use is associated with high levels of mental distress. A previous study found that cannabis usage was correlated to poor mental health, with frequent users being more at risk for mental distress than non-frequent users [11]. Our correlational results support these findings. Infrequent cannabis use is however positively associated with various other psychoactive drugs. Some of these positive correlations include a sedative or tranquillizer used with a prescription, not used within the last 12 months, use 20-39 times as well as used 10-19 times within the last 12 months. This correlation explains that infrequent cannabis use is linked with sedative or tranquillizer use. In addition, there is a positive correlation between infrequent cannabis use adrenochrome and psilocybin or mescaline use but not in the last 12 months. In regards to very frequent cannabis use, positive correlations exist among having smoked 100 cigarettes in one's life and at least one cigarette in a day as well as having used "sniff" or "huff" glue 40 or more times. Therefore, these positive correlations indicate that those who use cannabis very frequently are more likely to use "sniff" or "huff" as well as having smoked 100 or more cigarettes in their lifetime.

Associations between Nicotine with Mental Distress and Psychoactive Substances

The correlational results of this study indicate that infrequent use (few puffs to a whole cigarette in your life) of

nicotine and mental distress has negative correlations. Relationships between non-frequent use and feelings of hopelessness, restlessness or fidgety, nervousness, that everything was an effort, and not being able to do half or less than half of normal activities due to these feelings all had negative correlations. These correlational results suggest that infrequent use of nicotine may decrease symptoms of mental distress. Conversely, very frequent use of nicotine (100 or more cigarettes in your life and at least one cigarette per day in the last month) and mental distress had positive statistical correlations for feeling so depressed that nothing could cheer you up, feeling hopeless, feeling unable to work or carry out normal activities, and experiencing stress facilitates my learning and growth. This suggests that very frequent use of nicotine may increase symptoms of mental distress. A previous study found that smoking prevalence is higher among patients with mental illness compared to those without mental illness [23]. Our correlational results support these findings. Also, a previous study found that psychological disorders like depression, anxiety, alcoholism and eating disorders are correlated with smoking [24]. Our results also support these findings and that very frequent nicotine use can increase mental distress symptoms. With this in mind, nicotine use in a college setting should be highly discouraged and avoided as it may lead to increased symptoms of mental distress. Furthermore, we also analyzed the relationship between nicotine use and psychoactive substances. Very frequent nicotine usage was positively associated with cannabis usage 40 times in the last 12 months, used LSD 40 times or more in last 12 months, pain relief pills without a prescription in the last 12 months, used psilocybin 40+ times in last 12 months, used MDMA 40+ times in the last 12 months. This suggests that very frequent nicotine users are inclined to use psychoactive substances as well. Surprisingly, non-frequent nicotine usage was associated with taking any medications for ADHD such as, but not limited to; Adderall, Ritalin, Concerta, or Vyvanse, usage of pain relief pills without a prescription in the last 12 months, usage of sedatives or tranquillizers with a prescription in the last 12 months, and usage of psilocybin or mescaline (also known as "magic mushrooms", "shrooms", "mesc", etc.) 6-9 times in the last 12 months. This suggests that even non-frequent users of nicotine are inclined to use psychoactive substances.

V. Significance and Applications

The results of this study indicate many hallmarks of using different kinds of drugs tend to be correlated with negative mental distress while others have positive mental distress as well as an inclination to use certain other drugs and declination to use certain drugs simultaneously. As this study has predominantly shown participants ages 18-29 years and in college, it indicates that this is the certain target population of this problem. In other words, these aged students experience both negative and positive mental distress with certain drug use. Also, using a certain drug may sway towards using certain drugs over others or staying away from certain drugs over others. These results expand on an idea introduced in 2021 where a cyclic relationship between ADHD medication use and negative symptoms of mental distress was proposed [41]. To further this, our studies showed that with ADHD medication, nicotine, and cannabis use, there was some presence of mental distress and inclination towards using certain psychoactive substances over others.

To aid with the substance abuse epidemic experienced by 18-29-year-olds in college, who are the largest impacted population, colleges should aim to educate their students through educational programs or presentation of healthy alternatives, better ways to cope with stress, and ways to get help either through mental health or substance abuse counseling. These results show that students should be exposed to healthy alternatives such as exercise which releases healthy doses of endorphins and help reduce tension, meditation that manages stress and tension, communication and support, giving back to the community, and journaling that provides creative outlets [42]. Another way of helping these students that are commonly not educated enough is how important sleep and eating healthy. Sleeping 7 to 8 hours a night helps improve memory consolidation and improve mood. In addition, a healthy well-balanced diet may help improve focus which can be provided by Omega-3 fats from white fish. Study drugs are extremely common in most schools; thus, programs can be implemented on college campuses to convey these ideas. The use of psychoactive drugs can also be addressed in existing initiatives that warn students against drinking and using cannabis, nicotine, ADHD medication, and other drugs mentioned in the study.

VI. Study Limitations

The results of this study show statistically significant correlations between ADHD medication, nicotine, cannabis and other psychoactive substances as well as mental distress. However, there are potential confounding variables that should be addressed. For example, there were only 702 participants which indicate a small sample size. There is also a possibility of self-report bias. While the study was anonymous and confidential, social desirability, cultural norms and other outside pressures may have influenced these responses. Another possibility is that participants had never taken the drug before or were unaware of what the drug was as this was an option for each substance on the anonymous survey. Likewise, gender-neutral participants or “prefer not to say” participants, responses were not included in our results. These unanalyzed responses might have influenced our results in unknown ways. Another possibility is that our survey was mainly advertised in the Binghamton area, thus accounting for more responses from Binghamton than from other areas or universities.

VII. Conclusion

This study examined the relationship between ADHD medication use, psychoactive substance use, and mental distress. The study examined self-reported mental health

ratings and symptoms and analyzed their correlations to individual substance use, highlighting ADHD medication, cannabis, and nicotine but also including additional psychoactive substances such as LSD, sedatives, adrenochromes, mescalin, and sniff glue. The analyzed data revealed that ADHD medication usage was significantly correlated with increased symptoms of mental distress, however, ADHD medication usage did show positive effects when used to treat symptoms of ADHD, such as feeling restless/fidgety. Additionally, the data revealed that infrequent cannabis use was correlated to decreased symptoms of mental distress while frequent cannabis usage is significantly correlated with mental distress. Very frequent use of nicotine and mental distress also had positive correlations, while non-frequent nicotine use had negative statistical correlations with mental distress. Both non-frequent uses of nicotine and frequent use of nicotine had positive correlations with the use of psychoactive substances. This suggests that even non-frequent users of nicotine are inclined to use psychoactive substances. Our results suggest that those who use ADHD medication, cannabis, and nicotine may be inclined to abuse other substances as well and have mental distress. By addressing the abuse of study drugs on college campuses, we may hope to curtail the abuse of other prevalent substances among college populations. By addressing and educating students on college campuses about the abuse of ADHD medication, marijuana, and nicotine we hope to prevent abuse of these substances among this population.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Standards

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Institutional Review Board at Binghamton University.

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