



BSc in Psychology

The association between marijuana use,
suicidal ideation, suicide attempts and
intentional self-harm among Icelandic college
students and whether it affects males and
females differently

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Name: Hildur Karen Jóhannsdóttir

ID number: 210895-2569

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Abstract

The rise in mental health problems among young people in the recent years, which coincided with widespread acceptance of marijuana consumption, had sparked a debate about a possible link between the two. The main goal of this study was to investigate if there was an association between marijuana use, suicidal ideation, suicide attempts and intentional self-harm among 16-19 year old college students and whether it affects males and females differently. A comparison of data from the *Icelandic Centre for Social Research and Analysis* between 2010, 2013 and 2016 was made. All three datasets included approximately 4.000 participants with the sexes being almost proportionally even. The participants were asked the same questions in the 2010, 2013 and 2016 datasets. The questions were whether or not they had used marijuana in the past 30 days, whether or not they had ever had suicidal thoughts, attempted suicide or harmed themselves intentionally. The results showed that marijuana use among participants decreased and then remained relatively stable while suicidal ideation, suicide attempts and intentional self-harm increased. Female participants and participants who reported having used marijuana in the past 30 days were more likely to report having had suicidal ideation, attempted suicide or harmed themselves intentionally. Further discussion regarding the methodology, results and conclusion can be found in this paper.

Key words: marijuana, suicidal ideation, suicide attempt, self-harm, college students, gender

Abstract – Icelandic

Aukning geðkvilla hjá ungu fólki undanfarin ár, sem átti sér stað samhliða auknu samþykki á neyslu marijuana meðal almennings, hafði vakið umræðu um mögulega tengingu þar á milli. Megintilgangur þessarar rannsóknar var að skoða hvort það væru tengsl á milli marijúana notkunar, sjálfsvígshugsana, sjálfsvígstilrauna og sjálfsskaða á meðal 16-19 ára framhaldsskólanemenda og hvort þau höfðu mismunandi áhrif á karla og konur. Samanburður var gerður á gögnum frá Rannsóknir og greining á milli árána 2010, 2013 og 2016. Öll þrjú gagnasöfnin innihéldu rúmlega 4.000 þátttakendur þar sem kynjahlutföllin voru tiltölulega jöfn. Þátttakendur voru spurðir sömu spurninga í gagnasöfnunum þremur, þar sem spurt var hvort þátttakendur höfðu notað marijúana á síðastliðnum 30 dögum og hvort þeir hefðu nokkurn tímann haft sjálfsvígshugsanir, gert tilraun til sjálfsvígs eða viljandi valdið sjálfum sér skaða. Niðurstöður sýndu að það dróg úr marijúana neyslu á meðal þátttakenda en svo hélst hún tiltölulega stöðug á meðan tíðni sjálfsvígshugsana, tilrauna til sjálfsvígs og sjálfsskaða jókst á milli ára. Kvenkyns þátttakendur og þátttakendur sem sögðust hafa notað marijúana á síðastliðnum 30 dögum voru líklegri til að greina frá því að hafa nokkurn tímann haft sjálfsvígshugsanir, gert tilraun til sjálfsvígs eða viljandi valdið sjálfum sér skaða. Nánari umfjöllun um aðferðafræðina, niðurstöðurnar og túlkun þeirra má finna í þessari ritgerð.

Lykilord: marijúana, sjálfsvígshugsanir, sjálfsvígstilraunir, sjálfsskaði, framhaldsskólanemendur, kyn.

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Marijuana use, suicidal ideation, suicide attempt and self-harm

The increasing mental health problems among young people in the past few decades has sparked a debate about marijuana use among adolescents and whether it is related to this increase in health problems. With adolescence being, for some at least, a time period of impulsivity, sensation seeking and irrational decisions, experimentation with substances like marijuana is common (Romer, 2010). Human beings are however usually very healthy in their adolescent years. The most common threats to wellbeing and health during this period come from injuries and non-communicable disease risk factors (van Ours, Williams, Fergusson & Horwood, 2013). In addition, with the advent of puberty, pre-existing mental health conditions can become more severe or entirely new conditions can arise in adolescents. This could be a contributing factor in a heightened risk of suicide among young people (Patton et al., 2009). Recent advances in neuroscience have potentially informed researchers more on this matter. The pre-frontal cortex in the brains of adolescents is not fully developed at this time. This section of the brain has been associated with planning complex cognitive behaviour, personality expression, decision making and moderating social behaviour, all of which are crucial abilities at this time period in a young individual's life (Arain et al., 2013). Poor family environment, poor parental supervision as well as low social support can also be contributing factors in a heightened risk of suicidal ideation among adolescents (King et al., 2001). Another factor believed to have an impact on the mental health of adolescents is the recreational use of marijuana (Haas, Zamboanga, Bersamin & Hyke, 2018). Marijuana use has been related to many problems such as a decline in educational or occupational functioning and psychiatric comorbidity to name a few (Romer, 2010). With adolescents reporting having a relatively easy access to marijuana, many tend to view the substance as harmless (Haas et al., 2018). Furthermore legalizing recreational marijuana prompts

the normalization of the substance and appears to increase the probability of consumption among college students (Miller, Rosenman & Cowan, 2017).

The female plant of the *Cannabis sativa* is the plant which marijuana is harvested from. Many historical records date its use by humans back thousands of years, primarily for its intoxicating effect (Gruber & Pope Jr., 2002). Due to the increasing normalization of marijuana use it would come as no surprise if consumption of the substance became more widespread. In addition it appears that marijuana risk perceptions among adolescents are decreasing, however increase of marijuana use has not yet at least accompanied this rapid decrease and seems to be relatively stable over recent years (Sarvet et al., 2018). Chen, Martins, Strain, Mojtabei & Storr (2018) examined sex differences of marijuana involvement, among other things, during adolescence. They asked participants, who were 13-16 year old students, about their marijuana use for the past year. 20.6% of overall participants reported having used marijuana for the past year. Of them 12.1% reported occasional use, 4.3% frequent use and 3.8% regular use. Their results indicated that boys were more likely to be frequent and regular users than girls, while there was no difference between the sexes when using marijuana occasionally.

Research conducted by Buckner, Ecker & Cohen (2010) suggested that marijuana consumption can be an indicating factor in the development of depression, anxiety disorders and various personality disorders. These associations appear to be stronger in adolescents than adults, with younger age of initiation causing higher risk of developing mental health problems (Copeland, Rooke & Swift, 2013). A study by van Os et al. (2002) supports earlier suggestions that marijuana consumption is a risk factor in development of mental health problems in people with no history of mental health issues and that groups already at risk are particularly vulnerable

to these effects which makes this an important topic to investigate further. These mental health problems can possibly lead to suicidal tendencies.

Suicide is a major public health issue as well as an economic concern for most countries. Approximately one million people worldwide are believed to die from suicide every year (Bakhiyi et al., 2017). The rate of suicide among young people has increased during the last few decades, especially among young men (Beautrais, 2000). Mental health problems, low socio-economic status and experienced child negligence are known risk factors for suicidal behavior (Kliem, Lohmann, Mößle & Brähler, 2017). Substance abuse disorders have also been correlated with suicidal behavior, particularly in young people (Beautrais, 2000).

One of the major predictors for attempting to commit suicide and committing suicide is suicidal ideation (Kliem et al., 2017). Nock et al. (2008) defined suicidal ideation as referring to thoughts of engaging in behavior intended to end one's life. In a study conducted by Kisch, Leino & Silverman (2005) with a sample of 15,977 American college students, 9,5% of students reported having serious thoughts about committing suicide with less than 20% receiving any kind of treatment after reporting their suicidal behavior. A 30-year longitudinal study indicated that the earlier the intense use of marijuana first occurs the sooner susceptible individuals start having suicidal thoughts. Susceptible individuals start having increased suicidal thoughts with higher frequency of marijuana use, increasing in proportion with higher rates of consumption (van Ours et al., 2013). Fortunately most of the individuals that are having suicidal thoughts do not attempt suicide (Klonsky & May, 2013). Suicide attempt has been defined as referring to implementation in potentially self-harming behaviour where there is at least some intent to die (Nock et al., 2008). Since many definitions for suicide attempts overlap with various forms of self-harm it becomes apparent that studying and more clearly defining self-harm in conjunction

with suicide attempts is essential. It can be challenging to distinguish between self-harm that was carried out intentionally and unintentionally on the one hand and on the other whether or not self-harm should include acts of suicide attempts (James & Stewart, 2017). Repeated self-harm has been identified as one of the strongest risk factors for suicide. Young people appear to be most at risk for self-harm, particularly 15-19 year old females and 20-24 year old males. Overall the risk difference between the sexes seems to be minimal (Bennardi, McMahon, Corcoran, Griffin & Arensman, 2016). In a study conducted by Freeman et al. (2017) on 5212 participants from 4 different countries results showed that of the participants who were under the age of 30, 11.1% of males had intentionally harmed themselves and 13,8% of females.

A cross-sectional study based on the 2003 European School Survey Project on Alcohol and Other Drugs (ESPAD) conducted on 13.187 French students and the Youth Risk Behavior Survey (YRBS) conducted on 15.136 American students, assessed the association between the age of substance initiation and suicide ideation and suicide attempt among students (Swahn et al., 2012). The study was limited to students 13 years of age and older. Overall the sample from France showed that 6.84% of the boys reported having suicide ideation and 12.11% of the girls compared to the sample from USA where 16.81% of the boys had suicide ideation and 21.23% of the girls. Furthermore 5.38% of the boys in the French sample had attempted suicide and 12.10% of the girls compared to the USA sample where 4.73% of the boys had attempted suicide and 10.57% of the girls. To measure their substance initiation they were asked whether they had ever used any substance, if they had they were then asked about their substance initiation prior to age 13 or after the age of 13. The time period prior to age 13 is often referred to as pre-teen. In the USA, prevalence of pre-teen marijuana use of the sample was 9.7% and in France it was 3.9% respectively. Results indicated that there was an association between pre-teen initiation of using

marijuana and suicide ideation and attempts among boys and girls in France and among girls only in the USA. Implying that the association between initiation of substance use and suicidal behaviours varies between the sexes. Furthermore the analysis of early initiation of marijuana use and the associations with suicide ideation and suicide attempts supports previous findings on the relationship between marijuana use and adolescents in England and Norway deliberately causing themselves harm (Rossow, Hawton & Ystgaard, 2009). These results show how important it is to focus on preventing young adolescents from starting using marijuana, especially when they are at critical developmental stages. A recent study conducted by Delforterie et al. (2015) further supports these findings, that there is an association between marijuana use and suicidal behaviour, indicating danger of impairment in physical, psychological or emotional functioning which could result in higher risk of suicidal behaviour by the repeated use of marijuana, and at an earlier age of initiation. Another recent longitudinal research has shown a substantially greater association between heavy marijuana use and suicidality in men when compared with women. Although women are more likely than men to show suicidality during the initiation of marijuana use (Shalit, Shoval, Shlosberg, Feingold & Lev-Ran, 2016). It has also been observed that males are at twice the risk of repeat attempts after attempted suicide when compared with females but very little research has gone towards attempting to explain the cause of this difference (Nordström, Samuelsson & Åsberg, 1995).

The aims and objectives of this study is to find out whether there is an association between marijuana use, suicidal ideation, suicide attempts and intentional self-harm among college students and whether it affects females and males differently. To accomplish this, this study will be looking at the results from three surveys, which were conducted in the years 2010, 2013 and 2016. This study aims to confirm whether Icelandic youth research indicate similar

results as previous research regarding the effects of marijuana consumption on suicidal ideation, suicide attempts and intentional self-harm among adolescents.

Three hypotheses will be presented in this study. First, suicidal ideation, suicide attempts, intentional self-harm among students and marijuana use will have increased between 2010, 2013 and 2016. Second, students who report having used marijuana will have a higher probability of suicidal ideation, suicide attempts and intentional self-harm than students who do not report having used marijuana. And third, marijuana use will have a higher impact on suicidal ideation, suicide attempts and intentional self-harm among female students than male students.

Method

Participants

The results presented in this study are based on a survey conducted in October 2010, November 2013 and October 2016 by *The Icelandic Centre for Social Research and Analysis (ICSRA)* on 16-19 year old students from all colleges in Iceland. The participants were the daytime students that were present in class at the time of the survey. Participants were chosen with a random sampling from population from surveys conducted in 2010, 2013 and 2016. Valid responses in the sample from 2010 were 4060 (1921 males and 2139 females), they were 3991 in the sample from 2013 (1945 males and 2046 females) and in the sample from 2016 there were 3897 valid responses (1948 males and 1949 females). Total of 11.948 (5.814 males and 6.134 females) participants.

Instruments and measures

The measuring equipment used in this study was a questionnaire for college students developed every three years, first by the researchers of *The Icelandic Institute for Educational Research* in collaboration with the ministry of education, but more recently by the ICSRA (see

Appendix A for the questions used in the study from the questionnaires). The questions are formulated by social science professionals, with strict requirements that lead to accurate results and with emphasis on achieving high reliability and validity. Scales are often used to increase the questions' validity, in these questionnaires the *Likert scale* was mostly used. In 2010 the questionnaire listed 36 pages with 110 questions, in 2013 it contained 96 questions and in 2016 it contained 85 questions on 32 pages, differing in number of items for each question. Five questions were used from the original studies in 2010, 2013 and 2016 regarding marijuana use, gender, suicidal ideation, suicide attempt and intentional self-harm (see description of variables below). The study contained five variables. The independent variables were two, marijuana use in the past 30 days and gender, and the dependent variables were three, suicidal ideation, suicide attempt and intentional self-harm.

Marijuana use in the past 30 days

In the original study marijuana use in the past 30 days among participants was measured by asking: "How often in the past 30 days have you used: marijuana?". The question was assessed with numerical values from 1 to 7 where, "never" = 1, "1-2 times" = 2, "3-5 times" = 3, "6-9 times" = 4, "10-19 times" = 5, "20-39 times" = 6 and "40 times or more often" = 7. However the variable was recoded into a different variable so it became dichotomous like all the other variables in this study. Now the same question was assessed with 0 if participants had not used marijuana in the past 30 days and 1 if they had used marijuana in the past 30 days.

Gender

To measure gender participants were asked if they were "male" = 1 or "female" = 2.

Suicidal ideation

To measure if participants had ever had suicidal ideation they were asked: “Have you ever had serious thoughts about committing suicide?”. For this variable the value of the negative outcome had to be recoded from “no” = 2 into “no” = 0 for the question, so that the value of the affirmative response (“yes” = 1) had a higher value than the negative response (“no” = 0). The reason for this was to make an increase in the outcome value represent an increase in the frequency of suicidal ideation.

Suicide attempt

To measure if participants had ever attempted suicide they were asked: “Have you ever attempted suicide?”. For this variable the value of the negative response had to be recoded from “no” = 2 into “no” = 0 for the question, so that the value of the affirmative response (“yes” = 1) had a higher value than the negative response (“no” = 0). The reason for this was to make an increase in the outcome value represent an increase in the frequency of suicide attempts.

Self-harm

Self-harm among participants was measured by asking “Have you ever: harmed yourself?”. In the original study the question was assessed with numerical values from 1 to 5 where, “never” = 1, “1x” = 2, “2x” = 3, “3-4x” = 4 and “5+” = 5. However the variable was recoded into a different variable to make it dichotomous like the other variables in the study. Now the same question was assessed with 0 if participants had not harmed themselves and 1 if they had ever harmed themselves.

Procedure

The questionnaires were sent to all colleges in Iceland with specific instructions for the teachers on how to conduct the survey and submit the questionnaires correctly. The students were

instructed not to write their name or social security number on the answer sheets to ensure anonymity. They were also asked to answer all of the questions honestly to the best of their ability and ask for help if necessary. After they had completed filling in the answer sheets they were given an unsigned envelope to hand in their answer sheets anonymously. A letter was sent to the homes of 16-17 year old students for parental permission to participate in the survey (see Appendix B). Thus parents could notify if the student will not participate in the survey. The same procedure was used in 2010, 2013 and 2016.

Statistical analysis

SPSS version 24.0 was used for all data analyses in this study. The method used is called Binary logistic regression. It is used to predict the relationship between the independent variables and the dependent variable where the independent variables can be either continuous or categorical and the dependent variable is binary. The independent variables are the predictors, there must be two or more for a logistic regression, and the dependent variable is the predicted variable. There are a few assumptions that apply to the Binary logistic regression which will be mentioned here. The observations are required to be independent of each other. In this study we have different participants and therefore different data for each year so this assumption is not violated. There should also be little or no multicollinearity among the independent variables, in other words the independent variables should not be too highly correlated with each other. Logistic regression should also have a large sample size. This assumption is not violated in this study since the sample for each of the three datasets contains approximately 4,000 students (Field, 2009).

Results

Descriptive statistics

Table 1 shows descriptive statistics for the proportions of the two independent variables in this study, gender and marijuana use in the past 30 days. Furthermore it shows the comparison of the proportions of the variables between the years 2010, 2013 and 2016.

Table 1

Proportions of gender and marijuana use in the past 30 days between the years 2010, 2013 and 2016

Independent variables		2010		2013		2016	
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Gender	Male	1921	(47.3)	1945	(48.7)	1948	(50)
	Female	2139	(52.7)	2046	(51.3)	1949	(50)
Marijuana use in the past 30 days	Yes	467	(11.9)	295	(7.6)	305	(7.9)
	No	3462	(88.1)	3608	(92.4)	3540	(92.1)

Gender was rather proportionally even for 2010, 2013 and 2016. It appears that marijuana use in the past 30 days among participants decreased from 2010 to 2013, from 11.9% to 7.6%, and then slightly increased again by 0.3% in 2016.

Table 2 shows descriptive statistics for the proportions of the three dependent variables in this study, suicidal ideation, suicide attempt and intentional self-harm. Furthermore it shows the comparison of the proportions of the variables between the years 2010, 2013 and 2016.

Table 2

Proportions of suicidal ideation, suicide attempt and self-harm between the years 2010, 2013 and 2016

Dependent variables		2010		2013		2016	
		n	(%)	n	(%)	n	(%)
Suicidal ideation	Yes	760	(19.9)	910	(23.6)	1054	(27.8)
	No	3067	(80.1)	2944	(76.4)	2741	(72.2)
Suicide attempt	Yes	265	(6.9)	278	(7.2)	349	(9.2)
	No	3580	(93.1)	3586	(92.8)	3463	(90.8)
Self-harm	Yes	573	(14.5)	600	(15.2)	706	(18.6)
	No	3388	(85.5)	3349	(84.8)	3084	(81.4)

The most intriguing difference that can be seen from this table is the proportional increase from 2010 to 2013 and from 2013 to 2016 in participants reporting having had suicidal ideation, attempted suicide or harmed oneself intentionally. It is particularly notable for suicidal ideation where the proportion of participants reporting having had suicidal ideation increased for about 4% between 2010 and 2013 and again from 2013 to 2016.

A chi-square test of independence showed that males (71.1%) were more likely than females (28.9%) to have reported using marijuana for the past 30 days, $\chi^2(1, N = 11,583) = 249.89, p < .001$, this can be seen in table 3.

Table 3

A chi-square test of independence used to assess the relationship between gender and marijuana use in the past 30 days, suicidal ideation, suicide attempt and self-harm

Variables		Male	Female	χ^2
		<i>n</i> (%)	<i>n</i> (%)	
Marijuana use in the past 30 days	Yes	749 (13.5)	305 (5.1)	249.89*
	No	4796 (86.5)	5733 (94.9)	
Suicidal ideation	Yes	1083 (20)	1604 (26.9)	74.60*
	No	4328 (80)	4358 (73.1)	
Suicide attempt	Yes	328 (6)	549 (9.2)	39.29*
	No	5102 (94)	5439 (90.8)	
Self-harm	Yes	656 (11.8)	1195 (19.8)	138.35*
	No	4909 (88.2)	4843 (80.2)	

* $p < 0.001$

Females (59.7%) were however more likely than males (40.3%) to have reported having suicidal ideation, $\chi^2 (1, N = 11.373) = 74.60, p < .001$. Females (62.6%) were also more likely than males (37.4%) to have reported having attempted suicide, $\chi^2 (1, N = 11.418) = 39.29, p < .001$.

Furthermore females (64.6%) were more likely than males (35.4%) to have reported having harmed themselves $\chi^2 (1, N = 11.603) = 138.35, p < .001$.

Results using binary logistic regression

Suicidal ideation

Table 4 shows the results from a binary logistic regression predicting suicidal ideation from gender and marijuana use in the past 30 days and their interaction effect for the years 2010, 2013 and 2016.

Table 4

Binary logistic regression predicting suicidal ideation from gender and marijuana use in the past 30 days and their interaction effect for the years 2010, 2013 and 2016

	B	SE	p	Exp(B)	95% CI EXP(B)	
					LL	UL
Gender	.451	.049	< .001	1.570	1.426	1.728
Marijuana use in the past 30 days	.452	.214	.034	1.572	1.034	2.390
Gender x Marijuana use in the past 30 days	.390	.150	.009	1.477	1.102	1.980
(Constant)	-1.978	.082	< .001	.138		

The logistic regression model explained 2.3% (according to Cox & Shell R square) and 3.5% (according to Nagelkerke’s adjusted value) of the variance of the dependent variable, suicidal ideation. Chi-square was highly significant (*chi-square* = 262.45, *df* = 3, *p* < .001) indicating that our new model is significantly better than our baseline model (according to Omnibus Tests of Model Coefficients). Looking at the main effect revealed that both gender and marijuana use in the past 30 days were significantly related to suicidal ideation. Females were 1.6 times more likely to have reported having suicidal ideation than males. Participants that reported having used marijuana in the past 30 days were 1.6 times more likely to report having had suicidal ideation than participants that reported having not used marijuana for the past 30 days. The interaction effect between gender and marijuana use in the past 30 days on suicidal ideation was statistically significant (*B* = .390, *p* < .05). This would indicate that the effect of marijuana use in the past 30 days on suicidal ideation is dependent on whether the participant is male or female, having 1.5 times greater effect if the participant is female. Individually gender and marijuana use in the past 30 days each appear to have a greater effect on suicidal ideation than the combined effect of both gender and marijuana use in the past 30 days.

Suicide attempt

Table 5 shows the results from a binary logistic regression predicting suicide attempt from gender and marijuana use in the past 30 days and their interaction effect for 2010, 2013 and 2016.

Table 5

Binary logistic regression predicting suicide attempt from gender and marijuana use in the past 30 days and their interaction effect for 2010, 2013 and 2016

	<i>B</i>	<i>SE</i>	<i>p</i>	Exp(B)	95% CI EXP(B)	
					<i>LL</i>	<i>UL</i>
Gender	.578	.084	< .001	1.782	1.511	2.100
Marijuana use in the past 30 days	.891	.291	.002	2.438	1.377	4.316
Gender x Marijuana use in the past 30 days	.276	.189	.144	1.318	.910	1.907
(Constant)	-3.571	.146	< .001	.028		

The logistic regression model explained 1.8% (according to Cox & Shell R square) and 4.2% (according to Nagelkerke's adjusted value) of the variance of the dependent variable, suicide attempt. Chi-square was highly significant ($chi\text{-square} = 201.85, df = 3, p < .001$) indicating that our new model is significantly better than our baseline model (according to Omnibus Tests of Model Coefficients). By looking at the main effect this revealed that both gender and marijuana use in the past 30 days were significantly related to suicide attempts. Females were 1.8 times more likely to have reported attempting suicide than males. Participants that reported having used marijuana in the past 30 days were 2.4 times more likely to report having attempted suicide. The interaction effect between gender and marijuana use in the past 30 days on suicide attempt was statistically non-significant ($B = .276, p = .144$) indicating that the effect of marijuana use in the past 30 days on suicide attempt is not dependent on whether the participant is male or female.

Self-harm

Table 6 shows the results from a binary logistic regression predicting intentional self-harm from gender and marijuana use in the past 30 days and their interaction effect for 2010, 2013 and 2016.

Table 6

Binary logistic regression predicting intentional self-harm from gender and marijuana use in the past 30 days and their interaction effect for 2010, 2013 and 2016

	<i>B</i>	<i>SE</i>	<i>p</i>	Exp(B)	95% CI EXP(B)	
					<i>LL</i>	<i>UL</i>
Gender	.748	.061	< .001	2.112	1.876	2.378
Marijuana use in the past 30 days	.771	.231	.001	2.162	1.374	3.402
Gender x Marijuana use in the past 30 days	.393	.155	.011	1.482	1.093	2.010
(Constant)	-3.007	.105	< .001	.049		

The logistic regression model explained 3.7% (according to Cox & Shell R square) and 6.3% (according to Nagelkerke's adjusted value) of the variance of the dependent variable, self-harm. Chi-square was highly significant ($chi-square = 428.28, df = 3, p < .001$) indicating that our new model is significantly better than our baseline model (according to Omnibus Tests of Model Coefficients). By looking at the main effect this revealed that both gender and marijuana use in the past 30 days were significantly related to self-harm. Females were 2.1 times more likely to have reported causing harm to themselves than males. Participants that reported having used marijuana in the past 30 days were 2.2 times more likely to report having harmed themselves. The interaction effect of gender and marijuana use in the past 30 days on self-harm was statistically significant ($B = .393, p < .05$). This would indicate that the effect of marijuana use in the past 30 days on self-harm is dependent on whether the participant is male or female, having

1.5 times greater effect if the participant is female. Individually gender and marijuana use in the past 30 days each appear to have a greater effect on self-harm than the combined effect of both gender and marijuana use in the past 30 days.

Discussion

The primary purpose of this study was to examine whether there was an association between marijuana use and suicidal ideation, suicide attempt and intentional self-harm among 16-19 year old Icelandic college students and whether it impacts the sexes differently by using datasets from 2010, 2013 and 2016. The findings of the study support the first hypothesis partially. Suicidal ideation, suicide attempts and intentional self-harm among students all increased between 2010, 2013 and 2016, suicidal ideation showed the most difference with an increase of approximately 4% every 3 years, while marijuana use decreased from 11.9% to 7.6% from 2010 to 2013 and then slightly increased by 0.3% from 2013 to 2016. This is consistent with previous findings that marijuana use appears to have been relatively stable throughout the past years (Sarvet et al., 2018). The probability of suicidal ideation, suicide attempt and intentional self-harm is rather consistent with previous findings, however Icelandic college students appear to report having more suicidal ideation compared to their counterparts from France and the USA (Swahn et al., 2012). The prevalence of intentional self-harm among Icelandic college students is not consistent with previous studies since the difference between the sexes varies greatly (Bennardi et al., 2016). Also the prevalence of Icelandic female college students reporting having intentionally harmed themselves is considerably higher (19.8%) when compared to young females in other countries (13.8%) (Freeman et al., 2017).

The findings of the study supported the second hypothesis that students who reported having used marijuana for the past 30 days were more likely to have reported having suicidal

ideation, attempted suicide or intentionally harmed oneself than students who had not used marijuana in the past 30 days. Participants who reported having used marijuana in the past 30 days were 1.6 times more likely to have reported having suicidal ideation, 2.4 times more likely to have reported having attempted suicide and 2.2 times more likely to have reported having harmed oneself intentionally than participants who had not reported having used marijuana in the past 30 days. Previous studies have also shown an association between marijuana use and suicidal ideation, suicide attempt and intentional self-harm (Swahn et al., 2012; Rossow et al., 2009; Delforterie et al., 2015). Recreational use of marijuana among adolescents is believed to be an indicating factor in their mental health (Haas et al., 2018) possibly resulting in suicidal tendencies (van Os et al., 2002), which is consistent with the findings in this study. Early initiation of marijuana use seems to have a particularly high impact on mental health, possibly resulting in suicidal tendencies later in life (van Os et al., 2002). It has also been shown that, on average, increased consumption of marijuana increases suicidal ideation (van Ours et al., 2013).

The third hypothesis stated that marijuana use would have a higher impact on suicidal ideation, suicide attempt and intended self-harm among female students than male students. The findings in the study supported this hypothesis partially. Female students were 1.5 times more likely to have reported having suicidal ideation and 1.5 times more likely to have reported having harmed themselves intentionally of students who had used marijuana in the past 30 days. However the effect of marijuana use in the past 30 days on suicide attempt is not dependent on whether the participant is male or female. Earlier studies have shown that the association between initiation of substance use and suicidal behavior varies between the sexes (Swahn et al., 2012). Males are more likely to be frequent or regular marijuana users than females (Chen et al., 2018) and there is greater association between heavy marijuana use and suicidality in males

when compared with females although females are more likely to show suicidality during initiation of marijuana use (Shalit et al., 2016). In addition, females are more likely than males to report having suicidal ideation, attempted suicide and harmed themselves intentionally (Swahn et al., 2012) while males are at twice the risk of repeat attempts after attempted suicide when compared with females (Nordström et al., 1995).

The main strengths of this study is that it has a relatively large sample size containing a total of 11.948 participants, both males and females. The gender ratio was rather even with 5.814 males and 6.134 females. The data was accumulated over 3 separate occasions, in 2010, 2013 and 2016, which resulted in a larger overall sample size while also allowing observation of changes over time. Also the survey was conducted in a setting which the participants were familiar with and answers were anonymous.

The main limitations of this study was that it was a cross-sectional study so it is not possible to establish a cause and effect relationship. Participants were only asked about their marijuana use in the past 30 days resulting in potentially missing out on participants that had used marijuana prior to those 30 days. Also this was a self-reported survey where participants evaluated themselves and therefore there is a possibility of response bias and dishonesty among participants when filling out the survey.

An interesting forward follow-up research would be to study the sex difference for suicidal ideation, suicide attempts and intentional self-harm before the introduction of marijuana use. It would be interesting to study why females appear to be more likely than males to report having these suicidal tendencies. In addition, since suicidal ideation, suicide attempts and intentional self-harm among Icelandic college students seem to be increasing while marijuana

use appears to be decreasing or relatively stable, it would be interesting to study what other factors might be causing these effects.

In conclusion the study emphasizes the importance of preventing marijuana use among adolescents since other studies indicated that the earlier the intense use of marijuana first occurs the more likely it is that an individual will have mental health problems, such as suicidal tendencies, in the future. The results in this study indicated that suicidal ideation, suicide attempts and intentional self-harm has increased among Icelandic college students between 2010, 2013 and 2016 which is a great concern since marijuana use has been relatively stable for the past years. This suggests that further prevention and treatment which focuses on mental health among adolescents is necessary. Future research in this field could yield better results in maintaining and improving adolescents' mental health.

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Appendix A

The questions used in this study from the surveys conducted in 2010, 2013 and 2016

1. Ert þú strákur eða stelpa?

Strákur Stelpa

Section b)

33. Hefur þú einhvern tíma um ævina gert eitthvað af eftirtöldu? Merktu í EINN reit í HVERJUM lið

	Aldrei	Einu sinni	Tvisvar sinnum	3-4 sinnum	5 sinnum eða oftar
a) Hugleitt að skaða sjálfa(n) þig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Skaðað sjálfa(n) þig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section b)

73. Hve oft hefur þú notað eftirtalið síðustu 30 daga? Merktu í EINN reit í HVERJUM lið

	Aldrei	1-2 sinnum	3-5 sinnum	6-9 sinnum	10-19 sinnum	20-39 sinnum	40 sinnum eða oftar
a) Hass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Maríjúana	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Amfetamín (spítt)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) E-töflu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sections f) and h)

82. Eiga einhverjar eftirfarandi spurninga við um þig? (Merktu í EINN reit í HVERJUM lið)

	Já	Nei
a) Hefur einhver sagt þér frá því að hann eða hún væri að hugleiða að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
b) Hefur einhver kunningja þinna eða aðrir sem þú kannaðist við einhvern tíma reynt að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
c) Hefur einhver kunningja þinna eða aðrir sem þú kannaðist við framið sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
d) Hefur einhver góður vinur þinn eða annar þér nákominn einhvern tíma reynt að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
e) Hefur einhver góður vinur þinn eða annar þér nákominn framið sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
f) Hefur þú einhvern tíma í alvöru hugleitt að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
g) Hefur þú einhvern tíma sagt einhverjum frá því að þú værir að hugleiða að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
h) Hefur þú einhvern tíma gert tilraun til að fremja sjálfsvíg?	<input type="checkbox"/>	<input type="checkbox"/>
i) Hefur þú gert tilraun til að fremja sjálfsvíg sl. 12 mánuði?	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B

A letter for parental permission

**RANNSÓKNIR & GREINING**
Háskólanum í Reykjavík

Reykjavík 10. október 2016

Ágætu foreldrar / forráðamenn,

Síðustu tvær vikurnar í október er fyrirhugað að gera könnun á högum og líðan ungmenna í öllum framhaldsskólum á Íslandi. Könnun þessi er unnin af Rannsóknunum og greiningu samkvæmt samningi við mennta- og menningarmálaráðuneytið og rannsóknaráætlun **Ungt fólk** sem unnin hefur verið allt frá árinu 1992 í grunn- og framhaldsskólum landsins.

Rannsóknir & greining hefur sérhæft sig í rannsóknum á ungu fólki og nær gagnagrunnur okkar allt aftur til ársins 1992. Upplýsingar úr rannsóknunum eru notaðar við stefnumótun í málefnum ungs fólks og eru grunnur að vinnu fjölmargra þeirra sem vinna að málefnum ungs fólks á Íslandi, hvort heldur sem er ráðuneyta, sveitarfélaga, skóla, félagssamtaka eða einstaklinga. Rannsóknirnar hafa verið lagðar fyrir meðal framhaldsskólanema á Íslandi allt frá árinu 1992 og mynda því samfellda heild yfir tíma. Þessi rannsókn meðal framhaldsskólanema er sú sjöunda í röðinni en hún hefur verið lögð fyrir að meðaltali á þriggja ára fresti undanfarin 20 ár.

Könnunin lýtur sem fyrr að því að kanna hagi og líðan ungmenna, félagslega þætti svo sem tengsl við foreldra og vini, íþróttir og tómstundir, félagslíf, líðan, einelti, vímuefnanotkun, streitu, mataræði, nám, brottfallsáhættu, félagslega stöðu, svefn, lestur, andlega og líkamlega líðan, lestrarörðugleika, tölvunotkun, viðhorf til framtíðarinnar og fleira sem nýtist til að afla þekkingar um, og bæta hagi og líðan þessa aldurshóps.

Könnunin er með öllu nafnlaus og unnin samkvæmt reglum um persónuvernd. Þannig er ekki hægt að rekja nein svör til einstaklinga. Þegar nemendur hafa lokið við að fylla út spurningalistana eru þeir beðnir að setja þá í þar til gerð umslög og loka þeim vandlega. Listarnir eru svo sendir greiningaraðilum sem skrá upplýsingarnar án þess að geta með nokkru móti vitað hverjum þær tilheyra. Að skráningu lokinni er spurningalistunum eytt.

Samkvæmt venju upplýsum við foreldra og forráðamenn um fyrirlögnina og gefum þeim kost á því að óska eftir að börn þeirra taki ekki þátt. Einnig er nemendum sjálfum heimilt að ákveða að svara ekki spurningum ef þau svo kjósa. Kjósi foreldrar / forráðamenn að börn þeirra taki ekki þátt er best að hafa samband við Rannsóknir og greiningu eða viðkomandi skóla og láta vita. Verði þátttaka góð koma upplýsingarnar til með að skila mikilsverðum niðurstöðum, bæði hagnýtum og fræðilegum líkt og fyrri kannanir af þessu tagi hafa gert.

Ef nánari upplýsinga er óskað þá vinsamlega hafið samband við starfsfólk Rannsókna & greiningar með tölvupósti rannsoknir@rannsoknir.is eða í síma 599 6431.

Með vinsemd og virðingu
Starfsfólk Rannsókna & greiningar