



Utrecht University

MSc Youth Studies

Master's Thesis

“To what extent do self-control and peer cannabis use moderate the relationship between anxiety and cannabis use among adolescents?”

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Master program: Youth Studies 2019-2020

Wordcount: 4954

Date: June 15, 2020

Abstract

Aim: This study examined the association between anxiety and cannabis use among adolescents and investigated the moderating role of self-control and peer use. **Methods:** Data were used from three waves of the Tracking Adolescent Lives Survey. A total of 2229 participants ($M=11.09$; $SD=0.55$) were enrolled at (T1) and were followed until age 16 (T3; $N=1816$; $M=16.27$; $SD=0.73$). Anxiety was measured by the Revised Child and Depression Scale (T2). Self-control was measured via parental report of the Early Adolescent Temperament Questionnaire-Revised scale (T3). Peer use was measured by an adolescent's amount of cannabis smoking friends. Cannabis use was measured by the participant's experience with cannabis (T2-T3). **Results:** Logistic regression analyses showed no support for an association between anxiety and cannabis use (T2-T3). A significant risk factor for cannabis use was self-control, with poorer self-control at age 16 reported by the parent, increasing the likelihood of cannabis use at age 16. Peer use significantly strengthened the association between anxiety at age 14 and the likelihood of cannabis use at age 16. **Conclusions:** self-control affects an adolescent's risk of cannabis use. Adolescents with anxiety could be at risk for prospective cannabis particularly when affiliated friends use cannabis.

Keywords Adolescents, Cannabis use, Anxiety, Self-control, Peer affiliation

Abstract

In deze studie is de relatie tussen angstklachten en toekomstig cannabisgebruik onderzocht onder adolescenten. Tevens, is er gekeken in welke mate deze relatie wordt gemodereerd door zelfcontrole en het cannabisgebruik van leeftijdsgenoten. Deze studie heeft gebruik gemaakt van drie meetmoment van de Tracking Adolescent Lives Survey. Een totaal van 2229 deelnemers ($M=11.09$; $SD=0.55$) deden mee tijdens (T1), deelnemers zijn gevolgd tot een leeftijd van 16 (T3; $N=1816$; $M=16.27$; $SD=0.73$). Angstklachten zijn gemeten middels de Revised Child and Depression Scale (T2). Zelfcontrole is gemeten middels de ouderrapportage van de Early Adolescent Temperament Questionnaire-Revised (T3). Het cannabisgebruik van leeftijdsgenoten is gemeten middels het aantal vrienden van een deelnemer die cannabis gebruiken. Het cannabisgebruik van een deelnemer is gemeten op basis van persoonlijke ervaring met cannabisgebruik (T2-T3). Logistische regressie liet geen verband zien tussen angstklachten en cannabisgebruik (T2-T3). Een significante voorspeller voor cannabisgebruik was zelfcontrole. De adolescenten die relatief weinig zelfcontrole hadden vertoonden vaker cannabisgebruik. Het cannabisgebruik van vrienden versterkte de associatie tussen angstklachten bij 14-jarigen en het gebruik van cannabis bij 16-jarigen. Concluderend kan worden gesteld dat zelfcontrole een mogelijke invloed heeft op cannabisgebruik. Specifiek adolescenten met angstklachten die omringd worden door cannabis rokende leeftijdsgenoten lopen risico op toekomstig cannabisgebruik.

Keywords Adolescenten, Cannabisgebruik, Angstklachten, zelfcontrole, Peer-invloed

Introduction

In the Netherlands, the use of cannabis is most prevalent among 18-24-year-olds. Statistics show that 25% of these young adults smoked cannabis at least once in the last year (National drug monitor, 2018). Furthermore, eight percent of high school students between the age of 12-16 reported smoking cannabis at least once in the last year. The frequency and quantity of cannabis use was significantly higher among boys (National drug monitor, 2018). This gender difference seems to be consistent across studies (Malmberg et al., 2010; Guxensa, Nebot, Ariza, & Ochoa, 2007).

The use of cannabis during adolescence is not without consequences. Adolescent cannabis use has been linked to academic concerns like truancy and low school motivation/performance (Mazzone et al., 2007). Furthermore, adolescent cannabis use has been associated with feelings of hopelessness, aggressiveness, delinquency, and psychosocial problems such as cognitive impairment, anxiety, and depression (National drug monitor, 2018; Lubman, Cheetham & Yücel, 2015; Mazzone et al., 2007). In sum, cannabis use may have adverse effects on school performance and mental health (National drug monitor, 2018; Lubman, Cheetham & Yücel, 2015; Mazzone et al., 2007). Therefore, it is important to increase our knowledge on who is at risk, this information could be used in the field of drug prevention.

Role of anxiety in relation to cannabis use

Research has shown that the most common motives for cannabis use are coping, conformity, social, enhancement, and expansion of awareness (Fox, Towe, Stephens, Waler, Roffman, 2011). Coping motives are for instance common among adolescents who report feelings of anxiety (Crippa et al., 2009). The process of using drugs to alleviate anxiety symptoms is often referred to as self-medicating (Zehe, Colder, Read, Wiczorek & Lengua, 2013). Research has found that smoking cannabis in small quantities can have anxiolytic effects (Marco, Adriani, Llorente, Laviola, & Viveros, 2009). These anxiolytic effects could be one of the reasons why the use of cannabis is appealing to adolescents with anxiety. It can potentially relieve emotions and physical discomfort that is associated with anxiety (Crippa et al. 2009). However, using cannabis as a coping mechanism for anxiety is not without risks. Buckner, Mallott, Schmidt & Taylor (2006) argue that individuals with high levels of anxiety are more likely to use cannabis regularly to cope with stressful events or to deal with unfavorable emotions. This habitual cannabis coping mechanism could lead to more frequent or problematic patterns of cannabis use (Bonn-Miller, Zvolensky & Bernstein, 2007). As

people become more reliant on cannabis, they are risking the development of cannabis dependency and addiction (Buckner, Mallott, Schmidt & Taylor 2006). Therefore, it is important to discourage people and especially those with anxiety to cope with their feelings by using cannabis.

In contrast, Nelemans and colleagues (2015) oppose a different view, stating that youth with anxiety are less likely to start using cannabis. The authors argue that due to their anxiety symptoms, these adolescents often lack the urge to engage in cannabis use as they may fear the consequences of such use. Woicik, Stewart, Pihl and Conrod (2009) found results in line with this negative relationship between anxiety and cannabis use. Their study investigated the relationship between personality dimensions and substance use among adolescents. The authors found that anxiety sensitivity was indeed negatively associated with cannabis use. Peeters and colleagues (2014) concluded concerning alcohol use that anxiety in first place withholds adolescents from starting with the use of alcohol. However, as soon as they start drinking, they have an increased risk for problematic use due to specific coping characteristics, such as drinking to reduce fears of social situations or to inhibit feelings of stress. Perhaps, the same mechanism applies to adolescent's cannabis use. Possibly, adolescents feel hesitant to try cannabis in the first place but are more prone than their peers to use the drug after gaining more experience with it. In sum, the consensus is lacking regarding the question whether adolescents with anxiety are at risk for cannabis use. On one hand, it seems that people with anxiety fear the consequences of cannabis use (Woicik et al., 2009). On the other hand, cannabis use could be attractive for people with anxiety, cause the anxiolytic effects of the substance increases the self-medicating value of the substance (Marco et al., 2009). Therefore, it remains unclear whether and how adolescent's anxiety levels influence prospective cannabis use. This study aimed to increase our knowledge of the association between anxiety and cannabis use among adolescents. The specific focus on adolescents in this study was unique. Until now, research on the association between anxiety and cannabis use was mostly conducted on samples containing adults.

Role of self-control in relation to cannabis use

Research has shown that people with certain personality characteristics are more likely to use cannabis (Walther, Morgenstern & Hanewinkel, 2012). One of these personality characteristics that differentiate between users and non-users of cannabis is self-control (Finkenauer, Engels & Baumeister, 2005; Kashdan & Hofmann, 2008). An individual with poor self-control finds it difficult to control one's behavior. As a consequence, this individual has a higher risk of engaging in risk-taking behavior (Magar, Phillips, & Hosie, 2008). Low self-control has been attributed as a risk factor for cannabis use among adults and adolescents (Verdejo-García, Lawrence & Clark 2008; Otten, Barker, Maughan, Arseneault & Engels, 2010). Thus, research shows an association between self-control and cannabis use among adolescents.

Perhaps, self-control could have a moderating role in the association between anxiety and cannabis use among adolescents. Meaning that the association between anxiety and cannabis use is more prevalent when an adolescent has relatively low self-control. Kashdan and Hofmann (2008) did a study in which different subgroups of people with anxiety were examined based on novelty-seeking tendencies. The results showed the existence of two subgroups. One of these subgroups was characterized by people with anxiety scoring low on sensation seeking and self-control. The other subgroup was characterized by people with anxiety scoring high sensation seeking and self-control. The authors concluded that anxious individuals with relatively low self-control were more prone to engage in risky behavior such as hostility, drug abuse, and other forms of novelty-seeking behavior. As mentioned before, anxiety may withhold individuals from cannabis use (Woicik et al., 2009). However, the study by Kashdan and Hofmann (2008) indicated that individuals with poor self-control are more likely to use cannabis in comparison to individuals lacking self-control issues. Perhaps, anxious individuals with relatively low self-control are more likely to neglect their fear of experimenting with risky behavior. Therefore, this study will investigate the extent to which self-control moderates the relationship between anxiety and cannabis use among adolescents.

Role of peers in relation to cannabis use.

It is important to consider how peer influence can affect the cannabis use of an adolescent. Particularly since adolescents spend more and more time with their peers when they get older (Harakeh, et al., 2012). Kuntsche and Jordan (2006) examined the impact of peers on individual cannabis use among adolescents. The authors explain that peers who bring cannabis to school contribute to norms referring to cannabis use as acceptable and accessible. Furthermore, these adolescents provide opportunities to smoke cannabis for adolescents who cannot obtain cannabis in their social network. The authors argue that the perceived accessibility and the use of peers are associated with the personal cannabis use of an individual. Helmer and colleagues (2014) did a study among European undergraduate students from seven different countries. The authors found that perceived peer substance use was significantly related to the adolescent's substance use. Not only the perceived cannabis use of peers but also the actual use of peers has appeared to be related to personal cannabis use (Kilmer et al., 2006). Thus, research shows adolescents might imitate or get influenced by the cannabis use of their friends and peers.

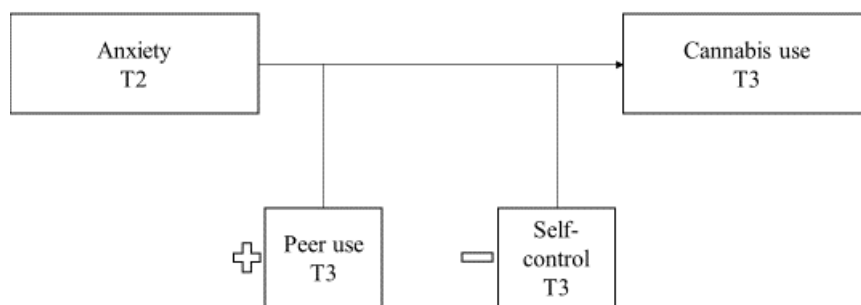
Perhaps, peer use could have a moderating role in the association between anxiety and cannabis use among adolescents. Meaning that the association between anxiety and cannabis use becomes stronger when affiliated peers engage in cannabis use. Buckner and colleagues (2006) examined the susceptibility of young adults with anxiety for peer influence. The authors found that the effect of anxiety on cannabis use is stronger when adolescents have friends who use cannabis themselves. The authors explain this finding by stating that people with anxiety often report having fewer friends than adolescents without anxiety. These adolescents would often be overly reliant on their affiliated peers. Furthermore, Buckner and colleagues (2012) state that adolescents with anxiety tend to use cannabis to prevent negative peer evaluation. Both factors enhance the susceptibility of these adolescents to imitate their friends' cannabis use. (Bucker et al., 2006; Buckner et al., 2012). In situations without peers who smoke cannabis the effect of anxiety on cannabis use may be less prevalent (Caouette & Ewing, 2017). These results suggest that individuals with anxiety are at risk for cannabis use particularly when they have peers who already use cannabis. Therefore, it is important to investigate the extent to which the cannabis use of peers affects the relationship between anxiety and cannabis use.

This study aimed to investigate to what extent anxiety is related to prospective cannabis use among adolescents. It was hypothesized that anxiety at T2 is significantly related

to cannabis use at T3, and that self-control and peer use act as moderating variables. Furthermore, we controlled for the effects of cannabis at T2 and we examined gender differences since anxiety as well as cannabis use may be different between boys and girls. Based on previous research, the expectations were that relatively low self-control and high peer use were thought to increase the association between anxiety and cannabis use (Kashdan & Hofmann; Buckner et al., 2006).

Figure 1

Explanatory model



Methods

Sample and participants

This study used datasets from the second (T2) and third (T3) wave of the Tracking Adolescents' Individual Lives Survey (TRAILS). The second and third wave took place between 2003 and 2005. The Trails study included children around 10-11 years at baseline living in one of five municipalities in the northern part of the Netherlands. Both rural and urban areas were covered (Creemers et al., 2009). A total of 2229 participants with a mean age of 11.09 (SD=0.55) were enrolled at (T1), at (T2) 96.4% of participants (N=2149; M=13.56; SD=0.53) participated during the next wave (T2). (T3) was completed by 81.4% of participants (N=1816; M=16.27; SD=0.73). Preliminary to each measurement wave, informed consent was obtained after all participants and their guardian(s) were informed about the structure of the study (De Winter et al., 2005).

Procedure

During each assessment wave (T1-T3) children filled out a questionnaire in the classroom. Always under the supervision of a Trails researcher. Interviewers visited the guardian(s) to gather information about parental psychopathology, somatic health, developmental history, and information about the child (Huisman et al., 2007).

Measures

Anxiety (T2)

Anxiety was measured by the Revised Child Anxiety and Depression Scale (RCADS). This is a 47-item measure child self-report questionnaire (Chorpita, Yim, Moffitt, Umemoto, Francis, 2000). The scale includes 5 subscales, namely; generalized anxiety disorder (6 items, $\alpha = 0.81$), separation anxiety disorder (7 items, $\alpha = 0.67$), social phobia (9 items, $\alpha = 0.85$), panic disorder (9 items, $\alpha = 0.79$), obsessive-compulsive disorder (6 items, $\alpha = 0.68$) and major depression disorder (10 items, $\alpha = 0.81$). Respondents indicated on a 4-point Likert scale 0 = "never" to 4 = "always" to how often they felt a certain way. Example statements were, "I would find it scary to be home alone." and "Whenever I have a problem, I experience a strange sensation in my belly." Higher scores indicate a stronger severity of anxiety symptoms.

A principal axis factor analysis was conducted on the 47 items. This was done to test whether one underlying factor of anxiety was identifiable, and subscales could be analyzed

together. Oblique rotation was used, (KNMO =.915). An initial analysis was done to obtain eigenvalues for each factor in the data. One factor had an eigenvalue over Kaiser's criterion of 1. This factor explained 67.66% of the total variance. The scree plot showed a clear inflection that would justify retaining one factor as well (Field, 2013). The 6 subscales of the RCDA's all had high reliabilities, all Cronbach's $\alpha = .90$. The mean score based on the six different scales was used as the predictor variable in the logistic regression analysis.

Cannabis use (T2 and T3)

To investigate the frequency of cannabis use we used adolescent's responses to the questions: "How many times have you smoked cannabis in your life?". Respondents indicated on a 14-point Likert scale how often they used cannabis, 0-10 = "0-10", 11-19 = "11", 20-39 = "12", 40 or more = "13". Afterward, a dummy variable was made to distinguish participants who ever smoked cannabis versus participants who never used cannabis.

Peers cannabis use (T3)

To investigate the cannabis use of peers, adolescents responded to the question: "How many of your friends smoke cannabis?" respondents indicated on a 4-point Likert scale = "Nobody", 1 = "A few of them", 2 = "Half of them", 3 = "Most of them", 4 = "All of them".

Self-control (T3)

Self-control was measured with the Early Adolescent Temperament Questionnaire-Revised (Putnam, Ellis & Rothbart, 2001). Parents responded on a 5-point Likert scale 1 = "Rarely true" to 5 = "Almost always true" to statements regarding their child's inhibitory control (11 items, $\alpha = .86$). Example statements were "My child finds it easy to concentrate on a task" and "My child is paying good attention whenever someone explaining how he or she has to do something." Higher scores indicated higher levels of their child's self-control.

Data analysis

Statistical analysis was carried out by using the Statistical Package of Social Sciences (24) for Windows. An attrition analysis was performed to critically assess the characteristics of subjects who dropped out between (T2) and (T3). An independent sample t-test examined whether dropouts (N=411) differed significantly from responders (N=1811) based on gender, socioeconomic status, anxiety, and cannabis use at T2. Dropouts were more likely to be male $t(612) = -3.135, p = .002$, to score lower on SES $t(2185) = 8.784, p = .001$ and to score lower on anxiety symptoms $t(409) = 2.306, p = .002$. Dropouts and responders did not differ regarding cannabis use at T2.

A correlation matrix was used to check for patterns in the data. Collinearity between variables was examined because strong collinearity between variables can harm the reliability of regression analysis (Field, 2013). Normality and homoscedasticity assumptions were not met. Multivariate logistical regression was performed to test the opposed research model. This was done because the data was not normally distributed. The outcome variable “cannabis use” was made nominal by assigning cases to either having used cannabis or never used cannabis. Step one included demographic variables such as SES, age, and gender. Furthermore, cannabis use (T2) was included to control for previous cannabis use. The main effects were assessed by adding anxiety, self-control, and peer cannabis use as predictors to the model and cannabis use (T3) as the outcome variable (step 2). Moderation effects were assessed by adding the interaction term of peer cannabis use/self-control and anxiety in (step 4). The interaction terms were computed by the product of the two predictor variables after mean centering was performed (Field, 2013).

Results

Descriptive Statistics

An independent-samples t-test was conducted to compare gender differences on all predictors and the outcome variable. These analyses indicated several relevant gender differences. Boys scored significantly higher ($M = .64$, $SD = 3.93$) than girls ($M = .35$, $SD = 2.59$) on cannabis use at T2, $t(1729) = -1.97$, $p = 0.049$. Boys also scored significantly higher ($M = 5.88$, $SD = 12.62$) than girls ($M = 3.27$, $SD = 8.49$) on cannabis use at T3, $t(1323) = -4.85$, $p = 0.01$. Girls were more likely to report a higher degree of anxiety symptoms ($M = .49$, $SD = .32$) than boys ($M = .33$, $SD = .26$) at T2, $t(2026) = 12.54$, $p < .001$. Parents of girls more likely reported a higher degree of adolescent's self-control ($M = 3.35$, $SD = .63$) than parents of boys ($M = 3.05$, $SD = .66$) at T3, $t(1507) = 9.35$, $p < .001$. No gender differences were found with regard to number of friends an adolescent had who engaged in the use of cannabis. The descriptive of total scores can be found in table 1.

Table 1

Independent Sample T-test

	Male		Female		Total		Sex differences
	M	SD	M	SD	M	SD	t-test
Anxiety T2	.33	.26	.49	.32	.41	.30	12.54*
Self-control T3	3.05	.66	3.35	.63	3.20	.66	9.35*
Peer use T3	.86	.97	.83	.97	.84	.97	ns
Cannabis use T2	.64	3.94	.35	2.59	.49	3.32	-1.97*
Cannabis use T3	5.88	12.62	3.27	8.49	4.49	10.70	-4.85*

Note. * $p < .005$

Table 2

Correlation Matrix of Demographic Variables, Anxiety, Self-control, Peer use, and Cannabis use.

	1	2	3	4	5	6	7	8
1. Sex ^a	1							
2. Age T2	-.01	1						
3. SES T1	-.03	-.07**	1					
4. Anxiety T2	-.26**	-.05*	.01	1				
5. Self-Control T3	-.23**	-.04	.08**	-.01	1			
6. Peer use T3	.019	-.01	-.04	.05	-.05	1		
7. Cannabis use T2	.04*	.12**	.02	.01	-.05	.04	1	
8. Cannabis use T3	.12*	.90**	.03	-.01	-.23*	.01	.27**	1

Note. ^a Reference category = Female. * $p < .05$, ** $p < .01$, sex = Point biserial Correlation

Cannabis users versus non-users

As presented in table 3, findings from the binary logistic regression showed a non-significant effect between anxiety and cannabis use T3. Anxiety symptoms did not affect the likelihood that an adolescent used cannabis or not. A significant main effect was found between self-control and cannabis use T3 (OR = .46, SE = .11, 95% CI = .37-.57, $p < .05$). Adolescents scoring relatively low on self-control were more likely to use cannabis than those who score relatively high on self-control. No significant main effect was found between peer use and cannabis use T3. Peer use did not affect the likelihood that an adolescent used cannabis. No significant interaction was found between anxiety and self-control on cannabis use.

Adolescents scoring high on anxiety were not more likely to report cannabis use compared to adolescents scoring relatively low on self-control. The interaction effect between anxiety and peer use on cannabis use was significant (OR = 2.375, SE = .26, 95% CI = 1.43-3.94, $p < .05$).

The inspection of the interaction effect (figure 1) illustrated the nature of this relationship.

Adolescents scoring relatively high on anxiety more likely used cannabis if they had a relatively high number of friends who engage in cannabis use. Adolescents scoring relatively low on anxiety symptoms did not seem to be affected by the cannabis use of their friends in the same way.

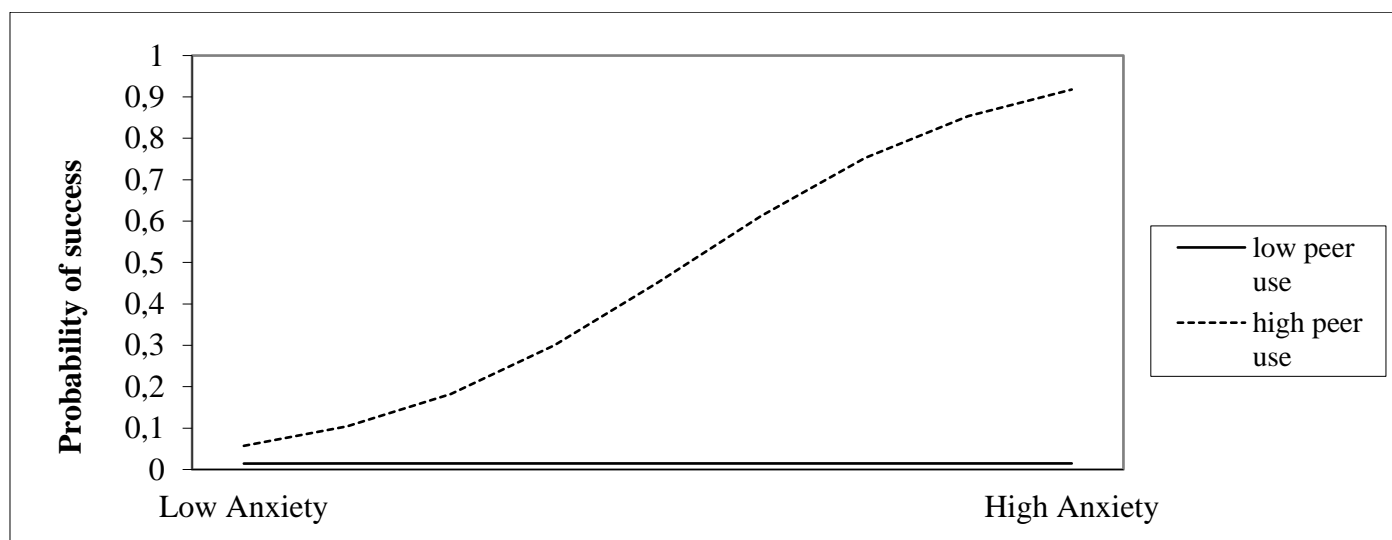
Table 3

Binary Logistic Regression

	b (SE)	95% CI for Odds Ratio		
		Lower	Odds Ratio	Upper
Never used cannabis versus ever used cannabis.				
sex	.13 (.13)	.88	1.14	1.47
age	.46 (.13)*	1.24	1.59	2.04
SES	.01 (.09)	.85	1.01	1.19
cannabis use T2 (model ^a)	.32 (.09)*	1.16	1.38	1.65
Anxiety Model ^b	.05 (.23)	.671	1.05	1.64
anxiety	-.03 (.23)	.61	.97	1.54
Self-control	-.78 (.11)*	.37	.457	.57
Peer use Model ^c	.05(.07)	.92	1.05	1.20
anxiety * peer cannabis use	.87 (.26)*	1.43	2.38	3.94
anxiety * self-control model ^d	-.08(.37)	.45	1.05	1.89

Note. Model^b, $R^2 = .0652$, (Nagelkerke). * $P < .05$. Model^d interaction terms have been separately included in the analysis.

Figure 2

Interaction between Anxiety and Peer use

Discussion

Using data from the longitudinal Trails adolescent dataset, we investigated the relationship between anxiety and prospective cannabis use, evaluating the moderating effects of peer cannabis use and self-control. Anxiety at T2 did not increase the likelihood that adolescents would use cannabis at T3. Only self-control predicted a greater likelihood of cannabis use. This finding emphasizes that adolescents who tend to score relatively low on self-control are more likely to engage in cannabis use. The interaction between anxiety and peer use predicted prospective cannabis use. Adolescents scoring relatively high on anxiety were more likely to use cannabis if they had a relatively high number of friends who engage in cannabis use. Adolescents scoring relatively low on anxiety symptoms did not seem to be affected by the cannabis use of their friends.

No support was found for the effect of anxiety symptoms at T2 predicting prospective cannabis use T3. It was expected that the anxiolytic properties of cannabis would stimulate adolescents to engage in self-medicating behavior (Marco et al., 2009). In this study, no support for this assumption was found. Possibly, these adolescents lack the tendency to engage in experimental behavior such as cannabis use, as they may fear the consequences of such use more than their peers without anxiety symptoms (Nelemans et al., 2015; Woicik et al., 2009).

However, this does not mean that adolescents are not at risk for prospective cannabis use. Perhaps the absence of an association between anxiety and cannabis use can be explained by the fact that our sample consisted of relatively young adolescents. As adolescents grow older, they are more likely to direct their behavior based on their own needs, instead of the needs and wishes of parents and caretakers (Arnett, 2012). Furthermore, experimenting with cannabis use also increases as adolescents get older (National Drug Monitor, 2018). Peeters and colleagues (2014) found in their study that adolescents with anxiety are hesitant to drink alcohol. However, as soon as they start drinking, they have an increased risk for problematic use due to specific coping characteristics such as drinking to reduce fears of social situations or to inhibit feelings of stress. Perhaps adolescents with anxiety might feel hesitant to try cannabis as well. However, as soon as they start smoking cannabis some of them will notice that the substance can be used to alleviate anxiety symptoms (Crippa et al. 2009). Future research should explore whether older adolescents dealing with anxiety also remain abstinent from cannabis use when they get older. Possibly the association between anxiety and cannabis use is more apparent among older adolescents.

Self-control was found to be a significant predictor of prospective cannabis use in this

study. This result is in line with the results of prior research, indicating that low self-control is a risk factor for cannabis use (Verdejo-García et al., 2008; Otten et al., 2010). This finding emphasizes how a personality factor such as self-control can differentiate between users and non-users of cannabis (Finkenauer, Engels & Baumeister, 2005; Kashdan & Hofmann, 2008). An adolescent with relatively low self-control experiences greater difficulties when it comes to resisting temptations and to evaluate long term consequences of drug use (Wills, Walker, Mandoza & Ainette, 2006).

No support was found for the moderating effect of self-control on the association between anxiety and cannabis use. This result is not in line with prior research stating that anxious individuals with an impulsive character trait are more prone to engage in risky behavior such as hostility, drug abuse, and other forms of novelty-seeking behavior (Kashdan & Hofmann, 2008). The former might be explained by study differences. For instance, Kashdan and Hofmann (2008) used a sample containing adults instead of adolescents. As mentioned before cannabis use is more prevalent among young adults than among adolescents (National drug monitor, 2018). Additionally, in contrast to the non-clinical sample in the current study, all participants in the study by Kashdan et al. (2008) were diagnosed with anxiety. These two differences might explain why distinctive results were found in the current study. We recommend future research to address the moderating effect of self-control in the association between anxiety and cannabis use on a sample of older adolescents.

In line with our expectations, peer cannabis use did moderate the association between anxiety and cannabis use. We found in agreement with Buckner et al. (2006) that anxious adolescents who have friends that smoke cannabis are more prone to use cannabis. Adolescents with anxiety often are sensitive to peer influence and more reliant on smaller social circles than those adolescents without anxiety symptoms (Buckner et al., 2006). The latter could explain why in particular adolescents with anxiety are at risk for peer influences. It is important to acknowledge that the interaction between peer use and anxiety was explained while controlling for self-control. When differences in cannabis use explained by self-control are ruled out, a clear interaction effect between anxiety and peer use emerges which is absent in a model without self-control. Self-control may be an important element in explaining the influence of peer use among adolescents with anxiety symptoms. We recommend researchers to consider the confounding effect of self-control in more detail in future studies on cannabis use.

Surprisingly, this moderation effect was present in the absence of main effects. Prior research has shown that peer cannabis use often strongly relates to personal use (Coffey,

Lynskey, Wolfe, & Patton, 2000; Helmer et al., 2014). In this study, no support was found for the main effect of peer cannabis use on individual use. Various explanations can be provided for why this was the case. In this study, only a marginal part of the sample had ever tried cannabis at T3. Furthermore, the adolescents in this study were relatively young, as their mean age was 16 years old. Previous studies investigating the association between peer and personal cannabis use often used samples containing older adolescents, with mean ages above 20 years old (Kilmer et al., 2006, Helmer et al., 2014). As research has shown, the likelihood of having experience with cannabis increases when adolescents grow older (National drug monitor, 2018; Nelemans et al., 2015). Therefore, we expect that the link between peer use and personal use is more apparent among older adolescents.

Strengths and limitations

A strength of this study is the use of a large longitudinal dataset. This made it possible to control for prior cannabis use at T2. Many cross-sectional studies can only use data available at baseline, making it harder to assess confounding relationships and to draw conclusions regarding effects over time. It is important to mention that this study is not without limitations. For instance, personal as well as friend's cannabis use were measured by self-report. It could be the case that this leads to a response bias among participants. Perhaps, adolescents provided socially desirable answers, as cannabis use during adolescence remains illegal and controversial behavior (Monshouwer et al., 2006). However, previous studies have compared self-reported cannabis use and actual cannabis use by examining THC levels in participant's urine. These studies found no signs indicating that self-report is unreliable (Akinci, Tarter & Kirisci, 2001; Buchan et al., 2006). Moreover, this study encountered dropouts. Participants who dropped out were more likely to be male and have a lower socioeconomic status. Both characteristics can be seen as risk factors for cannabis use (Malmberg et al., 2010; Guxensa, et al., 2007; Creemers et al., 2010; Ter Bogt et al., 2006). Their absence may have led to the underrepresentation of effects. Furthermore, more advanced statistical methods could have been used. The present study, for example, did not control for clustering. It is likely, that students within school classes are more similar to each other than those in other classes. For instance, students potentially influenced each other's cannabis use. This problem could have been tackled by using multilevel modeling techniques (Hox, 2011). Lastly, the use of a more specified anxiety scale would have been preferable. In this study, the anxiety variable was computed by mean scores for each participant based on the (RCDA) scale. This means that a part of the anxiety score was explained by a scale that

measures major depression. Although, the existence of comorbidity between anxiety and depression in adolescence, a validated anxiety scale would have been preferable in this case (Cummings, Caporino & Kendall, 2014).

Conclusions and implications

This study showed no association between anxiety and cannabis use among adolescents. This finding could be explained by the notion that anxious individuals fear the consequences of such experimental behavior (Nelemans et al., 2015; Woicik et al., 2009). Furthermore, this study showed that adolescent's self-control increased the likelihood of cannabis use.

Additionally, adolescents with high levels of anxiety more likely seem to use cannabis when affiliating with friends who engage in cannabis use themselves. Adolescents with relatively low levels of anxiety do not seem to be affected by their friends' cannabis use likewise. These findings add to our understanding of adolescent lifetime cannabis use, which has been shown to reinforce the risks of developing a cannabis use disorder (Behrendt et al., 2009; Swift et al., 2008).

The findings of this study emphasize the influence of adolescent's self-control on prospective cannabis use. We recommend including self-control training in prevention programs targeted at adolescents. Onrust and colleagues (2006) performed a meta-analysis to investigate certain aspects often associated with effective school prevention programs. The authors advised that prevention programs should include aspects that reinforce the development of certain skills, such as self-control and decision-making skills. Fortunately, studies have shown that self-control training can be effectively used to increase self-control (Friese et al., 2017). Furthermore, the findings of this study propose that a specific group of anxious adolescents should be targeted in prevention programs. In particular, those affiliated with cannabis-using peers. These characteristics showed to be risk factors for prospective cannabis use. Future research should aim to investigate and evaluate different implementation options, considering peer influences. Lastly, we recommend prevention programs to include aspects of cognitive-behavioral therapy. Specifically, those elements that potentially stimulate the development of healthy coping mechanisms should be included, such as learning to cope with stress and social pressure (Onrust et al., 2016; Hendriks, van der Schee & Blanken, 2011). These skills could potentially help adolescents in the future when the temptation of cannabis use becomes more apparent (National drug monitor, 2018).

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Appendix 1: Interdisciplinarity

Youth studies are an interdisciplinary field, we study elements from various disciplines and try to integrate these ideas. A psychological scope stimulates us to investigate the lives of individuals. This is also one of the main themes within this paper. You could for example look at psychological themes like depression, anxiety or intelligence. However, just focusing on these individual elements is not enough. Social reality is complex, youth get in contact with their near surroundings. They learn from experiences with peers, parents and teachers. But their lives are also affected by greater sociological themes. You can think of SES, neighborhoods and safety. Therefore, it is important to research the field of youth studies from an interdisciplinary viewpoint. The aim of Youth Studies should be to integrate the theories, ideas and methodologies from all different disciplines. The following paragraph will elaborate on Bronfenbrenner's ecological systems theory. This theory can be used to understand interrelations between different domains. The model expands from individual surroundings to the abstract influence of ideology, culture and mass media. For now, we will focus on those elements relevant to the topic of this paper.

The research questions in this paper mostly connects to three layers of the ecological model of Bronfenbrenner. Anxiety and self-control are both considered from an individual level. Both could have been the result of a genetic disposition (Pandey, Zhang, Roy, & Xu, 2005). This means that anxiety and its symptoms can manifest without any interaction with other domains prescribed within Bronfenbrenner's ecological systems theory. Humans can have a genetic predisposition to get addicted or drawn to a specific substance because of its psychoactive properties (Agrawal, Verweij, Gillespie, Heath, Lessov-Schlaggar, Martin, & Lynskey, 2012). The psychoactive effects of cannabis can be anxiolytic, this could be one of the reasons why adolescents with anxiety find its use appealing.

Microsystem: the immediate environment of an adolescent has an important role to the proposed research question. The influence of peer norms can have an impact on the individual use of cannabis (Buckner et al., 2006). These peers also influence school culture, in some schools the use of cannabis is more tolerated and socially accepted. In other it uncommon and less accepted among students (Kuntsche & Jordan, 2006).

Mesosystem: different domains like schools, neighborhoods and the home situation all interact with each other. If an adolescent is in doubt whether he or she should try to use cannabis for the first time. This person can be affected by people of school, the parents or by

peers in the neighborhood. All these elements interact and contribute to the decision of someone choosing to try cannabis (Wallace and Fisher, 2007).

Appendix 2: Contract data use (TED)

Utrecht, 2019

This letter constitutes formal confirmation of the fact that the data from the Utrecht University Youth Studies 2019/2020 have been made available to Levi van Ravesteyn of Utrecht University.

These data will not be made available to others, and the data may be used only for analysis and reporting on topics for the thesis, about which agreement has been reached with Margot Peeters.

Levi van Ravesteyn will receive access to the data from the dataset in order to answer the following research questions within the framework of the thesis:

Research

question: The aim of this study is to investigate to what extent anxiety is related to adolescent cannabis use. The hypothesis is that Anxiety at T2 is significantly related to cannabis use at T3, and that self-control and peer use act as moderating variables. Based on previous research, the expectations were that low self-control and high peer use were thought to increase the association between anxiety and cannabis use.

The following variables will be used:

Dependent variable: Cannabis use T3 (c3rad13a)-(c3rad13b)-(c3rad13c)

Independent variables: Anxiety T2 (RCADS,47 items)

Self-control T3 (Effortful control P3EAEFC, 11 items)

Peer cannabis use T3 (c3cu4)

No report based on the data from the project entitled may be made public, unless permission has been obtained in advance from the Project Coordinator for the Trails project. After the expiration of this contract, dated 28/01/20-1/7/20, Levi van Ravesteyn shall delete The Trails T2 and Trails T3 data.

Dates and signature:

28-1-2020

