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**The association between cannabis use, anxiety and depression in
Norwegian adolescents**

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Preface

My interest for substance use and mental health was one of the main reasons for writing this thesis. Through my job at a rehabilitation center for drug related problems I got to see and learn the interaction between mental health and drugs. This experience made my curiosity for this topic to develop, and I therefore contacted Rolf W. Gråwe at the Clinic of Substance Use and Addiction Medicine in Trondheim to explore research opportunities. We had many interesting talks, and I would like to thank him for the encouragement for writing this thesis. I would also like to thank my principal supervisor Roger Hagen for his help with structure and his many good advices during this project. Finally, I want to thank NOVA for allowing me to use the data from the national survey “Ungdata”.

Abstract

Cannabis is one of the most commonly used substances across different age groups. Comorbidity between anxiety, depressive episodes and substance use is furthermore common. The aim of the study was to explore the use of cannabis among Norwegian adolescents, and examine the association between self-reported symptoms of anxiety and depression and the use of cannabis. The sample consisted of 36,715 Norwegian adolescents at the age of 13 to 17. Cannabis use was found to be more prevalent among the older grades and the use increases with age. The results show that cannabis users report significantly more symptoms of anxiety and depression compared to non-users. The difference between users and non-users, is further emphasized in the findings that there were no significant difference on the anxiety and depression scores for those who had tried the drug once compared to six or more times. More longitudinal studies are needed to get a better understanding of the causality of cannabis use and mental health.

Keywords: cannabis, depression, anxiety, adolescents

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Introduction

Adolescence is a transitional period characterized by changes in cognitive, social and psychological functioning (Petersen & Spiga, 1982; Seiffge-Krenke, 1995). There is also in this period an increasing incidence of psychiatric disorders, including anxiety and mood disorders, psychosis, eating disorders and substance use (Paus, Keshavan, & Giedd, 2008). One in every three to four adolescents experience a mental health disorder (Merikangas, et al., 2010). In Norway it is estimated that 8 % of children and adolescents meets the criteria for a mental health disorder (Helsedirektoratet, 2015). Results from epidemiologic studies shows that anxiety disorders are the most common mental health disorders among American adolescents, followed by behavior disorders, mood disorders and substance use disorders (Merikangas, et al., 2010). Anxiety disorders, depressive episodes and behavior disorders are the most prevalent conditions for adolescents in Norway (Helsedirektoratet, 2015).

Experimentation and exploration is typical characteristics for the adolescence (Klein & Wilson, 2002). Behavior and attitudes adopted during this period is often continued into adulthood (Klein & Wilson, 2002). According to Chambers, Taylor & Potenza (2003) adolescence is a critical period that has a greater vulnerability for developing addiction. Impulsivity, addiction and motivational circuits are associated with neurodevelopmental changes prominent during the adolescence. More specifically, the maturational changes in frontal cortical and subcortical monoaminergic systems are thought to grant greater vulnerability to the addictive actions of drugs (Chambers et al., 2003). A study by Helzer, Burnam, & McEvoy (1991) found that over 40 % of alcohol dependent adults had experienced their symptoms of addiction already between the ages 15 and 19. Moreover, results from Young et al., (2002) demonstrate a regular use of alcohol among adolescents, as more than 50 % of the adolescents reported having been drunk at least once in their lifetime.

In most countries, cannabis or marijuana is one of the most commonly used substance across different age groups (Moore, et al., 2007), and is used about five times that of other substances (EMCDDA, 2015). It is estimated that 11, 7% of young Europeans (age group 15-34) used cannabis in last year. Whereas countries like Germany, United Kingdom and Spain reports a stable or decreasing use of cannabis in the youth population, the Nordic countries (Sweden, Norway, Denmark, Finland) reports an increase in the use of cannabis in the last decade (EMCDDA, 2015). In 2014 it was reported that 10.2 % of Norwegians in the age 16-30 had used cannabis during the last year (SIRUS, 2015). According to EMCDDA (2015) there has been an increase in the number of people entering treatment for problems

with cannabis, and it is the most frequently reported reason for entering drug treatment by first-time clients in Europe.

Over the last 30 years the association between mental health disorders and substance use has gained increased interest (Lai, Cleary, Sitharthan & Hunt, 2015). According to Schukit (2006) there are different subgroups of comorbid substance use disorders and psychiatric disorders, which can occur either concurrently or successively (Hall, Degenhardt & Teesson, 2009). Concurrent comorbidity is when two or more disorders are present at the same time, whereas successively comorbidity occurs when disorders occur in different times in the individuals' life (Hall et al., 2009). Results from epidemiological studies shows that comorbidity between anxiety, depressive episodes and substance use is very common (Merikangas & Kalaydjian, 2007). However, since anxiety disorders, depressive episodes and substance use all typically have their onset in late adolescence, the issue of cause and effect is often challenging (Kessler & Wang, 2008).

Cannabis use and symptoms of anxiety

The association between anxiety and use of cannabis has been widely examined. Relaxation and relief from tension, mood and sensory alteration is reported to be the most common effects and reasons for using this drug (Green, Kavanagh & Young, 2003). Of negative mental health effects paranoia (6-15 %), depression (1-10%), hallucinations (2-14%) and anxiety (2-15 %) were respectively reported as the most common negative effects related to the use of cannabis (Green et al., 2003).

Results from meta-analysis drawn from the general population of ten countries shows small, but positively associations between anxiety disorders and cannabis use or cannabis use disorders in different cohorts (Kedzior & Laeber, 2014). The main finding of the study was that cohorts with anxiety disorder are more likely to use cannabis (OR=1.24, 95% CI: 1.06-1.45), or to have a cannabis use disorder (OR=1.68, 95% CI: 1.23-2.31). Moreover, cohorts with concurrent anxiety and depression were also more likely to use cannabis (OR=1.68, 95% CI: 1.17-2.40). These associations were observed even after controlling for confounding factors. Furthermore, prospective analysis indicated that cannabis use at baseline was positively associated with anxiety problems at follow-up (Kedzior & Laeber, 2014).

The evidence of an association between cannabis use and anxiety are strongest when cannabis use begins during adolescence as compared to a later starting point (Degenhardt et al., 2012). A study by Degenhardt et al., (2012) exploring the association between adolescent

cannabis use and anxiety symptoms at age 29 found that especially early regular cannabis use increased the risk of developing an anxiety disorder at age 29 compared to non-users. The risk increased slightly more if the individual continued to use the drug at age 29. A review by Crippa et al., (2009) demonstrates further the evidence of an association between cannabis use and anxiety. They found that frequent cannabis users had a higher prevalence of anxiety disorders, and that patients with anxiety disorders had relatively high rates of cannabis use.

Furthermore, the effects of cannabis have proven to give different outcomes in individuals, for example relaxation/euphoria versus anxiety/dysphoria (Leweke & Koethe, 2008). Crippa et al., (2009) reported that acute and short-lasting episodes of anxiety could be experienced by those who are not habitual users, whereas long-term users typically report that cannabis use is associated with a reduction in anxiety (Crippa et al., 2009). Other influencing factors on the effects of cannabis are personality traits, dose, degree of tolerance and time frame (Leweke & Koethe, 2008). Furthermore, episodes of anxiety, panic attacks and psychotic phenomena occur more often in inexperienced users or in high dosages (McDowell, 2005; Quickfall & Crockford, 2006). The causal relationship is still not established, and more research is needed to fully understand the direction of causality between cannabis and anxiety symptoms (Kedizor & Laeber, 2014).

Cannabis use and symptoms of depression

Longitudinal studies that have explored the association between cannabis use and depression have provided mixed results. Meta-analysis by Lev-Ran et al., (2014) found a modest association, as the odds-ratio for developing depression for cannabis users compared to controls was 1.17 (95% CI=1.05-1.30). However, the odds-ratio increased for the heavy users (OR=1.62, 95% CI=1.21-2.16) when compared to non-users or light users (Lev-Ran et al., 2014). In addition, a review by Degenhardt, Hall & Lynskey (2003) found a modest association between heavy cannabis use and depression, and no evidence for association between depression and infrequent cannabis use. Moreover, the authors found little evidence for developing greater risk of cannabis use for the individuals with baseline depression.

Bavasso (2001) found that participants with a diagnosis of cannabis abuse and no depressive symptoms at baseline were four times more likely than those with no use of cannabis to have depressive symptoms 14-16 years later. Nevertheless, depressive symptoms at baseline but no cannabis abuse diagnosis did not predict later abuse of cannabis. A study by Horwood et al., 2012 found a modest increase in depressive symptoms associated with

more frequent use. They also found that this association was stronger in adolescence and then declined into adulthood (Horwood et al., 2012). Moreover, a recent meta-analysis found supporting evidence of a small but significant association between cannabis use in adolescence and higher level of depression (Cairns, Yap, Pilkington & Jorm, 2014). Finally, a longitudinal study by Feingold, Weiser, Rehm & Lev-Ran (2015) found that the risk of developing Major Depressive Disorder (MDD) was not higher among cannabis users compared with non-users. The study also revealed that individuals with MDD had higher risk of initiating cannabis use (Feingold et al., 2015). However, more prospective studies are needed to help understand the comorbidity between depression and cannabis use (Horwood et al., 2012).

To sum up briefly, research indicates that one could expect to find a small positive association between the adolescent's use of cannabis and reported symptoms of anxiety. When it comes to the associations between depression and cannabis use, research indicates that heavy use of cannabis is necessary to develop depressive symptoms. Further research is needed to fully understand the causal direction of cannabis use and symptoms of anxiety and depression.

Less is known about the association between cannabis and symptoms of anxiety and depression among Norwegian adolescents and findings are mixed. Pedersen (2008) found no association between use of cannabis and depression among Norwegian adolescents. However, a prospective follow up study of 2 399 Norwegians adolescents found that attention problems, anxiety and depressive symptoms and bodily pain in early adolescence might increase the risk for later substance use (Strandheim, Brathberg, Holmen, Coombes & Bentzen, 2011).

Aims of this study

The increase among Norwegian adolescents in the use of cannabis raise the question if this is damaging for their mental health. The aims of this study are to explore the use of cannabis among Norwegian adolescents, and examine the association between self-reported symptoms of anxiety and depression and the use of cannabis.

Method

Design and sample

Data for the present study is gathered from the national survey “Ungdata”, which have been conducted by NOVA, in cooperation with the Regional Drug and Alcohol Competence Centers in Norway. The Norwegian Directorate of Health, Ministry of Children, Equality and Social Inclusion, and the Ministry of Justice and Public Security has financed Ungdata. This survey is an internet-based and anonymous questionnaire, and is administered to a nationally representative cross-sectional of adolescents in junior high school and senior high school. The participants completed the questionnaire during school hours, and the use of time to fill out the questionnaire was estimated to one hour. The survey was conducted in 2014 in 86 municipalities in Norway. In lower secondary school the response rate was 85 % and in upper secondary school the response rate was 68%. Participants in the group of 12th and 13th grade were excluded due to a low number of participants. Thus, the sample consisted of 36, 715 Norwegian adolescents of the ages 13 to 17 (see table 1 for further details).

Table 1 here

Measures

The questionnaire consists of a broad range of questions concerning the adolescents’ life. The following topics were assessed in the questionnaire; parents and friends (social network, relationship between the parents and child), spare time (hobbies and organizational sports), mental health (symptoms of depression, anxiety, self-worth, self-harm), school and future beliefs (grades, satisfaction in school, future academic dreams), substance use (cigarettes, alcohol and marijuana) and risk behavior (gambling, violence, traffic offences). Of interest for the present study the following measures were used:

Cannabis use

Cannabis use was assessed based on the question “Have you ever used hash/marihuana/cannabis?” The response categories were “No” (1), “Yes, once” (2), “Yes, 2-5 times” (3), “Yes, 6 or more times” (4).

Symptoms of anxiety

Symptoms of anxiety were measured using six items from Hopkins Symptom Checklist (HSCL) (Derogatis, 1982; Derogatis, Lipman, Rickels, Uhlenhuth & Covi, 1974). HSCL is a self-report inventory that measures symptomatology of somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic-anxiety, psychoticism, paranoid ideation and sleep difficulty (Derogatis, 1982; Derogatis, Lipman, Rickels, Uhlenhuth & Covi, 1974). The six items should address how the subject felt during the previous week, e.g. “Suddenly felt scared for no reason”, “Feeling tense or keyed up” with response categories ranging from not bothered at all (1) to very bothered (4). HSCL are proven to be valid instruments (Strand, Dalgard, Tambs & Rognerud, 2003). In this study the six items was added together in a total score that ranged from 6 to 24.

Symptoms of depression

Symptoms of depression were measured in Ungdata by using eight items. Of the eight items, three of the items were taken from the Hopkins Symptom Checklist (HSCL). Furthermore, three items were taken from the Depressive Mood Inventory (Kandel & Davies, 1982; Kandel, Raveis & Davies, 1991). Ungdata also developed additionally two items concerning feeling tense or feeling angry. The eight items in total should address how the adolescent have felt during the previous week, in a response rate ranging from “not been affected at all”(1) and “been affected a great deal”(4). Both the HSCL and Depressive Mood Inventory are proven to be valid instruments (Strand, Dalgard, Tambs & Rognerud, 2003). In this study the eight items was added together in a total score that ranged from 8 to 32.

Results

Descriptive analyses shows that cannabis use among Norwegian adolescents is more prevalent among the older grades than the younger grades, and that the use increases with age. In 8th grade 99 % reported that they never had tried cannabis ($n=6116$) and 0.2% ($n=14$) reported having used cannabis six or more times. In comparison, in 11th grade 84.6% ($n=3680$) reported they had never tried cannabis, and 4.9 % ($n=215$). See table 2 for further details.

Table 2 here

There seem to be slightly more males ($n=268$) who report having used cannabis once compared to females ($n=220$). The gender difference increases with the frequency of use, as indicated by the number of males ($n=232$) who report having tried cannabis six or more times compared with the number of females ($n=115$). See table 3 for further details.

Table 3 here

Results also indicate that non-users ($M=8.88$, $SD=3.71$) report less symptoms of anxiety compared with the group that reports having tried cannabis 6 or more times ($M=10.16$, $SD=4.70$). See table 4 for further details.

Table 4 here

For the depression score, the results also indicate that non-users ($M=14.84$, $SD=5.70$) report less symptoms of depression compared with the group that reports having tried cannabis 6 or more times ($M=18.70$, $SD=6.68$). See table 5 for further details.

Table 5 here

In order to compare the groups, the items of anxiety and depression were as described earlier in this section merged into one total score for anxiety and one total score for depression. Cannabis use was divided into two groups of cannabis users and non-users. An independent-samples t-test was conducted to compare cannabis use with anxiety and depression scores. There was a significant difference in the scores for cannabis users ($M=10.21$, $SD=4.72$) and non-users ($M= 8.87$, $SD= 3.70$) in anxiety scores; $t(1224,58) = -9,422$, $p= .000$, two tailed). Results also show a significant difference in scores for cannabis users ($M=18.20$, $SD=6.43$) and non-users ($M= 14.84$, $SD= 5,69$) in depression scores; $t(1234,24) = -17,25$, $p = .000$, two-tailed).

A one-way ANOVA was conducted to compare the effects of frequency, defined here as how many times the individual has tried cannabis, on symptoms of anxiety. Frequency is grouped into four conditions “Never tried”, “Tried once”, “Tried 2-5 times” and “Tried 6 or more times”. An analysis of variance showed that the effect on frequency was significant, $F(3, 22052) = 47,47, p = .000$. Post hoc comparisons using Bonferroni corrections indicated that the mean score for “Never tried” condition ($M=8.88, SD=3.71$) was significantly different than “Tried once” condition ($M=10.00, SD=4.50$), “Tried 2-5 times” condition ($M=10.58, SD=5.04$), and “Tried 6 or more times” condition ($M=10.16, SD=4.70$). However, the “Tried 2-5 times” did not significantly differ from the “Tried once” condition and “Tried 6 or more times” condition. These results indicate that the difference of having tried cannabis or not is more important for symptoms of anxiety, than how many times the individual has tried cannabis.

Similar results were found by doing the same analysis to compare the effects of frequency on symptoms of depression. An analysis of variance showed that the effect on frequency was significant, $F(3, 21883) = 125,03, p = .000$. Post hoc comparisons using Bonferroni corrections indicated that the mean score for “Never tried” condition ($M=14.84, SD=5.70$) was significantly different than the “Tried once” condition ($M=17.85, SD=6.16$), “Tried 2-5 times” condition ($M=18.24, SD=6.57$), and “Tried 6 or more times” ($M=18.70, SD=6.68$). The “Tried 2-5 times” did not significantly differ from the “Tried once” condition and “Tried 6 or more times” condition. These results indicate that the difference of having tried cannabis or not has more impact for symptoms of depression, than how many times the individual has tried cannabis.

Discussion

The most prominent finding in this study was that the adolescents who reported having used cannabis also reported more symptoms of depression and anxiety compared with non-users. The difference between use and non-use, is further emphasized in the findings that there were no significant difference on the anxiety and depression scores for those who had tried the drug once compared to six or more times. The results also show that cannabis use among Norwegian adolescents is more prevalent among the older grades than the younger grades, and that the use increases with age. Females report slightly less use of cannabis compared to males. This is consistent with other research that shows small gender differences in cannabis use.

Frequency of cannabis use on anxiety and depression scores

The finding that cannabis users report more symptoms of anxiety and depression is consistent with previous research showing there is a significant association between the use of cannabis and anxiety symptoms (Crippa et al., 2009; Degenhardt et al., 2012; Kedzior & Laeber, 2014), and the use of cannabis and depressive symptoms (Bavasso, 2001; Horwood et al., 2012; Lev-Ran et al., 2014).

The results that there was no difference in the group that have used cannabis once compared to several times on their anxiety and depression score is not consistent with previous research. For instance, a review by Degenhardt, Hall & Lynskey (2003) found an association between depression and heavy use of cannabis, and no evidence for an association with infrequent use. An interpretation of the results in the present study might be that the frequency of cannabis use in this sample did not make a difference related to anxiety and depression scores. Although the study has some methodological limitations, the results highlight that there is a difference in the users compared to non-users, and that cannabis use has an impact on their mental health, and not frequency of cannabis use per se.

On the other hand, the link between depression, anxiety and cannabis use can also be explained by other additional factors not examined in this study. It might be that cannabis use alone not necessary increase the risk for developing anxiety or depression, but might be explained by other additional factors. For instance, the comorbidity between cannabis dependence and mental health disorders might arise from a shared common cause, like a genetic predisposition, or family environment (Hall, Degenhardt & Teesson, 2009). Moreover, the prevalence of depression increases notably after puberty (Thapar, Collishaw,

Pine & Thapar, 2012), hence the association between cannabis use and e.g. depression can simply reflect a co-occurring incidence. Alcohol and poor school performance might furthermore be factors that influence both the use of cannabis and mental health. This study however has only investigated cannabis use and its association with anxiety and depression. It would therefore be of great interest to explore how different risk factors might interact with the use of cannabis. This would possibly help us to get a better understanding for why some adolescents develop problems when using cannabis and some not.

Self-medication hypothesis

This study does not provide information about the directionality of the association between cannabis use and anxiety and depressive symptoms. However, one might speculate if the results could provide support for the self-medication hypothesis. The self-medication hypothesis holds that the individual attempt to relieve painful feelings or symptoms of mental health disorder by using specific drugs aimed at the specific symptoms the individual experience (e.g. cocaine for mood alteration) (Khantzian, 1985; Lembke, 2012).

It is unlikely that a one-time use of cannabis would increase the prevalence of anxiety and depression symptoms. Although anxiety and depression symptoms is reported as acute negative health effects of cannabis use, higher frequency is needed to produce long lasting symptoms (Crippa et al., 2009). The self-medication hypothesis has been widely discussed, and research shows mixed results. Degenhardt, Hall & Lynskey (2003) found little evidence for developing greater risk of cannabis use for the individuals with baseline depression.

Nevertheless, Agosti, Nunes & Levin (2002) argue that cannabis could work as self-medication for some individuals, as most of the individuals in their study already had developed anxiety disorders prior to the first symptoms of cannabis dependence. Indeed, Feingold et al., (2015) found even after controlling for substance use disorders, socio-demographics and other psychiatric disorders, an increased risk for initiating cannabis use for individuals with Major Depressive Disorder. Looking at the most reported reasons for using cannabis; individuals report relaxation and mood alteration as the most commonly reasons for using the drug. Although this does not implicate that all individuals who uses cannabis have symptoms of depression or anxiety, it does give a rationale why individuals who might experience more severe symptoms of anxiety or depression find the drug useful for relieving symptoms.

The use of cannabis as medication for mental health problems was observed in a qualitative study of Norwegian cannabis users (Pedersen, 2015). More specifically, self-diagnosed ADHD was the most prevalent disorder reported as medical reason for using cannabis. The individuals reported having problem with “tension”, “problems with concentration” and “restlessness”. The use of cannabis was seen as a solution to their problems, as they felt more focused and not felt as tense as they would without the use (Pedersen, 2015). In this way, one might find support for the self-medication hypothesis.

However, Pedersen (2015) also highlight the issue with the high comorbidity of individuals with ADHD with anxiety and mood disorders. Many of the individuals in the study had furthermore never gotten their diagnosis confirmed by professionals, which makes the association between ADHD and cannabis more challenging. The individuals themselves however, saw their use of cannabis as medicine for their problems.

Pedersen (2015) also found that those who perceive themselves as users due to medical reasons were not that interested in the effects of euphoria/intoxication of the drug, but the release of their symptoms. This may implicate that we are talking about different groups of cannabis users, which might have implications for research done on the topic. It may be necessary to distinguish those two groups when looking for association of cannabis use and mental health problems such as anxiety and depression.

Finally, one might speculate if the social context around the adolescent has an indirect influence on the development of anxiety and depression. Many adolescents choose their friends based on their opinion about cannabis use (de la Haye, Green, Kennedy, Pollard & Tucker, 2013), and the regular users often end up in marginalized groups (Pedersen, 2009), and are often involved in small-scale dealing (Hammersvik, Sandberg & Pedersen, 2012). In Norway where cannabis is illegal one might further speculate if the young cannabis users might end up in more criminal, marginalized groups, or gets excluded by the social group, and therefore have higher probabilities of developing mental health problems indirectly as a consequence of cannabis use.

To sum up, this study supports the findings that the adolescents who use cannabis report more symptoms of both depression and anxiety compared to non-users, but the explanation for why this is remains unclear. To get a better understanding on the issue with cannabis and its effects on mental health, more longitudinal studies are therefore needed.

Strengths and limitations

The strength of this study is the large sample size, which gives us a good estimate of the current status on Norwegian adolescents use of cannabis and its relation to mental health problems.

This study has several limitations. The main limitation is the cross-sectional design, which makes the present study unable to determine any inference about causality between cannabis use and anxiety and depression in adolescents. The use of self-report might furthermore lead to both under- and over-estimates. For instance, since cannabis is illegal in Norway, one might speculate if this affects the adolescents' answers due to social desirability. The present study did not control for socioeconomic factors, which possibly would have weakened the association found between cannabis use, anxiety and depression. Another limitation is that the question regarding cannabis was in the supplementary module, which might have accounted for the high missing answers on this item.

The response rate in upper secondary school (68%) was lower than in lower secondary school (85%), which might have influenced the estimated prevalence rate of cannabis use, anxiety and depressive symptoms and hence the association between the items. Non-responders have been found to have a lower socioeconomic status (Harald, Salomaa, Jousilahti, Koskinen, & Vartianinen, 2007) and less favorable relations with peers (Gerrits, Voogt & van den Oord, 2001). Hence, it could be that an important proportion of adolescents were not included in the study. However, the response rate for both lower and upper secondary school is regarded as high, and the study should therefore be able to give a quite accurate estimate of the Norwegian adolescents use of cannabis and anxiety and depressive symptoms.

The final limitation concerns the questionnaires used in the survey. The response categories used in the measurement of cannabis were limited to how many times the adolescent have tried cannabis in his or her life. More specificity on the measurement of cannabis use, e.g. how many times a month, dose, and for how long the adolescent have used the drug would have allowed the study to examine more throughout the association of cannabis use with anxiety and depression. Another limitation is that the measurement of depression was based on eight items, whereas the assessment of anxiety symptoms was based on six items. Moreover, the two items meant to assess depression symptoms was not taken from any valid questionnaire, but developed by Ungdata. Those two items related to depressive symptoms asked if the adolescent have felt angry or tense during the previous week. Answering yes on those items will lead to a higher score on the depression scale,

without necessarily reflecting that the adolescent has felt depressed. Moreover, there is also a limitation regarding the time-aspect on the measurement of cannabis and anxiety and depression symptoms. The questions on anxiety and depression were all based on how many times the adolescent have felt a certain way during the last week. The cannabis question were on the other hand based on how many times the adolescent have used it ever in his/her life. The adolescent may report having used cannabis, for instance two years ago, and now reporting symptoms of depression without this necessarily having an association with the use of cannabis.

Conclusion and further directions

The high prevalence of cannabis use among Norwegian adolescents and its association to anxiety and depression was demonstrated in the present study. Most research done on cannabis use and mental health factors has a cross-sectional design; so longitudinal studies are therefore preferred in future research on this topic. Moreover, there is an inconsistency in terminology and in how to measure dose/frequency of cannabis use. For instance, frequency is defined by some as the number of times the individual has tried cannabis, whereas other define it in terms of dose. At the same time, some studies exclude users that do not meet the criteria for cannabis dependence, whereas others measure frequency of use when examining effects of cannabis. The same inconsistency is prevalent in the measurement for anxiety and depression, where one can find difference in measurement of symptoms versus diagnosis. Therefore, there is a need to apply more standardized measurement of cannabis use, anxiety and depression. To get a better understanding of cannabis use and its influence on mental health, more longitudinal studies are needed and the context around the individual and other influencing factors needs to be examined. The use of standardized measurements across different countries would furthermore increase our knowledge of cannabis and its effect on mental health.

Clinical implications

The present study contributes to the existing knowledge about an association between cannabis use and symptoms of anxiety and depression in adolescents. This knowledge could be useful for health care practitioners who work with youth, as it emphasize the relatively prevalent use of cannabis for youth down to the age of 13. Thus, for clinicians it is important to ask if the adolescent are using drugs, as a more integrated treatment might be necessary.

References

- Agosti, V., Nunes, E., & Levin, F. (2002). Rates of psychiatric comorbidity among U.S. residents with lifetime cannabis dependence. *The American Journal of Drug and Alcohol Abuse*, 28(4), 643-652. doi: 10.1081/ADA-120015873
- Bovasso, G.B. (2001). Cannabis Abuse as a Risk Factor for Depressive Symptoms. *The American Journal of Psychiatry*, 158(12), 2033-2037.
- Cairns, K.E., Yap, M.B.H., Pilkington, P.D., & Jorm, A.F. (2014). Risk and protective factors for depression that adolescents can modify: A systematic review and meta-analysis of longitudinal studies. *Journal of Affective Disorders*, 169, 61-75. doi:10.1016/j.jad.2014.08.006
- Chambers, A. R., Taylor, J. R., & Potenza, M. N. (2003). Developmental Neurocircuitry of Motivation in Adolescence: A Critical Period of Addiction Vulnerability. *The American Journal of Psychiatry*, 160(6), 1041-1052.
- Chen, C-Y., Storr, C.L., & Anthony, J.C. (2009). Early-Onset drug use and risk for drug dependence problems. *Addictive Behaviors*, 34(3), 319-322. doi:10.1016/j.addbeh.2008.10.021
- Copeland, J., Rooke, S., & Swift, W. (2013). Changes in cannabis use among young people: impact on mental health. *Current Opinion in Psychiatry*, 26(4), 325-329. doi:10.1097/YCO.0b013e328361eae5
- Crippa, J.A., Zuardi, A.W., Martín-Santos, R., Bhattacharyya, S., Atakan, Z., McGuire P., & Fusar-Poli, P. (2009). Cannabis and anxiety: a critical review of the evidence. *Human Psychopharmacology: Clinical and Experimental*, 24(7), 515-523. doi: 10.1002/hup.1048
- Degenhardt, L., Coffey, C., Romaniuk, H., Swift, W., Carlin, J.B., Hall, W.D., & Patton, G.C. (2012). The persistence of the association between adolescent cannabis use and common mental health disorders into young adulthood. *Addiction*, 108, 124-133.
- Degenhardt, L., Hall, W., & Lynskey, M. (2003). Exploring the association between cannabis use and depression. *Addiction*, 98, 1493-1504. doi: 10.1046/j.1360-0443.2003.00437.x

- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behavioral Science, 19*, 1-15. doi: 10.1002/bs.3830190102
- European Monitoring Centre for Drugs and Drug Addiction. (2015). European Drug Report-Trends and Development. Retrieved from:
<http://www.emcdda.europa.eu/publications/edr/trends-developments/2015>
- Feingold, D., Weiser, M., Rehm, J., & Lev-Ran, S. (2015). The association between cannabis use and mood disorders: A longitudinal study. *Journal of Affective Disorders, 172*, 211-218. doi:10.1016/j.jad.2014.10.006
- Gerrits, M.H., Voogt, R., & van den Oord, E.J. (2001). An Evaluation of Nonresponse Bias in Peer, Self, and Teacher Ratings of Children's Psychosocial Adjustment. *Journal of Child Psychology and Psychiatry, 42*(05), 593-602.
- Green, B., Kavanagh, D., & Young, R. (2003). Being stoned: a review of self-reported cannabis effects. *Drug and Alcohol Review, 22*(4), 453-460.
- Hall, W., Degenhardt, L., & Teesson, M. (2009). Understanding comorbidity between substance use, anxiety and affective disorders: Broadening the research base. *Addictive Behaviors, 34*, 526-530. doi:10.1016/j.addbeh.2009.03.010
- Hammersvik, E., Sandberg, S., & Pedersen, W. (2012). Why small-scale cannabis growers stay small: Five mechanisms that prevent small-scale growers from going large scale. *International Journal of Drug Policy, 23*, 458-464.
- Harald, K., Salomaa, V., Jousilahti, P., Koskinen, S., & Vartianinen, E. (2007). Non-participation and mortality in different socioeconomic groups: the FINRISK population surveys in 1972-92. *Journal of Epidemiology & Community Health, 61*, 449-454.
- de la Haye, K., Green, H. D., Kennedy, D. P., Pollard, M. S. and Tucker, J. S. (2013). Selection and Influence Mechanisms Associated With Marijuana Initiation and Use in Adolescent Friendship Networks. *Journal of Research on Adolescence, 23*, 474-486. doi: 10.1111/jora.12018

- Helsedirektoratet. (2015). Internasjonalt perspektiv på psykisk helse og helsetjenester til mennesker med psykiske lidelser. Hentet fra:
<https://helsedirektoratet.no/publikasjoner/internasjonalt-perspektiv-pa-psykisk-helse-og-helsetjenester-til-mennesker-med-psykiske-lidelser>
- Helzer, J. E., Burnam, M. A., & McEvoy, L. T. (1991). *Alcohol abuse and dependence, in Psychiatric Disorders in America: The epidemiologic Catchment Area Study*. New York: Free Press.
- Horwood, L.J., Fergusson, D.M., Coffey, C., Patton, G.C., Tait, R., Smart, ... Hutchinson, D.M. (2012). Cannabis and depression: An integrative data analysis of four Australasian cohorts. *Drug and Alcohol Dependence, 126*, 369-378.
- Kandel, D.B., Raveis, V.H., & Davies, M. (1991). Suicidal Ideation in Adolescence: Depression, Substance Use, and Other Risk Factors. *Journal of Youth and Adolescence, 20*, 290-309.
- Kessler, R.C., & Wang, P.S. (2008). The Descriptive Epidemiology of Commonly Occurring Mental Disorders in the United States. *Annual Review of Public Health, 29*, 115-29.
- Klein, J., & Wilson, K. (2002). Delivering quality care: adolescents' discussion of health risks with their providers. *Journal of Adolescent Health, 30*(3), 190–195.
- Lai, H.M.X., Cleary, M., Sitharthan, T., & Hunt, G.E. (2015). Prevalence of comorbid substance use, anxiety and mood disorders in epidemiological surveys, 1990–2014: A systematic review and meta-analysis. *Drug and Alcohol Dependence, 154*, 1-13.
- Lembke, A. (2012). Time to Abandon the Self-Medication Hypothesis in Patients with Psychiatric Disorders. *The American Journal of Drug and Alcohol Abuse, 38*(6), 524-529. doi:10.3109/00952990.2012.694532
- Lev-Ran, S., Roerecke, M., Le Foll, B., George, T., McKenzie, K., & Rehm, J. (2014). The association between cannabis use and depression: a systematic review and meta-analysis of longitudinal studies. *Psychological Medicine, 44*(04), 797-810.
- Leweke, F.M., & Koethe, D. (2008). Cannabis and psychiatric disorders: it is not only addiction. *Addiction Biology, 13*, 264-275. doi:10.1111/j.1369-1600.2008.00106.x

- Merikangas, K. R., He, J.-P., Burstein, M., Swanson, S., Avenevoli, S., Cui, L.,... Swendsen, J. (2010). Lifetime Prevalence of Mental Disorders in U.S. Adolescents: Results from the National Comorbidity Survey Replication– Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry*, 49(10), 980–989. doi:10.1016/j.jaac.2010.05.017
- Merikangas K. R., & Kalaydjian, A. (2007). Magnitude and impact of comorbidity of mental disorders from epidemiologic surveys. *Current Opinion in Psychiatry*, 20(4), 353-358. doi: 10.1097/YCO.0b013e3281c61dc5
- Moore, T. H. M., Zammit, S., Lingford-Hughes, A., Barnes, T. R. E., Jones, P. B., Burke, M., & Lewis, G. (2007). Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *The Lancet*, 370, 319-28.
- Paus, T., Keshavan, M., & Giedd, J. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience*, 9, 947-957.
- Pedersen, W. (2008). Does cannabis use lead to depression and suicidal behaviours? A population-based longitudinal study. *Acta Psychiatrica Scandinavica*, 118(5), 395-403. doi:10.1111/j.1600-0447.2008.01259.x
- Pedersen, W. (2009). Cannabis Use: Subcultural Opposition or Social Marginality?. *Acta Sociologica*, 52(2), 135–148. doi:10.1177/0001699309104001
- Pedersen, W. (2015). From badness to illness: Medical cannabis and self-diagnosed attention deficit hyperactivity disorder. *Addiction Research & Theory*, 23(3), 177-186. doi: 10.3109/16066359.2014.954556
- Quickfall, M.D., & Crockford, D. (2006). Brain Neuroimaging in Cannabis Use: A Review. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 18, 318-332.
- Seiffe-Krenke, I. (1995). *Stress, coping, and relationships in adolescence*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc., Publishers.
- SIRUS. (2015). Bruk av illegale rusmidler: Resultater fra befolkningsundersøkelser 2012-2014. Hentet fra: <http://www.sirus.no/publikasjon/rapporter/2015-2/bruk-av-illegale-rusmidler/>

- Strandheim, A., Bratberg, G.H., Holmen, T.L., Coombes, L., & Bentzen, N. (2011). The influence of behavioural and health problems on alcohol and drug use in late adolescence - a follow up study of 2 399 young Norwegians. *Child and Adolescent Psychiatry and Mental Health*, 5(1), 17. doi:10.1186/1753-2000-5-17
- Thapar, A., Collishaw, S., Pine, D.S., & Thapar, A.K. (2012). Depression in adolescence. *The Lancet*, 379(9820), 1056-1067. doi: 10.1016/S0140-6736(11)60871-4
- Wichstrøm, L. (1995). Harters Self-Perception Profile for Adolescents – Reliability, Validity, and Evaluation of the Question Format. *Journal of Personality Assessment*, 65(1), 100-116. doi: 10.1207/s15327752jpa6501_8

Tables

Table 1

Characteristics of the sample

Educational level		Gender		Total
		Male	Female	
Lower secondary school	8 th grade	5165	5102	10267
	9 th grade	5183	4998	10181
	10 th grade	4834	4777	9611
Upper secondary school	VG1*	3448	3207	6655
Total		18630	18084	36714

Note. * =11th grade in the Norwegian school system

Table 2

Prevalence of cannabis use

		“Have you ever tried marijuana?”				
		Never tried	Yes, 1 time	Yes, 2-5 times	Yes, 6 or more times	Total
Grade	8th grade	6116 (99 %)	29 (0.5%)	17 (0.3%)	14 (0.2%)	6176 100%
	9th grade	6042 (97,5 %)	76 (1,2%)	46 (0,7%)	30 (0,5%)	6194 (100%)
	10th grade	5449 (94,6%)	135 (2,3%)	89 (1,5%)	86 (1,5%)	5759 (100%)
	VG1*	3680 (84,6%)	250 (5,7%)	204 (4,7%)	215 (4,9%)	4349 100%
Total		21287 (94,7%)	490 (2,2%)	356 (1,6%)	345 (1,5%)	22478 (100%)

Note. * =11th grade in the Norwegian school system

Table 3

Gender distribution in cannabis use

“Have you ever tried marijuana?”	Gender		Total
	Male	Female	
Never tried	10486	10950	21436
Yes, 1 time	268	220	488
Yes, 2-5 times	206	150	356
Yes, 6 or more times	232	115	347
Total	11192	11435	22627

Table 4

Anxiety symptoms in cannabis users and non-users

	Cannabis frequency	Mean	Std. Deviation
Anxiety	Never tried	8.88	3.71
	Yes, once	10.00	4.50
	Yes, 2-5 times	10.58	5.04
	Yes, 6 or more times	10.16	4.70
Total		8.95	3.78

Table 5

Depression symptoms in cannabis users and non-users

	Cannabis frequency	Mean	Std. Deviation
Depression	Never tried	14.84	5.70
	Yes, once	17.85	6.16
	Yes, 2-5 times	18.24	6.57
	Yes, 6 or more times	18.70	6.68
Total		15.02	5.79