



**Bachelor of Science  
Department of Psychology**

**The Association of Attention Deficit Hyperactivity Disorder  
and Adolescent Substance Use, and its Relations to  
Socioeconomic Status, Educational Status, and Parental  
Support.**

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## **Foreword**

Submitted in partial fulfilment 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 2022 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

According to the current literature Attention Deficit Hyperactivity Disorder (ADHD) is positively associated with substance use. This study aimed to further investigate the association between ADHD and substance use and covariates. Subjects were late adolescents both in school ( $N = 2156$ ,  $M^{Age} = 17.14$ ,  $SD = 2.37$ ), and out of school ( $N = 528$ ,  $M^{Age} = 18.14$ ,  $SD = 1.40$ ) who participated in a survey administered by the Icelandic Centre for Social Research & Analysis in 2016. Analysis was conducted with Analysis of Variance and Analysis of Covariance. The results suggest that ADHD was positively associated with substance use in both groups. The covariates socioeconomic status, parental monitoring, and educational status were also positively associated with substance use. The results also indicated that ADHD likely plays a part in adolescents' early-onset substance use. Participants within the out-of-school group had a significantly higher mean substance use than those within the in-school group. The interaction between ADHD and education was positively associated with substance use. The results highlighted the relationship between ADHD and substance use, along with suggesting the importance of education as a protective factor in adolescents' substance use.

*Keywords:* substance use, attention deficit hyperactivity disorder, early-onset substance use, socioeconomic status, parental support, parental monitoring, educational status

### Útdráttur

Rannsóknir hafa sýnt fram á tengsl athyglisbrests og ofvirkni (ADHD) við meiri vímuefnaneyslu meðal ungmenna. Markmið þessarar rannsóknar voru að skoða sambandið frekar á milli ADHD og vímuefnaneyslu, ásamt því að skoða samspil stjórnbreyta. Þáttakendur voru ungmenni bæði í skóla ( $N = 2156$ ,  $M^{Aldur} = 17.14$ ,  $SD = 2.37$ ) og utan skóla ( $N = 528$ ,  $M^{Aldur} = 18.14$ ,  $SD = 1.40$ ) sem svöruðu spurningarlista sem var lagður fyrir af Rannsóknunum og greiningu árið 2016. Dreifigreining og samdrefigreining var notuð til þess að meta samband á milli breytanna. Niðurstöður sýndu fram á samband á milli ADHD og vímuefnaneyslu. Stjórnbreyturnar; félagshagfræðileg staða, eftirlit foreldra og námsstaða höfðu allar samband við vímuefnaneyslu meðal ungmenna en ekki stuðningur foreldra. Niðurstöðurnar bentu til þess að ungmenni með ADHD séu líklegri til þess að byrja fyrr að nota vímuefni en þeir sem eru ekki með ADHD. Samvirknin á milli ADHD og námsstöðu hafði tengsl við vímuefnaneyslu ungmenna. Enginn kynjamunur fannst í sambandinu á milli ADHD og vímuefnaneyslu. Niðurstöðurnar undirstrikuðu sambandið á milli ADHD og vímuefnaneyslu, ásamt því að benda á mikilvægi náms sem verndandi þátt í vímuefnaneyslu ungmenna.

*Lykilorð:* vímuefnaneysla, athyglisbrestur, snemmkominn vímuefnaneysla, félagshagfræðileg staða, stuðningur foreldra, eftirlit foreldra, námsstaða

## **The Association of Attention Deficit Hyperactivity Disorder and Adolescent Substance Use, and its Relations to Socioeconomic Status, Educational Status, and Parental Support.**

Adolescence is the stage of development that occurs between childhood and adulthood (Murberg & Bru, 2004). During this time adolescents face new and different challenges that include physical, emotional, cognitive, and social changes which subject adolescents to stress. There are discrepancies in the literature regarding the age that adolescence refers to (Göbel et al., 2016; Martyn et al., 2009). However, this study defines adolescents as young people from ages 14 to 21 years. This developmental stage is essential in the development of substance use disorders, as substance use often begins at an early age often under the age of 18 (Andersen et al., 2003; Robaeyes et al., 2005).

Substance use is the consumption of alcohol, illicit drugs, and tobacco. According to Johnston et al. (2017), the most popular substances among 18-year-olds are alcohol (64%), marijuana (45%), and cigarettes (31%). Substance use can escalate into substance misuse or abuse (McLellan, 2017). Using any of these substances in large quantities could result in immediate or long-term health or social problems. Substance misuse can also lead to the development of a substance use disorder. Using alcohol or cannabis in adolescence can be an indicator of further illicit drug use in young adulthood and decrease the odds of positive social outcomes (Patton et al., 2007).

ADHD is a neurobehavioral condition with symptoms such as lack of attention, hyperactivity, impulsivity, or a combination of these (Feldman & Reiff, 2014). ADHD is thought to affect 5% of children and adolescents (Faraone et al., 2015) and is the most common neurobehavioral condition worldwide (Feldman & Reiff, 2014). Diagnosis of ADHD is in the form of standardized criteria that uses interviews and standardized rating scales (Faraone et al., 2015). ADHD symptoms differ depending on the subject's

developmental stage and thus the diagnosis changes slightly. For example, where adolescents submit a self-report as part of the diagnostic evaluation, children usually do not, parental- and teacher reports are more commonly used instead (Feldman & Reiff, 2014). ADHD can increase the probability of various mental health problems, educational and career failure, frequency of accidents, criminal involvement, social impairment, and addictions across the lifespan (Faraone et al., 2015). According to a recent meta-analysis, the prevalence of ADHD in Substance Use Disorder patients was 23.1% (van Emmerik-van Oortmerssen et al., 2012) while the overall population had a rate of roughly 5% (Faraone et al., 2015).

Molina and Pelham (2003) found that children diagnosed with ADHD reported higher levels of substance use in adolescence than the control group in a longitudinal study. ADHD symptom intensity was found to be a predictor of using multiple substances in adolescence (Molina & Pelham, 2003). A meta-analysis (Lee et al., 2011), that looked at the association between ADHD and substance use among ADHD children and non-ADHD children, exclusively included longitudinal studies in the review. ADHD children were more likely to have used nicotine in adolescence and adulthood and were more likely to develop substance use disorders than their non-ADHD peers. Childhood and adolescent misbehaviour were shown to predict adolescent substance use and substance use severity in children with ADHD (Harty et al., 2013). Furthermore, more ADHD symptoms were associated with a higher risk for substance use.

A Swedish twin study (Chang et al., 2012), where the association between childhood ADHD and substance use in adolescence was examined, found that children with persistent hyperactivity and impulsivity symptoms of ADHD were at risk for early tobacco and alcohol use. The study found hereditary effects between the symptoms of ADHD and early-onset substance use. Although there was a correlation between substance use and childhood ADHD, this study concluded that the link is due to the hereditary impacts of ADHD. An

Iranian study examined the association between ADHD and substance use compared to the western world (Kousha et al., 2012). The study compared ADHD diagnosed adolescents and non-ADHD adolescents to establish their substance use behaviour (Kousha et al., 2012). ADHD diagnosed adolescents began using substances at a younger age, had less time between first use and substance dependence, used more severe substances such as cannabis, heroin, and other illicit drugs, and were found to have more functional impairment (Kousha et al., 2012). In other studies (Dunne et al., 2014; Wilens, 1997) where the association between ADHD and substance use was examined, correlations were found between diagnosed ADHD and early-onset substance use.

Multiple studies have examined the factor that age plays in the association between ADHD and substance use. Ottosen et al. (2016) found that ADHD girls were at a greater risk for developing a substance use disorder than ADHD boys, although both ADHD- girls and boys showed an increased risk for substance use disorder than their non-ADHD peers. The gender difference (Elkins et al., 2018) in ADHD children's risk for substance use in adolescence was that ADHD men lacked prosocial peers and sought out more deviant peers, which led to substance use, whereas ADHD symptoms were the main cause of substance use in women.

With regards to covariates, a study by Hanson and Chen (2007) found that adolescents with high socioeconomic status were more likely to use substances than adolescents with lower socioeconomic status. Socioeconomic status was found using family financial resources and family social status gathered from the adolescents' parents. Financial resources were a more significant indicator of substance use than family social status. Soteriades and DiFranza (2003) found that socioeconomic status was a predictor of adolescent smoking. The study found that with each step down in parental education and household income the likelihood of adolescents smoking increased significantly. Another

study (Charitonidi et al., 2016) found that high socioeconomic status was related to adolescents reporting more alcohol and substance use while lower socioeconomic status was more related to tobacco use.

Adolescent substance use behaviour can also greatly influence their academic performance and adolescents that use substances are more likely to skip school and have lower grades than their non-substance using peers (Bugbee et al., 2019). Students that drop out of school are more likely to use substances (Cho Je, 2018). Another study compared students in school and adolescents that had dropped out due to their substance use and found that adolescents that had dropped out were more likely to engage in substance use such as tobacco, alcohol, marijuana, and illicit drugs (Tice et al., 2017). Moreover, Fredriksen et al. (2014) showed that adolescents with ADHD were more likely to drop out of high school and suffer from persistent occupational impairment.

Parental support is generally believed to have positive effects on substance use. Whitney et al. (2002) looked at parental factors that impacted adolescents' substance use in the 6 months after inpatient treatment found that family aftercare and family helpfulness affected substance use in the subsequent 6 months. Family intimacy and parent-adolescent relationship influenced whether adolescents had ever tried alcohol, in a sample where 55% of adolescents reported having ever used alcohol (Martyn et al., 2009). Poor adolescent-parent relationships were more likely to predict substance use amongst girls, while parental monitoring served as a more protective influence against girls' substance use (Rusby et al., 2018). A study that focused on the buffering effects of parental monitoring and parent-adolescent relationship on the negative effects of substance use, such as emotional effects, interpersonal effects, and social and occupational impairment, found that parental monitoring and parent-adolescent relationship influenced the negative effects of substance use (Branstetter & Furman, 2013). Clark et al. (2012) found that parental monitoring had a

protective effect on adolescents' substance use. Furthermore, higher parental monitoring has been associated with a reduction in substance use consumption and lowers the probability of having peers that engage in substance use (Tornay et al., 2013).

The current study examines the association of ADHD and adolescent substance use, along with the covariance of socioeconomic status, educational status, and parental support. Furthermore, this study will examine the difference in substance use behaviour between adolescents in and out of high school. This study hypothesizes that ADHD does have an association with higher substance use amongst adolescents, that adolescents who are out of school are more likely to engage in substance use behaviour, that lower socioeconomic status is positively related to substance use, that parental support and monitoring are negatively related to substance use, and lastly that adolescents with ADHD are at risk of early-onset substance use.

### **Method**

This study is based on data from the Icelandic Centre for Social Research & Analysis (ICSRA). ICSRA administers a high school survey study at a three-year interval and periodically they administer an out of school survey which is aimed at adolescents that are not in school. The two survey studies used in this study are from the year 2016 and are called *Youth in Iceland* (i. Ungt fólk) and *Youth in Iceland – out of school* (i. Ungt fólk – Utan skóla) and the participants were from the ages 14-21 which is the age of where adolescents in Iceland typically enrol in high school. This study was approved by the National Bioethics Committee of Iceland (reference: VSNb2022010061/03.01) and by the Icelandic Data Protection Agency (case number: 22-039).

### **Participants**

#### ***“Youth in Iceland”***



Participants were all students who were present in school, on a particular day in 2016, who decided to take part in the study. In total 10,717 participated in the survey and the survey had a 71% response rate. There were 48.6 % male- and 49.7% female participants, along with 1.7% without gender classification. Participants' age ranged from 14 to 21 ( $M = 17.14$ ,  $SD = 2.37$ ). A random sample was drawn from the data and employed in this study ( $N = 2,156$ ).

### ***“Youth in Iceland – out of school”***

To find the sample, social security numbers of all students in high school were compared to social security numbers of young people from the ages of 16-20, excluded were all social security numbers from non-Icelandic people with temporary work permits. Phone numbers for each of the social security numbers were collected along with the phone numbers of parents or legal guardians of the participants. Next, a third party excluded participants with less than two courses in the spring semester of 2016. In total 453 participated in the survey and the survey had a total response rate of 51%. Participants were 58.9% male and 41.1% were female. Participants' age ranged from 16 to 20 ( $M = 18.14$ ,  $SD = 1.40$ ). The complete sample will be used for this study ( $N = 453$ ).

### **Procedure**

#### ***“Youth in Iceland”***

ICSRA has a contact within each high school in Iceland which lets them know how many questionnaires are needed for each school. The questionnaires come in an open white envelope and participants are asked to not write their names or social security numbers anywhere on the questionnaire to make sure that answers cannot be traced back to the participants. The survey is administered by a teacher or staff and participants are urged to ask them for help if something is not clear. When the participant is finished, the questionnaire is placed in a white envelope and closed. The questionnaires are then scanned by a third party and turned into ICSRA.

### ***“Youth in Iceland – Out of School”***

A third party was tasked with calling everyone in the sample, introducing them to the research, and inviting them to participate. A total of six attempts were made to reach the sample. If the individual decided to participate, they would immediately receive an email with a special link to the survey. The participant can only fill out the survey once and if they had not opened the link in a few days, they would get an electronic reminder, with a total of two reminders.

### **Measures**

In this study, ADHD and substance use was explored amongst adolescents in Iceland, along with confounding variables such as socioeconomic status, educational status, and parental support, also, “gender” and “age” were included as descriptive variables. The dependent variable was substance use, and the independent variables were ADHD, socioeconomic status, educational status, parental support, parental monitoring, gender, and age.

### ***Descriptive variables***

Gender was scored from 1 = *male* to 2 = *female* in both surveys and age was scored as 14 = “14 years old” to 21 = “21 years old”.

### ***ADHD***

In both survey studies, ADHD was measured on a 6-point Likert scale on “how much ADHD affects your performance in school” from 1 = “not at all” to 6 = “very much”.

### ***Substance use***

Substance use was measured using three categories: tobacco-, alcohol- and substance use. Substance use was measured in the same way in “Youth in Iceland” and “Youth in Iceland – out of school”. All questions followed a 7-point Likert scale (1 = “never” to 7 = “40 times or more”). First, “How often have you smoked cigarettes in your life?”, second, “How

often have you smoked e-cigarettes in your life?”, third, “How often have you consumed alcohol in your life?”, fourth, “How often have you gotten intoxicated in your life?”, and lastly, “How often, if at all, have you used marijuana in your life?”. Substance use was summed forming a scale ranging from 5 to 35.

### ***Socioeconomic status***

“Socioeconomic status” was measured with a question regarding the financial status of your family versus other families in Iceland. “Socioeconomic status” was measured in the same way in both survey studies. The measure “How is your family’s financial status compared to other families in Iceland?” was inverted and scored on a 7-point scale (1 = “much worse off” to 7 = “much better off”).

### ***Educational status***

To measure if the participant was in high school or out of school, assumptions were made by which survey study the individual was a participant of (0 = “Youth in Iceland” and 1 = “Youth in Iceland – out of school”)

### ***Parental support and monitoring***

Parental support and monitoring were measured in the same way in both surveys. “How easy or hard is it for you to get the following from your parents?”, was used to measure parental support, with two sub-questions “caring and warmth” and “conversations about personal issues” (1 = “very hard” to 4 = “very easy”). The two sub-questions were summed forming a scale ranging from 2 to 8. Parental monitoring was measured with the question “How well do the following assertions apply to you?” with four sub-questions “My parents monitor who I’m with in the evenings”, “My parents monitor where I am in the evenings”, “My parents know my friends” and, “My parents know my friend’s parents”. The questions were scored on a scale from 1 to 5 (1 = “Applies very poorly” to 4 = “Applies very well”, 5 = “missing”). The four questions were summed forming a scale ranging from 4 to 20.

## Data analysis

IBM SPSS 27<sup>th</sup> version was used for this study's data analysis. Analysis of Covariance (ANCOVA) was used to test the relationship between substance use and ADHD while considering age, gender, education, parental support, parental monitoring, and socioeconomic status. Also, an Analysis of Variance (ANOVA) was used to look at the relationship between ADHD and substance use and the interaction between ADHD and age on substance use. Main effects were gathered for all variables in the model along with an interaction between ADHD and education. A Kolmogorov-Smirnov test indicated that the dependent variable, "substance use" did not follow a normal distribution,  $D(2592) = .157, p < 0.05$ . The skewness of "substance use" was found to be .63 ( $SE = .048$ ) and the kurtosis was found to be -.91 ( $SE = .096$ ). Levene's Test for Equality of Variances indicated that group variances were not equal ( $F = 1.78, p < .001$ ). This studies data analysis was done using the two surveys merged into one data set. A p-value of 0.05 or below ( $p < 0,05$ ) was considered statistically significant in all statistical procedures.

## Results

The dependent variable "substance use" had a mean of 14.65 ( $SD = 9.44$ ) on a 5 to 35 scale. As stated before, the dependent variable did not follow a normal curve and that can be explained by the fact that 23.6% of participants answered "never" on all counts. Figure 1 shows the frequency of the dependent variable.

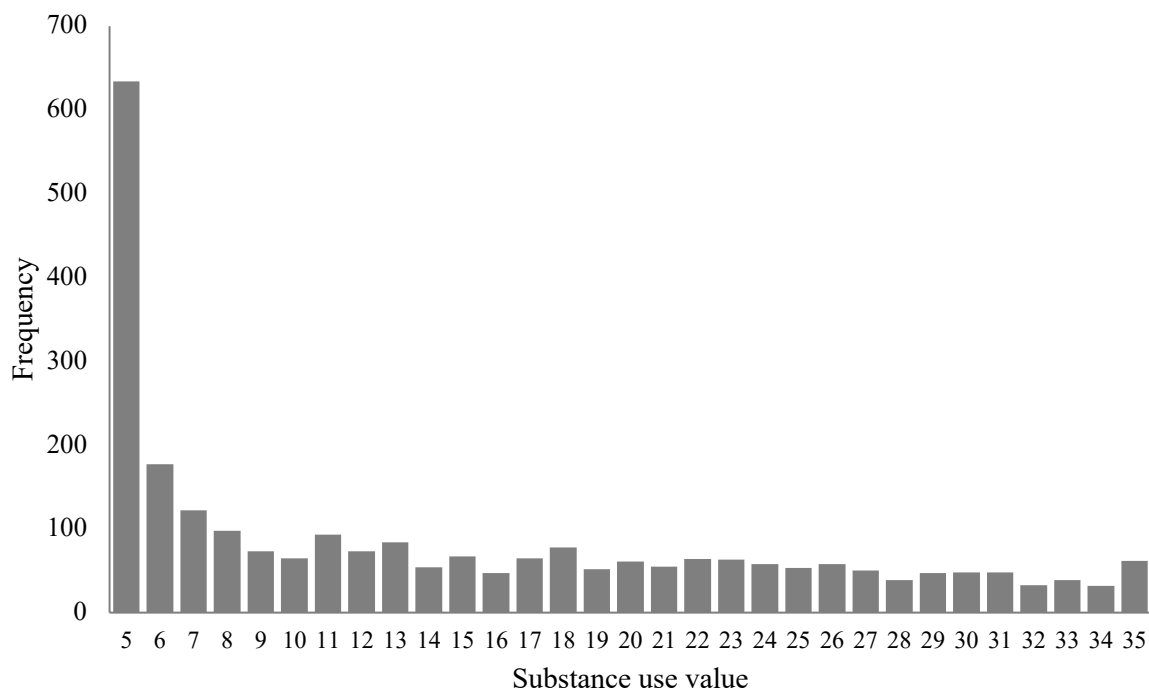
Of the 2,684 participants, 1,025 participants reported "somewhat" to "very much" on the question "how much ADHD affects your performance in school" and 1,026 said that ADHD did not affect their performance in school. Table 1 shows the descriptive statistics for the ADHD variable including, minimum- and maximum value, mean, standard deviation, skewness, and kurtosis. The descriptive statistics of the independent variable, descriptive

variables and covariates are also shown in Table 1. The covariates are age, gender, socioeconomic status, parental support, parental monitoring, and education.

The first hypothesis was that ADHD has an association with higher substance use amongst adolescents. A one-way ANOVA was conducted to test the hypothesis to compare the association between ADHD and substance use without controlling for covariates  $F(5, 2543) = 49.05, p < .001, \eta_p^2 = .088$ . The second hypothesis was that adolescents that are out of school are more likely to engage in substance use behaviour and that lower socioeconomic status influences higher substance use, that parental support and monitoring are negatively related to substance use.

### Figure 1

#### *Frequency of Substance Use*



*Note.* The figure shows the frequency of the dependent variable substance use on a scale of 5 to 35.

**Table 1***Descriptive Statistics of Independent-, and Descriptive Variables, Along with Covariates*

	N	Min.	Max.	Mean	Std.- deviation	Skewness	Kurtosis
ADHD	2,610	1.00	6.00	2.84	1.83	0.43	-1.30
Gender	2,648	1.00	2.00	1.48	0.50	0.05	-2.00
Age	2,564	15.00	21.00	17.56	1.24	0.29	-0.66
Socioeconomic status	2,627	2.00	14.00	10.46	2.17	-0.89	0.47
Parental support	2,606	2.00	8.00	6.98	1.42	-1.51	1.84
Parental monitoring	2,344	4.00	16.00	12.17	2.85	-0.64	-0.12
Educational status	2,684	0.00	1.00	0.20	0.40	1.53	0.33

*Note.* N = participants, min. = minimum value, max. = maximum value, Std. deviation = Standard deviation.

To test the association of the confounders, an ANCOVA was conducted to compare ADHD and substance use while controlling for age, gender, socioeconomic status, parental support, parental monitoring, and education. ADHD was positively associated with substance use  $F(5, 2154) = 18.30, p < .001, \eta_p^2 = .041$ . A significant difference was found in educational status on the substance use variable  $F(1, 2154) = 60.76, p < .001, \eta_p^2 = .027$ . Parental support did not have a significant association with substance use  $F(6, 2154) = 1.36, p = .227, \eta_p^2 = .004$ . Parental monitoring had a significant association with substance use  $F(12, 2154) = 7.14, p < .001, \eta_p^2 = .038$ . Socioeconomic status did not have a significant association with substance use  $F(11, 2154) = 1.45, p = .192, \eta_p^2 = .004$ . Gender did not have a significant association with substance use  $F(1, 2154) = .64, p = .425, \eta_p^2 < .001$ . Age had a significant association with substance use  $F(6, 2154) = 60.96, p < .001, \eta_p^2 = .145$ . The interaction between ADHD and educational status had a significant association with

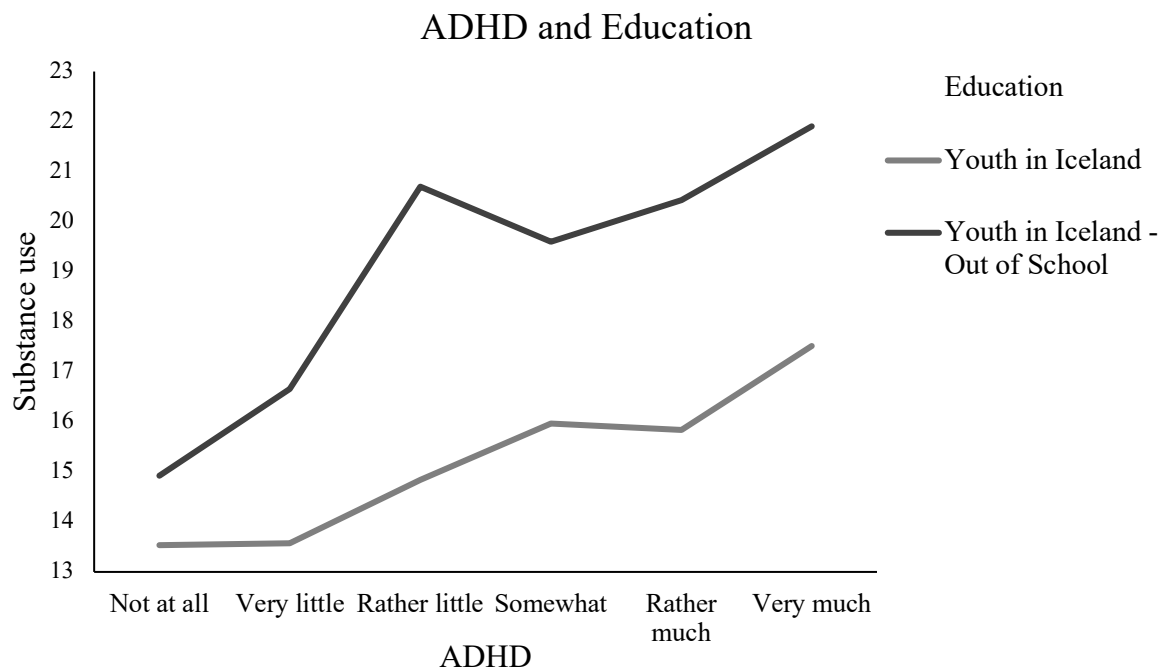
substance use  $F(5, 2154) = 2.39, p = .036, \eta_p^2 = .006$ . This means that the relationship between ADHD and substance use was significantly stronger among the out-of-school group compared to the in-school group. Figure 2 shows the interaction between ADHD and education on substance use.

Those who reported the highest value of ADHD (6 = “very much”) had the highest estimated marginal mean of substance use ( $M = 21.32, SE = .78$ ). As stated before, educational status had an association with substance use and those that were out of school (1 = “Youth in Iceland - out of school) had a higher mean substance use ( $M = 20.62, SD = 9.92$ ) than those that were in school ( $M = 13.20, SD = 8.73$ ) (0 = “Youth in Iceland”). Also, ADHD was more prevalent within the out of school group ( $M = 3.79, SD = 1.89$ ). The independent variables and covariates explained 33.9% in substance use.

The last hypothesis of this study was that adolescents with ADHD were at risk of early-onset substance use. A two-way ANOVA was conducted to test this hypothesis to test the association between age, ADHD, and substance use. The interaction between ADHD and age was also significantly related with substance use  $F(28, 2417) = 1.65, p < .05, \eta_p^2 = .02$ . ADHD and age explained 28.6% of the variance in substance use. This means that as age increases substance use increases. In table 2 the means of substance use are compared by ADHD and age. The table shows that among 17-year-olds, those who reported “not at all” had a substance use mean of 10.05 while those who reported “very much” had a mean substance use of 17.28. This difference was found within all age groups except those aged 15 and 20.

**Figure 2**

*The Interaction Between ADHD and Education on Substance Use*



*Note.* This figure shows the interaction between ADHD and education on substance use.

### **Discussion**

The results indicate that ADHD is associated with substance use. This relationship holds both with and without the covariates, Socioeconomic status, parental support and monitoring, and education. Substance use was more frequent within the “out of school” group than in the “in school” group. Among the covariates, parental monitoring, socioeconomic status, and age were all associated with substance use. However, parental support and gender were not significantly related to substance use. The interaction between ADHD and Educational status was associated with substance use, meaning that adolescents with ADHD who were out of school were more likely to engage in substance use behaviour. The independent variable and covariates explained 33.9% in the dependent variable.



**Table 2***Substance Use Means Amongst Age Groups Compared to ADHD*

Age	ADHD					
	Not at all	Very little	Rather little	Somewhat	Rather much	Very much
15	6.00	5.00	5.00	6.00	<sup>1</sup>	-
16	7.63	9.24	9.53	8.89	10.55	10.90
17	10.05	10.22	11.58	14.00	15.04	17.28
18	14.15	14.77	17.17	16.79	19.07	21.71
19	16.21	16.20	21.53	21.97	22.68	23.40
20	22.73	18.25	20.22	24.00	19.36	22.33
21	22.92	22.25	25.75	17.67	20.00	29.00

*Note.* This table shows the substance use means within the age groups regarding their reported ADHD.

<sup>1</sup> No participants aged 15 reported “rather much” – “very much”

ADHD explained 4.1% in the dependent variable and age explained the highest variance, 14.5%, in the substance use of all covariates. The interaction between ADHD and age had an association with substance use and a comparison of the means of substance use within ADHD and age indicates that adolescents with more ADHD have an increased chance of using more substances at an earlier age. This suggests that they are more likely to engage in early-onset substance use behaviour.

The analysis supports the first hypothesis that ADHD is positively associated with substance use. The data contributes to a clearer understanding of the association between ADHD and substance use and is in line with previous studies (Chang et al., 2012; Dunne et al., 2014; Elkins et al., 2018; Harty et al., 2013; Kousha et al., 2012; Lee et al., 2011; Molina & Pelham, 2003; Ottosen et al., 2016; Wilens, 1997). The analysis also supported the second

hypothesis; that the association of the covariates with substance use as all covariates were associated with substance use except parental support. The literature on socioeconomic status was inconclusive mainly on whether high or low socioeconomic status was positively related to substance use. Hanson and Chen (2007) found that high socioeconomic status increased the risk of adolescent substance use while Soteriades and diFranza (2003) found that lower socioeconomic status increased the risk of adolescent smoking. Charitonidi et al. (2016) found that high socioeconomic status was related to more alcohol and substance use while lower socioeconomic status was related to more tobacco use. In the current study, low socioeconomic status was associated with more substance use behaviour. Parental support did not have a relationship with substance use which contradicts previous studies. Prior research suggests a connection between substance use and parental support, as parental support is believed to have a protective influence on adolescent substance use (Martyn et al., 2009; Whitney et al., 2002). Parental support and monitoring have been shown to be positively associated with reducing the negative effects of substance use (Branstetter & Furman, 2013). Although this study did not find a relationship between adolescent substance use and parental support, but parental monitoring was found to be positively associated with substance use. In the literature parental monitoring is stated to have a protective effect against substance use which is also supported by this study (Clark et al., 2012; Rusby et al., 2018; Tornay et al., 2013).

In line with the second hypothesis, substance use was more prevalent within the out-of-school group than in the in-school group which is in line with prior research (Bugbee et al., 2019; Cho He, 2018; Fredriksen et al., 2014; Tice et al., 2017). The results contribute to a clearer understanding of the potential influence that education may have on substance use amongst adolescents. Why are adolescents that are out of school more likely to use substances? Bugbee et al. (2019) found that adolescents that use substances are more likely to

skip school and have lower grades than those who do not use substances and therefore are more likely to drop out of their studies. Students who drop out are more likely to use substances such as tobacco, alcohol, and marijuana (Cho Je, 2018; Tice et al., 2017). ADHD was also more prevalent within the out-of-school group which supports previous studies on dropout rates amongst adolescents with ADHD (Fredriksen et al., 2014). No significant gender relations were found in substance use within the sample which challenges previous research that indicated that there was a gender difference in adolescent substance use (Elkins et al., 2018; Ottosen et al., 2016). Previous studies on gender differences were not conclusive on which gender was more likely to use substances; Ottosen et al. (2016) found that girls with ADHD were at an increased risk for substance use disorder compared to boys, however, Elkins et al. (2018) indicated that boys with ADHD were more likely to engage in substance use behaviour than girls with ADHD. The current study's results suggested that adolescents with ADHD were at risk of early-onset substance use, supporting the third hypothesis of this study. These results build on existing evidence of ADHD children being more likely to engage in early-onset substance use (Chang et al., 2012; Dunne et al., 2014; Wilens, 1997;).

Few studies have looked at educational status and its association with ADHD and substance use in a cross-sectional way as this study has. The literature on educational status and substance use has focused mainly on drop-out rates and reasons for adolescents dropping out of school (Bugbee et al., 2019; Cho He, 2018; Fredriksen et al., 2014; Tice et al., 2017). This study suggests that educational status is associated with ADHD and substance use, as ADHD and substance use was more prevalent within the out of school than in the in-school group. These results have good validity as the two surveys, *Youth in Iceland*, and *Youth in Iceland – out of school*, had relatively similar questionnaires and samples of the same age. The current study underlines the importance of education in substance use behaviours and is one of the first studies to cover this topic in this context.

As with any research, there were limitations to this study. The independent variable was based on a question regarding “how much ADHD affects your performance in school?” but not a clinically proven ADHD measurement. As the survey is self-reported there is no way of knowing if the participants had a clinical diagnosis of ADHD. To better determine the effect that ADHD has on the participant, a parental questionnaire could be included. The dependent variable did not follow a normal distribution which is an assumption for ANCOVA and may therefore have influenced the results. When analysing whether substance use had an association with early-onset substance use this study did not have a variable regarding the age of substance use onset. This study was based on cross-sectional data which prevents assumptions of a causal relationship. Although the sample size was rather large when compared to the population of Iceland, the results are only applicable to an Icelandic population and may not be applicable to other countries or societies.

Despite these limitations, this study had many important strengths. This study is the first to look at the association between ADHD and substance use in “in school” and “out of school” groups in Iceland. This study is based on data from the Icelandic Centre for Social Research & Analysis which has administered such surveys for elementary schools, high schools, and out-of-school groups since 1992 and is well established as a researcher in the field (Rannsóknir og Greining, n.d.). In the procedure of this study, the participants were aware of the passive consent and anonymity of this study, making it easy and comfortable for the participants to answer truthfully.

To improve the investigation into the association between ADHD and substance use a better-established ADHD measure would be needed. Future research should focus on the association between ADHD and substance use with an improved diagnostics tool for ADHD and assess the importance of educational status in this relationship. Research should also focus on the reason for out-of-school adolescents’ higher substance use and whether ADHD

is important for these findings. Focus should also be brought to the association between ADHD and the covariates on substance use in other social groups and societies.

By analysing the relationship between ADHD and substance use among adolescents in Iceland this study has reached three main conclusions. First, ADHD was positively associated with substance use among adolescents. Second, adolescents within the out-of-school group were more likely to use substances than in the in-school group. Third, ADHD was more prevalent within the out-of-school group. Lastly, adolescents with ADHD were at a greater risk to participate in more substance use at an earlier age. Considering that ADHD can be a risk factor for adolescent substance use, this study emphasizes the importance of accurately identifying and treating ADHD in adolescents. Furthermore, this study highlights the importance of education as a preventive factor against adolescent substance use.

## References

- Andersen, A., Due, P., Holstein, B. E., & Iversen, L. (2003). Tracking drinking behaviour from age 15–19 years. *Addiction, 98*(11), 1505–1511. <https://doi.org/10.1046/j.1360-0443.2003.00496.x>
- Branstetter, S. A., & Furman, W. (2013). Buffering effect of parental monitoring knowledge and parent-adolescent relationships on consequences of adolescent substance use. *Journal of Child and Family Studies, 22*(2), 192–198. <https://doi.org/10.1007/s10826-012-9568-2>
- Bugbee, B. A., Beck, K. H., Fryer, C. S., & Arria, A. M. (2019). Substance use, academic performance, and academic engagement among high school seniors. *Journal of School Health, 89*(2), 145–156. <https://doi.org/10.1111/josh.12723>
- Chang, Z., Lichtenstein, P., & Larsson, H. (2012). The effects of childhood adhd symptoms on early-onset substance use: A swedish twin study. *Journal of Abnormal Child Psychology, 40*(3), 425–435. <https://doi.org/10.1007/s10802-011-9575-6>
- Charitonidi, E., Studer, J., Gaume, J., Gmel, G., Daepfen, J.-B., & Bertholet, N. (2016). Socioeconomic status and substance use among Swiss young men: A population-based cross-sectional study. *BMC Public Health, 16*(1), 333. <https://doi.org/10.1186/s12889-016-2949-5>
- Cho Je, Seong. (2018). Study on Substance Use and Delinquency Behavior of Drop-out of School Youth. *Korean Association of Addiction Crime Review, 8*(3), 31–47. <https://doi.org/10.26606/kaac.2018.8.3.2>
- Clark, H. K., Shamblen, S. R., Ringwalt, C. L., & Hanley, S. (2012). Predicting high risk adolescents' substance use over time: The role of parental monitoring. *The Journal of Primary Prevention, 33*(2), 67–77. <https://doi.org/10.1007/s10935-012-0266-z>

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.  
<https://doi.org/10.4324/9780203771587>
- Dunne, E. M., Hearn, L. E., Rose, J. J., & Latimer, W. W. (2014). ADHD as a risk factor for early onset and heightened adult problem severity of illicit substance use: An accelerated gateway model. *Addictive Behaviors, 39*(12), 1755–1758.  
<https://doi.org/10.1016/j.addbeh.2014.07.009>
- Elkins, I. J., Saunders, G. R. B., Malone, S. M., Wilson, S., McGue, M., & Iacono, W. G. (2018). Mediating pathways from childhood ADHD to adolescent tobacco and marijuana problems: Roles of peer impairment, internalizing, adolescent ADHD symptoms, and gender. *Journal of Child Psychology and Psychiatry, 59*(10), 1083–1093. <https://doi.org/10.1111/jcpp.12977>
- Emmerik-van Oortmerssen, K., van de Glind, G., van den Brink, W., Smit, F., Crunelle, C. L., Swets, M., & Schoevers, R. A. (2012). Prevalence of attention-deficit hyperactivity disorder in substance use disorder patients: A meta-analysis and meta-regression analysis. *Drug and Alcohol Dependence, 122*(1), 11–19.  
<https://doi.org/10.1016/j.drugalcdep.2011.12.007>
- Faraone, S. V., Asherson, P., Banaschewski, T., Biederman, J., Buitelaar, J. K., Ramos-Quiroga, J. A., Rohde, L. A., Sonuga-Barke, E. J. S., Tannock, R., & Franke, B. (2015). Attention-deficit/hyperactivity disorder. *Nature Reviews Disease Primers, 1*(1), 1–23. <https://doi.org/10.1038/nrdp.2015.20>
- Feldman, H. M., & Reiff, M. I. (2014). Attention deficit–hyperactivity disorder in children and adolescents. *New England Journal of Medicine, 370*(9), 838–846.
- Fredriksen, M., Dahl, A. A., Martinsen, E. W., Klungsoyr, O., Faraone, S. V., & Peleikis, D. E. (2014). Childhood and persistent ADHD symptoms associated with educational

- failure and long-term occupational disability in adult ADHD. *ADHD Attention Deficit and Hyperactivity Disorders*, 6(2), 87–99. <https://doi.org/10.1007/s12402-014-0126-1>
- Göbel, K., Scheithauer, H., Bräker, A.-B., Jonkman, H., & Soellner, R. (2016). Substance use patterns among adolescents in Europe: A latent class analysis. *Substance Use & Misuse*, 51(9), 1130–1138. <https://doi.org/10.3109/10826084.2016.1160120>
- Hanson, M. D., & Chen, E. (2007). Socioeconomic status and substance use behaviors in adolescents: The role of family resources versus family social status. *Journal of Health Psychology*, 12(1), 32–35. <https://doi.org/10.1177/1359105306069073>
- Harty, S. C., Galanopoulos, S., Newcorn, J. H., & Halperin, J. M. (2013). Delinquency, aggression, and attention-related problem behaviors differentially predict adolescent substance use in individuals diagnosed with ADHD. *The American Journal on Addictions*, 22(6), 543–550. <https://doi.org/10.1111/j.1521-0391.2013.12015.x>
- Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2018). *Monitoring the future national survey results on drug use, 1975-2017: Overview, key findings on adolescent drug use*. Institute for Social Research.
- Kousha, M., Shahrivar, Z., & Alaghband-rad, J. (2012). Substance use disorder and ADHD: Is ADHD a particularly “specific” risk factor? *Journal of Attention Disorders*, 16(4), 325–332. <https://doi.org/10.1177/1087054710387265>
- Lee, S. S., Humphreys, K. L., Flory, K., Liu, R., & Glass, K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: A meta-analytic review. *Clinical Psychology Review*, 31(3), 328–341. <https://doi.org/10.1016/j.cpr.2011.01.006>
- Martyn, K. K., Loveland-Cherry, C. J., Villarruel, A. M., Gallegos Cabriales, E., Zhou, Y., Ronis, D. L., & Eakin, B. (2009). Mexican adolescents' alcohol use, family intimacy,



- and parent-adolescent communication. *Journal of Family Nursing*, 15(2), 152–170.  
<https://doi.org/10.1177/1074840709332865>
- Mclellan, A. T. (2017). Substance misuse and substance use disorders: Why do they matter in healthcare? *Transactions of the American Clinical and Climatological Association*, 128, 112–130.
- Molina, B. S. G., & Pelham, W. E., Jr. (2003). Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. *Journal of Abnormal Psychology*, 112(3), 497–507. <https://doi.org/10.1037/0021-843X.112.3.497>
- Murberg, T. A., & Bru, E. (2004). School-related stress and psychosomatic symptoms among Norwegian adolescents. *School Psychology International*, 25(3), 317–332.  
<https://doi.org/10.1177/0143034304046904>
- Ottosen, C., Petersen, L., Larsen, J. T., & Dalsgaard, S. (2016). Gender differences in associations between attention-deficit/hyperactivity disorder and substance use disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 55(3), 227-234.e4. <https://doi.org/10.1016/j.jaac.2015.12.010>
- Patton, G. C., Coffey, C., Lynskey, M. T., Reid, S., Hemphill, S., Carlin, J. B., & Hall, W. (2007). Trajectories of adolescent alcohol and cannabis use into young adulthood. *Addiction*, 102(4), 607–615. <https://doi.org/10.1111/j.1360-0443.2006.01728.x>
- Robaey, G., Matheï, C., Van Ranst, M., & Buntinx, F. (2005). Substance use in Belgium: Prevalence and management. *Acta gastro-enterologica Belgica*, 158, 46-49.
- Rusby, J. C., Light, J. M., Crowley, R., & Westling, E. (2018). Influence of parent–youth relationship, parental monitoring, and parent substance use on adolescent substance use onset. *Journal of Family Psychology*, 32(3), 310–320. <https://doi.org/10.1037/fam0000350>

- Soteriades, E. S., & DiFranza, J. R. (2003). Parent's socioeconomic status, adolescents' disposable income, and adolescents' smoking status in massachusetts. *American Journal of Public Health, 93*(7), 1155–1160. <https://doi.org/10.2105/AJPH.93.7.1155>
- Tice, P., Lipari, R. N., & Van Horn, S. L. (2013). Substance use among 12th grade aged youths, by dropout status. In The CBHSQ Report. *Substance Abuse and Mental Health Services Administration (US)*.  
<http://www.ncbi.nlm.nih.gov/books/NBK458749/>
- Tornay, L., Michaud, P.-A., Gmel, G., Wilson, M. L., Berchtold, A., & Surís, J.-C. (2013). Parental monitoring: A way to decrease substance use among Swiss adolescents? *European Journal of Pediatrics, 172*(9), 1229–1234.  
<https://doi.org/10.1007/s00431-013-2029-0>
- Um okkur – ICSRA – Rannsóknir og greining.* (n.d.). Retrieved May 8, 2022, from <https://rannsoknir.is/um-okkur/>
- Whitney, S. D., Kelly, J. F., Myers, M. G., & Brown, S. A. (2002). Parental substance use, family support and outcome following treatment for adolescent psychoactive substance use disorders. *Journal of Child & Adolescent Substance Abuse, 11*(4), 67–81. [https://doi.org/10.1300/J029v11n04\\_04](https://doi.org/10.1300/J029v11n04_04)
- Wilens, T. E., Biederman, J., Mick, E., Faraone, S. V., & Spencer, T. (1997). Attention deficit hyperactivity disorder (ADHD) is associated with early onset substance use disorders. *The Journal of Nervous and Mental Disease, 185*(8), 475-482.