BSc in Psychology
Department of Psychology

Risk Correlates of Non-Medical Use of Prescription Stimulants Among High School Students in Iceland

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Foreword

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavik University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.

This thesis was completed in the Spring of 2021 and may therefore have been significantly impacted by the COVID-19 pandemic. The thesis and its findings should be viewed in light of that.

Abstract

The aim of the current study was to examine potential risk correlates of non-medical use of prescription stimulants (NMUPS) among high school students in Iceland, as previous studies have mainly focused on college students in the United States and less is known about NMUPS among high school students. Cross-sectional data from a random sample of 2,053 students aged 16– 19 years old (51.8% girls) were used, as part of the larger survey *Youth in Iceland 2018*. The results revealed a lifetime NMUPS prevalence of 5.1%. Students with a history of NMUPS were more likely to be male, have lower grades, report inattention problems interfering with academic performance, more depressive and anxiety symptoms, perceive lower parental monitoring and parental support, and have a history of other substance use compared to students without a history of NMUPS. Binary logistic regression analyses demonstrated that marijuana use in the overall model, parental monitoring and inattention problems among girls, and non-medical use of other prescription drugs among boys and girls significantly predicted NMUPS when accounting for other risk correlates. These findings can assist in identifying high-risk students to help inform prevention and intervention efforts. Longitudinal research is needed to examine directional relationships.

Keywords: non-medical use of prescription stimulants, attention-deficit/hyperactivity disorder (ADHD), high school students

Útdráttur

Helsta markmið rannsóknarinnar var að skoða mögulega áhættuþætti misnotkunar lyfseðilsskyldra örvandi lyfja meðal framhaldsskólanemenda á Íslandi, þar sem meirihluti rannsókna hefur einblínt á háskólanema í Bandaríkjunum og minna er vitað um misnotkun lyfseðilsskyldra örvandi lyfja meðal framhaldsskólanema. Stuðst var við tilviljunarkennt úrtak 2053 nemenda á aldrinum 16–19 ára (51,8% stelpur) úr rannsókninni *Ungt fólk á Íslandi 2018*. Niðurstöður rannsóknarinnar gáfu til kynna að 5,1% þátttakenda höfðu misnotað lyfseðilsskyld örvandi lyf á lífsleiðinni. Nemendur sem höfðu sögu um misnotkun voru líklegri til að vera karlkyns, hafa lægri meðaleinkunnir, glíma við athyglisbrest sem hefur áhrif á frammistöðu í námi, greina frá fleiri þunglyndis- og kvíðaeinkennum, upplifa lægra eftirlit og stuðning frá foreldrum, og eiga sögu um annars konar vímuefnanotkun samanborið við nemendur sem ekki höfðu misnotað lyfseðilsskyld örvandi lyf. Niðurstöður aðhvarfsgreiningar hlutfalla sýndu að marijúana notkun í heildarmódelinu, eftirlit foreldra og athyglisbrestur í námi meðal stelpna, og misnotkun annarra lyfseðilsskyldra lyfja meðal stráka og stelpna, spáðu marktækt fyrir um misnotkun lyfseðilsskyldra örvandi lyfja þegar gert var grein fyrir öðrum áhættuþáttum. Þessar niðurstöður er hægt að nota til að bera kennsl á framhaldsskólanemendur í áhættuhópum, með það að markmiði að þróa forvarnir og inngrip. Langtímarannsóknir eru þarfar til að skoða stefnuháð sambönd.

Lykilorð: misnotkun lyfseðilsskyldra örvandi lyfja, athyglisbrestur með ofvirkni (ADHD), framhaldsskólanemendur

Risk Correlates of Non-Medical Use of Prescription Stimulants Among High School Students in Iceland

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder with estimated global prevalence between 2% and 7% (Sayal et al., 2017). The disorder is characterized by behavioral symptoms including impulsiveness, hyperactivity, and inattention, that can result in performance issues in everyday settings (Newcorn et al., 2018).

The prevalence of pharmacological treatment for ADHD has increased substantially worldwide in the last two decades as stimulant medications have proven to be a very effective treatment for improving ADHD's core symptoms (Caye et al., 2019; Raman et al., 2018). Research suggests that lower than normal baseline levels of dopamine and norepinephrine in the brain, which is often seen in ADHD, account for the effectiveness of prescription stimulants (del Campo et al., 2011). Methylphenidate and amphetamines, commonly prescribed stimulant medications (Raman et al., 2018), elevate dopamine and norepinephrine levels in the brain, resulting in enhanced alertness, concentration, and euphoria (Faraone et al., 2020). These effects may appear desirable, and with increased prevalence of prescriptions for stimulant medication, access to these medications is concurrently growing for individuals without prescriptions (Benson et al., 2015).

Non-medical use of prescription stimulants (NMUPS) is the use of prescription stimulants either without having a prescription, using prescribed stimulants in higher quantities or in another manner than prescribed, or taking prescription stimulants to feel euphoria (National Institute on Drug Abuse [NIDA], 2020). NMUPS is most prevalent among adolescents and young adults in the United States (U.S.; Substance Abuse and Mental Health Services Administration [SAMHSA], 2020), and has been found to be especially high in the student population. For example, recent studies have reported lifetime prevalence rates

between 7% and 13% among high school students (Becker et al., 2020; McCabe et al., 2017; McCabe & West, 2013; Zullig et al., 2015).

Academic enhancement is the most frequently reported motive for engaging in NMUPS among the student population (Faraone et al., 2020) despite little evidence that prescription stimulants enhance cognition among healthy individuals (Roberts et al., 2020). Other motives, such as recreational use (e.g., to get high), and experimentation have also been frequently reported (Faraone et al., 2020; McCabe et al., 2019).

When used as prescribed, prescription stimulants are considered safe and with few severe side effects (Benson et al., 2015). However, NMUPS is associated with increased health risks, including an elevated risk for psychosis, and raised blood pressure, which increases the risk for heart attacks and strokes (Moran et al., 2019; Sussman et al., 2006). Early onset of NMUPS has also been found to increase the likelihood of major depressive disorder (Schepis & McCabe, 2012). Furthermore, as with illicit stimulants (e.g., cocaine), NMUPS can lead to addiction and overdose deaths, with death rates increasing considerably in recent years (Seth et al., 2018). This highlights the need to identify high risk individuals as to inform prevention and intervention efforts.

Student Characteristic Correlates of NMUPS

Examination of students' characteristics is likely to help identify individuals at high risk for NMUPS. Several studies have found boys to be more likely than girls to engage in NMUPS (e.g., Becker et al., 2020; Benson et al., 2015; Gallucci et al., 2018), however, findings have been inconsistent, as other studies have not found significant gender differences (e.g., Goodhines et al., 2020; Teter et al., 2020).

Studies have also found students' grade point averages (GPAs) to be negatively associated with NMUPS (e.g., Becker et al., 2020; Clegg-Kraynok et al., 2011; Weyandt et al., 2009). In a recent study, Teter and others (2020) found that high school students who

reported NMUPS for any non-academic motives had significantly lower GPAs than non-users. Another study found that high school students who co-ingested prescription stimulants with other drugs were more likely to have lower GPAs compared to students who did not use other drugs simultaneously with NMUPS (McCabe et al., 2015).

Psychological Correlates of NMUPS

Psychological factors such as depression and anxiety have been found to predict NMUPS. Prior studies have hypothesized that individuals who engaged in NMUPS were self-medicating to cope with anxiety and depressive symptoms (Sattler & Wiegel, 2013; Teter et al., 2010). Few studies have examined these psychological factors among the high school population, but one study found that students who reported NMUPS were significantly more likely to experience depressive symptoms and suicidal risk (Zullig, et al., 2015). Additionally, Goodhines and others (2020) found that high school students who reported NMUPS also reported more depressive and anxiety symptoms.

Substance Use Correlates of NMUPS

As for substance use, research has demonstrated strong association with NMUPS. Research suggests that individuals with ADHD are two to three times more likely to endorse cigarette smoking and develop substance use disorders, compared to the general population (Wilens & Kaminski, 2018). Therefore, it is possible that students who engage in NMUPS are experiencing ADHD symptoms and self-medicate with prescription stimulants and other substances (Khantzian, 1997). For example, one longitudinal study found that college students who reported persistent NMUPS were more likely to report use of other drugs compared to students who only reported persistent marijuana use or had no history of NMUPS nor use of other illegal drugs. They also found that non-medical users were more likely to report more ADHD symptoms (Arria et al., 2011).

A few studies have found alcohol consumption, marijuana use and cigarette smoking to be the most problematic substances used concurrently with NMUPS. Other illicit drug use and non-medical use of other prescription drugs (NMUPD) have also been found to associate with NMUPS (e.g., McCabe et al., 2015; McCabe & West, 2013; Teter et al., 2020). For example, McCabe and West (2013) found that NMUPD was much higher among high school students who reported NMUPS than among non-users. Co-ingestion of prescription stimulants and other substances have similarly been found at high rates among high school students, with higher odds of non-oral routes of administration and recreational motives (McCabe et al., 2015).

Contextual Correlates of NMUPS

Research has demonstrated that the role of parental behavior is an important factor in prevention of substance use behavior among adolescents (Sigfúsdóttir et al., 2009). Despite this, few studies have examined the role of parental behavior in predictions of NMUPS. One study found that 12–17-year-old adolescents who reported both low parental warmth and monitoring were more likely to have friends and opinions more positively oriented towards NMUPS (Donaldson et al., 2015). Goodhines and colleagues (2020) also found parental monitoring to be negatively associated with NMUPS among high school students.

Current Study and Hypotheses

The health risks associated with NMUPS makes research on this topic crucial. Previous studies have mainly focused on college students, with less existing research among high school students. Nonetheless, earlier onset of NMUPS and other substance use has been found to be associated with harmful consequences, such as major depression and substance abuse later in life (Newcomb & Locke, 2005; Schepis & McCabe, 2012). Thus, it is important to examine whether NMUPS is occurring at younger ages, including high school

students, as earlier identification facilitates earlier prevention and intervention efforts and may avert adverse effects later in life.

Furthermore, there is a lack of studies on NMUPS outside of the U.S. In a recent study, lifetime NMUPS prevalence among Icelandic college students was found to be 13%, which is considerably higher than in many other European countries (Gudmundsdottir et al., 2020). This, coupled with the fact that Iceland has the highest consumption of methylphenidate per capita worldwide (Kaye & Darke, 2012), highlights the dire need for further research on NMUPS in Iceland, particularly among high school students.

The aim of the present study was therefore to examine possible risk correlates of NMUPS among high school students in Iceland. Based on the literature, the following hypotheses were examined. First, male high school students would be more likely than female high school students to engage in NMUPS. Second, students' GPAs would be negatively associated with NMUPS. Third, depressive and anxiety symptoms would be positively associated with NMUPS. Fourth, students who reported more frequent lifetime alcohol intoxication and a history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other NMUPD would be more likely to engage in NMUPS compared to students who reported less frequent alcohol intoxication and no history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other NMUPD. Fifth, parental monitoring and parental support would be negatively associated with NMUPS.

Method

Participants

High school students, attending all high schools in Iceland (N = 10,259), participated in the cross-sectional national survey, *Youth in Iceland*, which examines adolescents' health and well-being. The survey was conducted by the Icelandic Centre for Social Research and Analysis (ICSRA) in 2018 (Guðmundsdóttir et al., 2018). All students who attended class the

day the survey was conducted were invited to participate and were administered anonymous questionnaires. Parents received emails about the survey and were instructed to inform teachers only if they would not give their consent for adolescents younger than 18 years old to participate (i.e., passive consent). Participation was optional and no compensation was provided. The overall response rate was 71%. In the present study, data from a random subsample of 2,053 high school students were used, 1,055 (51.8%) girls, 959 (47.1%) boys, as well as 39 (1.9%) students who did either not answer or specify their gender. Participants' age ranged from 16 to 19 years old, with a mean age of 17.2 years (*SD* = 1.01).

Measures

Non-Medical Use of Prescription Stimulants

To assess NMUPS, participants were asked how often (if ever) they had used prescription stimulants (e.g., Ritalin, Ritalin Uno, Concerta, Methylphenidate Sandoz) in their lifetime without a prescription from a physician. Response scale ranged from 1 to 7 (1 = *never*, 2 = *1–2 times*, 3 = *3–5 times*, 4 = *6–9 times*, 5 = *10–19 times*, 6 = *20–39 times*, and 7 = *40 times or more*). Responses were converted to a binary categorical variable (0 = *no NMUPS*, 1 = *yes NMUPS*). This question (McCabe et al., 2017; McCabe & West, 2013) and coding (Becker et al., 2020) have been used previously in similar studies.

Demographic Measures

Participants were asked if they identified as a boy or girl (0 = *girl*, 1 = *boy*, 2 = *other*), where "other" was coded as missing, and the year they were born.

Grade Point Average

Participants were asked what their average grades were in the last semester from the school they attended, whether it was secondary school, high school, or another school, including math and Icelandic. Response scale ranged from 1 to 9 (e.g., 1 = *not applicable*, 2 = *below 4*, 3 = *approximately 4*, 4 = *approximately 5*, 9 = *approximately 10*). The response

option “not applicable” was coded as missing. Items for both math and Icelandic were summed together and divided by two, to obtain average GPAs (*M* = 6.40, *SD* = 1.43). Previous studies have used self-reported GPAs (Becker et al., 2020; Teter et al., 2020).

Psychological Symptoms

Anxiety Symptoms. The *General Anxiety Disorder-7* (GAD-7) is a 7-item self-report anxiety scale used to screen for General Anxiety Disorder (Spitzer et al., 2006). GAD-7 was used in this study and participants were asked, “Over the last 2 weeks, how often have you been bothered by the following?” followed by seven anxiety symptoms such as: “Worried too much about different things?” and “had trouble relaxing?” Response scale ranged from 1 to 4 (1 = *never*, 2 = *few days*, 3 = *more than half the days*, and 4 = *almost every day*). The items were summed together, creating a scale from 7 to 28 (*M* = 12.48, *SD* = 4.93, α = .90). The GAD-7 scale has been found to have high internal consistency in the student population (α = .91; Duffy et al., 2019) and has been used to measure anxiety symptoms previously in a similar study (Grant et al., 2018).

Depressive Symptoms. The *Symptom Checklist-90* is a self-report scale that screens for depressive symptoms among other symptom dimensions (Derogatis et al., 1971). Thirteen items from the SCL-90 were used to measure depressive symptoms in the current study. Participants were asked, “How often did you experience the following unpleasurable feelings or discomfort in the past week?” followed by depressive symptoms such as: “You had little appetite,” “you felt sad, or had little interest in doing things,” and “you felt lonely.” Response scale ranged from 1 to 4 (1 = *almost never*, 2 = *rarely*, 3 = *sometimes*, and 4 = *often*). The items were summed together, creating a scale from 13 to 52 (*M* = 24.43, *SD* = 9.02, α = .92). A previous study used eight items from the SCL-90 to measure depressive symptoms, yielding high internal consistency (α = .89; Sigfusdottir et al., 2013).

Other Substance Use

Lifetime Alcohol Intoxication. Participants were asked how often they had been drunk in their lifetime, to separate those who had drunk more than few sips of alcoholic beverages in their lifetime from participants who had only had few sips. Response scale ranged from 1 = *never* to 7 = *40 times or more*. This question and scale have been used in a previous study (Kristjansson et al., 2013).

Lifetime Cigarette Smoking. Participants were asked how often they had smoked cigarettes in their lifetime (1 = *never* to 7 = *40 times or more*). Responses were collapsed to a binary categorical variable of lifetime history of cigarette smoking (0 = *no cigarette smoking*, 1 = *yes cigarette smoking*). This question and coding have been used in a similar previous study (Goodhines et al., 2020).

Lifetime Marijuana Use. Participants were asked how often (if ever) they had used marijuana in their lifetime (1 = *never* to 7 = *40 times or more*). Responses were collapsed to a binary categorical variable of lifetime history of marijuana use (0 = *no marijuana use*, 1 = *yes marijuana use*). This question and coding have been used previously in a similar study (Baiden & Tadeo, 2019).

Lifetime Other Illicit Substance Use. Participants were asked how often (if ever) they had used any of the following substances in their lifetime: Hash, cocaine, amphetamine, ecstasy, lysergic acid diethylamide (LSD), and mushrooms containing psilocybin (1 = *never* to 7 = *40 times or more*). The items were summed together and converted to a binary categorical variable of lifetime history of other illicit substance use (0 = *no illicit substance use*, 1 = *yes illicit substance use*). Previous studies have summed together illicit substances and used this coding (Baiden & Tadeo, 2019; McCabe & West, 2013).

Lifetime Non-Medical Use of Other Prescription Drugs. Participants were asked how often (if ever) they had used the following prescription drugs in their lifetime non-

medically: Sleeping pills or sedatives, often called "Benzo drugs" (e.g., Xanax, Rivotril, Tafil, Valium, Sobril, Mogadon, Lyrica) and morphine-related painkillers (e.g., Oxycontin, Contalgin, Parkodin Forte, Tramadol, Nobligan, Fentanyl). Response scale ranged from 1 = *never* to 7 = *40 times or more*. The items were summed together and converted to a binary categorical variable of lifetime history of other NMUPD (0 = *no other NMUPD*, 1 = *yes other NMUPD*). Previous research has summed together other prescription drugs and converted to a categorical variable (Baiden & Tadeo, 2019).

Parental Monitoring

To measure parental monitoring, participants were asked: "How well do the following statements apply to you?" followed by four items: (1) "my parents monitor who I spend time with in the evening," (2) "my parents monitor where I am in the evening," (3) "my parents know my friends," and (4) "my parents know my friends' parents." Response scale ranged from 1 to 4 (1 = *does not apply to me at all*, 2 = *applies rather poorly to me*, 3 = *applies rather well to me*, and 4 = *applies very well to me*). Participants could also report if they did not live with their parents, which was coded as missing. The items were summed together to create a scale from 4 to 16 (M = 12.37, SD = 2.85; α = .75). A previous study summed together two of the items (i.e., "my parents monitor who I spend time with in the evening" and "my parents monitor where I am in the evening") to measure parental monitoring (Kristjansson & Sigfusdottir, 2009).

Parental Support

To measure parental support, participants were asked: "How easy or difficult is it for you to get the following from your parents?" followed by five items: (1) "care and warmth," (2) "conversations about personal matters," (3) "advice regarding academics," (4) "advice regarding other matters," and (5) "help with other projects." Response scale ranged from 1 to 4 (1 = *very difficult*, 2 = *rather difficult*, 3 = *rather easy*, and 4 = *very easy*). The items were

summed together to create a scale from 5 to 20 (M = 17.48, SD = 3.24, α = .90). This measure has been used in a previous study with high internal consistency (α = .86; Kristjansson et al., 2010).

Inattention Problems

Participants were asked how much (if at all) inattention problems interfered with their academic performance. Response scale ranged from 1 to 6 (1 = *nothing at all*, 2 = *very little*, 3 = *rather little*, 4 = *somewhat*, 5 = *much*, and 6 = *very much*). This was used as a control variable to control for inattention as a possible ADHD symptom.

Procedure

Data collection was conducted by ICSRA in October/November 2018. The questionnaires used in the survey were sent to all high schools in Iceland and administered by teachers. As the survey was anonymous, participants were instructed to not write down their name nor social security number on the survey or the envelope that came with it, so that the answers could not be traced back to them. Participants were asked to answer the questions truthfully and to seek assistance from the teachers if they had any questions. When participants had completed the survey, they returned it to their teacher sealed in a blank envelope. Permission for the current study was obtained from the National Bioethics Committee in Iceland and notified to the Icelandic Data Protection Authority.

Data Analysis

All analyses were conducted using SPSS (27th edition). The current study examined 12 independent variables: Gender, GPA, inattention problems interfering with academic performance, depressive and anxiety symptoms, parental monitoring, parental support, lifetime frequency of alcohol intoxication, and history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other non-medical use of prescription drugs. The dependent variable was non-medical use of prescription stimulants.

Pearson's correlation was used to calculate bivariate correlations between study variables. Descriptive statistics were computed for all study variables in the complete sample, as well as the groups of NMUPS users and non-NMUPS users. Chi-square tests for categorical independent variables and independent samples *t*-test for continuous independent variables were then computed to compare the NMUPS and non-NMUPS groups. Finally, two binary logistic regressions were used to predict NMUPS. Gender, GPA and depressive symptoms, as well as the control variable (i.e., inattention problems interfering with academic performance) were fitted in Model 1, parental monitoring and parental support were added to Model 2, and frequency of lifetime alcohol intoxication, and history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other NMUPD were added to Model 3. The second binary logistic regression was divided by gender to examine how the independent variables predicted NMUPS between boys and girls. Assumptions for all statistical tests were met.

Results

Descriptive Statistics and Correlations

Lifetime frequencies of substance use are presented in Table 1. Overall, 5.10% of the students reported having engaged in NMUPS in their lifetime (6.50% boys; 3.40% girls), most commonly reporting lifetime use of 1–2 times and 3–5 times. History of lifetime alcohol intoxication (53.20%), cigarette smoking (36.20%), and marijuana use (18.80%) were most common. Students who had a history of lifetime alcohol intoxication reported on average having been drunk 10–19 times; lifetime cigarette smoking 10–19 times; and lifetime marijuana use 6–9 times. Students who had used illegal substances (i.e., hash, cocaine, amphetamine, MDMA, LSD, or mushrooms) reported on average having used 6–9 times in their lifetime, and other NMUPD 3–5 times.

Table 1

Lifetime Frequencies of Substance Use

Substances	Never	1-2 times	3-5 times	6-9 times	10-19 times	20-39 times	40 times or more
NMUPS	1868 (95.00%)	31 (1.60%)	28 (1.40%)	13 (0.70%)	9 (0.50%)	1 (0.10%)	16 (0.80%)
Alcohol Intoxication	923 (46.80%)	211 (10.70%)	139 (7.00%)	125 (6.30%)	174 (8.80%)	148 (7.50%)	253 (12.80%)
Cigarette Smoking	1257 (63.80%)	172 (8.70%)	104 (5.30%)	79 (4.00%)	82 (4.20%)	67 (3.40%)	208 (10.60%)
Marijuana Use	1596 (81.20%)	111 (5.60%)	78 (4.00%)	31 (1.60%)	34 (1.70%)	26 (1.30%)	90 (4.60%)
Other Illegal Substance Use							
Hash	1816 (92.30%)	73 (3.70%)	26 (1.30%)	14 (0.70%)	12 (0.60%)	3 (0.20%)	24 (1.20%)
Cocaine	1826 (88.90%)	51 (2.60%)	21 (1.10%)	15 (0.80%)	20 (1.00%)	9 (0.50%)	21 (1.10%)
Amphetamine	1870 (95.00%)	33 (1.70%)	9 (0.50%)	9 (0.50%)	11 (0.60%)	12 (0.60%)	24 (1.20%)
MDMA	1891 (96.20%)	25 (1.30%)	15 (0.80%)	9 (0.50%)	10 (0.50%)	4 (0.20%)	11 (0.60%)
LSD	1912 (97.60%)	25 (1.30%)	10 (0.50%)	3 (0.20%)	5 (0.30%)	1 (0.10%)	4 (0.20%)
Mushrooms	1898 (96.90%)	24 (1.20%)	11 (0.60%)	6 (0.30%)	11 (0.60%)	3 (0.20%)	6 (0.30%)
Other NMUPD							
Sleeping Pills or Other Sedatives	1810 (91.90%)	87 (4.40%)	28 (1.40%)	12 (0.60%)	9 (0.50%)	6 (0.30%)	18 (0.90%)
Morphine-Related Painkillers	1782 (90.70%)	73 (3.70%)	44 (2.20%)	18 (0.90%)	21 (1.10%)	14 (0.70%)	12 (0.60%)

Note. Number of participants may vary because of missing data. NMUPD = non-medical use of prescription drugs.

Bivariate correlations between all study variables are shown in Table 2. NMUPS had a significant positive relationship with male gender, inattention problems interfering with academic performance, depressive symptoms, anxiety symptoms, alcohol intoxication and history of other lifetime substance use (i.e., cigarette smoking, marijuana use, other illicit substance use, other NMUPD) and a significant negative relationship with GPA, parental monitoring, and parental support. High intercorrelation was found between depressive symptoms and anxiety symptoms ($r = .73$, $p < .001$), indicating multicollinearity. As depressive symptoms had higher correlation with NMUPS, anxiety symptoms were not included in the binary logistic regression.

In the total sample of complete data, students reported on average low levels of depressive symptoms, anxiety symptoms, and inattention problems interfering with academic performance. Furthermore, students reported on average high levels of parental monitoring

and parental support. Average grades were marks of 74 out of 100 in the total sample (see Table 3, first column).

Comparisons Between NMUPS and Non-NMUPS Groups

Table 3 shows group comparisons between students who reported a lifetime history of NMUPS and students who reported no history of NMUPS. Chi-square tests (categorical variables) and independent samples *t*-tests (continuous variables) were computed to examine potential NMUPS and non-NMUPS group differences, to test the hypotheses of the study at the bivariate level.

The results demonstrated that boys were significantly more likely than girls to report NMUPS. Also, students with lower GPAs, more inattention problems interfering with academic performance, more depressive and anxiety symptoms, lower parental monitoring and parental support, more frequent alcohol intoxication, and history of other lifetime substance use, were all significantly more likely to report a history of NMUPS.

Table 2

Pearson's Bivariate Correlations Between All Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Lifetime NMUPS	-												
2. Gender (Male)	.07**	-											
3. GPA	-.11**	-.14**	-										
4. Impact on Academic Performance: Inattention	.16**	.02	-.26**	-									
5. Depressive Symptoms	.12**	-.24**	-.12**	.27**	-								
6. Anxiety Symptoms	.10**	-.28**	-.08*	.27**	.73**	-							
7. Parental Monitoring	-.16**	-.15**	.18**	-.09**	-.13**	-.08*	-						
8. Parental Support	-.15**	-.04	.16**	-.16**	-.33**	-.21**	.36**	-					
9. Lifetime Alcohol Intoxication	.26**	.00	-.24**	.20**	.08**	.08**	-.22**	-.03	-				
10. Lifetime Cigarette Use (1 vs. 0)	.27**	.06*	-.25**	.23**	.13**	.12**	-.21**	-.10**	.68**	-			
11. Lifetime Marijuana Use (1 vs. 0)	.37**	.11**	-.20**	.20**	.12**	.09**	-.22**	-.11**	.55**	.57**	-		
12. Lifetime Other Illicit Substance Use (1 vs. 0)	.41**	.07*	-.13**	.19**	.12**	.07**	-.11**	-.11**	.46**	.45**	.63**	-	
13. Lifetime NMUPD (1 vs. 0)	.41**	.00	-.11**	.13**	.14**	.12**	-.13**	-.16**	.23**	.22**	.29**	.32**	-

Note. NMUPS = non-medical use of prescription stimulants; GPA = grade point average; NMUPD = non-medical use of prescription drugs.

* = $p < .05$, two-tailed. ** = $p < .01$, two-tailed.

Table 3

Percentages or Means (and Standard Deviations) of Predicting Variables as a Function of NMUPS, and a Comparison Between NMUPS and Non-NMUPS Groups

	All Participants	No History of NMUPS	History of NMUPS	Comparison Between NMUPS and Non-NMUPS Groups
Variable	(*N* = 2053)	(*n* = 1848)	(*n* = 98)	
Gender				$\chi^2(1) = 10.24$*
Male	47.60%	45.90%	62.80%	
Female	52.40%	54.10%	37.20%	
GPA (2-9)	6.40 (1.43)	6.45 (1.41)	5.73 (1.64)	*t*(85.89) = 3.87**
Impact on Academic Performance: Inattention (1-6)	2.67 (1.74)	2.59 (1.70)	3.84 (1.88)	*t*(1910) = -6.91**
Depressive Symptoms (13-52)	24.43 (9.02)	24.17 (8.86)	29.20 (10.47)	*t*(95.45) = -4.48**
Anxiety Symptoms (7-28)	12.48 (4.92)	12.37 (4.86)	14.70 (5.58)	*t*(1887) = -4.44**
Parental Monitoring (4-16)	12.37 (2.85)	12.48 (2.77)	10.31 (3.50)	*t*(94.36) = 4.76**
Parental Support (5-20)	17.48 (3.24)	17.63 (3.10)	15.37 (4.46)	*t*(78.18) = 5.32**
Lifetime Alcohol Intoxication (1-7)	2.94 (2.26)	2.79 (2.19)	5.52 (2.05)	*t*(1950) = -12.00**
% Lifetime Cigarette Use	36.20%	33.00%	92.90%	$\chi^2(1) = 145.01$**
% Lifetime Marijuana Use	18.80%	15.50%	82.80%	$\chi^2(1) = 263.11$**
% Lifetime Other Illicit Substance Use	11.70%	8.80%	71.10%	$\chi^2(1) = 322.98$**
% Lifetime other NMUPD	13.80%	10.50%	76.30%	$\chi^2(1) = 334.70$**

Note. Number of participants may vary because of missing data. GPA = grade point average; NMUPD = non-medical use of prescription drugs.

* = $p < .01$, two-tailed, ** = $p < .001$, two-tailed.

Binary Logistic Regression Analysis

Binary logistic regression was used to examine how the variables of interest (gender, GPA, depressive symptoms, parental monitoring, parental support, lifetime frequency of alcohol intoxication, and history of other lifetime substance use) predicted NMUPS, to test the hypotheses at the multivariate level (see Table 4). Inattention problems interfering with academic performance was used as a control variable.

Inattention problems and depressive symptoms were significant predictors of NMUPS in Model 1, but depressive symptoms became non-significant when parental monitoring and parental support were added to the model. In Model 2, parental monitoring significantly

predicted NMUPS, but became non-significant in Model 3, when all the substances (i.e., alcohol intoxication, marijuana, cigarettes, other illicit substances, and prescription drugs) were added to the model. The overall model (Model 3) explained 44.90% of the variance in NMUPS, model fitness indices indicated that the model was good, $\chi^2(8) = 4.80$, $p = .778$, and the included variables significantly contributed to the model, $\chi^2(11) = 179.30$, $p < .001$. Inattention problems significantly predicted NMUPS in the overall model. Furthermore, marijuana use and other NMUPD significantly predicted NMUPS when controlling for other

Table 4

Binary Logistic Regression Predicting NMUPS

						95% CI	
Predictors	B	S.E.	Wald	*p*	Exp(B)	*LL*	*UL*
Model 1							
Nagelkerke R^2 = .105							
Gender	.50	.31	2.69	.101	1.65	.91	3.01
GPA	-.08	.10	.53	.467	.93	.76	1.14
Impact Academic Performance: Inattention	.35	.09	15.28	**<.001**	1.42	1.19	1.69
Depressive symptoms	.05	.02	9.06	**.003**	1.05	1.02	1.08
Constant	-5.46	.95	33.34	**<.001**	.00		
Model 2							
Nagelkerke R^2 = .144							
Gender	.34	.31	1.19	.275	1.41	.76	2.61
GPA	-.04	.10	.16	.690	.96	.78	1.18
Impact on Academic Performance: Inattention	.35	.09	15.03	**<.001**	1.41	1.19	1.68
Depressive symptoms	.03	.02	3.42	.065	1.03	1.00	1.07
Parental Monitoring	-.16	.05	10.86	**<.001**	.85	.74	.94
Parental Support	-.05	.05	1.36	.244	.95	.87	1.04
Constant	-2.39	1.35	3.17	.075	.09		
Model 3							
Nagelkerke R^2 = .449							
Gender	.37	.37	1.03	.310	1.45	.71	2.98
GPA	.10	.13	.63	.427	1.10	.86	1.41
Impact on Academic Performance: Inattention	.22	.10	4.77	**.029**	1.25	1.02	1.52
Depressive symptoms	.03	.02	1.72	.190	1.03	.99	1.07
Parental Monitoring	-.06	.06	.93	.334	.94	.84	1.06
Parental Support	-.04	.06	.41	.520	.97	.87	1.08
Alcohol Intoxication	.12	.11	1.28	.259	1.13	.91	1.40
Cigarette Smoking	.94	.63	2.22	.136	2.56	.74	8.83
Marijuana Use	1.14	.55	4.30	**.038**	3.12	1.07	9.16
Other Illicit Substance Use	.47	.45	1.11	.293	1.60	.67	3.84
Other NMUPD	2.24	.37	36.99	**<.001**	9.39	4.56	19.32
Constant	-6.84	1.76	15.04	**<.001**	.00		

Note. N = 1450. S.E. = standard error; CI = confidence interval; LL = lower limit; UL = upper limit. GPA = grade point average; NMUPD = non-medical use of prescription drugs. Significant *p* values are highlighted in bold.

variables. Students who reported a history of other NMUPD had 9.39 higher odds of having a history of NMUPS compared to students with no such history of NMUPD, 95% CI [4.56, 19.32], $p < .001$. Other variables did not significantly predict NMUPS.

Another binary logistic regression predicting NMUPS was conducted to examine these relationships by gender (see Table 5). Model fitness indices deemed that the gender-divided models demonstrated adequate fit and the variables included contributed significantly to the models. Depressive symptoms significantly predicted NMUPS among boys in Model 2 but became non-significant when all the substances were added to the model. The overall models (Model 3) explained 46.40% of the variance in NMUPS among boys and 50.50% among girls. Parental monitoring and inattention problems were significant predictors of NMUPS among girls in Model 3 but did not significantly predict NMUPS among boys. Lifetime other NMUPD significantly predicted NMUPS among boys and girls after controlling for other variables in the models, where girls with a history of NMUPD had 7.69 higher odds of having a history of NMUPS compared to girls without a history of NMUPD, 95% CI [2.57, 22.94], $p < .001$, and boys who had a history of NMUPD had 16.64 higher odds of having a history of NMUPS compared to boys without a history of NMUPD, 95% CI [5.80, 47.71], $p < .001$.

Table 5

Binary Logistic Regression Predicting NMUPS Divided by Gender

	Boys							Girls						
						95% CI							95% CI	
Predictors	B	S.E.	Wald	*p*	Exp(B)	*LL*	*UL*	B	S.E.	Wald	*p*	Exp(B)	*LL*	*UL*
Model 1														
GPA	.08	.15	.25	.614	1.08	.80	1.46	-.21	.14	2.05	.152	.81	.62	1.08
Impacting Academic Performance: Inattention	.22	.12	3.21	.073	1.24	.98	1.57	52	.14	14.12	**<.001**	1.68	1.28	2.20
Depressive Symptoms	.07	.02	11.16	**<.001**	1.07	1.03	1.12	.02	.02	.98	.321	1.02	.98	1.07
Constant	-6.06	.13	21.48	**<.001**	.00			-4.59	1.30	12.51	**<.001**	.01		
Model 2														
GPA	.10	.15	.46	.498	1.11	.82	1.50	-.15	.15	1.10	.294	.86	.65	1.14
Impacting Academic Performance: Inattention	.23	.12	3.63	.057	1.26	1.00	1.60	.51	.14	13.89	**<.001**	1.67	1.28	2.19
Depressive Symptoms	.05	.02	4.70	**.030**	1.05	1.01	1.10	.01	.03	.13	.724	1.01	.96	1.06
Parental Monitoring	-.13	.07	3.57	.059	.88	.77	1.01	-.21	.07	8.36	**.004**	.82	.71	.94
Parental Support	-.11	.07	2.64	.104	.90	.79	1.01	.00	.07	.00	.965	1.00	.88	1.15
Constant	-2.56	1.85	1.91	.167	.08			-2.11	1.93	1.19	.275	.12		
Model 3														
GPA	.20	.19	1.15	.284	1.23	.85	1.78	.05	.17	.10	.755	1.06	.75	1.08
Impacting Academic Performance: Inattention	.09	.15	.36	.546	1.09	.82	1.45	.38	.15	5.98	**.014**	1.46	1.08	1.97
Depressive Symptoms	.03	.03	1.21	.272	1.03	.98	1.09	.02	.03	.47	.492	1.02	.96	1.08
Parental Monitoring	.01	.09	.02	.879	1.01	.85	1.21	-.21	.10	4.54	**.033**	.82	.68	.98
Parental Support	-.13	.08	2.27	.132	.88	.75	1.04	.07	.08	.68	.411	1.07	.91	1.26
Alcohol Intoxication	.01	.16	.01	.933	1.01	.74	1.39	.29	.17	2.84	.092	1.34	.95	1.87
Cigarette Smoking	1.71	.89	3.70	.054	5.53	.97	31.54	.55	.94	.34	.559	1.73	.28	10.90
Marijuana Use	.97	.80	1.48	.225	2.63	.53	12.47	1.07	.78	1.88	.170	2.92	.63	13.51
Other Illicit Substance Use	-.07	.67	.01	.922	.94	.25	3.49	.85	.65	1.70	.192	2.34	.65	8.41
Other NMUPD	2.81	.54	27.37	**<.001**	16.64	5.80	47.71	2.04	.56	13.36	**<.001**	7.69	2.57	22.94
Constant	-3.51	2.72	1.67	.196	.03			-5.61	2.51	4.23	**.040**	.01		

Note. N = 1450. S.E. = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; GPA = grade point average; NMUPD = non-medical use of prescription drugs. Significant *p* values are highlighted in bold.

Discussion

The main aim of the current study was to examine potential risk correlates (being male, low GPA, inattention problems interfering with academic performance, depressive and anxiety symptoms, low parental monitoring and parental support, and history of other lifetime substance use) of NMUPS among Icelandic high school students to help inform prevention and intervention efforts as serious health risks are associated with NMUPS.

Results revealed a lifetime prevalence rate of 5.1%, which is somewhat consistent with estimates in previous studies among high school students in the U.S. (7%–8%; Goodhines et al., 2020; Zullig et al., 2015), but lower than estimated prevalence in others (10%–13%; Becker et al., 2020; McCabe et al., 2015; McCabe et al., 2017; McCabe & West, 2013).

The first hypothesis, that male students would be more likely than female students to engage in NMUPS was partially supported. At the bivariate level, the male gender correlated positively and significantly with NMUPS, and group differences showed that boys were significantly more likely than girls to have a history of NMUPS. These findings are consistent with some previous studies among high school and college students (e.g., Becker et al., 2020; Gallucci et al., 2018). However, at the multivariate level when controlling for other significant risk correlates, gender became a non-significant predictor of NMUPS. These findings imply that other risk correlates of NMUPS explained these gender differences, as gender became non-significant once additional variables had been taken into consideration.

The second hypothesis, that students' GPAs would be negatively associated with NMUPS was also partially supported. GPA correlated significantly and negatively with NMUPS, and students with a history of NMUPS were significantly more likely to report lower GPAs than students with no history of NMUPS. This is consistent with prior research (e.g., Teter et al., 2020; Weyandt et al., 2009). As previous studies found that co-ingestion of

prescription stimulants with other drugs, and NMUPS for any non-academic motives were associated with lower GPAs in the student population (McCabe et al., 2015; Teter et al., 2020), it would be interesting to further examine different motives and their association with GPA in future studies. GPA was not a significant predictor of NMUPS at the multivariate level, that is, when controlling for other significant risk correlates.

The third hypothesis, that depressive and anxiety symptoms would be positively associated with NMUPS, was largely supported. Students who had a history of NMUPS reported significantly more depressive and anxiety symptoms than students without a history of NMUPS. Both depressive and anxiety symptoms significantly and positively correlated with NMUPS, but also shared a high intercorrelation between each other, indicating multicollinearity. Therefore, anxiety was only examined at the bivariate level.

At the multivariate level, depressive symptoms significantly predicted NMUPS while controlling for gender, GPA, inattention problems, parental monitoring and parental support among boys, but became a non-significant predictor when history of other lifetime substance use was added to the model. These results indicate that boys who report more depressive symptoms are more likely to use various substances, including NMUPS, than boys who report fewer depressive symptoms.

Previous research has found that individuals who engage in non-oral routes of NMUPS administration are more likely to report depressive symptoms, which could be because non-oral routes can cause greater and faster effects, resulting in a “crash” when the euphoric effects decrease, and individuals experience depressive symptoms as a result (Teter et al., 2010). It may be that boys are engaging in non-oral routes of NMUPS for partying and getting high, as boys who reported more depressive symptoms were more likely to use various substances in the current study. It may also be that boys who experience depressive symptoms self-medicate with NMUPS and other substances as previous research has

suggested (Sattler & Wiegel, 2013; Teter et al., 2010). Further research is needed to examine this possibility.

The fourth hypothesis, that students who reported more frequent lifetime alcohol intoxication and a history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other NMUPD would be more likely to engage in NMUPS than students who reported less frequent alcohol intoxication and no history of lifetime cigarette smoking, marijuana use, other illicit substance use, and other NMUPD was largely supported. All substances correlated significantly and positively with NMUPS. Regarding group differences, students who reported a history of NMUPS had significantly higher lifetime frequencies of alcohol intoxication on average than students without a history of NMUPS. Also, students with a history of NMUPS were significantly more likely to have a history of cigarette smoking, marijuana use, illicit substance use, and other NMUPD. These findings are consistent with previous studies, as many have found that NMUPS co-occurs with other substance use (e.g., McCabe et al., 2015; McCabe & West, 2013; Teter et al., 2020).

At the multivariate level, marijuana use predicted NMUPS in the overall model, but when gender-divided, marijuana use was neither significant among boys nor girls, indicating that the effects were small in the overall model. NMUPD was the strongest significant predictor among both boys and girls, indicating that if students have a history of engaging in other NMUPD, they are much more likely to engage in NMUPS. This is in line with previous findings (McCabe & West, 2013; Teter et al., 2020). Alcohol intoxication, cigarette smoking and other illicit substance use, however, were not significant predictors of NMUPS.

The fifth hypothesis, that parental monitoring and parental support would be negatively associated with NMUPS was supported for parental monitoring, but only partially for parental support. Both parental monitoring and parental support correlated negatively and significantly with NMUPS, and students who perceived lower parental monitoring and

parental support were significantly more likely to have a history of NMUPS than students who perceived higher monitoring and support.

Parental support was not a significant predictor of NMUPS in any of the models in the binary logistic regression, but parental monitoring was a significant predictor among girls in the overall model. These findings indicate that the group differences found in parental support were explained by other risk correlates in the models. Based on the current findings, parental monitoring appears to be more important among girls than boys. Goodhines and others (2020) did not find parental monitoring to be a significant predictor of NMUPS when taking other variables into account. The findings of the current study therefore add knowledge to the limited research by implying that girls in particular, who report low parental monitoring, are more likely to engage in NMUPS.

In addition, inattention was found to be a significant predictor of NMUPS among girls, suggesting that girls who experience inattention problems that interfere with their academic performance are more likely to engage in NMUPS. Research has shown that girls with ADHD are more likely to have inattention symptoms, which are less salient than the hyperactive and impulsive symptoms boys are more likely to have. This leads to girls not only being underdiagnosed in comparison to boys, but also receiving diagnoses on average of five years later than their male peers (Walters, 2018). It may be that girls in the current study were experiencing untreated ADHD symptoms and used prescription stimulants to self-medicate. Further research is needed to examine this possibility.

As with any research, the current study was not without limitations. First, pre-collected data were used, limiting the ability to address other important factors, such as diversion of stimulant medication, motives and subgroups of NMUPS, as well as other main ADHD symptoms (i.e., impulsiveness and hyperactivity). Second, the data were cross-sectional and therefore, no causal inferences can be made between NMUPS and the study

variables. Third, as a relatively small number of participants reported NMUPS, drawing decisive inferences from the findings must be done with caution. Lastly, the wording of the question asking if students had ever used prescription stimulants without having a prescription from a physician may have caused confusion as students can have a prescription and still engage in NMUPS by taking the medication in another manner or in higher quantities than prescribed. As a result, NMUPS may have been underestimated in the sample, which could explain the somewhat lower lifetime prevalence estimate than has been found in previous studies.

Despite these limitations, this study had many strengths. No prior study has examined risk correlates of NMUPS among a large sample of high school students (N = 2,053) in Iceland. These findings may assist in identifying high-risk students to help inform prevention and intervention efforts. The current study examined risk correlates that have not been researched much among the high school population, notably depressive and anxiety symptoms, and parental monitoring and support. Furthermore, gender distribution between boys and girls was virtually equal, which suggests that the current study estimated the prevalence of NMUPS correctly regarding gender differences, which has been a limitation in some previous studies among college students (e.g., Dussault & Weyandt, 2013; Gallucci et al., 2018; Gudmundsdottir et al., 2020).

The findings of the study may inform future directions. Longitudinal research is needed to demonstrate how NMUPS, and its correlates unfold over time to adequately examine directional relationships. Future research should also seek to examine diversion of prescription stimulants, motives and subgroups of NMUPS to better understand this behavior among high school students. Furthermore, because inattention problems were a significant predictor of NMUPS among girls in the current study, it could be useful to investigate other symptoms of ADHD, as it could reveal symptomatology that requires clinical attention.

References

Arria, A. M., Garnier-Dykstra, L. M., Caldeira, K. M., Vincent, K. B., O'Grady, K. E., & Wish, E. D. (2011). Persistent nonmedical use of prescription stimulants among college students: Possible association with ADHD symptoms. *Journal of Attention Disorders*, *15*(5), 347-356. https://doi.org/10.1177/1087054710367621

Baiden P., & Tadeo S. K. (2019). Examining the association between bullying victimization and prescription drug misuse among adolescents in the United States. *Journal of Affective Disorders*, *259*, 317-324. https://doi.org/10.1016/j.jad.2019.08.063

Becker, K. J., King, K. A., Vidourek, R. A., & Merianos, A. L. (2020). Examining the influence school factors have on stimulant misuse among a national sample of adolescents. *Journal of Substance Use*, *26*(3), 280-285. https://doi.org/10.1080/14659891.2020.1821805

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. https://doi.org/10.1007/s10567-014-0177-z

Caye, A., Swanson, J. M., Coghill, D., & Rohde, L. A. (2019). Treatment strategies for ADHD: An evidence-based guide to select optimal treatment. *Molecular Psychiatry*, *24*(3), 390-408. https://doi.org/10.1038/s41380-018-0116-3

Clegg-Kraynok, M. M., McBean, A. L., & Montgomery-Downs, H. E. (2011). Sleep quality and characteristics of college students who use prescription psychostimulants nonmedically. *Sleep Medicine*, *12*(6), 598-602. https://doi.org/10.1016/j.sleep.2011.01.012

del Campo, N., Chamberlain, S. R., Sahakian, B. J., & Robbins, T. W. (2011). The roles of dopamine and noradrenaline in the pathophysiology and treatment of attention-

deficit/hyperactivity disorder. *Biological Psychiatry, 69*(12), e145-e157. https://doi.org/10.1016/j.biopsych.2011.02.036

Derogatis, L. R., Lipman, R. S., Covi, L., & Rickels, K. (1971). Neurotic symptom dimensions: As perceived by psychiatrists and patients of various social classes. *Archives of General Psychiatry, 24*(5), 454-464. https://doi.org/10.1001/archpsyc.1971.01750110066011

Donaldson, C. D., Nakawaki, B., & Crano, W. D. (2015). Variations in parental monitoring and predictions of adolescent prescription opioid and stimulant misuse. *Addictive Behaviors, 45*, 14-21. https://doi.org/10.1016/j.addbeh.2015.01.022

Duffy, M. E., Twenge, J. M., & Joiner, T. E. (2019). Trends in mood and anxiety symptoms and suicide-related outcomes among U.S. undergraduates, 2007-2018: Evidence from two national surveys. *Journal of Adolescent Health, 65*(5), 590-598. https://doi.org/10.1016/j.jadohealth.2019.04.033

Dussault, C. L., & Weyandt, L. L. (2013). An examination of prescription stimulant misuse and psychological variables among sorority and fraternity college populations. *Journal of Attention Disorders*, *17*(2), 87-97. https://doi.org/10.1177/1087054711428740

Faraone, S. V., Rostain, A. L., Montano, B., Mason, O., Antshel, K. M., & Newcorn, J. H. (2020). Systematic review: Nonmedical use of prescription stimulants: Risk factors, outcomes and risk reduction strategies. *Journal of American Academy of Child & Adolescent Psychiatry, 59*(1), 100-112. https://doi.org/10.1016/j.jaac.2019.06.012

Gallucci, A. R., Hackman, C., & Wilkerson, A. (2018). Examining the relationship between religious coping and the misuse of prescription stimulants among a sample of undergraduate students. *Substance Use & Misuse, 53*(9), 1571-1579. https://doi.org/10.1080/10826084.2017.1416405

Goodhines, P. A., Taylor, L. E., Zaso, M. J., Antshel, K. M., & Park, A. (2020). Prescription stimulant misuse and risk correlates among racially-diverse urban adolescents. *Substance Use & Misuse*, *55*(14), 2258-2267. https://doi.org/10.1080/10826084.2020.1800740

Grant, J. E., Redden, S. A., Lust, K., & Chamberlain, S. R. (2018). Nonmedical use of stimulants is associated with riskier sexual practices and other forms of impulsivity. *Journal of Addicition Medicine*, *12*(6), 474-480. https://doi.org/10.1097/ADM.0000000000000448

Gudmundsdottir, B. G., Weyandt, L., & Ernudottir, G. B. (2020). Prescription stimulant misuse and ADHD symptomatology among college students in Iceland. *Journal of Attention Disorders*, *24*(3), 384-401. https://doi.org/10.1177/1087054716684379

Guðmundsdóttir, M. L., Sigfússon, J., Tölgyes, E. M., Sigfúsdóttir, I. D., Þórisdóttir, I. E., & Kristjánsson, Á. L. (2018). *Ungt fólk 2018: Framhaldsskólanemar* [*Youth in Iceland 2018: High schools students*]. Rannsóknir & Greining.

Kaye, S., & Darke, S. (2012). The diversion and misuse of pharmaceutical stimulants: What do we know and why should we care? *Addiction*, *107*(3), 467-477. https://doi.org/10.1111/j.1360-0443.2011.03720.x

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry*, *4*(5), 231-244. http://doi.org/10.3109/10673229709030550

Kristjansson, A. L., & Sigfusdottir, I. D. (2009). The role of parental support, parental monitoring, and time spent with parents in adolescent academic achievement in Iceland: A structural model of gender differences. *Scandinavian Journal of Educational Research*, *53*(5), 481-496. https://doi.org/10.1080/00313830903180786

Kristjansson, A. L., Sigfusdottir, I. D., & Allegrante, J. P. (2013). Adolescent substance use

and peer use: A multilevel analysis of cross-sectional population data. *Substance Abuse Treatment, Prevention, and Policy*, *8*, Article 27. https://doi.org/10.1186/1747-597X-8-27

Kristjansson, A. L., Sigfusdottir, I. D., James, J. E., Allegrante, J. P., & Helgason, A. R. (2010). Perceived parental reactions and peer respect as predictors of adolescent cigarette smoking and alcohol use. *Addictive Behaviors*, *35*(3), 256-259. https://doi.org/10.1016/j.addbeh.2009.10.002

McCabe, S. E., Veliz, P., Wilens, T. E., & Schulenberg, J. E. (2017). Adolescents' prescription stimulant use and adult functional outcomes: A national prospective study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(3), 226-233. https://doi.org/10.1016/j.jaac.2016.12.008

McCabe, S. E., Veliz, P., Wilens, T. E., West, B. T., Schepis, T. S., Ford, J. A., Pomykacz, C., & Boyd, C. J. (2019). Sources of nonmedical prescription drug misuse among US high school seniors: Differences in motives and substance use behaviors. *Journal of the American Academy of Child and Adolescent Psychiatry*, *58*(7), 681-691. https://doi.org/10.1016/j.jaac.2018.11.018

McCabe, S. E., & West, B. T. (2013). Medical and nonmedical use of prescription stimulants: Results from a national multicohort study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *52*(12), 1272-1280. https://doi.org/10.1016/j.jaac.2013.09.005

McCabe, S. E., West, B. T., Schepis, T. S., & Teter, C. J. (2015). Simultaneous co-ingestion of prescription stimulants, alcohol and other drugs: A multi-cohort national study of U.S. adolescents. *Human Psychopharmacology: Clinical & Experimental*, *30*(1), 42-51. https://doi.org/10.1002/hup.2449

Moran, L. V., Ongur, D., Hsu, J., Castro, V. M., Perlis, R. H., & Schneeweiss, S. (2019).

Psychosis with methylphenidate or amphetamine in patients with ADHD. *The New England Journal of Medicine*, *380*(12), 1128-1138. https://doi.org/10.1056/NEJMoa1813751

National Institute on Drug Abuse. (2020). *Misuse of prescription drugs research report*. https://www.drugabuse.gov/publications/research-reports/misuse-prescription-drugs/overview

Newcomb, M. D., & Locke, T. (2005). Health, social, and psychological consequences of drug use and abuse. In Z. Sloboda (Ed.), *Epidemiology of drug abuse* (pp. 45-59). Springer Publishing Company. https://doi.org/10.1007/0-387-24416-6_4

Newcorn, J. H., Gurnani, T., & Chacko, A. (2018). Attention-deficit/hyperactivity disorder. In D. B. Arciniegas, S. C. Yudofsky, & R. E. Hales. (Eds.), *The American psychiatric association publishing textbook of neuropsychiatry and clinical neurosciences* (6th ed., pp. 153-169). American Psychiatric Association Publishing.

Raman, S. R., Man, K. K. C., Bahmanyar, S., Berard, A., Bilder, S., Boukhris, T., Bushnell, G., Crystal, S., Furu, K., KaoYang, Y.-H., Karlstad, Ø., Kieler, H., Kubota, K., Lai, E. C.-C., Martikainen, J. E., Maura, G., Moore, N., Montero, D., Nakamura, H., ... Wong, I. C. K. (2018). Trends in attention-deficit hyperactivity disorder medication use: A retrospective observational study using population-based databases. *The Lancet Psychiatry*, *5*(10), 824-835. https://doi.org/10.1016/S2215-0366(18)30293-1

Roberts, C. A., Jones, A., Sumnall, H., Gage, S. H., & Montgomery, C. (2020). How effective are pharmaceuticals for cognitive enhancement in healthy adults? A series of meta-analyses of cognitive performance during acute administration of modafinil, methylphenidate and D-amphetamine. *European Neuropsychopharmacology*, *38*, 40-62. https://doi.org/10.1016/j.euroneuro.2020.07.002

Sattler, S., & Wiegel, C. (2013). Cognitive test anxiety and cognitive enhancement: The

influence of students' worries on their use of performance-enhancing drugs. *Substance Use & Misuse*, *48*(3), 220-232. https://doi.org/10.3109/10826084.2012.751426

Sayal, K., Prasad, V., Daley, D., Ford, T., & Coghill, D. (2017). ADHD in children and young people: Prevalence, care pathways, and service provision. *The Lancet Psychiatry*, *5*(2), 175-186. https://doi.org/10.1016/S2215-0366(17)30167-0

Schepis, T. S., & McCabe, S. E. (2012). Exploring age of onset as a causal link between major depression and nonmedical use of prescription medications. *Drug and Alcohol Dependence*, *120*(1-3), 99-104. https://doi.org/10.1016/j.drugalcdep.2011.07.002

Seth, P., Scholl, L., Rudd, R. A., & Bacon, S. (2018). Overdose deaths involving opioids, cocaine, and psychostimulants – United States, 2015-2016. *American Journal of Transplantation*, *18*(6), 1556-1568. https://doi.org/10.1111/ajt.14905

Sigfusdottir, I. D., Asgeirsdottir, B. B., Gudjonsson, G. H., & Sigurdsson, J. F. (2013). Suicidal ideations and attempts among adolescents subjected to childhood sexual abuse and family conflict/violence: The mediating role of anger and depressed mood. *Journal of Adolescence*, *36*(6), 1227-1236. https://doi.org/10.1016/j.adolescence.2013.10.001

Sigfúsdóttir, I. D., Thorlindsson, T., Kristjánsson, Á. L., Roe. K. M., & Allegrante J. P. (2009). Substance use prevention for adolescents: The Icelandic Model. *Health Promotion International*, *24*(1), 16-25. https://doi.org/10.1093/heapro/dan038

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing general anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092-1097. https://doi.org/10.1001/archinte.166.10.1092

Substance Abuse and Mental Health Services Administration. (2020). *Key substance use and mental health indicators in the United States: Results from 2019 National Survey on*

Drug Use and Health. https://www.samhsa.gov/data/sites/default/files/reports/rpt29393/2019NSDUHFFRDWHTML/2019NSDUHFFR090120.htm

Sussman, S., Pentz, M. A., Spruijt-Metz, D., & Miller, T. (2006). Misuse of "study drugs:" prevalence, consequences, and implications for policy. *Substance Abuse Treatment, Prevention, and Policy, 1*, Article 15. https://doi.org/10.1186/1747-597X-1-15

Teter, C. J., DiRaimo, C. G., West, B. T., Schepis, T. S., & McCabe, S. E. (2020). Nonmedical use of prescription stimulants among US high school students to help study: Results from a national survey. *Journal of Pharmacy Practice*, *33*(1), 38-47. https://doi.org/10.1177/0897190018783887

Teter, C. J., Falone, A. E., Cranford, J. A., Boyd, C. J., & McCabe, S. E. (2010). Nonmedical use of prescription stimulants and depressed mood among college students: Frequency and routes of administration. *Journal of Substance Abuse Treatment*, *38*(3), 292-298. https://doi.org/10.1016/j.jsat.2010.01.005

Walters, A. (2018). Girls with ADHD: Underdiagnosed and untreated. *The Brown University Child and Adolescent Behavior Letter*, *34*(11), 8. https://doi.org/10.1002/cbl.30337

Weyandt, L. L., Janusis, G., Wilson, K. G., Verdi, G., Paquin, G., Lopes, J., Varejao, M., & Dussault, C. (2009). Nonmedical prescription stimulant use among a sample of college students: Relationship with psychological variables. *Journal of Attention Disorders*, *13*(3), 284-296. https://doi.org/10.1177/1087054709342212

Wilens, T. E., & Kaminski, T. A. (2018). The co-occurrence of ADHD and substance use disorders. *Psychiatric Annals*, *48*(7), 328-332. https://doi.org/10.3928/00485713-20180613-01

Zullig, K. J., Divin, A. L., Weiler, R. M., Haddox, J. D., & Pealer, L. N. (2015). Adolescent nonmedical use of prescription pain relievers, stimulants, and depressants, and suicide

risk. *Substance Use & Misuse*, *50*(13), 1678-1689.

https://doi.org/10.3109/10826084.2015.1027931